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An Econometric Analysis of the Impact of Colombia's Subsidized Health Insurance on
Preventative Care Utilization Using Instrumental Variables

Preventative Care Utilization in Latin American Countries with Social Health Insurance(SHI)
or Subsidized Healthcare Schemes: A Literature Review

By
Cindy Abarca
B.A., Brown University, 2016

Thesis

Submitted in partial fulfillment of the requirements for the
Degree of Master of Public Health in the Brown University School of Public Health

PROVIDENCE, RHODE ISLAND
MAY 2017

This thesis by Cindy Abarca is accepted in its present form
by the Brown University School of Public Health as satisfying the
thesis requirements for the degree of Master of Public Health.

Date_____

Omar Galarraga, Ph.D., Advisor

Date_____

Judith Bentkover, Ph.D., Reader

Date_____

Patrick M. Vivier, MD, Ph.D
Director, Master of Public Health Program

Approved by the Graduate Council

Date_____

Andrew G. Campbell, Dean of the Graduate School

Vita

Cindy Jasmin Abarca was born in Los Angeles, CA on January 5, 1994. Cindy attended South Gate High School and graduated as Valedictorian in 2012. Cindy is a Gates Millennium Scholar and Warren Christopher Scholar. She attended Brown University where she took a range of courses from public health to engineering. She was an undergraduate teaching assistant for three years for ENGN12: Crossing the Space/Consumer Chasm Through Engineering Design and a teaching assistant for PHP2350: Economics of Medical Therapies for two years. During her fall senior year, Cindy studied abroad in Copenhagen, Denmark where her interest in international healthcare systems emerged. Upon her return from abroad, Cindy graduated from Brown University magna cum laude with a concentration in Public Health. Her undergraduate honor thesis was a multivariable logistic regression examining the association between metropolitan status and HPV vaccination among US women and men between the ages of 18-26 years old using the 2012 Behavioral Risk Factor Surveillance System (BRFSS). After graduating Brown, she started the Master of Public Health Program as part of the 5-year AB/MPH dual degree program at Brown University. Her areas of interest include healthcare law, health economics, global health systems and preventative care.

Preface and Acknowledgements

The thesis was made possible due to the collaboration and feedback from many individuals who invested their time and knowledge into this project.

I would like to initially thank my thesis advisor, Professor Galarraga for encouraging me to seek a thesis topic outside my area of comfort and challenging me to engage in a more rigorous statistical analysis in the field of health econometrics. I appreciate your commitment to meet with me constantly as well as your dedication in guiding me throughout each stage of the thesis process. You have enriched my knowledge and instilled in me a passion towards global healthcare systems. I cannot express my gratitude and admiration towards you for providing me the opportunity to be mentored by you during my thesis development. You have been instrumental in my academic growth both as a professor and as a thesis advisor. You have taught me to view and evaluate healthcare systems in different perspectives.

I would also like to thank my reader, Professor Bentkover for your timely feedback on my thesis. Working alongside you for PHP2350: Economics of Medical Therapies taught me to be a more experienced lecturer and has influenced my teaching style and methods. You have also made me a strong candidate with skill sets that can be applied to a wide range of fields. Your advice throughout my time at Brown has tremendously influenced my career aspirations. Your constant support and encouragement have influenced me to pursue more challenging opportunities and has made me grow as a scholar.

I would also like to thank the Departamento Administrativo Nacional de Estadística (DANE) for their clarification and help during the extraction of the database.

Lastly, I would like to thank my family for their unconditional support throughout my academic, professional and personal endeavors. My family has been one of my strongest motivators to pursue my academic goals and have encouraged me to reach my highest potential.

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Part 1. An Econometric Analysis of the Impact of Colombia's Subsidized Health Insurance on Preventative Care Utilization Using Instrumental Variables

ABSTRACT

An econometric analysis was conducted to evaluate the impact of enrollment to Colombia's subsidized health insurance regime on the utilization of preventative services (annual doctor and dentist visits) using instrumental variables to correct for endogeneity. This study used the 2015 Encuesta Nacional Calidad de Vida (ECV) survey to conduct a two-stage least square regression (2SLS) with instrumental variables to estimate the program effect among a sample population of N=46,770. The instrumental variables that were examined consisted of: (1) the proportion of individuals that were eligible for affiliation to the Sistema de Identificación de Beneficiarios (SISBEN) I and II by department for the year 2011 and (2) the 1994 presidential election results by department. Selection of the 1994 presidential election results by department was used as an instrumental variable because of the association found between political affiliation of municipalities or departments and enrollment to subsidized health schemes. This association is explained by the municipalities' ability to adjust the cutoffs for eligibility to the subsidized regime according to the amount of federal funding that the municipalities receive annually. Furthermore, Durbin-Wu-Hausman test of endogeneity, Hansen J-test of overidentification, and F-test for weak instrumental variables were conducted as part of our statistical analysis. The results of our analysis found that enrollment to the subsidized health insurance regime had a positive effect 0.728 ($p < 0.01$) on preventative care utilization compared to the uninsured after removing endogenous variables as part of our sensitivity analysis. These findings suggest that affiliation with the subsidized health schemes or programs can increase an individual's decision to utilize preventative services.

INTRODUCTION

In the late 1980s, several Latin American countries began a movement towards universal health coverage as an effort to improve the health of the population by providing social protection, financial protection, and ensuring access to essential health services. Before the health reform, countries such as Colombia had problems with low rates of insurance coverage, inefficiency in public provision, and inequality in access to health services (Gaviria *et al.*, 2006). To reduce the financial constraints that individuals were facing when seeking healthcare, Colombia became one of the first Latin American countries to introduce a health reform in 1993. The reform led to the implementation of the Sistema General Seguridad Social en Salud (SGSSS) which resulted in the development of the subsidized and contributive regimes (Gaviria *et al.*, 2006; Ruiz *et al.*, 2007; Ramírez *et al.*, 2013). Affiliation to the contributive regime is mandatory for all workers, and each worker is also obligated to contribute 4% of their salary while the employer covers the remaining 8.5% (Gaviria *et al.*, 2006; Ruiz *et al.*, 2007; Ramírez *et al.*, 2013). Under the contributive regime, both employees and their families are covered.

Conversely, the subsidized regime was designed to provide health coverage to individuals who were unable to pay for healthcare. It was financed by both central and local government public funds and solidarity contributions from individuals enrolled in the contributive regime (Restrepo *et al.*, 2007; Ruiz *et al.*, 2007; Ramírez *et al.*, 2013). Eligibility to the subsidized regime was determined by the municipalities using the Sistema de Identificación de Beneficiarios (SISBEN), which is proxy-means test used by the central government that ranks families based on a set of household characteristics, human capital endowment, and income (Trujillo *et al.*, 2005). An individual is usually eligible for the subsidized regime if they fall under SISBEN index I and II; however, municipalities have the power to change the cutoffs according to their funding. Nonetheless, the central government

is responsible for determining eligibility to the subsidized regime by establishing a baseline selection criterion through the use of SISBEN. The central government also provides technical support and capitated payments to the municipalities for each eligible individual identified (Trujillo *et al.*, 2005).

The central government then designates the municipal government the responsibility to adjust cutoffs for selection to the subsidized regime according to the local needs and the amount of funding available for each municipality. Oftentimes there is not sufficient funding to cover all the eligible population for the subsidized regime, and municipal officials are forced to prioritize coverage to pregnant women, children, and the elderly before providing coverage to the rest of the eligible population (Trujillo *et al.*, 2005; Restrepo *et al.*, 2007; Ruiz *et al.*, 2007; Ramírez *et al.*, 2013). However, eligibility to the subsidized regime faces many shortcomings, since not all municipal governments have the administrative capabilities to both determine and enroll eligible individuals. This results in greater affiliation to the subsidized regime among larger municipalities over smaller ones (Trujillo *et al.*, 2005). Additionally, the SISBEN questionnaire has shown to be a poor measure of household income, especially when accounting for the rural populations (McGee, 1999).

Several studies have examined Colombia's subsidized regime's effect in enhancing access to health services and offering financial protection. Fewer studies have corrected for endogeneity, which is when program participation or affiliation is affected by self-selection bias. Endogeneity arises from outside factors that influence an individual's likelihood of enrollment, resulting in an underestimation or overestimation of the program's effect. A method to control for this self-selection bias consist of using instrumental variables that strongly correlate with program participation but do not directly correlate with the outcome.

