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The impact of Seguro Popular enrollment on quality of life of older adults with chronic degenerative diseases: an approximation

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“There are many ways of killing. You can stick a knife in someone’s stomach, take someone’s bread away, not cure someone’s illness, put someone in poor accommodation, work someone to death, drive someone to suicide, take someone to war and so on. In our country some of this is forbidden.”

Bertolt Brecht

Aknowledgements

Al Maestro por esta vida, a mis camaradas conocidos y por conocer y a mis amigos entre ellos, a los mexicanos más desfavorecidos porque son ellos quienes hacen posible la educación pública, a mi padre, a mis compañeros de promoción, a mi asesor porque me guio desde mi primera evaluación en la maestría, a mis profesores del programa por contribuir a mi formación académica como nunca antes, a mi madre y a mi tía.

Summary

This thesis hypothesizes a positive relationship between affiliation to Seguro Popular and a decrease in health deterioration during aging. The objective of this thesis is to show that Seguro Popular affiliates experienced a decrease in the loss of functionality as they age. Here, functionality is approximated with information on limitations with mobility and activities of daily living (basics and instrumental). The data source used is the Mexican Study of Health and Aging (MHAS): the 2003 round is used as the presented in the pre-treatment or baseline year, the 2012 round as in which the intervention occurs, and the 2015 round as the correspondent to post-treatment year. Because, as recorded in the existing literature, Seguro Popular enrollment was not strictly random, the research combines two econometric methods. Propensity Score Matching technique is to obtain two control groups that are as consistent as possible and, the Differences-in-Differences technique serves to estimate the effect by taking into account unobserved characteristics that are constant over time between the two groups. For the intervention that considers those enrolled in Seguro Popular concerning the control group made up of individuals with any other different health insurance or without insurance, a negative, small and, not statistically significant effect is obtained. The estimated coefficient for the intervention that considers those enrolled in Seguro Popular concerning those not enrolled in any health insurance was also negative, although larger. Thus, those who had Seguro Popular in 2012, on average, obtain better results than those who had no insurance at all, and even than those enrolled in another health insurance. The results suggest that affiliation to Seguro Popular concerning enrolled in another health insurance or not enrolled in another health insurance and not enrolled in any insurance has not had a significant impact on the progression of disability. After the analysis, it is clear that using more than one control group enriches the study, especially if it is taken into account that disability is a difficult quality to treat in developing countries such as ours, where the socioeconomic structure is less uniform and where are more conditions for this process to present itself as a progressive one. In addition, the results suggest that the part of the study of the effects between those enrolled in Seguro Popular and those enrolled in other health insurance programs presents a better approach for comparison to analyze the effects of the intervention in question insofar as there are access barriers that are difficult to overcome for the most marginalized, even in the case of non-contributory insurance.

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Introduction

Since 1992, when poverty was first measured in Mexico, little progress has been made in combating it. Even since 2009, when the Mexican government began to use an official poverty measurement, the behavior has been practically the same. Although as a percentage of the total population people in poverty decreased in the decade corresponding to 2008 and 2018, from 44.4% to 41.9%, in levels, the number of people in this situation went from 49.5 million to 52.4 million (Coneval, 2019). In addition, although the average number of deprivations of the population in poverty and people in extreme poverty, went from 2.8 to 2.2 and from 3.9 to 3.6, respectively, in the same period mentioned, the number of social deprivations experienced by the population continues to be an indicator of the severity of the deprivations (Coneval, 2019).

At the same time, the country's per capita income despite certain ups and downs and its recent decline since 2019, has had a growing trend (CEFP, 2019) without such growth translating into palpable benefits for people living in poverty; our country is one of the most unequal in the world (Pimentel et al., 2021).

In general, the resources and efforts that the Mexican government has dedicated through programs aimed at improving the conditions of people with lower incomes have not had results that correspond to the goals set; these have been insufficient. In 2008, social programs and actions achieved an average performance of 36% of the fulfillment of their goals or objectives (Coneval, 2008); in 2019 this figure was 66%[1] (Coneval, 2021).

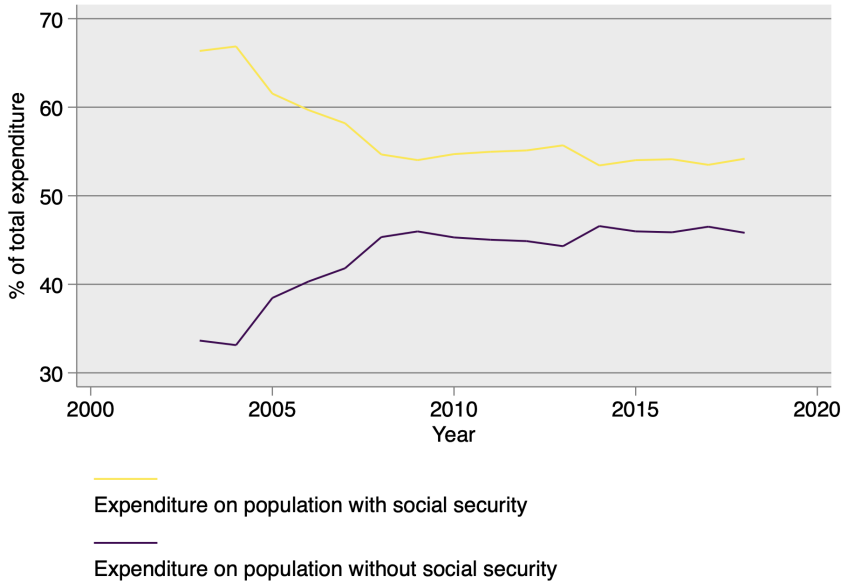
In particular, although Mexico's basic health indicators have generally improved over time, some have done so at a slower pace than expected according to their level of development (Lustig, 2017) and others that have gained relevance continue to lag. Mexico, among the countries of the Organization for Economic Co-operation and Development (OECD), presents consistently below-average levels in life expectancy, avoidable mortality, morbidity due to chronic diseases, overweight, population coverage, financial protection, effective secondary care, health expenditure, the share of health expenditure and practicing physicians and nurses (OCDE, 2019). Additionally, there are large differences between geographic areas, ethnic groups, and socioeconomic levels.

The environment described above is, to a large extent, a reflection of inequality in public action, since public spending on health is not progressive to the extent that inequalities persist in the number of resources

[1]The average performance is calculated including the indicators of all levels of the Matrix of Indicators for Results (MIR) calculated by Coneval, which identifies in summary form the objectives of a program, incorporates the results and management indicators that measure these objectives; specifies the means for obtaining and verifying indicator information, and includes the risks and contingencies that may affect program performance.

allocated among the different insurance schemes: Figure 1 show that public spending for people with social security has been greater than that for people without social security, both in terms of levels and percentages of total health spending. Furthermore, although the population with access to health services represents 82% according to figures from the Ministry of Health, as has been the case for several years (Lustig, 2017), a high percentage of the population remains outside the public health insurance systems, 26% in 2020 based on Inegi data.

Figure 1: Trajectory of health expenditure percentages according to the Mexican population's affiliation status



Source: own elaboration with Ministry of Health data.

Given the fragmentation and insufficient linkage between financing, insurance and provision of social security medical services, the Mexican health system also presents efficiency problems. Although there is evidence of positive impacts of Seguro Popular on the supply of health services (Huffman & van Gameren, 2018; Parker et al., 2018a; Arenas et al., 2015), neither it nor its substitute, the Instituto de Salud para el Bienestar (INSABI), have completely solved this problem. Negative empirical evidence (Murayama-Rendón, 2011; Barofsky, 2011) and mixed evidence (Urquieta-Salomón & Villarreal, 2015) supports the claim regarding the former and, regarding the latter, despite the inexistence of evidence because to date it lacks clear rules of operation.

Based on the general panorama described above, it makes sense to study the need for a certain reorientation of public spending and certain aspects of economic policy, since it seems that these two elements are

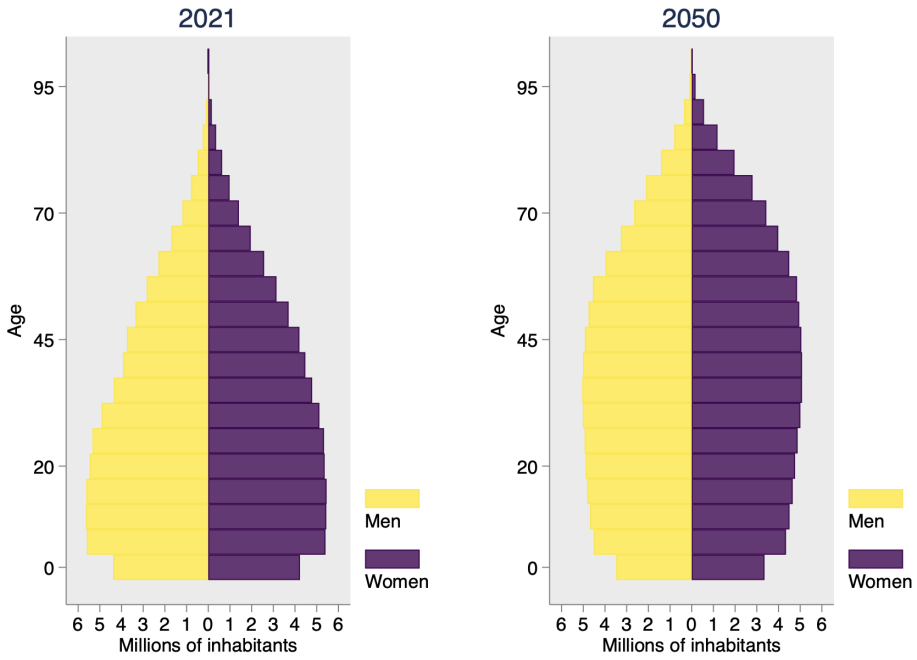
not allowing the search for poverty reduction to be effective.

This thesis considers the role of a public policy that represented one of the largest health policy reforms in the world in the last decade of the last century and the first decade of the current century (King et al., 2007) and whose non-contributory nature is relevant in a context of high informality and poverty. Seguro Popular was a public health program proposed as a key element for reducing health inequity and as a pioneering program in the region (Frenk et al., 2007). According to its main promoters, it was a policy that responded to one of the main challenges of low- and middle-income countries, which is to guarantee universal financial protection in health. "This public insurance scheme provides universal access to a comprehensive package of personal health services with financial protection that guarantees the effective exercise of the right to health protection" (Frenk et al., 2007). As for the existing evidence, as noted in the next section, most of the evidence shows that their effects are positive or, at least, non-negative. In the case of Latin American countries with schemes similar to Seguro Popular in the sense that they are oriented to the poor population, there is the experience of Microinsurance in Costa Rica and the subsidized social security health system in Colombia, which through the Mandatory Subsidized Health Plan (POSS), since 1993 has provided coverage without health contributions to a little more than half of the population.

This thesis hypothesizes that there was a positive relationship between Seguro Popular and less deterioration of health (functionality) as one age. For its part, the creation of INSABI does not change the relevance of analyzing the impacts of its predecessor due to its young age and the changes it has so far implied. Examining the aging phenomenon in Mexico still offers important opportunities because, first, the demographic transition in Mexico consists of a process of population aging that has occurred faster than in other developing countries (Gonzalez-Gonzalez et al., 2014) as a consequence of mortality and fertility gradually declining to controlled levels modifying the age structure of the population. That is, the number of adults will increase substantially (see Figure 2) because future generations will live longer, and aging in Mexico has and will have a relatively greater impact because when the population ages rapidly in a relatively shorter period, economic and institutional infrastructures cannot continue to absorb the aging process.

Second, the cohorts of Mexican citizens who reached the age of 60 or older after 1990 are different from those of other developing countries since their mortality rate during childhood and adulthood was reduced thanks to medical technology adopted after 1930 (Cruz, 2009) and thanks to some progress in improving social conditions (Tuirán et al., 2004), especially in terms of access to health measured as the percentage of the population, although, in general, Mexico's multidimensional poverty rate remains high (Coneval, 2018).

Figure 2: Projected Mexican population pyramids



Source: Own elaboration based on CONAPO population projection data.

One of the consequences of the above is that, even though Mexico still has a mixed epidemiological profile, there is a high prevalence of chronic degenerative diseases, in all age groups but, especially among older adults. And the costs of care associated with these types of conditions, as in general, can contribute to a more rapid depletion of family resources and increase health inequalities. In this regard, despite recent advances in expected life years, the persistence of health disadvantages from one generation to the next is high (De la Torre, 2020).

Third, aging in Mexico is premature in the sense that the country's socio-economic conditions and institutional infrastructure are insufficient to support population aging, although it has not occurred as rapidly as in developed countries (Chande, 2003). In regions where there are aging populations with a high burden of chronic diseases and disabilities, such a situation implies an increase in long-term care needs. For Latin America and the Caribbean, a region to which Mexico belongs, the prevalence of severe disability is expected to almost triple between 2000 and 2050 (WHO, 2015). Regardless of the demographic and sociocultural heterogeneity of the countries, a significant increase in the demand for care services is expected, in a context of a lack of supply of formal public care services and a decrease in the supply of unpaid family care associated with the change in the size and composition of households, the increase in female partic-

ipation in the labor market and migration. And a care system comes with costs: the economic impact on unpaid caregivers is enormous. The implementation of a long-term care system can not only reduce costs, but also generate economic benefits through the creation of a market for formal caregivers and according to the interrelation of caregiving activities and the labor force participation decision (van Gameren & Naranjo, 2015).

Fourth, the Mexican population has historically experienced a history of high and constant migration, which implies an aging population closely linked to that of the main receiving country of such migration, the United States, either because migrants have returned (Wong & Gonzalez-Gonzalez, 2010), or simply because they continue to belong to social and family networks (Wong & Palloni, 2009).

And, fifth, social and economic reforms were carried out that affect the welfare of the generations of adults currently aging in Mexico, such as the IMSS pension reform since 1997, the "70 y Más"[2] pension programs, and the health reform that began with Seguro Popular around 2003 (Knaul et al., 2005; Wong & Palloni, 2009).

Some of the multiple dimensions of health in the aging process are functionality, economic conditions, family and institutional support, among others, and encompass various contexts, including the individual, the family, the environment, and the community. Thus, the study of the aging process is structured with a multidisciplinary and multidimensional approach from a life course perspective. Here, instrumented functionality is studied through the study of the progression of disability[3] with the intention of understanding and analyzing one of the characteristics of old age considered as a result of the decisions, behaviors, exposures, and context to which the individual was exposed throughout life; in particular, with respect to exposure to non-contributory health insurance.

In Mexico, a developing country with persistently high levels of inequality, the progression of disability is linked to socioeconomic conditions, especially poverty, in a vicious cycle: disability increases poverty and poverty increases the chances of being disabled (Mitra et al., 2011). In turn, countries with low inequality can provide more resources, social capital and better overall quality of life and, as a result, generate cohesive societies better able to cope with physical limitations (Wilkinson, 2000).

International comparative studies on disability highlight the challenges faced by developing and developed countries when socioeconomic inequalities and cultural differences exist (Madans et al., 2011).

[2] In 2003 in the Federal District, now Mexico City, and as of 2007 in the rest of the country.

[3] Disability progression is measured in this thesis in the manner done by (Díaz-Venegas et al., 2016).

However, little information exists regarding disability and how the older population, especially those in developing countries, makes the transition from healthy aging to disability (Eide et al., 2011; Díaz-Venegas et al., 2016; Eide & Loeb, 2005). The relevance of this research lies in providing evidence about the reversal effect that is generated through public policies that offer free or low-cost health services in the transition from healthy aging to disability in a developing country.

In this sense, two considerations prompt me to investigate the effect generated through a non-contributory health insurance program. First, as mentioned, Seguro Popular had an important magnitude in terms of the number of affiliates at the national level for almost two decades and, second, the use of non-contributory social programs has increased as a mechanism to reduce the vulnerability of older adults without social security coverage or security provided by their employers. In general, cash transfers are scarcer in developing countries. Therefore, this thesis, as will be detailed below, by comparing the effect with entitlement to other health insurance or the lack of it, also attempts to contribute to the investigation of one of the indirect, and perhaps longer-term, redistributive consequences of non-contributory social programs.

The effect on the quality of life of members over 50 years of age suffering from chronic degenerative diseases is studied through an approximation, through the impact that enrollment in the program had on a validated measure of the functionality of adults reaching advanced ages. The relationship between the evolution of a disability level indicator and the efficiency of public action is analyzed through the econometric methodology of Differences in Differences.

The contribution that this thesis intends to offer consists of a longitudinal analysis of the progression of disability as one of the signs of the quality of life of adults over 50 years of age suffering from chronic degenerative diseases in a developing country. The data source used to perform the analysis of disability progression of the target population over the long term, from 2003 to 2015, is the National Health and Aging Study (MHAS), a panel dataset that allows identifying disability progression at the individual level.

Almost two decades after its creation, despite its replacement and expansion through INSABI, it is pertinent to advance in the study of the less immediate or indirect effects of Seguro Popular, because the characteristics of the socio-economic environment (high levels of labor informality and persistent poverty) that made it important will continue to be present in the Mexican environment and, therefore, it seems necessary to improve and promote non-contributory programs: affiliation to this program has increased significantly over time, it is a progressive program since most of its beneficiaries belong to the population in

the first four deciles of the lowest income and, finally, elements are required to help determine the aspects in which INSABI should differentiate itself and seek to have an impact.

The rest of the thesis is structured as follows. Section 2 presents the literature review on the progression of disability and its determinants, as well as research on the effects of non-contributory social security on various indicators. Section 3 discusses the socioeconomic context and other relevant aspects that characterize the population of interest based on the MHAS. Section 4 discusses the research design: the identification strategy, the econometric specification used and the methodological limitations. Section 5 describes the results. Section 6 contains a discussion of the results. Finally, section 7 presents the conclusions.

Literature review

The following review of the literature represents an effort to address the elements of the existing literature that show the relationship between the economy and the lesser deterioration of "functionality" in aging, both in terms of the relationship of such deterioration with the possibilities of (labor) production and in its relationship with the consequences for the cost of long-term care. This without losing sight of the fact that, on the other hand, population well-being in general and population health, in particular, are public policy objectives. Therefore, the health sector requires the allocation of resources and their assignment through the most efficient mechanism possible to fulfill this objective.

Health in economic performance and the role of public health policies

Health status is not only defined by the absence or presence of disease; it is also defined according to one's ability to develop one's physical and cognitive potential throughout life.

Health is an essential element for long-term economic development (Wolf, 1970), and although the empirical evidence on the aggregate effect of economic growth on population health is quite heterogeneous and inconclusive, there is consensus that additional resources generated through economic growth are potentially useful for improving population health (Lange & Vollmer, 2017).

Because health is one of the main components of the so-called human capital, it is one of the key determinants of economic growth and also of poverty. Lack of health directly affects the labor force and has profound repercussions on the economy, causing the loss of workers as economic units, either through premature death or reduced working time and capacity (Wolf, 1970).

Lack of health is reflected in higher economic costs for curative services; therefore, measures aimed at increasing the active life of the labor force have an economic value in that they allow the labor force, so necessary in most developing countries, to maintain its productivity for a longer period (Wolf, 1970). On the other hand, health, although not the only causal factor in the ability to absorb education and become more productive, is a factor in the mobility of those with lower incomes. Health is also one of the main determinants of the persistence of poverty over time: poverty traps (Lustig, 2017). Poor households are prevented from breaking this vicious circle by the presence of market failures caused by various factors such as the inexistence or restrictions of credit and insurance markets for the poorest population; imperfect parenthood due to the absence of one or both parents; parents who do not have adequate health, nutrition or knowledge, or who do not prioritize the welfare of their children; a high rate of impatience or excessive risk aversion associated with poverty or, also, the lack of investment in public goods (in health and education) (Lustig, 2017).

Available empirical studies indicate that in the case of Mexico, health can explain about one-third of long-term economic growth, as well as the presence of poverty traps (David, 2001).

Public investment in health can then have important results, since market forces will not correct underinvestment in health, or will do so extremely slowly (Lustig, 2017). Economic theory indicates three justifications for state intervention in the health care market: public goods or services with large externalities; poverty; and failures inherent in insurance markets for health care (Musgrove, 1996).

Given the importance of health as a determinant of economic growth, poverty, and people's well-being, and given that it is a sector in which market failures are frequent, public sector action takes on particular importance. Public policies must act both to promote the accumulation of health and to minimize its decline in the event of illness.

According to the definition proposed by the World Health Organization, health inequities refer to those "systematic differences in health -considering outcomes, but also the process for their generation- between socially, economically, demographically or geographically defined population groups that are avoidable or remediable and therefore constitute unfair differences". Thinking about health inequalities as avoidable and remediable, and therefore unjust, implies identifying the systematic differences in health outcomes for different social groups (according to social class, gender, ethnic-racial descent, territory, among others), which -because they are potentially modifiable- are the object of public policy intervention. In particular, inequities in health at certain stages of life are key to later health outcomes, in addition to the fact that

inequalities accumulate throughout life, generating differential vulnerability to the conditions in which the lives of these individuals will be spent.

The cost of long-term care and the role of public health policies

Long-term care is the supportive activities developed by third parties that enable the person with a dependency to maintain a level of functioning that allows them to live their lives in accordance with their basic rights, autonomy, fundamental freedoms, and human dignity (WHO, 2016).

Individuals need long-term care because of a disability, chronic condition, trauma, or illness, which limits their ability to perform basic self-care or personal tasks that they must perform every day. Thus, the difference between long-term care and health care differs in that while health care in general consists of modifying the health condition (from unwell to well), long-term care simply aims to make the current condition more bearable (Oliveira Martins & Maisonneuve, 2015).

The issue of long-term care is of great relevance to healthcare systems because the healthcare sector has a key role to play in the prevention and treatment of disability, in the consequent containment of the current rise in dependency[4], and because there are significant costs to the healthcare system. These costs are the costs associated with unpaid (volunteer) caregivers and the costs of the public policies needed to address this issue.

Although the difference between health expenditure on general care and expenditure on long-term care for the treatment of dependency is that the cost of the latter per beneficiary is practically independent of age (Oliveira Martins & Maisonneuve, 2015), disability is associated with age, especially for those over 65 years of age. Furthermore, according to Zweifel's "red herring", healthcare costs are concentrated in the last (two) years of life (Zweifel et al., 1999; Breyer & Lorenz, 2019). With an aging population, even without long-term care programs, at the macro level, "normal" costs will increase in the future.

The determinants driving the cost of long-term care are the same as those driving health care in general: demographic and non-demographic (Oliveira Martins & Maisonneuve, 2015). Demographic determinants refer to the number of dependent persons which depends on the evolution of life expectancy and health expenditure. The non-demographic determinants are first related to the evolution of income since income is assumed to have a direct effect through the increase in the standard of living and an indirect effect through

[4]Based on the conceptualization of the World Health Organization (WHO), the dependency of interest here occurs when the older adult is no longer able to independently carry out basic activities of daily living and requires assistance to perform them because the deterioration of the abilities in question can no longer be compensated by other elements of his or her environment.

cost-illness effects. And second, with changes in the demand for publicly funded long-term care services.

With the rapid increase in long-term care needs, the negligible role of the market, and the decreasing role of informal family care, from the theoretical perspective addressed throughout the thesis, one would expect the government to take a more proactive role in supporting dependent elderly people, especially those who cannot, for whatever reason, rely on the help of their family (Pestieau & Ponthiere, 2018).

Today in most advanced economies, the state participates in the provision or financing of long-term care services, but to an extent that varies greatly from one country to another and is not as extensive and generous as the financing of general health services.Most countries have struggled to develop systems that ensure access to quality long-term care services that meet growing health and care needs and are consistent with basic rights (as cited by WHO (2020)).

In Mexico, based on the agreement of the Consejo de Salubridad General (SEGOB, 2018) on the design and implementation of public policy for the granting of long-term care by the institutions of the Sistema Nacional de Salud, long-term care is defined as that granted to "persons who, for reasons derived from age, illness or disability, have a lack and/or loss of physical, mental, intellectual or sensory autonomy, require the attention of other people to carry out their daily life activities, in the case of people with intellectual disabilities or mental illness, require other support for their personal autonomy".

Empirical evidence

This section presents studies related to the impact of non-contributory health insurance on the functionality or progression of disability in older adults. First, the meaning of functionality or disability progression, its components, measurements, and determinants, as well as the elements involved in the persistence of its alterations over time are delimited. Subsequently, the factors on which the effect of non-contributory health insurance has been documented are reviewed and the research that has evaluated these various indicators (labor supply, allocation of resources within the household, mental state, poverty, among others) is highlighted.

Disability is a process that is affected by individual conditions and also highlights cultural and social differences between nations (Chan et al., 2011). Unfortunately, there is no standard measure of disability that is consistently used by social or medical researchers (Mcdermott & Turk, 2011), and its calculation is confounded by different methodologies and by viewing disability only as a process in which the individual has no chance to recover partially or fully (Freedman et al., 2004).

In older adults, disability is usually measured by the presence of physical limitations. These limitations refer to difficulties in performing activities of daily living (ADLs) such as bathing, dressing, toileting, getting in and out of bed, and eating (Mlinac & Feng, 2016). Transitions from healthy aging to disease and disability are expressed through the disability process. This process is modeled as a progression of a healthy individual moving from limitations in lower extremity functions (mobility) such as climbing stairs, walking, and carrying heavy objects, to limitations in instrumental activities of daily living (IADLs) including preparing meals, shopping, taking medications, managing money, and/or the aforementioned basic activities of daily living (ADLs), and limitations in all three areas (Verbrugge & Jette, 1994).

The progression of disability is linked to socioeconomic conditions, particularly poverty, in a vicious circle: disability increases poverty and poverty increases the chances of being disabled (Mitra et al., 2011). Countries with low inequality can provide more resources, social capital, and a better overall quality of life and, as a result, generate cohesive societies better able to cope with physical limitations (Wilkinson, 2000). In addition, cultural differences within a country tend to assign gender roles that influence behavior, attitudes, and the way men and women approach disability (Zunzunegui et al., 2008).

However, as mentioned above, there is little information on disability and how the elderly population, especially in developing countries, move from healthy aging to disability (Eide & Loeb, 2005).