The only studies that have corrected for self-selection bias include Trujillo *et al.*, (2005), Gaviria *et al.*, (2006), Miller *et al.*, (2013), and Atehortúa *et al.*, (2015) all who found that individuals in the subsidized regime had higher levels of utilization of preventative services compared to the uninsured across different time periods. However, the most recent data analyzed was in 2008, and no further studies have examined this positive relationship using current data and rigorous methodologies to correct for self-selection bias.

Additionally, Ramírez *et al.*, (2013) and Atehortúa *et al.*, (2014) reported a negative effect on preventative care utilization (doctor visits and cervical cytology screening) among individuals affiliated to the subsidized regime. But Atehortúa *et al.*, (2014) study population only consisted of women after the age of 19 in Medellin. Similarly, Ramírez *et al.*, (2013) only examined individuals who had responded to the Medellin Living Standard Survey for the year 2007. Due to the differences in findings and study populations, using older data, it is important to examine current data to determine whether the positive effect of affiliation to the subsidized regime on preventative care utilization is consistent across different years. Therefore, this study aimed to test whether the positive findings on preventative care utilization among individuals in the subsidized regime compared to the uninsured that were found in Trujillo *et al.*, (2005), Gaviria *et al.*, (2006), Miller *et al.*, (2013) and Atehortúa *et al.*, (2015) were still evident using 2015 data and instrumental variables to correct for endogeneity.

METHODS

We analyzed the 2015 Encuesta Nacional Calidad de Vida (ECV), a national representative cross-sectional survey conducted annually at random in Colombia by the Departamento Administrativo Nacional de Estadística (DANE). ECV collects information on different aspects and conditions of household welfare including health status, access to public services such as technology, and living conditions among others (DANE, 2016). The

2015 ECV survey collected information from 23,005 households and 76,026 individuals from the following regions: Bogotá, D.C., Antioquia, Valle del Cauca, Atlántica Región, Oriental Región, Central Región, Pacífica Región, San Andrés, Orinoquía-Amazonía and Buenaventura (DANE, 2016).

The study population consisted of all individuals in the households with valid responses and excluded individuals with missing information on health coverage and utilization of preventative services. Adults and children with missing covariates were categorized under missing and were reported in Table 1 if the missing category consisted of more than 10% of the study population. After excluding individuals enrolled in the contributive or special regime, the final sample population was N=46,770. Of those, 42,838 were enrolled in the subsidized health insurance, and 3,932 had no healthcare coverage.

The explanatory variable is a dichotomous indicator of whether each individual in the household is affiliated to the subsidized regime or was uninsured according to the municipality cutoffs of the SISBEN score. The dependent variable is a dichotomous indicator of whether the interviewee consulted a doctor and or dentist at least once a year as a preventative measure. Since enrollment to the subsidized regime is voluntary for individuals identified in SISBEN index I and II or individuals eligible in accordance to their residing municipality cutoffs, this potentially leads to a self-selection problem resulting in a biased estimate of the subsidized regime program effect. To reduce self-selection bias, we looked for instrumental variables that were strongly associated with affiliation to the subsidized regime but were not correlated with an individual's decision to utilize preventative services. We also tested for exogeneity to verify that the errors of the outcome equation were not correlated with the instrumental variables.

The two instrumental variables that were included were: (1) the proportion of individuals that were eligible to be affiliated to the SISBEN I and II by department for the

year 2011, and (2) election results for the 1994 presidential election by department. To estimate the program's effect, a two-stage least squared regression (2SLS) model was conducted using STATA 14. In the first stage of the 2SLS, a regression of the treatment variable (affiliation to the subsidized regime) with the instrumental variables and covariates was performed. The confounder variables consisted of age, gender, race, education, marital status, metropolitan status, and region. The variables health status, chronic disease status, employment status, household income per capita, size of household and household monthly income were removed as part of a sensitivity analysis to correct for the endogenous variables. For children, the variables: household income per capita, household size, and household monthly income were based on the head of household response. Marital status and employment status were not included for children unless a valid response was provided. The variable race was categorized according to the response options provided by the ECV and age was made a continuous variable to be consistent with other studies categorization of age. The predicted treatment variable was then used in the second stage regression of the outcome variable (preventative care utilization) with the covariates (Wooldridge, 2010; Greene, 2003). The ordinary least squares (OLS) regression was also performed to illustrate the naïve regression.

For the first instrumental variable, a proportion was calculated for each department for the year 2011, where the numerator was the population likely to be affiliated to the subsidized regime (individuals in SISBEN I and II plus the indigenous population minus individuals in SISBEN I & II who were registered in the contributive regime or another regime). This information was extracted from Fondo de Solidaridad y Garantía (FOSYGA) for each department for the year 2011 (FOSYGA, 2016). The denominator was the population size of the department in 2011 found in the DANE website (DANE, 2015). The instrumental variable is relevant because categorization into SISBEN I & II were associated with the

probability of eligibility and affiliation to the subsidized regime. The coefficient of the instrumental variable degree of penetration to the subsidized regime in the first stage was positive (0.072) and statistically significant ($t=8.31$).

The second instrumental variable is election results by department for the 1994 presidential election that was gathered from Georgetown University Political Database of the Americas and was categorized as a binary variable for either conservative or liberal party (Base de Datos Politicos de las Americas, 1999). The use of the 1994 presidential election as an instrumental variable is important because municipal officials can influence the selection process to the subsidized regime for political gain (Jaramillo, 2001). Additionally, the political affiliation of the department, a year after implementation of the subsidized health insurance regime can illustrate whether enrollment was higher in departments affiliated with the same political party that established the health reform. A similar instrumental variable was utilized by Trujillo *et al.*, (2005) as the study examined how voter turnout for the 1994 presidential election demonstrated to be a strong instrumental variable that influenced an individual's decision to affiliate to the subsidized regime. Likewise, Baez *et al.*, (2012) also found an association between election results and affiliation to governmental programs such as Familias en Acción in Colombia, demonstrating how election results can be an indicator for program affiliation. The coefficient of the instrumental variable degree of penetration to the subsidized regime in the first stage was negative (-0.038) and statistically significant ($t=-13.90$).

RESULTS

To test whether our instrumental variables are weak, an F-test was conducted, and the value of the F-test was above the minimum threshold of 10, $F(2,46760) = 135.33$, $\text{Prob} > F = 0.0000$ (Staiger and Stock, 1994). In order to prove that there is endogeneity in the main equation we conducted the Durbin-Wu-Hausman test of endogeneity and our results

rejected the null hypothesis that the variables were exogenous, $F(1,46760) = 13.5742$ with a $p\text{-value} = 0.0002$ (Wu, 1974; Hausman, 1978; Durbin, 1994). We then conducted the Hansen J test of over-identification, and our results (1.12433, $p = 0.2890$) failed to reject the null hypothesis that the instruments are valid (Hansen, 1982).

In the study population, only 31.31% of individuals with no health coverage had visited a healthcare provider at least once a year, while 67.99% of the individuals in the subsidized regime reported visiting a health care provider at least once a year. The mean age of individuals with no health coverage was 29.30 years compared to 31.35 years among individuals enrolled in the subsidized regime. Individuals with no health coverage had an average household size of 3.02 compared to 3.45 among individuals enrolled in the subsidized regime. The instrumental variables (proportion of individuals likely to be affiliated to SISBEN I and II by department for the year 2011, and election results for the 1994 presidential election by department) had means of 0.36 and 0.75 for individuals with no health coverage compared to 0.39 and 0.61 respectively for individuals enrolled in the subsidized regime. Characteristics of the study population are presented in Table 1.

Furthermore, Table 2 presents the results of the econometric analysis on the effect of affiliation to the subsidized regime on preventative care utilization when instrumental variables were applied to address endogeneity in enrollment. After adjusting for confounders, Table 2 reports the naïve OLS regression, where affiliation to the subsidized regime was positive on preventative care utilization with a coefficient of 0.357 ($p < 0.01$). Similarly, using the instrumental variables in a two-stage least squares regression, we found that the effect of affiliation to the subsidized regime on preventative care utilization was positive with a coefficient of 0.728 ($p < 0.01$) and larger compared to the results of the naïve regression. After stratifying by gender, we found similar results (male 0.655, $p < 0.01$; women 0.562, $p < 0.01$) that show that affiliation to the subsidized regime has a positive

effect on an individual's choice in utilizing preventative care services. Additionally, we found that individuals whose department voted for a liberal party candidate during the 1994 presidential election were less likely to be affiliated to the subsidized regime with a negative coefficient of -0.038 ($p < 0.01$). The results of the ordinary least squares (OSL) and both first and second two-stage least square regressions (2SLS) with instrumental variables are presented in Table 2.