Barrantes-Monge et al. (2007) explored, based on the MHAS, the relationship between chronic diseases and functional capacity (the inverse way of treating disability) for the Mexican case. The authors found that the prevalence of functional dependence is high among Mexicans older than 65 years, that joint disease, cerebrovascular disease, cognitive impairment and, depression were associated with dependence in ADLs and IADLs; that is, they showed that chronic conditions are closely associated with functional dependence and thus provide a perspective for developing preventive measures.

Rodriguez et al. (2020), through the MHAS Fact Sheet:20-1[5] reports that, currently, Mexican adults spend more years of life with physical limitations, that among Mexican older adults the number of limitations per person is also increasing in an environment where low education and socioeconomic status are associated with higher levels of disability in late life; furthermore, that Mexican older adults with obesity, underweight or diabetes are more likely to suffer a disability.

Also in Mexico, older women develop more disabilities and deteriorate more rapidly than older men; between 2001 and 2012, disability in ADLs increased among adults aged 50 and older, and the risk of

[5] http://www.mhasweb.org/images/MHAS-20-1-AgingInMexico_Disability04132020.pdf

disability doubles between the ages of 65 and 85; however, recovery from a disability is possible; approximately 60% of older adults with an ADL limitation went on to have no ADL limitations within two years; having more chronic diseases and being underweight or obese are associated with disability; Mexicans have a higher prevalence of ADL disability (16%) than their Mexican-American counterparts (13%); and, migrant women returning to Mexico from the U.S. have 1.7 times the prevalence of ADL disability as their Mexican-American counterparts (13%); and, migrant women returning to Mexico from the U.S. have 1.7 times the prevalence of ADL disability as their Mexican-American counterparts (13%). Women migrants who return to Mexico from the U.S. are 1.7 times more likely to be disabled than those who have never migrated (as cited in Rodriguez et al. (2020)). In particular, these facts are in line with and congruent with the interest of this thesis.

Worldwide, also cite Rodriguez et al. (2020), more than 40% of adults aged 60 and older have physical limitations, including hearing and visual limitations; people aged 60 and older with disabilities are more likely to be frail; and memory loss, depression, illness and poverty can increase the risk of disability in older adults. Additionally, in the United States, the developed country geographically closest to Mexico and with almost universal health care, disability has increased in proportion to the aging of the population.

For developed countries, the impact found is that not having health insurance is associated with increased mortality because it increases the probability of dying by 26% (Woolhandler, 2017; Wilper et al., 2009); moreover, having health insurance is associated with better diagnosis and, therefore, treatment of chronic diseases, as it decreases the mortality rate by 6.3% (McWilliams et al., 2004). In this regard, the impact of health insurance enrollment for low-income, uninsured adults in the United States was also found to be associated with a reduction in the prevalence of undiagnosed depression by almost 50%, of untreated depression by more than 60%, of the proportion of respondents reporting unmet mental health care needs by almost 40% (Baicker et al., 2018b), and an increase in medication use (Baicker et al., 2018b); (Baicker et al., 2017), significantly reduced the proportion of respondents who reported needing dental care or having unmet dental care needs (Baicker et al., 2018a), an increase in the use of urgent care and emergency services (Finkelstein et al., 2016); (Taubman et al., 2014) found no significant effect on employment or income (Baicker et al., 2014), did not generate statistically significant improvements in physical health outcomes measured in the first two years, but generated higher use of medical care, higher rates of diabetes detection and management, lower rates of depression (Baicker et al., 2013), and in the first year, the treatment group had substantial and statistically significantly higher health care utilization (including primary and preventive

care as well as hospitalizations), lower out-of-pocket medical expenses and medical debt (including fewer bills sent to collections) (Finkelstein et al., 2011).

In the case of developing countries, the evidence is scarce and inconclusive. First, it shows that, having health insurance is associated with a reduction in infant mortality of 7% in poor municipalities in Mexico (Conti & Ginja, 2016), in Costa Rica the reduction in infant mortality with higher health insurance is not explained. And regarding the mortality rate in adults over 60 years of age, there are mixed results for Taiwan: null effect (Chen et al., 2007) and decreased risk of dying (Chang, 2012).

Regarding the incidence in utilization and catastrophic spending previous studies on the impact of Seguro Popular found an increase in the utilization of health services: a positive impact on consultations, hospitalization (Parker et al., 2018a), more limited effects on treatment, conditional of being sick (Parker et al., 2018a; Rivera-Hernandez et al., 2016; Parker et al., 2018b), an 18% increase in consultations (Arenas et al., 2015) and an increase in the in receipt of diagnostic tests (Parker et al., 2018b). In addition, a reduction in health expenditure of between 36 and 43% was found (Avila-Burgos et al., 2012; Grogger et al., 2014). And regarding health incidence, the evidence, on the one hand, indicates that, in general, there are no effects (Barofsky, 2011), an increase in diabetes treatment (Sosa-Rubí et al., 2009; Rivera-Hernandez et al., 2016; Parker et al., 2018a), a reduction in maternal and infant mortality by 7.1% (Knaul et al., 2012; Pfutze, 2014; Conti & Ginja, 2016), lower frequency in preterm birth (Strouse et al., 2016). Regarding labor supply, there is little evidence of any correlation between Seguro Popular and workers' decision to be employed in the formal or informal sector (Campos-Vázquez & Knox, 2013). They have also been found to have an effective positive average impact on Mexico's health resources (Huffman & Van Gameren, 2019) and constitute an effective solution to problems of coverage and inequity in services (Knaul et al., 2012).

The evidence showing that such chronic degenerative diseases have been investigated as determinants of health status is composed of research that uses them to measure their impact on self-reported health (Samper-Ternent et al., 2012) and mortality (Gonzalez Gonzalez et al., 2014). Research has also been conducted on life expectancy free of diabetes (Andrade, 2009), hypertension and depressive symptoms (García-Fabela et al., 2009).

The literature also offers several arguments on the usefulness of non-cash transfers (Case & Deaton, 1996), as is the case of non-contributory social programs and in particular of Seguro Popular. Even when taxes and lump-sum transfers are possible, donors (or taxpayers) are often thought to have preferences over the consumption pattern of recipients (Garfinkel, 1973). In second optimums, in-kind transfers may

be useful to correct other distortions (Guesnerie & Roberts, 1984) or to exclude undesirable beneficiaries (Nichols & Zeckhauser, 1982).

As can be seen, relatively little is known about the impact of health insurance and Seguro Popular on the avoidability of functional loss and its recovery over a long period. It is in this aspect that this thesis seeks to contribute.

Context

Data

The data source used is the Mexican Health and Aging Study (MHAS). This source of information was considered because it contains information on Mexican adults aged 50 years or older, which allows us to observe the socioeconomic and health characteristics of the group of interest.

The first edition of the survey was conducted in 2001, with national and urban/rural representation of adults born in 1951 or earlier. This baseline survey was conducted shortly before the implementation of Seguro Popular, thus providing a convenient baseline for the analysis in question. The original study sample consisted of households with at least one age-eligible resident. The eligible person and his or her spouse (regardless of age) were part of the study; the latter with the objective of ensuring follow-up of the former in case any difficulty made direct follow-up impossible. Given that the MHAS collects information on the subject of the study from before death, in some cases, it can provide information on up to a decade of life before the deceased. For example, it asks whether he or she had the right to receive medical care in a health care institution, which is also relevant in this research work.

Follow-up rounds were conducted in 2003, 2012, 2015, and 2018. Since the 2003 survey, respondents interviewed in 2001 were followed up even if they had moved or were deceased (in this case, a proxy respondent was interviewed, as planned). In 2012, a new sample of adults born between 1952 and 1962 was added to the study. Similarly, in 2018, a new cohort of those born between 1963 and 1968 was added.

The MHAS includes questions on basic and Instrumental Activities of Daily Living (ADL, IADL), which have already allowed exploring the relationship between chronic diseases and functional capacity, the impact of physical activity on disability, and disability and well-being among return migrants (as cited in Montes de Oca-Zavala & Nava-Bolaños (2021)). On the other hand, Díaz-Venegas et al. (2016) have begun to conduct research with longitudinal techniques also through the MHAS, with which they analyze

the progression of the disability hierarchy of individuals used in this thesis.

Given that the MHAS collects information on the study subject from before death, in some cases, it can provide information from up to a decade of life before the deceased. The MHAS offers the possibility of advancing the generation of knowledge in this sense, since, according to the document detailing its design, it is explicitly stated that it was constructed in a focused manner and recording the disability burden in detail.

It is worth mentioning that Seguro Popular pilot tests began to be implemented in 2003, but self-reported information on Seguro Popular enrollment is not available in MHAS until the next survey round that was conducted in 2012. To validate such self-reported information, Parker et al. (2018b) compare the number of Seguro Popular beneficiaries in the weighted MHAS data with the actual numbers of beneficiaries in 2012 according to administrative data; they find that, by age group and sex, Seguro Popular receipt is quite comparable for the population aged 51 to 65. For the population aged 65 and older, the number of beneficiaries is somewhat lower in the MHAS (about 16%) than according to the administrative data; with the latter finding, the authors note, a greater reporting bias among the older population could be suggested.

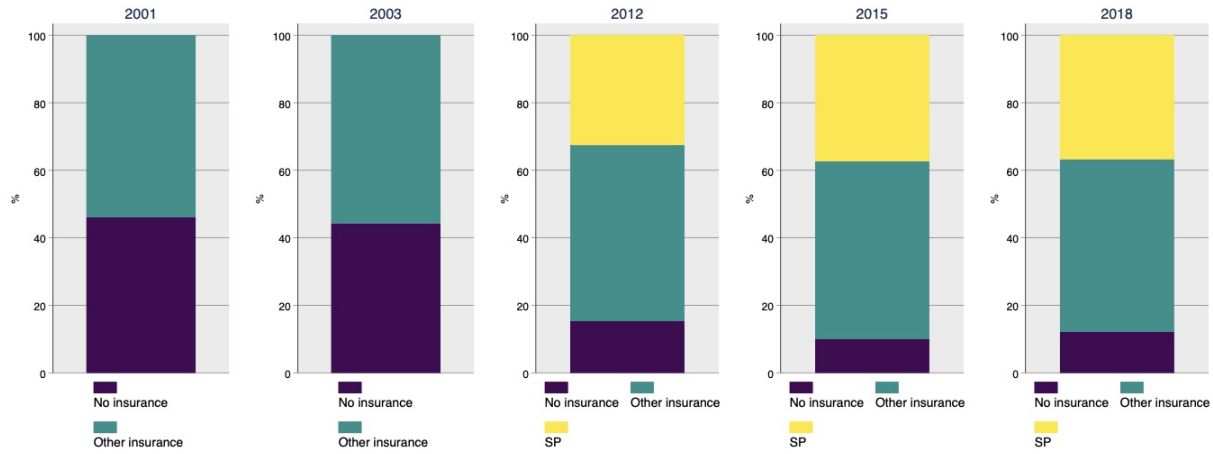
The main source of attrition in the MHAS is mortality (Orozco-Rocha et al., 2020), although given that other individuals in the study are lost to follow-up primarily due to inability to locate them and refusal to respond, there is possibly additional potential selection. The results of Parker et al. (2018b) suggest that the subsequent analysis conducted in this study, which restricts attention to individuals in the sample in 2003, 2012, and in 2015, is unlikely to be biased by differential attrition due to program participation. However, as expected, health and disability indicators are strong predictors of attrition, again through their effects on mortality. Despite the above, attrition occurs to a greater extent in the short period (Orozco-Rocha et al., 2020) and does not significantly interfere with our object of study that seeks to emphasize the long term. Thus, it is likely that those whom it was possible to re-interview are a selected sample of those who were in the original 2001 baseline; in particular, those who survive may be more likely to be younger and healthier in 2001 than those who dropped out of the sample, but by using the testimony of surrogate informants, the corresponding selection is avoided. The latter does not affect this research, since death is one of the elements of the indicator used here, following Díaz-Venegas et al. (2016), as a proxy for the impact of Seguro Popular affiliation.

The information contained in the MHAS makes it possible to perform an analysis and pose a question such as the one that concerns us here, in that sense, the following will illustrate the panorama of the progression of the disability and the characteristics of the individuals included in this research.

Health insurance coverage in Mexico for adults 50 years of age and over

Figure 3 shows the percentage composition of the population in the MHAS according to social security status (whether or not they are affiliated) throughout the different rounds of the MHAS. The population aged 50 and over who in 2001, before the creation of Seguro Popular, did not have any type of social security represented slightly more than 45%; more than any of its substitutes, the other types of health insurance. In 2003, the composition remained practically the same as in 2001. In the following years, the way in which Seguro Popular obtained affiliates is striking[6]. Figure 4 shows the behavior of the population affiliated to Seguro Popular over the years using administrative data.

Figure 3: Type of health insurance coverage for adults 50 years or older



Source: own elaboration with MHAS data.