DISCUSSION AND CONCLUSION

The results of the 2SLS with instrumental variables show that affiliation to the subsidized regime had a positive effect on utilization of preventative care visits in Colombia. We found that the ordinary least square regression underestimated the effect (0.357, $p < 0.001$) but once corrected for self-selection, the effect of affiliation to the subsidized regime on use of preventative care was found to be larger (0.728, $p < 0.001$). The instrumental variables demonstrated to be strong predictors of affiliation to the subsidized regime because they accounted for the likelihood of enrollment to the subsidized regime by department and the effects of political elections on an individual's decision to enroll into the subsidized regime. Furthermore, our findings illustrate that the positive effects found from previous studies using older data are still evident with more recent data. As Trujillo *et al.*, (2005) found higher rates of preventative care utilization among individuals in the subsidized regime between the ages of 0-59 using both propensity score matching and instrumental variables. However, the study only examined data from 1997 ECV, four years after the reform and with a smaller sample size. Likewise, Atehortúa *et al.*, (2015) examined 2008 data and found a positive effect; however, not all age ranges and genders were found to be statistically significant, as the study found that only children between 4-14 years of age; women between 15 to 49; and men older than 50 years of age who were enrolled in the subsidized regime had a positive effect on preventative care utilization.

The variation in findings can be due to the different time intervals that were analyzed for each study. Since Trujillo *et al.*, (2005) looked at the 1997 ECV, four years after the implementation of the social health insurance scheme, while Atehortúa *et al.*, (2015) looked at more recent data using the 2008 ECV with a larger study population which was double the size of Trujillo's study. Due to the variation in sample size and eleven-year difference in the data, our study focused on examining the most recent data with a sample population almost double of Atehortúa *et al.*, (2015) to see if the positive effect is still sustained.

Similar to Gaviria *et al.*, (2006), Miller *et al.*, (2013) used the 2003 ECV data and the 2005 Demographic and Health Survey (DHS) and found that individuals in the subsidized regime were associated with a 29% increase in probability of visiting a physician compared to those not enrolled ($\alpha=0.01$). The study, however, had a small sample population of less than 5,000 and a risk of measurement error due to differences in eligibility thresholds established in the study compared to the threshold used in practice.

Conversely, Ramírez *et al.*, (2013) and Atehortúa *et al.*, (2014) found a negative effect on preventative care utilization. Ramírez *et al.*, (2013) found that individuals enrolled in the subsidized regime visited doctors less frequently (21%) compared to the uninsured. Although their study only looked at Medellín and had a small sample size of 12,975 and did not look at the effects by segments of the population. Atehortúa *et al.*, (2014) also reported lower utilization of cervical cytology screening in women in the subsidized regime (2.9%), but the study did not use instrumental variables in addition to propensity score matching for more robustness results. It also only consisted of women with a small sample population of approximately 7,000 using 2008 ECV data. The inconsistency in methodologies across the studies that ranged from propensity score matching, two-stage least square regression,

poisson and binary models and instrumental variables could have resulted in either an underestimation or overestimation of the program's effect.

Nonetheless, our study had some limitations. The 2015 ECV database did not disclose information about the municipality where the individual resided at the time of the interview or how long the individual had lived in that municipality. Therefore, our analysis only focused on data at the department level instead of the municipality level as initially intended. We were also not able to take into account municipality fixed effects and the influence of social and political connections at the local level and its effect on affiliation to the subsidized regime. Other instrumental variables that were tested but were not included in the analysis were: proportion of individuals enrolled in the subsidized regime for the years 2011 and 2015 by department, and proportion of individuals likely to be affiliated to SISBEN I & II by department for the year 2015 because they proved to be weak instruments. Nonetheless, the findings suggest that enrollment to the subsidized regime had a positive effect on utilization of preventative services among our study population and validated the findings from previous literature. It also showed that the positive effect seems to be sustained over different time periods.

Outside of Colombia, other similar studies have been conducted in both Nicaragua and Mexico using instrumental variables and propensity score matching to correct for selection bias and endogeneity for program affiliation to subsidized health schemes and preventative visits but have yielded inconsistent findings. For instance, Sosa-Rubí *et al.*, (2009) found that individuals enrolled in Mexico's Seguro Popular had a greater likelihood of visiting a physician compared to the uninsured. Yet, King *et al.*, (2009) and Rivera-Hernandez *et al.*, (2016) found no effect on utilization of preventative services among Seguro Popular users. Similarly, a study conducted in Nicaragua by Thornton *et al.*, (2010) found that enrollment in the Nicaraguan Social Security Institute Health Insurance Program

had no effect in increasing the probability of seeking a healthcare provider. However, there was no consistency in methodologies across the studies in terms of their study population, outcome of measure, time period analyzed, and eligibility to the subsidized health scheme. Nonetheless, these studies highlight the benefits of using instrumental variables as a method to address selection bias and endogeneity when examining the effects of affiliation to a subsidized health scheme and utilization of health services.

Table 1: Descriptive Characteristic of Colombian adults and children based on health coverage: 2015 Encuesta Nacional de Calidad de Vida [2015 Colombia Living Standard Survey] (N=46,770)

	No Health Insurance 3,932 (8.41%) Unweighted n (%)	Subsidized Regime 42,838 (91.59%) Unweighted n (%)	p-value
Preventative visit			P<0.001
No	2,707 (68.69%)	13,714 (32.01%)	
Yes	1,231 (31.31%)	29,124 (67.99%)	
Age			P<0.001
Ages 0-104 (years) Mean (SD)	M=29.30 (19.26)	M=31.35 (22.05)	
Gender			P<0.001
Male	2,287 (58.16%)	20,407 (47.64%)	
Female	1,645 (41.84%)	22,431 (52.36%)	
Race			P<0.001
Indigenous	232 (5.90%)	3,262 (7.61%)	
Gitano/Palanquero/Raizal del Archipiélago	7 (0.18%)	166 (0.39%)	
Afro-descendants	899 (22.86%)	6,912 (16.14%)	
None of the above	2,794 (71.06%)	32,498 (75.86%)	
Education			P<0.001
None	234 (5.95%)	3,131 (7.31%)	
Preschool	80 (2.03%)	985 (2.30%)	
Elementary	1,188 (30.21%)	17,672 (41.25%)	
Secondary School	740 (18.82%)	8,306 (19.39%)	
High School	770 (19.58%)	6,750 (15.76%)	
Vocational School	276 (7.02%)	1,687 (3.94%)	
College or higher	269 (6.84%)	851 (1.99%)	
Missing	375 (9.54%)	3,456 (8.07%)	
Marital Status			P<0.001
Married	362 (9.21%)	5,889 (13.75%)	
Not Married	2,921 (74.29%)	29,298 (68.39%)	
Missing	649 (16.51%)	7,651 (17.86%)	
Employment Status			P<0.001
Work	1,607 (40.87%)	13,521 (31.56%)	
Looking for work	279 (7.10%)	1,094 (2.55%)	
Attend school	422 (10.73%)	5,692 (13.29%)	
Stay home	651 (16.56%)	10,535 (24.59%)	
Disabled and can't work	61 (1.55%)	1,125 (2.63%)	
Other	149 (3.79%)	1,423 (3.32%)	
Missing	763 (19.40%)	9,448 (22.06%)	
Health Status			P<0.001
Very Good	398 (10.12%)	2,623 (6.12%)	
Good	2,771 (70.47%)	29,701 (69.33%)	
Regular	697 (17.73%)	9,517 (22.22%)	
Bad	66 (1.68%)	997 (2.33%)	
Chronic Disease Status			P<0.001
Chronic disease and visits doctor regularly	157 (3.99%)	5,237 (12.23%)	

Chronic disease and does not visit doctor regularly	196 (4.98%)	1,163 (2.71%)	
Does not have chronic disease	3,579 (91.02%)	36,438 (85.06%)	
Hospitalized within last 12 months			P<0.001
Yes	179 (4.55%)	3,468 (8.10%)	
No	3,753 (95.45%)	39,370 (91.90%)	
Metropolitan Status			P<0.001
Urban area	2,336 (59.41%)	20,842 (48.65%)	
Rural area (< 20 homes)	672 (17.09%)	7,068 (16.50%)	
Rural area (>20 homes)	924 (23.50%)	14,928 (34.85%)	
Home Type			P<0.001
Home	2,738 (69.63%)	34,910 (81.49%)	
Apartment	990 (25.18%)	6,599 (15.40%)	
Room	127 (3.23%)	1,089 (2.54%)	
Indigenous home	74 (1.88%)	182 (0.42%)	
Other	3 (0.08%)	58 (0.14%)	
*Household Size			P<0.001
Mean (SD)	M=3.02 (1.86)	M=3.45 (1.90)	
*Total monthly household income			P=0.004
Colombian pesos, Mean (SD)	M=1,237,600 (1,998,095)	M=1,080,095 (1,773,329)	
*Per capita income			P<0.001
Mean (SD)	M=501759.6 (853697.9)	M=371656.8 (816857.4)	
Region			P<0.001
Atlántica	610 (15.51%)	7,502 (17.51%)	
Oriental	390 (9.92%)	5,467 (12.76%)	
Central	489 (12.44%)	6,169 (14.40%)	
Pacífica (sin valle)	703 (17.88%)	8,162 (19.05%)	
Bogotá	313 (7.96%)	1,077 (2.51%)	
Antioquia	314 (7.99%)	5,565 (12.99%)	
Valle del Cauca	980 (24.92%)	7,361 (17.18%)	
San Andrés	33 (0.84%)	472 (1.10%)	
Orinoquía-Amazonía	100 (2.54%)	1,063 (2.48%)	
2011 SISBEN proportion**			
Mean (SD)	M=0.36 (0.17)	M=0.39 (0.16)	
1994 presidential election***			
Mean (SD)	M=0.75 (0.43)	M=0.61 (0.48)	

Note: Missing information for covariates excluded when percent is less than 10%. P-value reported for chi-test for categorical variables and p-value of t-test reported for continuous variables

*Head of Household responses only

**2011 SISBEN proportion defined as the proportion of individuals that are eligible for affiliation to SISBEN I and II (Sistema de Identificación de Beneficiarios, a proxy means tests to determine low-income population conducted at the municipality level) by department for the year 2011

***Election results by department for 1994 presidential election was defined as 0=conservative party and 1=liberal party

Table 2: Ordinary Least Square Regression and Two- Stage Least Square Regression on affiliation to the subsidized regime and preventative care utilization among Colombian adults and children using 2015 Encuesta Nacional de Calidad de Vida [2015 Colombia Living Standard Survey] (N=46,770)

	OLS regression [†]	2SLS: first stage ^{††}	2SLS ^{**} : second stage ^{††}
Health coverage	0.357***	-	0.728***
Age	-0.000	0.000	-0.000
Gender	0.123***	0.035***	0.109***
Race	0.024***	-0.000	0.023***
Education	0.018***	-0.011***	0.022***
Marital status	0.063***	0.014***	0.057***
Metropolitan status	-0.010***	0.011***	-0.016***
Region	-0.008***	-0.001**	-0.007***
2011SISBENproportion		0.072*** (t=8.31)	-
1994 presidential election		-0.038*** (t=-13.90)	-
Constant	0.166***	0.904***	-0.167*

Notes:

(1) *** t value significant at p<0.01, **t value significant at p<0.05, *t value significant at p<0.1

(2) Ordinary Least Square regression outcome is preventative care utilization (0=No, 1=Yes) with the main explanatory variable being health coverage (0=No health insurance, 1=affiliated to subsidized regime) instrumented with 2011 SISBEN proportion (proportion of individuals that are eligible for affiliation to SISBEN I and II by department for the year 2011) and 1994 presidential election results by department (0=conservative party and 1=liberal party)

[†]Ordinary Least Square Regression (OLS) is naïve regression

^{††}2 Stage Least Square Regression (2SLS) reports first and second stage regression with the following instrumental variables: 2011 SISBEN proportion by department and 1994 presidential election results by department

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Part 2: Preventative Care Utilization in Latin American Countries with Social Health

Insurance (SHI) or Subsidized Health Care Schemes: A Literature Review

Introduction

In the late 20th century, a movement to embrace health as a human right began in several Latin American countries. Policy implementations were adopted, such as the American Convention on Human Rights¹, which focused on the State's obligation to promote economic, social and cultural human rights (Obligations C.J.A. American Convention on Human Rights, 2016). Under Article 10 of the Protocol of San Salvador, "everyone shall have the right to health, which includes enjoyment of the highest level of physical, mental and social well-being" (Obligations C.J.A. American Convention on Human Rights, 2016). However, in Latin American countries, social inequality has posed significant challenges towards improving health. According to the Economic Commission for Latin America and the Caribbean (ECLAC), approximately 34.1% of the region's residents live in poverty with more than 12.6% living in extreme poverty (ECLAC, 2008). Individuals living in more affluent neighborhoods enjoy access to advanced prevention and treatment services, while residents in remote villages are frequently marginalized from health care services.

Furthermore, the Pan American Health Organization (PAHO) reported that chronic, non-communicable diseases are the greatest cause of premature death and morbidity in Latin America (PAHO, 2007). According to PAHO, an estimate of 60% to 70% of all deaths in Latin America and the Caribbean are from chronic non-communicable diseases. PAHO projects that by 2030 over 1.6 million people per year will die from cancer in Latin America and the Caribbean (PAHO, 2008). Due to the rise of non-communicable infectious diseases in Latin America, there is a strong need to address the health inequity that is present in many of these Latin American countries.

¹ Commonly referred to as the "Pact of San Jose, Costa Rica" and the Protocol of San Salvador, which was adopted by the Organization of American States (OAS).

Before the development of universal health coverage programs, health systems in Latin American countries consisted of two-tier systems, where one tier was for individuals employed in the formal sector while the second-tier was managed through the ministries of health geared for the uninsured or the poor (Bliss, 2009). These systems; however, proved to be fragmented as the responsibility for healthcare delivery was placed at the state and local level and often without any transfer of resources from the federal level to the lower levels (Baeza, C. & Packard T., 2006). In many Latin American countries, funding for the health sector is often limited as few countries dedicate more than 4% of their GDP to public health services (Bliss, 2009). Likewise, 1.3 billion people in low and middle-income countries pinpoint financial constraints as the major barrier to access to health care (Preker *et al.*, 2004).

In order to reduce the financial difficulties that individuals face when seeking health care, some Latin American countries have established national or social health insurance (SHI) systems. Under SHI, health care is primarily financed through mandatory earmarked payroll contributions from workers, their employers, and the self-employed based on their income. In return, both the insured individuals and their dependents receive health coverage (Doetinchem *et al.*, 2010). Nonetheless, some SHI systems extend coverage to people who cannot pay (e.g. the poor, unemployed or individuals in the informal sector) by meeting or subsidizing their contributions with government tax or non-tax revenues. For this paper, the informal sector is defined as the segment of the labor force that doesn't pay taxes to the government; performs own-account work; microenterprises with no more than five workers; and domestic services (Rosenbluth, 1994). However, there are significant variations in SHI schemes ranging from mandatory contribution to voluntary enrollment. There are also differences in government involvement in regards to financing health care.

Therefore, the goal of SHI systems is to accomplish universal health coverage in a health system where financial risk is shared through risk pooling.

Another form of subsidizing health care cost for low-income populations consist of free-standing health schemes where the financial protection to the poor is achieved by subsidizing the cost of health care (Wagstaff, 2010). Subsidized health schemes consist of voluntary enrollment to an insurance program where health services are being offered at premiums considered below actuarially fair price (Wagstaff, 2010). Both SHI and subsidized health schemes such as Colombia's Sistema General de Seguridad Social en Salud (SGSSS) and Mexico's Seguro Popular have been studied in terms of their effect in enhancing access to care and providing financial protection to users.

For instance, King *et al.*, (2009) projected that Seguro Popular could result in a 23% reduction in catastrophic expenditure among those enrolled in Seguro Popular (King *et al.*, 2009). Likewise, Ruiz *et al.*, (2007), found that individuals enrolled in Colombia's subsidized regime had higher rates of inpatient care and lower rates of out of pocket expense compared to the non-insured (Ruiz *et al.*, 2007). The study also ran a simulation where the change in affiliation from uninsured to insured through the subsidized regime would result in a 7.0% increase in the probability of health care utilization and would reduce out of pocket expenditure (Ruiz *et al.*, 2007).

Although several studies have summarized the literature on the effects of health system reform on access to medical care and out of pocket expenditure, there is still little information on the effects of subsidized health schemes on the utilization of preventative services among individuals in the subsidized group. Acharya *et al.*, (2012), published the most recent literature review that summarized the impact of subsidized health schemes in the informal sector in both low-and-middle income countries; however, additional studies have been published since the literature review. Furthermore, the literature review

included countries that are not comparable to each other due to their variation in population demographics. The literature review also included studies that did not correct for endogeneity and self-selection bias. Therefore, this systematic review examines the impact of subsidized and social health insurance schemes on the utilization of preventative care services offered to the informal sector in Latin American countries using studies with rigorous methodologies that correct for self-selection bias for program affiliation.