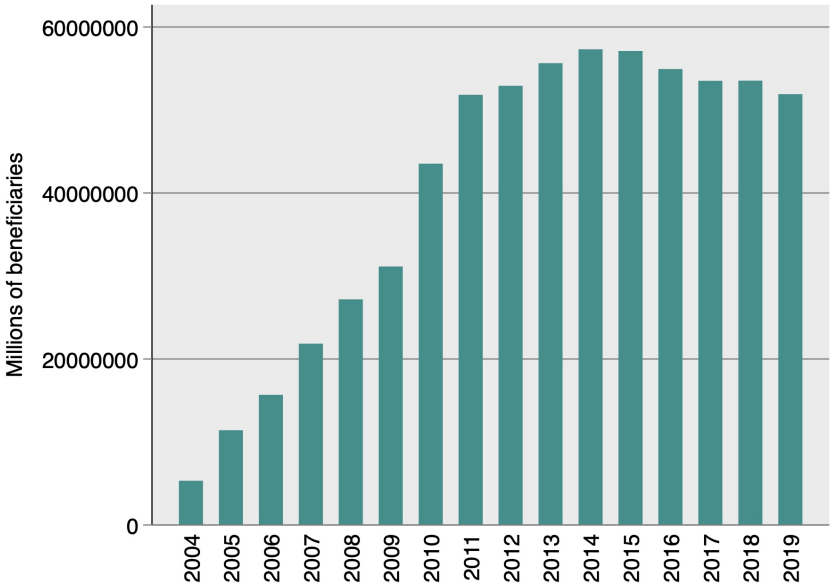
The enrollment of the population of interest to us according to the size of the locality, urban or rural, behaved in the same way as the expansion of insurance: first in urban and then in rural areas, with a growth of both expansions over time (see Figure 5).

Figures 6, 7 and 8 highlights that the Seguro Popular affiliation of the respondents, according to their level of education, consists mainly of people with primary education; in 2018 those with secondary education are increasing significantly. In this, as in the other socioeconomic aspects, it is important not to lose sight of the fact that these are adults aged 50 years or older, so the levels that characterize their socioeconomic status will most likely not change or will do so to a minimal and slow rate.

In this sense, the percentage of enrollees in the different health insurance plans in 2012 is shown in

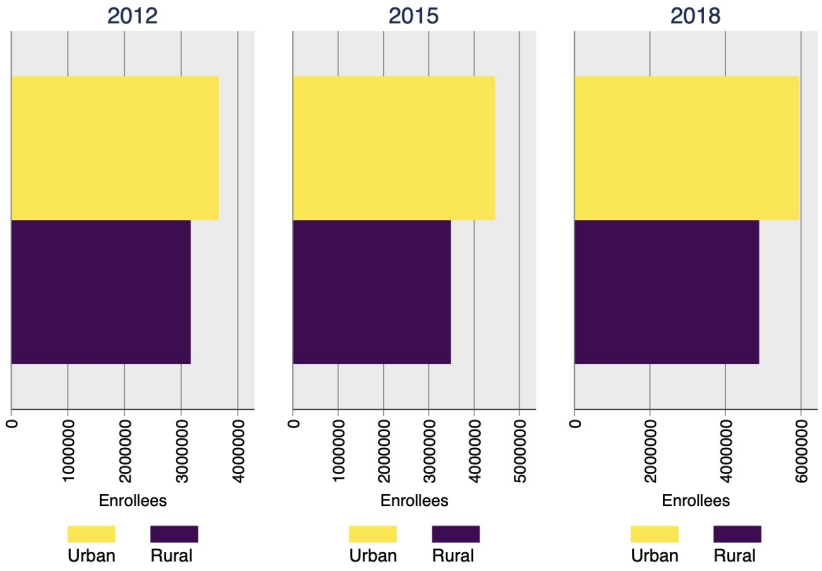
[6] Although Seguro Popular began to be implemented earlier, as mentioned above, the registration of self-declared enrollment it in MHAS began in 2012.

Figure 4: Number of Seguro Popular enrollees over time



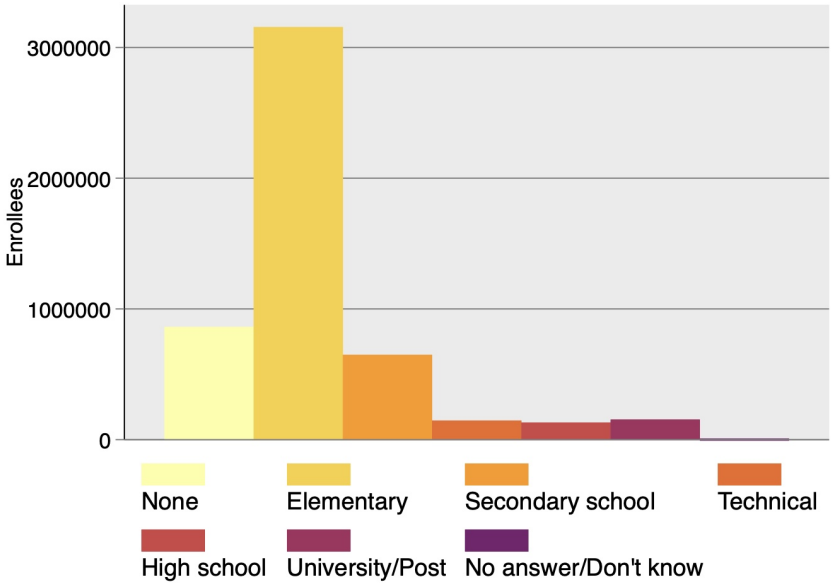
Source: own elaboration with Seguro Popular administrative data.

Figure 5: Seguro Popular enrollees by size of locality over time



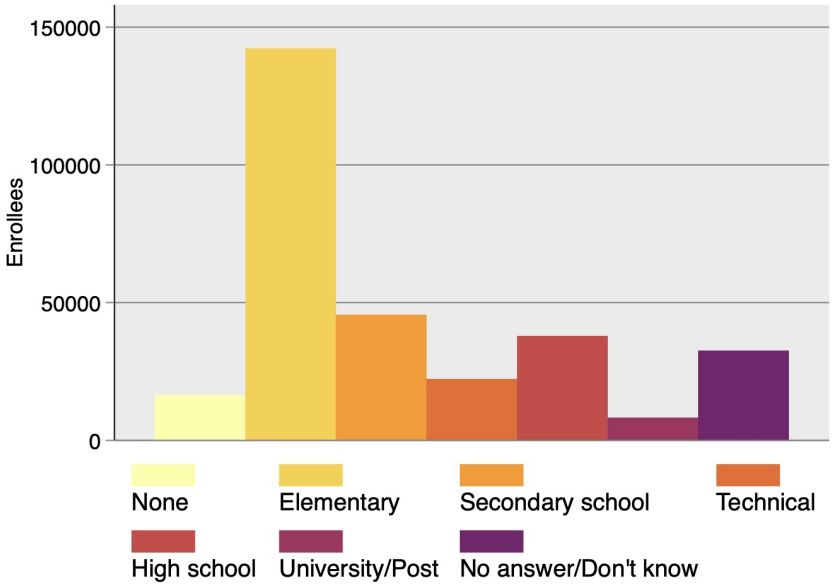
Source: own elaboration with MHAS data.

Figure 6: Seguro Popular enrollees by level of education in 2012



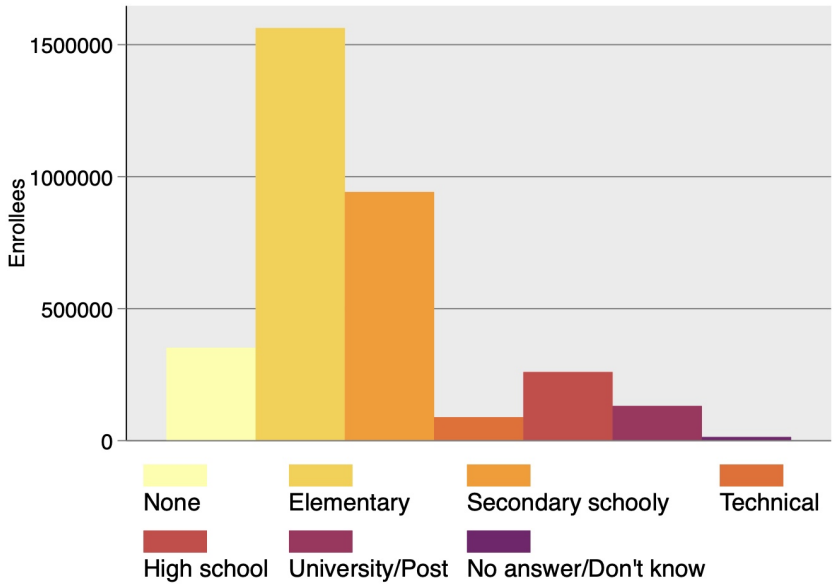
Source: own elaboration with MHAS data.

Figure 7: Seguro Popular enrollees by level of education in 2015



Source: own elaboration with MHAS data.

Figure 8: Seguro Popular enrollees by level of education in 2018



Source: own elaboration with MHAS data.

Figure 9.

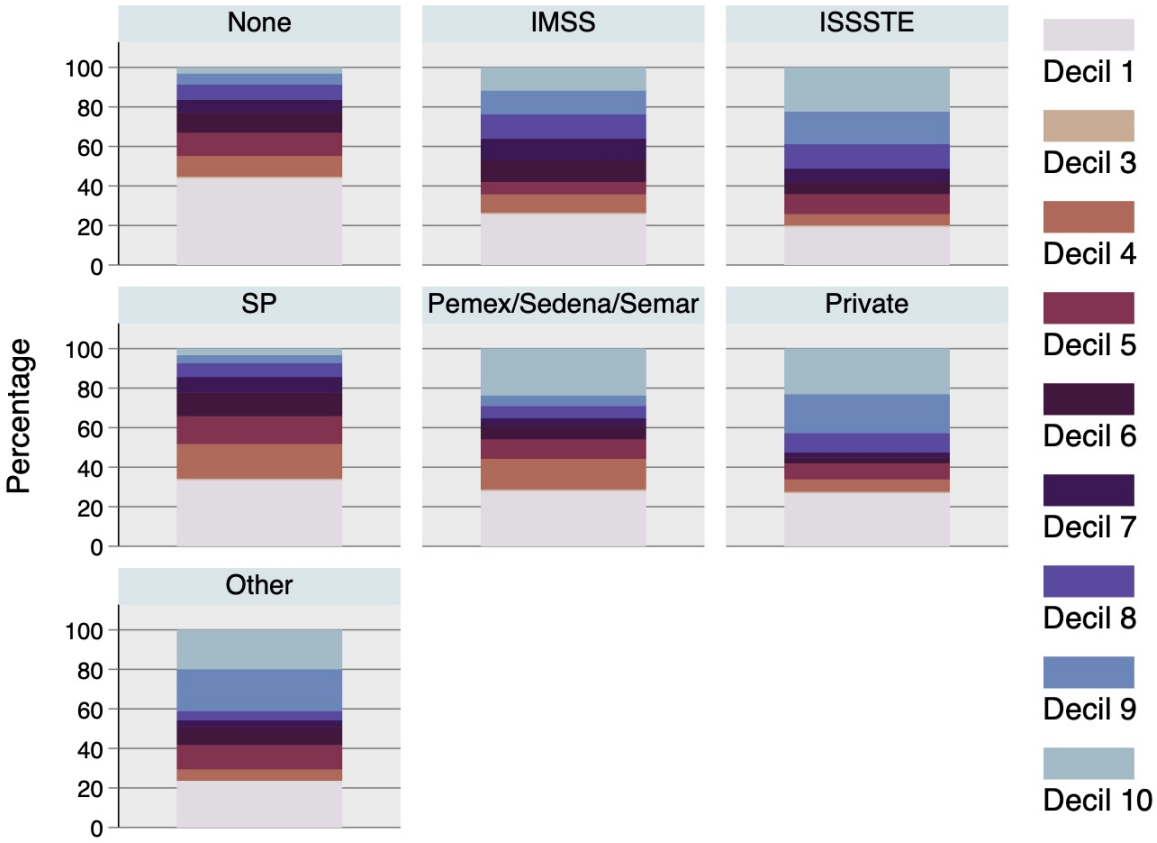
In this regard, it is also very clear that approximately 50% of those who do not have any type of social security correspond to the lowest income deciles 1 and 2; approximately 40% of those who have private health insurance or other types of insurance correspond to the two highest income deciles. In Seguro Popular, it is noticeable how those enrolled correspond to the lowest income deciles: more than 80% of those enrolled correspond to the 5 lowest income deciles.

Chronic degenerative diseases among adults aged 50 years and more

The chronic degenerative diseases self-reported in the MHAS are hypertension, diabetes, cancer, respiratory or pulmonary disease, heart disease or heart attack, and arthritis. All of these were taken into account in the different rounds of the survey. People suffering from a chronic degenerative disease or more were taken into account in the target population.

Table 1 shows that in the different rounds of the study, between 85% and 65% of the surveyed population (some follow-up) suffer from one or more chronic degenerative diseases. The reason that in some years there are variations in the percentages, in particular a decrease in the number of people suffering from these diseases, is logically due to the fact that the people who suffered from them have died and that, as mentioned

Figure 9: Enrollees in Seguro Popular and other health plans by income level in 2012



Source: own elaboration with MHAS data. Income decile 2 does not appear in this Figure because the calculation of the deciles shows that none of the respondents' income levels meet this category.

above, in certain rounds of the study the sample was updated.

Table 1: Percentage of people with or without chronic degenerative diseases (CDD)

	Year				
CDD or not	2001	2003	2012	2015	2018
No CDD	29%	35%	22%	15%	25%
At least one CDD	71%	65%	78%	85%	75%
Total	100%	100%	100	100%	100%

Source: own elaboration with MHAS data.

Table 2: Patients with CDD according to their health security since Seguro Popular began

	Type of health insurance in 2003							
CDD or not	None	IMSS	ISSSTE	SP	Pemex/Sede-na/Semar	Private	Other	Total
No CDD	39%	32%	33%	n/a	33%	35%	32%	34%
At least one CDD	61%	68%	67%	n/a	67%	65%	68%	66%
Total	100%	100%	100%	n/a	100%	100%	100%	100%
	Type of health insurance in 2012							
CDD or not	None	IMSS	ISSSTE	SP	Pemex/Sede-na/Semar	Private	Other	Total
No CDD	29%	18%	20%	21%	21%	22%	13%	20%
At least one CDD	71%	82%	80%	79%	79%	78%	87%	80%
Total	100%	100%	100%	100%	100%	100%	100%	100%
	Type of health insurance in 2015							
CDD or not	None	IMSS	ISSSTE	SP	Pemex/Sede-na/Semar	Private	Other	Total
No CDD	20%	11%	12%	17%	12%	10%	16%	14%
At least one CDD	80%	89%	88%	83%	88%	90%	84%	86%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Source: own elaboration with MHAS data.

Table 2 shows that in general, the distribution of people suffering from chronic degenerative diseases is similar among the different health insurance programs, very similar to the percentage distribution of the total. This is important, since those who do not have any type of health insurance, the potential population of the Seguro Popular, present the same picture as those insured by some public institution and even those with private health insurance. The next parts of the table records data from the time the MHAS began to register enrollment in Seguro Popular, shows a little more variation between having or not having diseases

Table 3: Disability levels of the population with or without CDD

	Variable measuring disability in 2003				
CDD or not	No	M[a]	M + IADL	M + ADL	M + IADL + ADL
No CDD	45%	30%	18%	19%	13%
At least one CDD	55%	70%	82%	81%	87%
Total	100%	100%	100%	100%	100%
	Variable measuring disability in 2012				
CDD or not	No	M	M + IADL	M + ADL	M + IADL + ADL
No CDD	27%	19%	11%	12%	10%
At least one CDD	73%	81%	89%	88%	90%
Total	100%	100%	100%	100%	100%
	Variable measuring disability in 2015				
CDD or not	No	M	M + (IADL or ADL)	M + IADL + ADL	Died
No CDD	19%	12%	9%	11%	14%
At least one CDD	81%	88%	91%	89%	86%
Total	100%	100%	100%	100%	100%

Source: own elaboration with MHAS.

[a]Here M is used as the acronym of Mobility.

Table 4: Age of the population with or without CDD in 2003

	Age range						
CDD or not	≤ 49	50-54	55-59	60-64	65-69	70-74	≥ 75
No CDD	50%	39%	39%	35%	33%	28%	26%
At least one CDD	50%	61%	61%	65%	67%	72%	74%
Total	100%	100%	100%	100%	100%	100%	100%

Source: own elaboration with MHAS data.

Table 5: Income decil of the population with or without CDD in 2003

	Income decil									
CDD or not	1	2	3	4	5	6	7	8	9	10
No CDD	32%	34%	35%	33%	33%	34%	34%	37%	36%	37%
Has at least one CDD	68%	66%	65%	67%	67%	66%	66%	63%	64%	63%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: own elaboration with MHAS.

Table 6: Self-reported of health by population with or without CDD in 2003

	Health quality					
CDD or not	Excellent	Very good	Good	Fair	Poor	No answer/Don´t know
No CDD	59%	63%	53%	30%	19%	50%
At least one CDD	41%	37%	47%	70%	81%	50%
Total	100%	100%	100%	100%	100%	100%

Source: own elaboration with MHAS data.

Table 7: Male and female population with or without CDD in 2003

	Type of chronic condition					
Gender	Hypertension	Diabetes	Cancer	Lung disease	Heart disease	Arthritis
Male	35%	42%	41%	43%	45%	32%
Female	65%	58%	59%	57%	55%	68%
Total	100%	100%	100%	100%	100%	100%

Source: own elaboration with MHAS data.

such as the ones we are concerned with within the population of the different types of health insurance. Those without insurance appear to be healthier, although since 2003 with greater emphasis on the later rounds of interest. These and other differences in characteristics will be taken into account in the subsequent analysis.Concerning the population enrolled in Seguro Popular, the percentages are very similar and in some cases lower than those of the other institutions; however, the difference between the care provided for these diseases can be significant and can manifest itself through the different levels of disability or in the lack of disability despite suffering from them.

The breakdown of the different types of health insurance in Table 3 and other tables below are considered because their similar characterization justifies taking social insurance together (along with private insurance, because of its small size) in the empirical analysis below.

The variable that captures the level of disability at the pre-treatment time, in 2003, is composed of five progressive values that measure: (a) no limitation, (b) limitation only in mobility, (c) limitations in both mobility and IADLs, (d) limitations in both mobility and ADLs, and (e) limitations in all three. The variable capturing disability status in 2015, post-treatment time, is also composed of five categories that correspond progressively to: (a) zero disabilities, (b) one (mobility only), (c) two (mobility + IADLs or mobility + ADLs), (d) three (mobility + IADLs + ADLs), and (e) death[7]. The difference between the two is due to the

[7]The figures and tables illustrating the different levels of limitations in the thesis do not show the values corresponding to the

fact that what is intended to be measured is the progression of the disability and the changes between them would reflect this progression.

Thus, with regard to the levels of disability of those suffering from chronic degenerative diseases or not, Table 3 is presented for the 2003, 2012 and 2015 rounds. In descriptive terms, it is observed how higher levels of disability correspond to higher percentages of chronically ill. Moreover, this pattern is increasing over time, as is understandable in a context where, in general, interventions to prevent or reduce disability are insufficient. Of course, we should not lose sight of the use of panel data[8] in this thesis.

In addition, in an attempt to complete the analysis of the context in which this research was carried out, the main characteristics of the population with chronic degenerative diseases are presented. This characterization of the population of interest is done for the year 2003 because it is the pre-treatment year before any effects could be present; however, it is also important insofar as the variables described in the subsequent tables will be used later in the development of the methodology[9], will be accounted for in the (first -matching-stage of the) empirical analysis.

Table 8: Occupational categories by population with or without CDD in 2003

	CDD or not		
Occupational categories	No CDD	At least one CDD	Total
No answer	31%	69%	100%
Managers, professionals and middle managers	42%	58%	100%
Non-routine manual	52%	48%	100%
Commerce	39%	61%	100%
High-skilled manual	39%	61%	100%
Low-qualification manual	46%	54%	100%

Source: own elaboration with MHAS data.

Table 4 shows that, in 2003, people suffering from chronic degenerative diseases increased as a proportion of the total as the different age ranges moved up. This behavior is logical; we are dealing with chronic and degenerative conditions.

Tables 5 and 6 show that, on the one hand, respondents with higher income in aggregate terms were

death condition collected in the 2015 disability level measurement because it is the only data available when an individual's death is recorded in a given round. However, given that for Propensity Score Matching the variables used correspond to 2003 and, given that the variables capturing disability levels have all the information it requires, the information corresponding to the condition "dead" is available for the analysis.

[8] Although it is not a "pure" panel data sample because of the sample updates mentioned in the previous subsection; nor is it a "balanced panel" set because there is also attrition (and this is not necessarily due to death).

[9] Although important, the variable indicating the size of the locality is not available for 2003.

Table 9: Depressive symptoms by population with or without CDD in 2003

	Number of depressive symptoms								
CDD or not	0	1	2	3	4	5	6	7	8
No CDD	47%	40%	36%	35%	35%	30%	25%	24%	20%
At least one CDD	53%	60%	64%	65%	65%	70%	75%	76%	80%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: own elaboration with MHAS.

Table 10: Population with or without CDD by grade of education in 2003

	CDD or not		
Grade of education	No CDD	At least one CDD	Total
None	32%	68%	100%
Primary	34%	66%	100%
Secondary(Junior High)	36%	64%	100%
Technical or Commercial	39%	61%	100%
Preparatory or High scool	46%	54%	100%
Basic teaching school	38%	62%	100%
College	45%	55%	100%
Graduate	39%	61%	100%
No answer/Don´t know	10%	90%	100%

Source: own elaboration with MHAS data.

less likely to report chronic degenerative diseases, while self-reported health status seems to have an inverse relationship with the condition of suffering from these diseases. The percentage of those reporting poor health status doubled if they suffered from at least one of these diseases and, those reporting good health status decreased by just over half. The percentages corresponding to excellent or very good health are low in themselves; however, they are lower for those suffering from the diseases.

The percentage of women suffering from this type of disease is higher, by approximately 10%, than that of men (see Table 7).

According to occupation, Table 8 does not show a single pattern in terms of the different occupational hierarchies; what is clear is that individuals engaged in non-routine manual activities and those in jobs requiring lower qualifications are those who suffer most from the diseases we are concerned with.

For the variable accounting for the number of depressive symptoms presented by individuals, shown in Table 9, following Díaz-Venegas et al. (2016), the 8-item scale used in the MHAS was used to measure the number of depressive symptoms. Included in the MHAS are eight questions about whether respondents experienced certain depressive symptoms most of the time during the past week (0=no, 1=yes). The items are: feeling depressed, feeling that everything is an effort, sleeping restlessly, feeling happy, feeling lonely, enjoying life, feeling sad and, feeling tired. Two of the items feeling happy and enjoying life are reverse coded so that the symptoms are comparable. Each of the eight symptoms corresponds to dichotomous variables that were summed to generate a score with values between 0 and 8. The number of depressive symptoms presented increases as the proportion of people reporting one or more chronic degenerative diseases increases.

Table 10 shows that the proportion of people suffering from the diseases we are interested in decreases as the level of schooling increases. Only in the case of those who have studied up to university level does it decrease concerning the group with a lower level of schooling. In addition, as is understandable, the group of people who report not knowing their school grade has the highest percentage of chronically ill people.

Methodology

Measurement of disability progression in adults aged 50 years and older

The variable through which the measurement of the effect on the change in the level of disability of individuals will be approximated was constructed following Diaz, Reistetter and Wong (2015).

Three health-related measures are used to construct the disability progression. First, a modified version of the Katz ADL Index is used in the form of a score between 0 and 5 that measures whether the respondent needed assistance with bathing, dressing, eating, toileting, and transferring in and out of bed. Second, a similar score between 0 and 4 for ADLIs that measures whether the respondent needed help preparing meals, taking medication, shopping or clothing, and managing money. And third and last, the Rosow-Breslau functional health scale was included as a mobility score between 0 and 3 to measure whether the respondent needed help climbing a flight of stairs, walking a half mile, or lifting heavy objects.

Each of the above variables was dichotomized: a value of 0 was assigned if the respondent did not need assistance and 1 otherwise. After having the three mentioned measures, the variable measuring the level of limitation was created.

Thus, the variable measuring disability includes five categories for each year. In 2003, respondents with no limitations in ADLs, IADLs, or mobility receive a value of 0, respondents with a limitation only in mobility a value of 1, respondents with limitations in both mobility and IADLs a value of 2, respondents with limitations in mobility and ADLs a value of 3 and, respondents with limitations in mobility, ADLs and IADLs one of 4. In 2015, respondents with no limitations in ADL, IADL, or mobility receive a value of 0, respondents with a limitation only in mobility one of 1, respondents with limitations in both mobility and IADL or mobility and ADL one of 2, respondents with limitations in mobility, ADL and IADL one of 3 and, respondents who die one of 4. Death is considered as a natural progression in the model, it is considered as the worst and last outcome[10]. Including death, as indicated by Diaz, Reistetter, and Wong (2015), reduces the possibility of having a survival selection bias[11]. Thus, respondents who start with any level of disability at the pre-treatment time may “progress” at the post-treatment time to a worse state.

The approximation

As mentioned above, the effect is measured on the different levels that make up the progression of disability. The measurement in question is intended to be an approximation of the measurement of the impact on the quality of life, particularly the Health-Related Quality of Life (HRQoL), of the elements of the population of interest here.

[10]These values are illustrated in Table 3

[11]Despite this, an interesting reflection results when thinking about it from another angle: including death as the last outcome eliminates the survival bias, but perhaps introduces a "death bias" instead. That is, if one group is more likely to die younger, the fact that it jumps from any level of disability to the last may override the more gradual deterioration of the survivors.

Patrick et al. (1993) propose a widely cited definition of HRQoL. According to it, it is defined as the value placed on the length of life and its modification by impairments, functional status, perception, and social opportunities that are affected by illness, injury, treatment, or policy. The authors define it as: "The extent to which the value placed on the length of life is affected by the perception of physical, psychological and social limitations and diminished opportunities due to illness, its sequelae, treatment and/or health policies". Despite the different approaches to this definition, it is clear that it is based on an individual's perception of his or her well-being, which is multidimensional and includes the current health situation and the outlook for the future.

Thus, this thesis uses an indicator that reveals individual but also additive changes in the health status of a population, thus reflecting the impact generated by a health system (Patrick et al., 1993; Murray et al., 2003) on it. I see this as a health status variable that has the potential to show the indirect economic effects (albeit modulated by other types of effects) of membership status and its efficiency. I study the effects on disability of individuals with chronic degenerative diseases through non-contributory health insurance conditional on self-reporting of having a disease. Note that because the database used is a survey, only those who self-report having a disease are considered within the target population; therefore, the estimate does not include individuals who are sick but do not know it. However, according to Parker et al. (2018b), even if the results only reflect the impact on disability of those who are aware of their condition, there appear to be few observable predictors of individuals' unawareness of their health status.