Methods

A literature search was conducted on August 1st-September 18, 2016 based on the PRISMA guidelines. Studies were retrieved from the following electronic data sources: EconLit, PubMed, Google Scholar, MEDLINE, WorldBank, Academic Search Premier, Global Health, and SCIELO. Key search terms included: "social health insurance," "subsidized health care," "subsidized health scheme," "preventive care" and "preventative care." Additional search terms consisted of "health care," "instrumental variables," "endogeneity," "health insurance program evaluation," and "access to and use of health care." The search term "OR" was included to ensure that the search would yield articles that evaluated "social health insurance schemes" or "subsidized health care schemes." The search was further condensed to only studies in Latin American countries between 1990-2016. References of the articles were further examined for potential inclusion in the systematic review. Only English and Spanish language studies were included.

Inclusion Criteria

In order for articles to be included in the review, they had to meet the following criteria: (1) the studies focused on the evaluation of subsidized/social health insurance schemes on the utilization of preventative care services (e.g. number of yearly visits to a physician, annual screening and testing, vaccination uptake and/or health check-ups) in Latin American countries, (2) studies must be randomized control trials or quasi-

randomized control trials, if randomization is not possible, studies should create a matched control through either propensity score matching or a regression discontinuity design, (3) the study population must consist of individuals enrolled in a social or subsidized health insurance scheme with a matched control group with similar socioeconomic and neighborhood composition characteristics analyzed for the same time periods (e.g. individuals with no health insurance), (4) the study design must have an outcome of measure in terms of utilization of preventative services, (5) studies must correct for the problem of self-selection, (6) the studies must be published between 1990-2016, and (7) conducted in Latin American countries.

Studies were excluded if the control group included individuals enrolled in a private health insurance, mandatory contributive health insurance, or any other type of health insurance coverage. Studies were also excluded if preventative care was not one of the outcome variables; or were reviews of previously published articles, or did not use a rigorous methodology.

Eligible Health Schemes

Studies with eligible health schemes had to meet one of the following criteria: (1) a Social health insurance (SHI) scheme that subsidizes health care cost for individuals in either the informal sector, self-employed, unemployed or vulnerable populations (e.g. children, pregnant women, or the elderly), (2) a subsidized health scheme or program that offers financial protection on health care cost to individuals in poor households, children, pregnant women, and the elderly at a lower rate or free of charge or (3) a health scheme managed at the national level to help aid the cost of essential health care services to populations who could not otherwise afford it.

Rigorous Methodologies

To ensure the validity of the study's methodology and results, it's important to account for selection bias and endogeneity especially since selection bias can affect the outcome through adverse selection, which would result in a comparison of two demographically distinctive groups. For example, individuals who are healthier may opt out of healthcare coverage while those who are ill are likely to enroll. Thus resulting in a large pool where the insured are sicker compared to the small pool of healthier uninsured individuals. Nonetheless, individuals who are better informed, more educated and who may be healthier could be more likely to adopt insurance over their counterparts (Acharya *et al.*, 2012). Even if insurance is offered randomly, it cannot be assumed that individuals who adopt the insurance are similar to those who do not. Thus, a comparison between the insured and uninsured individuals can result in a flawed comparison since factors influencing selection into the insurance program have not been taken into account. Studies, therefore, must use rigorous methodologies such as propensity score matching, regression discontinuity design, difference-in-differences, and instrumental variables to evaluate the impact of health care schemes while correcting for self-selection bias and endogeneity.

Propensity score matching (PSM) is a method that relies on observed characteristics to construct a comparison group with the most similar characteristics to that of the treatment group. Propensity score matching assumes no unobserved differences between the treatment and comparison group are associated with the outcome of interest (Gertler *et al.*, 2011). In order to use propensity score matching, the study must have a representative and highly comparable survey to identify those enrolled and not enrolled in the program (Jalan *et al.*, 2003). The study must then pool the two samples and estimate the probability that each will enroll in the program according to the individual's characteristics thus resulting in a propensity score. Next, the samples are restricted to units in the propensity

score distribution, and each enrolled unit is matched with a subgroup of not enrolled units with similar propensity scores (Jalan *et al.*, 2003). Finally, the outcome of interest is compared to the enrolled units and their matched comparison of non-enrolled units. The difference in average outcomes is the measure of the impact and the mean of the individual impact which provides the estimated average treatment effect (Jalan *et al.*, 2003). Propensity score matching is often used when insurance uptake occurs outside a non-experimental setting (Acharya *et al.*, 2012). Some of the limitations of using propensity score matching is that it requires a large sample size and a common support between the enrolled and not enrolled (Giedion *et al.*, 2013). Additionally, matching can only be based on observed characteristics. Therefore, it doesn't control for unobserved selection bias (Giedion *et al.*, 2013).

Regression Discontinuity Design (RDD) is an impact evaluation method used when a program contains a continuous eligibility index with clear defined cutoff scores to determine who is eligible and not eligible for the program but is unrelated to the outcomes (Gertler *et al.*, 2011). Regression discontinuity design approach compares health care-related outcomes among the eligibles at the margin compared to those who are just above the cutoff, which constitute the control group (Gertler *et al.*, 2011). RDD yields an intention to treat estimation however one of the limitations is that it only provides information on the impact of participants close to the cutoff points and does not control for unobservable characteristics (Giedion *et al.*, 2013).

Differences-in-differences (DID) is a method that compares the changes in outcomes over time between a population that is enrolled in a program compared to a population that is not enrolled in the program (Gertler *et al.*, 2011). The first difference controls for factors that are constant over time for the same group to itself (Gertler *et al.*, 2011). However, outside time-varying factors remain. A way to capture outside time-varying factors is to

measure the before and after changes in outcomes for the group that did not enroll in the program but was exposed to the same environmental conditions, thus resulting in the second difference (Gertler *et al.*, 2011). By subtracting the second difference from the first difference, the primary source of bias is eliminated. One of the advantages of using difference-in-difference is that it eliminates selection bias due to unobservable characteristics. However, it does not control for unobservable selection bias and is less robust than randomized selection methods (Giedion *et al.*, 2013).

Instrumental variables approach (IVs) is a method for correcting for endogeneity when it is believed that individuals who enroll in the program are not easily comparable to those not enrolled in the program (Gertler *et al.*, 2011). Since the explanatory variable is depended on a variable that affects only entry into the program and has no effect on outcome (Gertler *et al.*, 2011). One of the disadvantages of IVs is the difficulty in finding instrumental variables that affect the participation in the program but is unrelated to the outcome (Giedion *et al.*, 2013).

Description of Health Systems

Colombia's health system is a social health insurance system with both a contributive regime (CR) and a subsidized regime (SR). Individuals in the contributive regime consist of private and public sector employees working in the formal sector or are self-employed (Giedion *et al.*, 2009). Payment in the contributive regime is based on payroll taxes in which 4% comes from the employee, and the remaining 8.5% comes from the employer (Giedion *et al.*, 2009). Individuals in the subsidized regime (SR) are individuals who fall under El Sistema de Selección de Beneficiarios Para Programas Sociales (SISBEN) index I or II and may vary by municipality. The subsidized regime is financed by a mix of national, local and solidarity contribution from the contributive regime of 1.5% (Giedion *et al.*, 2009). There is also the public network of providers (PN) that provide care for poor

people not enrolled in either the contributive or subsidized regime. These funds come from earmarked taxes, departmental and municipal resources; however, availability depends on supply (Giedion *et al.*, 2009).

Both Mexico and Nicaragua have a mixed health financing system. Nicaragua's health system is a mix of a tax based and SHI health system. Under the tax based health-financing system, health care services are provided in seventeen health districts under the District System for Integrated Healthcare Delivery (SILAIS) (Giedion *et al.*, 2013). Furthermore, the SHI component is administered through Nicaraguan Institute of Social Security (INSS) and provides health care access through a network of private providers. There is also private health insurance and community-based health insurance schemes that focus on the informal sector or rural workers (Giedion *et al.*, 2013).

Like Nicaragua's healthcare system, Mexico's healthcare system is a mixed health system with different organizations geared to various sectors. Under the Mexican Social Insurance System (IMSS) health coverage is focused on formal sector employees, while civil servants receive health coverage from Governmental Workers Social Security and Services Institute (ISSSTE) (Giedion *et al.*, 2013). Seguro Popular; however, is a subsidized health program available to subsidize the cost of health care to unemployed and self-employed workers in the informal sector. Lastly, the Ministry of Health Financed Facilities (MOHFF) provides health coverage for individuals not enrolled in any health insurance (Giedion *et al.*, 2013).