The results obtained of the calculation of disability progression are presented through the percentage of individuals according to their health insurance status in Tables 11 and 12.

Table 11: Disability levels by type of health care service in 2003

	Type of health insurance in 2003						
Variable measuring disability	None	IMSS	ISSSTE	Pemex/Sedena/Semar	Private	Other	Total
None	48%	46%	47%	52%	57%	45%	47%
Only in mobility	40%	41%	40%	39%	31%	42%	41%
In mobility and IADL	3%	3%	3%	2%	2%	3%	3%
In mobility and ADL	4%	5%	5%	4%	4%	4%	5%
In mobility, ADL, and IADL	4%	4%	4%	3%	5%	6%	4%
Total	100%	100%	100%	100%	100%	100%	100%

Source: own elaboration with MHAS data.

Table 12: Disability levels by type of health care service in 2015

Variable measuring disability	Type of health insurance in 2015							
	None	IMSS	ISSSTE	SP	Pemex/Sedena/Semar	Private	Other	Total
None	39%	33%	34%	32%	36%	52%	37%	34%
In mobility	36%	39%	39%	41%	43%	31%	43%	40%
In mobility + IADL/mobility + ADL	15%	16%	15%	16%	11%	10%	15%	16%
In mobility, ADL, and IADL	10%	11%	12%	11%	11%	8%	5%	11%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Source: own elaboration with MHAS data.

From Table 11, it is striking how in 2003, those who were not affiliated to any health insurance had more or less the same proportions for the progression of disability; that is, there is a difference, but not as marked as in Table 2 where what is taken into account is whether or not one suffers from a chronic degenerative disease.

Despite the limitations that the indicator to be used may have concerning other HRQoL indicators, the considerations that were taken into account in deciding to use it as the scenario through which the impact would be measured essentially fall on the need to use the MHAS. In addition to the ability to exploit its conceptual framework, this survey would ensure external validity due to its ability to represent the population in question, is longitudinal, has an acceptable response and follow-up rates, and is internationally comparable.

Identification Strategy

To answer the question of whether or not the intervention materialized in the implementation of Seguro Popular was effective, a "natural experiment" is studied; this is a quasi-experiment in which the assignment of the treatment is not carried out by the researcher but by an "exogenous agent". In the case of the implementation of Seguro Popular, this is a sectoral public policy. The comparison of the results found in the group or groups affected by the treatment, concerning the control group or groups (the counterfactuals) or those not affected by the treatment, makes it possible to predict the possible effects of a policy with certain characteristics and in a given environment. In a randomized clinical trial (RCT) with two groups, the propensity score of the patients depends on the randomization of the exercise: if the experimenter decides to enroll a certain percentage in the treatment and the rest as control, randomly, this is how the propensities would be distributed. However, in the absence of randomization, the probability of receiving a given

treatment is different among study members; this probability is the propensity score and is, therefore, a number that takes any value between zero and one (Ojeda et al., 2016). In the exercise developed in this thesis, the propensity score matching and Differences-in-differences methods together are assumed to solve the potential endogeneity problems.

The method that will be used to estimate the effect of interest is the Differences-in-Differences method, which compares changes in a group unaffected by the policy intervention with changes over time in a group affected by the policy intervention and attributes the "difference-in-differences" to the effect of the policy. Differences-in-differences before-after estimators have the advantage, compared to cross-sectional after-program estimators, of allowing selectivity in the program to be based on fixed unobserved attributes, as fixed-effects methods do. The Differences-in-Differences method compares the outcome variable pre-and post-treatment between the treated group and one or more comparison groups called the control group under the assumption of "parallel trends" between the compared groups over time.

In principle, the treatment group consists of individuals enrolled in Seguro Popular; the treatment is such enrollment. However, the identification of the control group in this exercise is not trivial. The control group has to be counterfactual, it has to represent what would have happened to the treated subjects if they had not received the treatment.

One way to obtain a control group is through the econometric technique known as matching. The matching method consists precisely in matching certain elements of the treatment group with similar elements of the comparison population based on certain observable characteristics. The matching identification assumption consists of conditioning based on the selected observable characteristics so that the assignment of an element (individual) to the treatment is random. The implicit assertion is that unobservable variables (not contained in X) play no role in treatment assignment.

Often exact matching on the characteristics selected as potential covariates is not feasible, largely because of the so-called problem of the dimensionality of observable characteristics. This problem consists in the fact that, as the number of characteristics intended to determine the selection of items comparable with the items exposed to the treatment increases, it becomes increasingly difficult to find a sufficient number of observations for each of the interactions of the relevant characterstics. A widely used solution proposed by Rosenbaum & Rubin (1983) to the above problem is the matching of items based on a single index or propensity score. This single index summarizes all relevant information contained in the X covariates. Matching based on this index is equivalent to matching on the X, i.e., for a given value of the index the distri-

bution of X should be the same for treatment participants and non-participants (this is called the propensity score theorem). Then, to reduce the problem of covariate dimensionality the propensity score is used which reflects the probability of receiving the treatment conditional on the covariates reflects the probability of element participation in the treatment, and being comparable with these could achieve consistent estimates of the treatment effect.

Thus, in this thesis, the control group chooses through this specific form of matching called propensity score matching. The idea is to match participants to non-participants with the same observed characteristics so that the difference in the outcome variable between the two should be due to treatment status alone. Propensity score matching serves to ensure that, at baseline, the treatment and control groups are comparable. It compensates for any initial differences and ensures that the difference-in-differences method can focus on changes over time, under the assumption of common (or parallel) trends for initially comparable individuals. If the key assumption of this technique is met, one can interpret the estimate of differences in outcomes conditional on X as a causal effect.

In summary, the individual (endogenous) decision to enroll in SP based on individual health care needs is constrained by the planned deployment of Seguro Popular in states and municipalities and the implicit efforts to enroll all eligibles in the area (without negative consequences), making individual enrollment quite random. Controlling for observable differences (through the propensity score matching method) along with the elimination of time fixed effects (through the Differences-in-differences method) helps to further contribute to the assertion of the randomness of the final treatment/control groups. Thus, the use of both propensity score matching and difference-in-differences estimation strengthens the identification strategy.

The treatment group consists of individuals who in 2012 reported being enrolled in Seguro Popular. The two potential comparison groups of interest are those without health insurance through the panel and those with health insurance other than Seguro Popular in the same period.

The first control group is made up of individuals who in 2003 were not enrolled in Seguro Popular and at the end of the panel were not enrolled in Seguro Popular either, even if they reported being enrolled in some other health insurance. The comparison with this group, on the one hand, can better approximate the impacts of the program given the context in which Seguro Popular was introduced (Parker et al., 2018b), a context in which several health insurance alternatives already existed, including contributory social security[12], and in which workers move between the formal and informal sectors (Calderón-Madrid, 2000). However, on

[12]IMSS, ISSSTE, state, parastatal sector and development banks.

the other hand, using all individuals without Seguro Popular as a comparison group may underestimate its impacts relative to the potential counterfactual of not having any other health insurance (for example, in a context with few jobs available in the formal sector there would be more potential users of Seguro Popular so its effect could be diluted).

The second control group used here is the group of individuals without health insurance both at baseline and in 2012. This group is considered taking into account that, first, one of the conditions for affiliation to Seguro Popular was not being a beneficiary of any other type of social security; second, that the previous chapters of this thesis identify the possibility of a more significant impact on the affiliation status of lower-income individuals (since for them both social security and private health are more inaccessible); and, third, given that a central feature of the social program under study is financial protection against catastrophic health expenditures[13], it is arguably an expected result that the economic impact of Seguro Popular has not been as large or radical and, therefore, it might be difficult to detect its effect in comparison with other health insurances.

Thus, one analysis considers respondents who at baseline (2003) had health insurance other than Seguro Popular, or none at all. And a second analysis considers respondents who at baseline (2003) had no health insurance. Respondents who remained in that situation in 2012 form the control groups, while those who had switched to SP in 2012 form the treatment group.

Making the two comparisons described above has the advantage that it will allow proximity to the economic aspect of this thesis: the progression of disability calculated for each group will allow us to exploit their main differences, which will give a clearer idea of the impact we are interested in.

Econometric specification

Propensity score estimation is performed using logistic regression, which is a specific functional form useful for estimating "discrete choice" models. A logistic regression is run where the outcome is 1 if the treatment is received and zero if it is not received. Subsequently, based on the $E[T|X]$ propensity scores are obtained. Thus, some matching algorithm is then run to create the comparison group(s); in our case, the algorithm is the so-called Nearest Neighbor. Subsequently, all treatment observations whose propensity scores were higher or lower than the maximum and minimum scores of the control group will be removed from the analysis to meet the common support condition (Heckman et al., 1997). The assumption for matching to

[13] Incurred by paying more than 30 percent of disposable income on health.

work, in addition to the selection-on-observables addressed in the previous section, is the Common Support: if there are individuals in both groups with similar propensity scores, then matching is feasible.

The strategy is to match treated units with comparison units whose propensity scores are close enough to be considered. Once propensity scores have been calculated, balanced intervention and comparison groups are created by one-to-one matching.

The main obstacle that this empirical analysis had to overcome is the potential endogeneity of individuals to participate in Seguro Popular. This fundamental issue, widely reported in the literature, is based on the fact that we are investigating a treatment that was not randomly assigned; it is a planned experiment. That is, there may be characteristics of the individuals that determine their enrollment in the program and therefore also determine the observed impact on the variable of interest. As the theory indicates, in this case, comparing the mean of the variables of interest between beneficiaries (treatment group) and non-beneficiaries (control group) of Seguro Popular would produce a biased estimator of the mean effect of the program(Rosenbaum & Rubin, 1983).

After demonstrating that the assumption of conditional independence and a sufficient region of common support is met, the difference in scores between the treated individual and the weighted comparison group is calculated, with the weight generated by the score distribution in the region of common support.

Then, for the strategy of identifying the impact of Seguro Popular, we used propensity score matching estimators on Differences in Differences.

Since it is not enough to find an estimator, it is also necessary to know the precision of that estimator, the standard errors are calculated at the end. Bootstrap methods are generally used to obtain the standard errors of the estimators; we do so here using the nonparametric bootstrap. Because propensity score matching is used, the estimated variance of the treatment effect must include the additional variance of the score estimate.

The Difference the Difference-in-Differences estimator is:

$$E(y_{i2015} - y_{i2003}|intervention_j = 1) - E(y_{i2015} - y_{i2003}|intervention_j = 0)$$

where 2015 = post-treatment, 2003 = pre-treatment and $j = \{1, 2\}$ because 1 and 2 indicates of the unique intervention for each control group. So, we could match the treatment subjects and the control subjects based on pre-treatment characteristics, characteristics.

The estimation of propensity scores is performed using first a binary model to estimate γ_0 and γ_1:

$$P(intervetion_{j,i} = 1|X_i) = G(\gamma_0 + \gamma_1 X_i)$$

where $G(\cdot)$ here a logit link. The predicted values of the propensity scores $\hat{PS}_i$ are then calculated:

$$\hat{P}(intervention_{j,i} = 1|X_i) = G(\hat{\gamma_0} + \hat{\gamma_1} X_i) = \hat{PS}_i$$

with

$$intervention_{j,i} = \begin{cases} 1 & \text{if respondent } i \text{ has SP in 2012 in sample } j \\ 0 & \text{if respondent } i \text{ does not have SP in 2012 in sample } j \end{cases}.$$

The covariates used in the propensity score matching procedure, in X_i are personal characteristics, socioeconomic characteristics and, health status characteristics in 2012. Covariates are age, income decile (decile 1 to decile 10), gender, occupational category (Managerial, Professional and Middle Management, Non-routine Manual, Trade, High Skilled Manual, Low Skilled Manual, and Ignored as the reference category), educational level (Elementary, Secondary, Technical or Commercial, High School, College, University, Graduate School and None used as the reference dummy variable), age, gender, whether or not depressive symptoms were present, and reported health status (Poor or other than any other, can be Excellent, Very Good, Good or Fair).All of these are considered as characteristics or determinants of characteristics that possibly influence a person's decision to enroll in Seguro Popular.

Based on this and the identification strategy described above, we have the following econometric specification through which the Difference-in-Differences estimator is obtained:

$$DiD_j = limit_{i2015} - limit_{i2003} = \beta_0 + \beta_1 * intervention_{j,i} + \epsilon_{it}$$

withβ_1 the coefficient we are interested in and $limit_{i2003}$ and $limit_{i2015}$ the levels of disability in 2003 and in 2015, respectively.