Description of Studies

Two thousand one hundred and fifty-four articles were found in the database search that pertained to social or subsidized health insurance schemes and preventative care utilization. After screening for duplicates and determining eligibility by title and by abstract, two thousand and ninety-six articles did not meet the inclusion criteria and were

excluded from the review. Thus, fifty-eight full-text articles were assessed for eligibility. Figure 1 illustrates the number of articles at each stage of the review process. Of the ten articles eligible for inclusion in the review, data was extracted into an excel spreadsheet. The information extracted from the study consisted of the country of study, author, publication date, type of healthcare scheme, description of health insurance coverage, the objective of the study, methodology, study population, impact of the study on preventative care utilization and study results (See Figure 2).

Among the ten articles in the study that met the inclusion criteria, six were from Colombia (Trujillo *et al.*, 2005; Gaviria *et al.*, 2006; Miller *et al.*, 2013; Ramírez *et al.*, 2013; Atehortúa *et al.*, 2014; Atehortúa *et al.*, 2015), three from Mexico (King *et al.*, 2009; Sosa-Rubí *et al.*, 2009; Rivera-Hernandez *et al.*, 2016) and one from Nicaragua (Thornton *et al.*, 2010).

Results

Among the ten articles in the study that met the inclusion criteria, four studies used propensity score matching to obtain results on impact evaluation (Trujillo *et al.*, 2005; Sosa-Rubí *et al.*, 2009; Atehortúa *et al.*, 2014; Atehortúa *et al.*, 2015). Ramírez *et al.*, (2013) used poisson and binary models for counterfactual analysis. Miller *et al.*, (2013) used both regression discontinuity design and instrumental variable approach and both Rivera-Hernandez *et al.*, (2016) and Gaviria *et al.*, (2006) used instrumental variable approach. King *et al.*, (2009) used difference-in-difference analysis and Thornton *et al.*, (2010) used a combination of ordinary least squares with instrumental variables and difference-in-difference to measure the outcome.

Of the ten studies, only three studies focused on a particular population of interest. Atehortúa *et al.*, (2014) focused on women between the ages of 19-49 years old and women over the age of 50. Rivera-Hernandez *et al.*, (2016) focused on individuals over the age of 50

years' old who were diagnosed with diabetes and hypertension and had either no health insurance or were insured through Seguro Popular. While Sosa-Rubí *et al.*, (2009) studied adults between the ages of 20-80 years old with diabetes that were either uninsured or insured through Seguro Popular. The remaining seven studies focused on adults and family members from a range of ages that were either uninsured or insured through a SHI scheme or a subsidized health scheme.

In terms of outcome of interest, five studies examined the effect of subsidized health schemes on utilization of preventative care services as well as hospitalization services (Trujillo *et al.*, 2005; Gaviria *et al.*, 2006; Thornton *et al.*, 2010; Ramírez *et al.*, 2013; Atehortúa *et al.*, 2015). Two studies looked at the utilization of preventative/medical services and financial protection (King *et al.*, 2009 and Miller *et al.*, 2013). Two studies looked at the utilization of preventative services for diabetic care (Sosa-Rubí *et al.*, 2009 and Rivera-Hernandez *et al.*, 2016) and one study looked at access to cervical cytology for prevention of cervical cancer among women (Atehortúa *et al.*, (2014)).

Regarding utilization of preventative care services, the studies reported whether utilization of preventative services was higher or lower among those insured in the subsidized health schemes compared to those who were uninsured during a particular time interval. Among the ten studies that examined the impact of subsidized health schemes on utilization of preventative care services in Latin American countries, only five found a positive impact on utilization of preventative services (Trujillo *et al.*, 2005; Gaviria *et al.*, 2006; Sosa-Rubí *et al.*, 2009; Miller *et al.*, 2013; Atehortúa *et al.*, 2015). Two studies found a negative effect on preventative care utilization (Ramírez *et al.*, 2013 and Atehortúa *et al.*, 2014) and the remaining three studies found no effect or an effect that was not statistically significant (King *et al.*, 2009; Thornton *et al.*, 2010; Rivera-Hernandez *et al.*, 2016).

Among the five studies that found a positive effect on preventative care utilization among those enrolled in a subsidized health scheme compared to those not enrolled; four of the studies were from Colombia while only one was from Mexico. In the Colombia studies, Trujillo *et al.*, (2005), Gaviria *et al.*, (2006), Miller *et al.*, (2013) and Atehortúa *et al.*, (2015) found higher levels of preventative care utilization among those in the subsidized regime compared to those uninsured at different time periods. Trujillo *et al.*, (2005) found that SHI increased preventative care utilization among individuals between the ages of 0-59 years old and was statistically significant in both propensity score matching and instrumental variable estimation method.

Similar findings were found by Atehortúa *et al.*, (2015); however, only children 4-14 years of age, women 15 to 49 and men older than 50 years of age had a positive effect on preventative care utilization upon enrollment to the subsidized regime. Variation in findings can be attributed to the different time intervals the studies analyzed. For instance, Trujillo *et al.*, (2005) looked at the 1997 Encuesta Nacional Calidad de Vida while Atehortúa *et al.*, (2015) used the 2008 Encuesta Nacional Calidad de Vida which had a larger study population from Trujillo's study.

Also, Gaviria *et al.*, (2006) found that the estimated effect of the subsidized regime on the use of preventative consultations with physicians was 25% higher among the enrolled compared to the uninsured when municipalities fixed effect were included. Miller *et al.*, (2013) also found that enrollment to the subsidized regime was associated with a 29% increase in preventative visits compared to those not enrolled ($\alpha=0.01$). However, Ramírez *et al.*, (2013) and Atehortúa *et al.*, (2014) found a negative effect of SHI on preventative care utilization. Ramírez *et al.*, (2013) reported less frequent doctor visits among those enrolled in the subsidized regime (21%) compared to the uninsured. Atehortúa *et al.*, (2014) found that utilization of cervical cytology screening in women in the

subsidized regime between the ages 19-49 years old was less by 2.9% compared to those not enrolled. One of the limitations of Ramírez *et al.*, (2013) study is that it did not look at the effects by segments of the population like Atehortúa *et al.*, (2015), who found that certain sections of the population had a positive effect while others segments such as men between the ages of 15 to 49 years old and women over the age of 50 years old had a negative effect.

For Mexico's Seguro Popular (SP), only Sosa-Rubí *et al.*, (2009) found that individuals enrolled in Seguro Popular had a greater likelihood of visiting their physician four or more times per year (0.093); had more blood glucose test per month (0.142); and received on average 3.13 times more insulin injections per week compared to those without health insurance. On the other hand, King *et al.*, (2009) and Rivera-Hernandez *et al.*, (2016) found no effect or marginal effect that was not statistically significant regarding preventative care utilization among the subsidized group compared to the uninsured. The differences in results can be explained by the variation in the study's population that was not similar across the three studies. For example, Sosa-Rubí *et al.*, (2009) looked at a population of diabetics between the ages of 20-80; however, Rivera-Hernandez *et al.*, (2016) also focused on diabetic care but for an older population of individuals 50 and older while King *et al.*, (2009) focused on health clusters instead.

For Nicaragua's only study by Thornton *et al.*, (2010), enrollment to the subsidized health scheme had no significant effect on increasing the probability of seeking preventative care among its enrollees. However, the study found that individuals who were insured were 42.7% more likely to have visited an Empresas Medicas Previsionales (EMPs) in the prior year; 8.9% less likely to visit a private clinic, and 11.5% less likely to visit a public hospital compared to individuals who were uninsured.

Discussion and Conclusion

Despite the significant movement towards universal coverage in Latin America through subsidized health schemes, there is still limited information regarding its benefits in improving preventative care utilization. Among the ten articles that were analyzed in this review, there was mixed evidence of the effectiveness of subsidized health schemes on the utilization of preventative care services. Colombia was the only country that had a greater number of studies that illustrated a positive effect on utilization of preventative services among those enrolled in the subsidized regime compared to the uninsured. The rise in the higher use of preventative services in Colombia can be attributed to the incentive structure in provider's contract which provides financial incentives to providers when participants utilize preventative care services (Miller *et al.*, 2009). Deb *et al.*, (2006) also found that mechanism for copayments; financial mechanisms of payment; and expectation of reimbursement policies have shown to produce an influence on uptake, utilization and health improvement.

However, for both subsidized health schemes in Mexico and Nicaragua the studies under review did not provide a consistent result to yield a determination of the health schemes effect on utilization of preventative services. Therefore, further studies should examine more closely this relationship and determine the factors that indirectly or directly influence the lack of utilization of preventative services among individuals in the subsidized group.

Another reason for the inconsistency in findings is that none of the studies included a variable for trust in government or financial institutions, levels of risk aversion, availability of care, or understanding of insurance (Acharya *et al.*, 2012). Since individuals who distrust the government may decide to opt-out of the program even though they may qualify. Another limitation of the studies was the low enrollment rate which could have

been influenced by factors such as perception, education, and cultural factors that were not taken into account. Likewise, low levels of health seeking behavior could have also been attributed to the lack of understanding of insurance or the existence of hidden charges outside of those covered by the insurance (Thornton *et al.*, 2010). As Thornton *et al.*, (2010) study on Nicaragua demonstrated that there was confusion concerning coverage as one of the individuals in the focus group raised the following concern, “I think that...most people don’t pay into the insurance, [because] we don’t know where to do it or with whom to do it. I think there needs to be more publicity” (Thornton *et al.*, 2010). Therefore, it is important that the subsidized health schemes are transparent in terms of the benefits that are covered, the process for enrollment, fees charged, and payment methods.

Nonetheless, some of the limitations of this review are the exclusion of studies that examined utilization of medical services but did not include any information in terms of utilization of preventative care services. Another limitation is the exclusion of studies that considered the effect of subsidized programs on the utilization of preventative care but did not have a rigorous methodology or included individuals in the contributive group. Additionally, due to the small sample of relevant studies in the systematic review and limitations on study designs, limited conclusions can be drawn. To address these limitations, more studies with rigorous methodologies such as instrumental variables should be included since it takes into account the effect of variables such as trust in government or understanding of insurance. Other common cited recommendations across studies consisted of examining whether the low cost of hospitalization has an influence on the decline of utilization of preventative care.

In conclusion, this systematic review found that for Nicaragua and Mexico, the subsidized health schemes demonstrated to have no effect on improving utilization of preventative services among those in the subsidized group and should, therefore, be further

examined with more rigorous study designs. For Colombia, there was some evidence of a positive effect of the social health insurance among the subsidized regime in the utilization of preventative care services compared to the uninsured across different time intervals. Lastly, the review demonstrated the need for evaluating subsidized programs across Latin American countries to determine if preventative services are adequately being utilized or whether individuals are relying on the low cost of hospitalization.

Figure 1: Flow Diagram

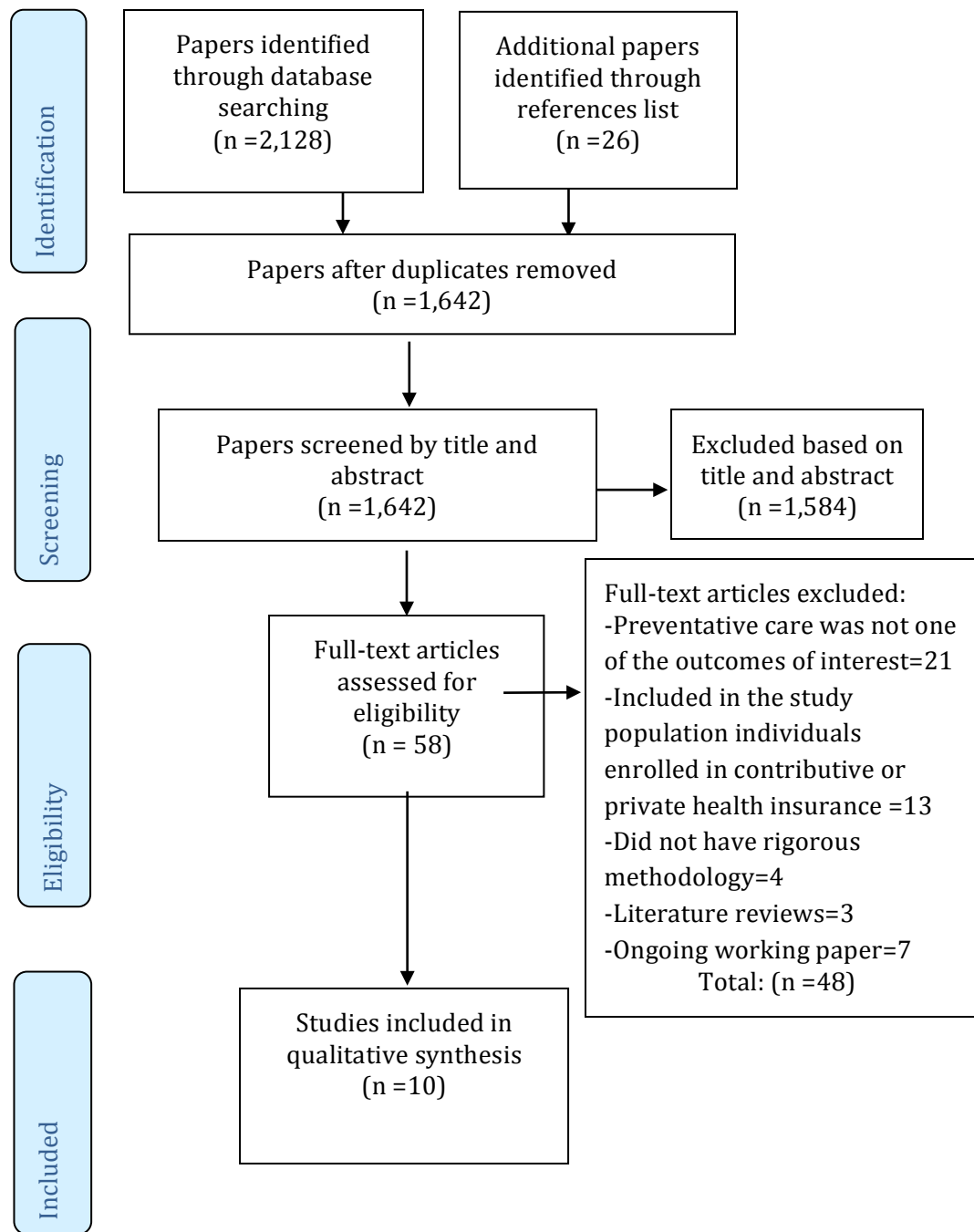


Table 1: Description of Studies

Country/ Title	Author & Date	Healthcare Scheme	Health Insurance Coverage	Objective of Study	Methodology	Study Population & Sample Size	Impact (+/-)	Results
Colombia "The impact of subsidized health insurance for the poor: evaluating the Colombian experience using propensity score matching"	Trujillo <i>et al.</i> , (2005)	Social Health Insurance (SHI) scheme with a contributive regime (CR), subsidized regime (SR) and public network of providers (PN)	•contributive regime-private or public sector employees working in the formal sector and self-employed. Covers primary and tertiary care as well as rehabilitation, prevention and treatment. •Subsidized regime-Poor people identified by proxy means test score which varies by municipality. Basic coverage but no full coverage on secondary care. •Public Network of Providers-individuals not enrolled in health insurance. Inexplicit coverage of primary and secondary care based on supply.	Evaluate the impact of Colombia's subsidized health insurance program on medical care utilization (preventative care, outpatient care, and hospital use).	Propensity Score Matching and instrumental variables estimation	1997 Colombia Living Standards Survey (ECV/97) (N=22,291) Subsidized regime (N=5,559) Have no health insurance (N=16,732)	+	Subsidized health insurance increased preventative care utilization among individuals between the ages of 0-59 years old but not for the elderly 60+ compared to those with no SHI. The results were consistent and statistically significant in both the propensity score matching and instrumental variable estimation methods. Regarding hospitalization, SHI enrollees who were older than 60 years old were more likely to use hospital services compared to non-SHI enrollees.
Colombia "Evaluating the impact of healthcare reform in Colombia: from theory to practice"	Gaviria <i>et al.</i> , (2006)	Social Health Insurance (SHI) scheme with a contributive regime (CR), subsidized regime (SR) and public network of providers (PN)	"See Trujillo <i>et al.</i> , (2005)"	To evaluate the impact of the subsidized regime on the state of health, use of medical services and household consumption of goods and services.	Ordinary Least Squares (OLS) and Instrumental variables (IV) estimates with and without municipality fixed effects	2003 Living Standard Measurement Study (LSMS) survey Study population were individuals who reported being enrolled in the subsidized regime and individuals who reported not being in the subsidized regime and excluding those belonging to the contributive regime or the special health regimes (N=45,836)	+	Preventative consultations were 25% higher among those in the subsidized regime compared to those not in the subsidized regime when municipalities fixed effect were included (39% when excluding municipalities fixed effect). For hospitalization, enrollment to the subsidized regime decreased the probability of being hospitalized by 11% compared to those not in the subsidized regime.