Empirical results

Logistic regressions for Propensity Score Matching are shown in Table 13. Logistic regression uses the observed relationships between the predictors or covariates of the observed treatment assignment to estimate the numerical relationships between those predictors and the probability (actually, odds) of treatment assignment. Thus, it can be observed that, for example, for the intervention concerning control group 1 (the one showing the most statistically significant estimators) it can be observed that the higher the income level the lower the probability that the individual enrolls in Seguro Popular; that when the individual's self-reported health is poor there is a higher probability that he or she will enroll; a worker employed in a low-skilled manual labor occupation has a higher propensity to enroll; etc. The signs of the propensities of the covariates are the same for the two types of intervention (the one considered concerning each of the control groups) except in the case of almost all dichotomized categorical covariates that were set to indicate different levels of education. This makes sense if we think about the general characteristics of the two control groups: it is evident that in the case of the intervention concerning control group 2, the group composed of persons not enrolled in any health insurance, lower educational levels show a greater relationship or greater propensity to enroll.

From the significance of the coefficients, we can see the difference between each control group and the treatment group. In general, since almost all the signs of the regression coefficients concerning control group 2 are positive, we can say that there is greater homogeneity of control group 2 concerning the group of those treated or effectively affiliated with Seguro Popular. To say something, based on the logistic regression represented in column 1, the sign of the corresponding coefficient would show that those who chose to enroll in Seguro Popular had worse health concerning control group 1; based on the coefficient in column 2 would show that those who chose to enroll in Seguro Popular have more or less the same health status as those who chose not to be insured. Thus, it could be inferred that based on the information from the logistic regression analysis that the control group 2 is a more feasible point of comparison than control group 1.

Once such numerical relationships are obtained, they are applied to the same data set that was used to estimate them to generate the predicted probabilities, the propensity scores.

Table 14 show the matches that meet the Common Support condition and In the case of the Covariate balance condition, Figures 10 and 11 visualize the balance that the covariates achieved with matching; both show a strong reduction in the standardized difference after matching, although more so for the case that

Table 13: Logistic regressions to obtain propensity scores

Covariates	Intervention respect to control 1	Intervention respect to control 2
Age	-0.00228	-0.00107
	(-1.61)	(-0.74)
Income decil (1 to 10)	-0.0804***	-0.0230
	(-7.41)	(-1.39)
Self-reported health (Poor=1)	0.373***	0.0985
	(5.01)	(0.90)
Gender	0.0687	0.0714
	(1.00)	(0.68)
Non-routine manual	0.106	1.001
	(0.15)	(1.14)
Commerce	1.575*	1.175
	(2.52)	(1.61)
High-skilled manual	1.273*	1.515*
	(2.06)	(2.08)
Low-qualification manual	2.169***	1.548*
	(3.55)	(2.18)
Ignored category	1.177	1.567*
	(1.94)	(2.22)
Primary	-0.735***	0.0726
	(-11.19)	(0.77)
Secondary or Junior high	-1.390***	0.0347
	(-9.65)	(0.15)
Technical or Commercial	-2.430***	-0.534
	(-11.23)	(-1.61)
Preparatory or High scool	-1.606***	0.0154
	(-5.43)	(0.03)
Basic teaching school	-2.662***	0.489
	(-4.47)	(0.41)
College	-2.710***	-1.373**
	(-7.76)	(-3.15)
Graduate	-2.597*	-1.753
	(-2.53)	(-1.46)
Depressive symptoms (Yes=1)	0.208*	-0.0407
	(2.55)	(-0.32)
Constant	-1.144	-0.406
	(-1.84)	(-0.56)
N	6456	2735

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

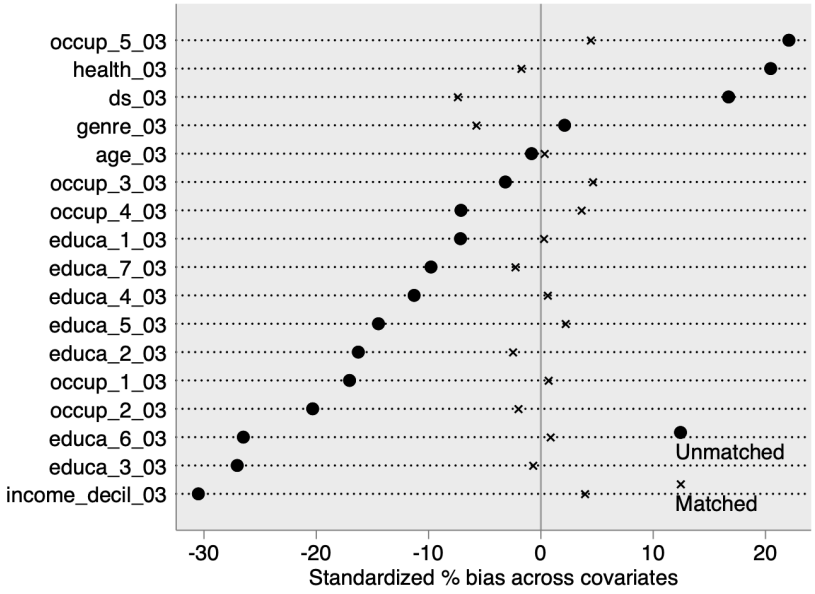
refers to Control group 1, the one composed of individuals with another type of security or without security, that is, the entire remaining sample after selecting those enrolled in Seguro Popular. This both conditions are the main measures of matching quality. More details of the propensity score estimation and matching can be found in the Appendix.

Table 14: Common support with Control 1 and 2

	Intervention 1		
Common support	Untreated	Treated	Total
On support	441	1,617	2,058
Total	441	1,617	2,058
On support	100%	100%	100%
	Intervention 2		
Common support	Untreated	Treated	Total
On support	568	1,617	2,185
Total	568	1,617	2,185
On support	100%	100%	100%

Source: own elaboration with MHAS data.

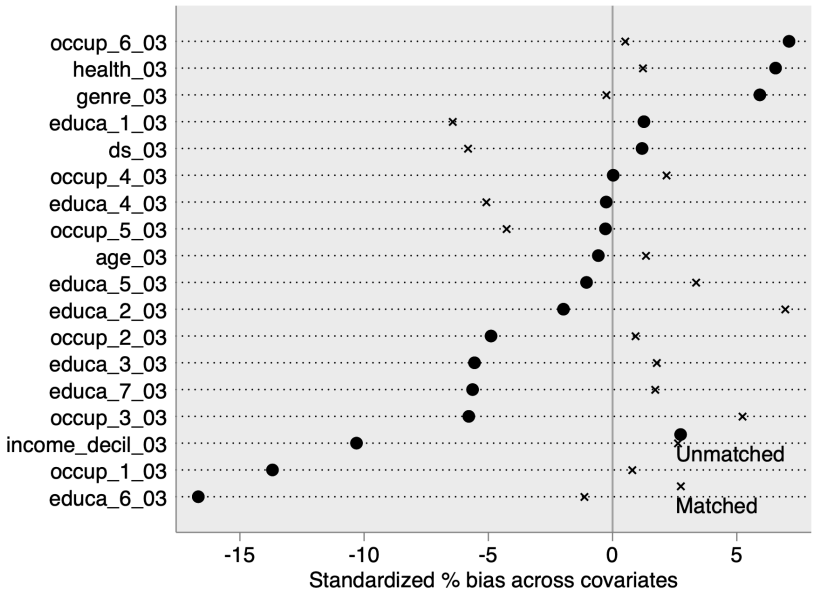
Figure 10: Pstest for treated and control group 1



Source: own elaboration with MHAS data.

In the estimation of the Difference-in-Difference shown in Table 15 for intervention 1, which considers those enrolled in Seguro Popular concerning control group 1, made up of individuals not enrolled in Seguro

Figure 11: Pstest for treated and control group 2



Source: own elaboration with MHAS data.

Popular (those enrolled in any other health insurance or without insurance). As can be seen, a negative effect on the progression of disability is obtained. This is desirable and implies that affiliation to Seguro Popular had a greater average effect on those enrolled than the average effect of not being enrolled and that this was negative, i.e., it had an inverse influence on progression.

On the other hand, the estimated coefficient for the intervention that considers those enrolled in Seguro Popular concerning those not enrolled in any health insurance, the effect found on the progression of disability is also negative and is greater. This result implies that the average effect on those enrolled in insurance was greater than the effect on the progression of disability of those who reported not having insurance and that it also had an inverse influence. Thus, those with Seguro Popular in 2012, on average, score better in this aspect than those who had no insurance at all, and even those enrolled in any other health insurance.

The t-statistic indicates whether the difference between the level of disability in the pre-treatment year and the post-treatment year is significantly different from zero or not. The null hypothesis for the test involving this statistic is that, given the intervention, the level of disability was the same in 2003 and 2015. The alternative hypothesis, is that the levels of disability were different before and after the intervention. That is, the null hypothesis is that the difference is zero because there is no significant difference and the alternative hypothesis is that it is non-zero because there is a significant difference. Here, to know which

Table 15: Difference-in-differences and Bootstrap standard with 1000 repetitions results

	DiD respect to control 1	DiD respect to control 2	Bootstrap respect to control 1	Bootstrap respect to control 2
Intervention	-0.0.0297		-0.028	
t	(-0.68)			
se	(0.043)		[-2.576 to 2.684]	
95% CI	{-.1465 to .0237}			
Intervention		-0.0448		-0.045
t		(-1.03)		
se		(0.043)		[-3.601 to 3.495]
95% CI		{-.1297 to .0401}		
Constant	0.559^{***}	0.581^{***}		
	(19.49)	(19.00)		
N	3206	3209		

se: upper and lower limit of standard error square brackets

CI: DiD confidence interval

$^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$

hypothesis we reject or not, taking the t statistic from Table 15, we obtain that the estimator is not statistically significant at any confidence level for both interventions.

Also bootstrapping has the same intention of indicating whether the parameters are significant, but circumvents the assumptions about the distribution by generating an "observational distribution" of the parameters by resampling and reestimating the model N times, in our case N=1000. Thus, additionally, the standard errors are calculated through the command `bsample`[14]. Table 15 also presents the results corresponding to the calculation of the nonparametric bootstrap of 1000 repetitions for the intervention concerning each of the control groups, respectively. In this case, the coefficients obtained for the interventions are the same and, in absolute value, standard error values greater than 2 are obtained, so we can say that the coefficients are significant.

In addition, in both cases, the 95% confidence intervals for the estimated impact of the intervention indicate that with 95% confidence the true impact will be between the values indicated. The interval includes zero, so we do not find convincing evidence of an impact of Seguro Popular on the reduction of limitations.

[14]This is because the command `bootstrap` does not accept weights in Stata, as is required in the difference-in-differences calculation performed. And the procedures described here are developed in Stata 16.

Discussion of the results

One of the concerns of difference-in-differences models is that the program and intervention groups may differ in ways that affect their trends over time, or their compositions may change over time. In the case of the research question of this thesis, the fact that endogeneity in Seguro Popular enrollment is possible undoubtedly leads to the presence of the problem that the groups studied in the differences-in-differences differ at the time of the intervention and affect their trends or compositions over time.

Difference-in-differences matching is an example of the usefulness of combining methods. Propensity Score Matching alone cannot take into account the unobserved characteristics that might explain why a group of people chooses to enroll in a program and, that might also affect outcomes; as the name implies, by taking into account certain characteristics of individuals, matching creates control group(s) that bring the application of a program closer to randomization by balancing the groups. Matching combined with the difference-in-difference calculation has the advantage that it precisely takes into account the unobserved characteristics that are constant over time between the two groups.

In our case, by checking that the basic assumptions involved in the two methods being mixed and implemented sequentially are met, It can be said that dual causality seems to be solved or at least is no longer a big problem.

Without losing sight of the fact that the effects we found are small and not statistically significant, the effect of Seguro Popular enrollment on disability progression measured concerning having some other type of security or not having it is interesting because, if we rely on the matching procedure and the assumption of the Differences-in-Differences method for similar trends, the (rather) insignificant impacts hold: hardly any effect of Seguro Popular protecting against (mobility/ADL/IADL) disabilities developed between 2003 and 2015. This result is consistent with other findings suggesting significant positive effects on utilization of health services and receipt of diagnostic tests, and more limited effects on treatment, conditional on illness, mentioned above.

In the case of the outcome of the intervention with respect to those who did not have access to health insurance services in 2012, which was most expected prior to the research, its measurement also results in a coefficient that is not statistically significant.

The low significance of both effects could stem from the fact that, since the effect is influenced to the extent that enrollment in Seguro Popular is voluntary and with few requirements, we could be facing the

case that after the intervention (after 2012), individuals not enrolled in any health insurance are those who require the least health care, those with the least disabilities. However, as we argued at the beginning, Seguro Popular represents a natural experiment with decisions made at a higher level than the individual respondent, as the different levels of government made efforts to enroll as many people as possible by making efforts to expand its services. That is, despite these efforts, individual decisions (reverse causality) may still be present to some extent.

Another element that could help explain these results is that, although the Seguro Popular program covered medications for certain chronic degenerative diseases (such as diabetes or hypertension), the limited effects of treatment could be the result of an insufficient supply of these medications or a lack of adherence to treatment despite having access to the medications, as has been recorded in the figures, especially in recent years.

Conclusions

Soon after its implementation, Seguro Popular promised to significantly reduce the out-of-pocket expenses of poor households while increasing the number of medical diagnoses and services and access to medicines. At that time, the information needed to analyze the extent to which Seguro Popular contributed to reducing poverty and inequality and improving the health conditions of the population was not yet available. Today, much of this information is available, and it is important to provide empirical evidence for long periods.