Colombia "Risk protection, service use, and health outcomes under Colombia's Health Insurance Program for the Poor"	Miller <i>et al.</i> , (2013)	Social Health Insurance (SHI) scheme with a contributive regime (CR), subsidized regime (SR) and public network of providers (PN)	"See Trujillo <i>et al.</i> , (2005)"	To examine the impact of the subsidized health insurance on financial risk protection, service use, and health outcomes among Colombia's poor.	Intention to treat estimation with regression discontinuity design with instrumental variables. The study created their own SISBEN index to determine eligibility to account for manipulation of SISBEN scores in practice	2003 Encuesta Nacional Calidad de Vida (ECV) and 2005 Demographic and Health Survey (DHS) N=4,300 families both eligible and ineligible	+	Individuals in the subsidized regime were associated with a 29% increase in the probability of visiting a physician as a preventative measure compared to those not eligible for the subsidized regime ($\alpha=0.01$).
Colombia "The impact of subsidized health insurance on the poor in Colombia: evaluating the case of Medellin"	Ramírez <i>et al.</i> , (2013)	Social Health Insurance (SHI) scheme with a contributive regime (CR), subsidized regime (SR) and public network of providers (PN)	"See Trujillo <i>et al.</i> , (2005)"	Evaluate the effect of the subsidized health care program on preventative care utilization and hospital utilization in Medellin.	Poisson and Binary models with endogenous variables to account for endogeneity.	Medellin Living Standards Survey, 2007 (N=12,975) Subsidized Regime (N=9893) Not enrolled in the Subsidized Regime but eligible (N=3082)	-	Individuals enrolled in the subsidized regime visited doctors less frequently (21%) compared to individuals not covered in the subsidized regime. However, individuals in the subsidized regime had a higher probability of hospitalization compared to those who were not covered. The study found that individuals enrolled in the subsidized regime and whose self-perception of health status was good, had a higher probability of hospitalization (3.28%) compared to individuals with the same characteristics but were not enrolled in the subsidized regime (0.48%).

Colombia "Impacto del seguro de salud subsidiado en el acceso a la citología cervical en Medellín, Colombia"	Atehortúa <i>et al.</i> , (2014)	Social Health Insurance (SHI) scheme with a contributive regime (CR), subsidized regime (SR) and public network of providers (PN)	"See Trujillo <i>et al.</i> , (2005)"	Assess the impact of subsidized healthcare insurance on access to cervical cytology for women in Medellín, Colombia.	Propensity Score Matching using stratification estimates, k-nearest neighbor algorithms, and kernel density	2008 Encuesta de Calidad de Vida de Colombia Study population were women 19-49 years and women over the age of 50 years (N=7,337) Enrolled in the subsidized group (N=5,707), while the control group was uninsured individuals who had been identified in the SISBEN (N=1,630).	-	The utilization of cervical cytology screening in women between the ages of 19-49 years' old enrolled in the subsidized regime was 2.9% less compared to women who were not enrolled in any health insurance using kernel density method. For women over the age of 50 years and older, the findings were not statistically significant to illustrate the impact of the subsidized health insurance on access to cervical cytology screening.
Colombia "Impacto del seguro subsidiado en el acceso y el uso de servicios de salud: el caso de Medellín"	Atehortúa <i>et al.</i> , (2015)	Social Health Insurance (SHI) scheme with a contributive regime (CR), subsidized regime (SR) and public network of providers (PN)	"See Trujillo <i>et al.</i> , (2005)"	Evaluate the impact of the subsidized health insurance on access and utilization of medical services in Medellín stratified by population groups.	Propensity Score Matching	2008 Encuesta Nacional Calidad de Vida (ECV) (N=26,663) Subsidized regime (N=20,221) Not enrolled in the subsidized regime but identified in the SISBEN (N=6,442)	+	Enrollment to the subsidized regime had a positive effect on preventative care utilization, among children under the age of four, children between 5 to 14 years of age; women between the ages of 15 to 49 years old; and men older than 50 years of age. However, it did not have a positive effect on preventative care utilization among men 15 to 49 years old and women older than 50. Regarding access to hospitalization, the subsidized health insurance had a positive effect on access among children under the age of four and women between the ages of 15 to 49. However, it had a negative effect on access to hospitalization among men over the age of 50 years.

Mexico "Diabetes treatment and control: the effect of public health insurance for the poor in Mexico"	Sosa-Rubí <i>et al.</i> , (2009)	Mixed Health Financing System with Mexican Social Insurance System (IMSS), Government Workers Social Security Services Institute (ISSTE), Seguro Popular and Ministry of Health Financed Facilities (MOHFF)	• Mexican Social Insurance System (IMSS) - employers working in the formal sector. Coverage includes preventative and curative care. • Governmental Workers Social Security and Services Institute (ISSSTE) - federal and some state employees. Covers preventative and curative care. • Seguro Popular - Unemployed and self-employed working in the informal sector. Covers basic health services, primary & secondary care. • Ministry of Health Financed Facilities (MOHFF) - individuals enrolled in no health insurance.	To analyze the effect of enrollment in Seguro Popular on access to health resources, treatment and blood glucose control among low-income adults with diabetes.	Propensity Score Matching	2006 National Health and Nutrition Survey Study population consisted of adults 20-80 years old with diabetes (N=1,491) Enrolled in Seguro Popular (N=430) Uninsured (N=1061)	+	Individuals enrolled in Seguro Popular had a greater likelihood of visiting their physician four or more times per year (0.093) compared to those with no health insurance. Those enrolled in Seguro Popular also had more blood glucose test per month (0.142). Individuals enrolled in Seguro Popular received on average, 3.13 times more insulin injections per week compared to those without health insurance.
Mexico "The impact of social health Insurance on diabetes and hypertension process indicators among older adults in Mexico"	Rivera-Hernandez <i>et al.</i> , (2016)	Mixed Health Financing System with Mexican Social Insurance System (IMSS), Government Workers Social Security Services Institute (ISSTE), Seguro Popular and Ministry of Health Financed Facilities (MOHFF)	" See Sosa-Rubí <i>et al.</i> , (2009)"	Examine the impact of Seguro Popular on diabetes and hypertension care for older adults (50+ years old).	Fixed effects instrumental variable (FE-IV) at the individual level with municipality fixed-effects estimation	Encuesta Nacional de Salud y Nutrición (ENSANUT) for the year 2000, ENSANUT 2005-2006, and ENSANUT 2011-2012. N=3,015 older adults (50+ years old) diagnosed with diabetes who have no health insurance or are insured through Seguro Popular N=5,307 older adults (50+ years old) diagnosed with hypertension	No effect	Individuals diagnosed with diabetes who are enrolled in Seguro Popular were more likely to use insulin or oral agents as a pharmacological treatment option; however, the finds were marginally significant at p=0.051. Additionally, the study found that Seguro Popular had no effect on diabetic treatment and care for individuals older than 50 years old.

Nicaragua "Social security health insurance for the informal sector in Nicaragua: a randomized evaluation"	Thornton <i>et al.</i> , (2010)	Mixed health financing system with tax-based health financing and SHI scheme	• In the tax based health-financing system, health care services are provided in 17 health districts known as District System for Integrated Healthcare Delivery (SILAIS) that manage and supervise the Ministry of Health facilities in its district. • The second pillar is the Nicaraguan Institute of Social Security (INSS), which operates a social health insurance scheme for a portion of the population. A network of private providers provides the SHI benefits. • Additionally, there are private health insurance companies and community-based health insurance schemes that target the informal sector or low-income workers in rural or underserved areas.	To evaluate the impact of the extended Nicaraguan Social Security Institute (INSS's) health insurance program for the informal sector workers using microfinance institutions (MFIs) as delivery agents.	Local average treatment effect, ordinary least squares, instrumental variables and differences in differences	Insurance offered randomly in selected market booths with a pre-experiment baseline Households (N=2,610)	No effect	The study found no significant effect of enrollment to subsidized program and utilization of preventative visits. However, the study found that individuals who were insured were 42.7% more likely to have visited an Empresas Medicas Previsionales (EMPs) in the prior year; 8.9% less likely to visit a private clinic; 6.3% less likely to visit a public health center and 11.5% less likely to visit a public hospital compared to individuals who are uninsured.
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