The results suggest that affiliation to Seguro Popular (as opposed to being enrolled in other health insurance or not being enrolled in other health insurance and not being enrolled in any insurance) has had no impact on the progression of disability. However, there is no doubt that, using more than one control group enriches the study that was conducted if it is taken into account that disability is a difficult quality to treat in developing countries (where there are more dissimilar socioeconomic structures) and that in the latter there are more conditions for this to be presented as a progressive process (Díaz-Venegas et al., 2016).

Furthermore, the results suggest that studying the effects between Seguro Popular enrollees and those enrolled in other health insurance presents a better comparison approach to analyze the effects of the intervention in question to the extent that there are barriers to access that are hardly insurmountable by the most marginalized (Medina-Gómez & López-Arellano, 2019). Much future work is needed to understand and address these various barriers to effective chronic disease management (Rivera-Hernandez et al., 2016) and

their implications.

Recently, the Mexican government has begun to rethink ways, such as fiscal reform, in which it could obtain the resources to set more ambitious goals and, above all, to close the enormous gaps that persist between regions and between groups such as those with lower incomes, the elderly and women. In this sense, it would be advisable for health development planning schemes to set goals at the level of affected groups (for example, by the presence or absence of chronic degenerative diseases), as well as a scheme of universal coverage against health risks. This is because, providing access on paper (from enrollment in Seguro Popular or INSABI) does not imply that services - let alone of guaranteed quality - are available (Huffman & Van Gameren, 2019). A changing health system could make it difficult to navigate services.

The increase of people in poverty due to the impacts of the Covid-19 pandemic, according to Coneval estimates, will be approximately 9 million Mexicans, which would imply that the number of people in poverty could reach 70 million in the country, bringing the income poverty rate to 56% of the total population, the highest level of poverty so far this century. This will be a lasting impact (Esquivel, 2020) and, at the same time, one that requires immediate attention. That is, existing social programs that have not achieved their objectives will not be able to cope with the economic and health outcomes either. Additional measures must be taken. INSABI must take on a new character, more based on empirical evidence and on old and new needs, which are, after all, intrinsically related. In this regard, while the pandemic has brought more forcefully to public attention its immediate effects and the need to be prepared for current and future contingencies, it has also demonstrated that there are structural challenges that must also be addressed. This is the case of improving access to long-term care systems.

Finally, given that the level of labor participation of Mexican older adults has been maintained in recent years (Román-Sánchez et al., 2019), it is important to consider the obstacles that disabilities, even in their different levels, and their progression, may have on their quality of life in this aspect as well. That is to say, even though they need and/or are willing to work, their physical capacities prevent them from doing so and this, in turn, has a vicious circle effect, both in their state of mind and in terms of their income; or, on the other hand, that older adults, despite their disabilities, continue to work in suboptimal conditions.

In this regard, it is important to remember that investments in human capital are not enough to improve living conditions in less developed regions; these investments must be complemented. Investments in development must be balanced so that growth increases in pace with a minimum of friction.

The approach followed in the thesis, the combination of matching with diffence-in-difference methods,

has provided reliable estimates of the effect of Seguro Popular affiliation on the progression of disability. However, further research should include additional analyses based on both additional data and methods.

Appendix

The potential treatment and control groups are shown in Tables 16 and 17:

Table 16: Treatment group and control group 1

	Type of health services in 2012							
Affiliated to a health service in 2012	None	IMSS	ISSSTE	SP	Pemex/Sedena/Semar	Private	Other	Total
No SP enrollment	1,287	4,610	1,665	0	235	237	211	8,245
Enrollment in SP	0	0	0	3,427	0	0	0	3,427
Total	1,287	4,610	1,665	3,427	235	237	211	11,672

Source: own elaboration with MHAS data.

Table 17: Treatment group and control group 2

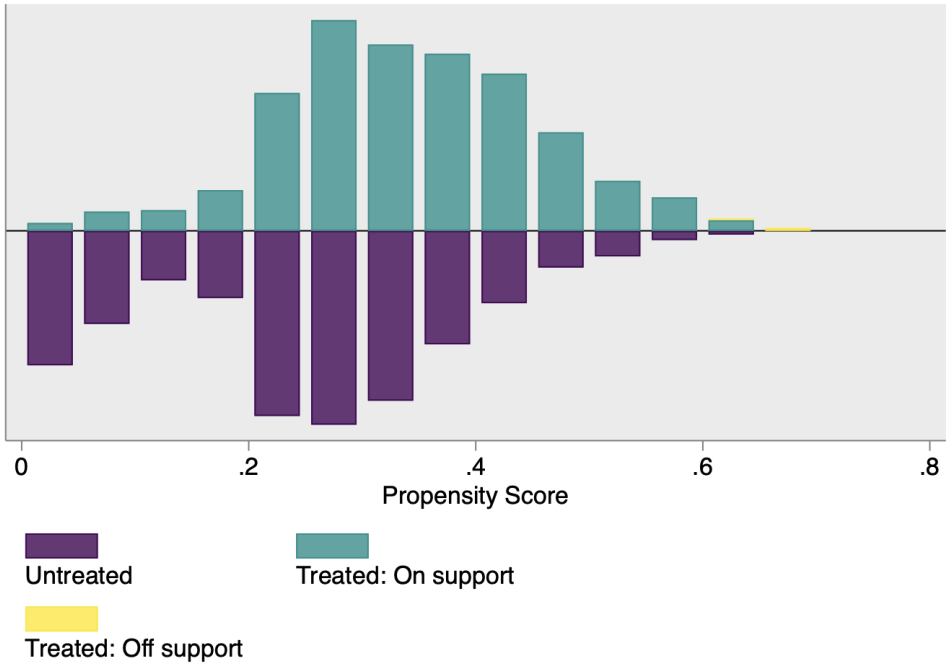
	Type of health services in 2012		
Enrollment status	None	SP	Total
Not affiliated	1,287	0	1,287
Enrollment in SP	0	3,427	3,427
Total	1,287	3,427	4,714

Source: own elaboration with MHAS data.

The procedure to estimate the propensity scores that are subsequently matched consists of starting by running a logit model to estimate the probability that the members of the control group would be assigned to the treatment group, considering a set of variables that characterize the units of measurement in the year in which they are exposed to the treatment that could affect the probability of such probability and which elements are known as covariates. The variable used as the outcome is the disability progression recorded in 2015 in comparison to the initial (pre-treatment level) in 2003, the treatment is enrollment in Seguro Popular in 2012.

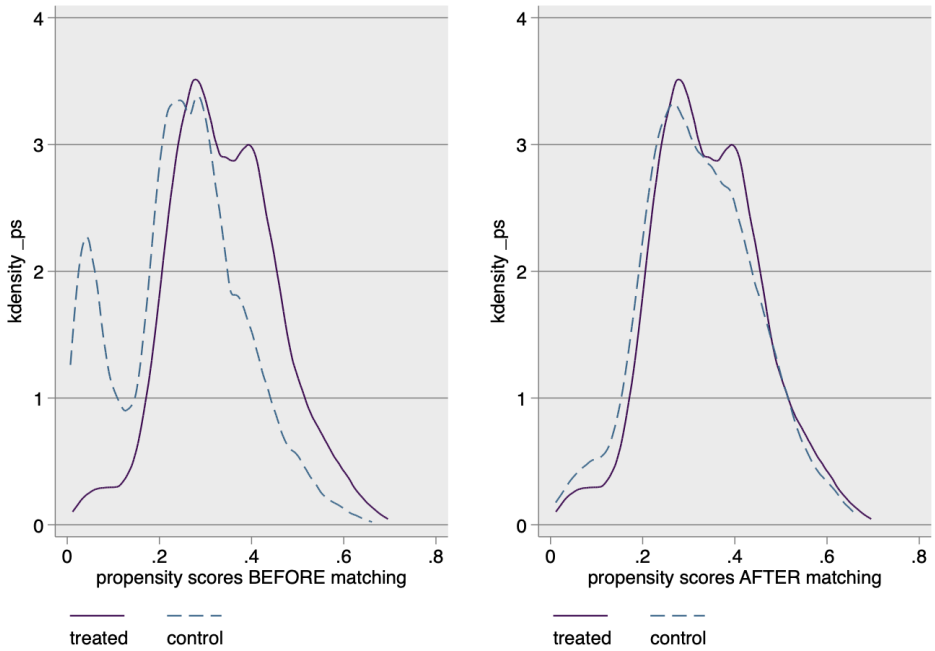
After running the algorithm following the estimation of the logit model, it is useful to plot the distributions of the propensity scores of the treated and untreated groups to visually check the Common Support condition and to see if the matching is able to make the distributions more similar, i.e., make the trends more similar between groups. The distributions of the propensity scores, before and after matching, are presented in Figures 13 and 15. Visual inspection of those plots suggests that the densities of the propensity scores are more similar after matching. The plot also reveals a clear overlap of the distributions.

Figure 12: Common support condition for treated and control group 1



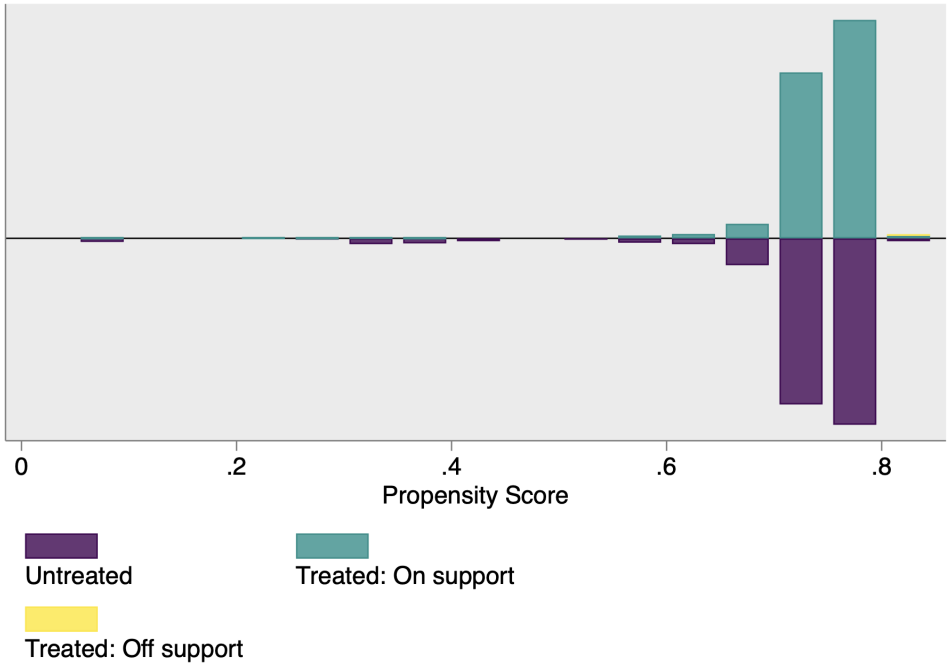
Source: own elaboration with MHAS data.

Figure 13: Common support condition for treated and control group 1



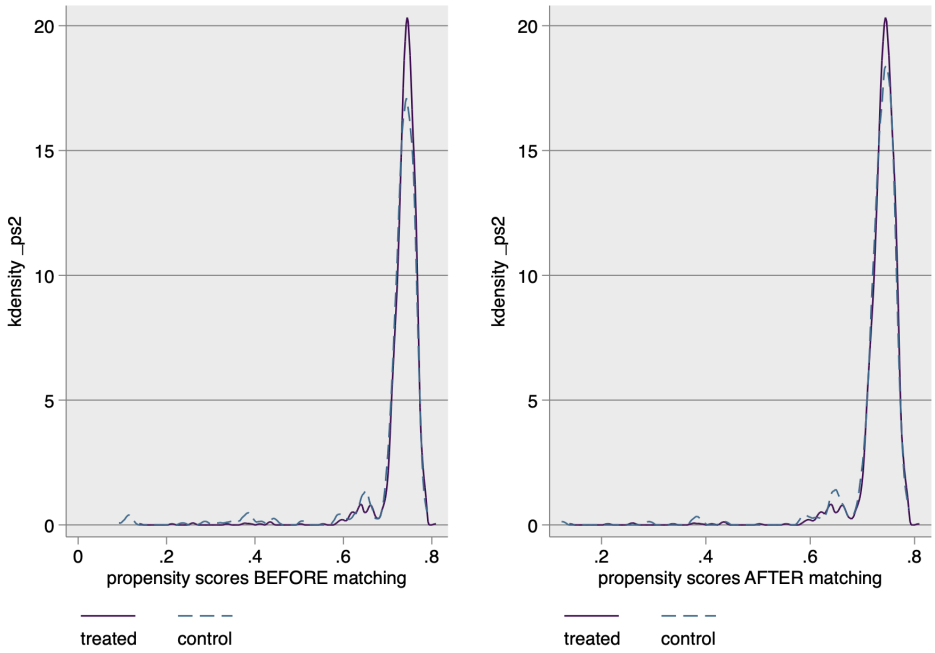
Source: own elaboration with MHAS data.

Figure 14: Common support condition for treated and control group 2



Source: own elaboration with MHAS data.

Figure 15: Common support condition for treated and control group 2



Source: own elaboration with MHAS data.

We then performed propensity score matching with replacement based on the propensity scores, only for the elements of the subsamples that are located in the Common support (see Table 14). The balance of the covariates was also reviewed and is satisfied in both cases following Figures 10 and 11.

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