The Effects of Mexico's Seguro Popular Health Insurance on Infant Mortality: An Estimation with Selection on the Outcome Variable

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Summary. — This paper estimates the effects of Mexico's Seguro Popular health insurance on infant mortality during its first 5 years of implementation. It uses data on births reported in the micro sample from Mexico's 2010 general population census. However, births of surviving children are more likely to be observed than births of non-surviving ones. This selection on the outcome variable is addressed using the weighted exogenous sampling maximum likelihood (WESML) estimator, originally developed for the case of choice-based samples. The results indicate that the program can be expected to reduce Mexico's infant mortality by close to 5 out of 1,000 births.
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Key words — infant mortality, health insurance, Mexico, sample selection

1. INTRODUCTION

The provision of basic health services to the entire population has become an increasingly important policy issue in many middle-income countries, and especially in Latin America. Some countries have opted for a single payer system with direct provision of health services by the government, most notably Brazil which started to introduce its Unified Health System (SUS) in the later 1980s (Paim, Travassos, Almeida, Bahia, & Macinko, 2011). Many other countries, however, have opted for an insurance model that separates the provision of health services from payment, for example Colombia (Giedion *et al.*, 2010), Costa Rica (Cercone, Etoile, Pacheco-Jimenes, & Briceno, 2010) or Peru (Bitrán, Muñoz, & Prieto, 2010).

The present paper analyzes the effect of one such program, the Seguro Popular health insurance in Mexico, on one of the most important public health outcomes, infant mortality. Exploiting variations in the program's lengthly roll-out, it will be shown that it had a significant impact on reducing neonatal and infant mortality. Moreover, coverage during pregnancy is a more important factor than coverage at birth. The analysis uses individual level survey data, which, as is often the case, suffers from potentially severe bias due to selection on the outcome variable. Not only are complete data for non-surviving children more likely to be missing, but data are only available on a mother's last live birth. Both aspects result in a higher probability that the birth of a surviving child forms part of the sample than that of a non-surviving one. Such selection on the dependent variable is a fairly common, but often ignored, problem when working with survey based mortality data. This problem is addressed by using a simple correction method first proposed by Manski and Lerman (1977) for the case of choice-based sampling.

The paper's main contributions are twofold. Firstly, it is to my knowledge the first study that applies choice-based sampling techniques to the estimation of mortality risk to address the selection on the outcome problem. It is fairly common for survey data to only collect detailed information on a woman's last birth. As will be discussed in more detail below, this, by construction, under-samples births of non-surviving children. If survival is the outcome of interest, this induces selection on the dependent variable. The proposed method should therefore be of great use for future research. The second contribution is that it is also the first paper to rigorously estimate the impact of Seguro Popular on measures of infant mortality, showing that the program had a large and statistically significant effect on its reduction. As discussed below, the literature on national health care systems in low- and middle-income countries has still not produced conclusive evidence that greater coverage leads to improved health outcomes. Either because of insufficient data quality or because many measurable health outcomes, especially for the adult population, are slow moving targets that do not change significantly within the time frame usually available to conduct an impact evaluation. By focusing on infant mortality, which can be expected to respond quickly to health care improvements, this study gets around the latter pitfall. However, being a rare event, this outcome also requires a very large data set in order to make statistically meaningful inferences. The choice-based sampling correction makes it possible to use micro data from Mexico's decennial census, which provide a very large sample of births (>700,000) in the country over a five-year period (2004–09).

The effects of universal health insurance for low-income populations in developing countries have been studied by Economics and Public Health. One focus of the former has been on the incentives to pursue formal *vs.* informal sector employment. Results find either no statistically significant effect or a relatively small shift toward informality (Azuara & Marinescu, 2010; Barros, 2008; Bosch & Campos-Vázquez, 2010; Camacho, Conover, & Hoyos, 2010; Martínez & Aguilera, 2010; Levy, 2008). In the Public Health literature, three

principal questions stand out (Giedion & Díaz, 2010): The impact of health insurance on (i) access to and use of health services, (ii) financial protection (avoiding catastrophic expenditures), and (iii) health outcomes. After systematically reviewing 49 quantitative studies, Giedion and Díaz (2010) find that most studies find positive impacts on the first two outcomes, but no conclusive evidence on the third.

This last point deserves some special attention. Giedion and Díaz (2010) discuss various studies that attribute the lack of conclusive results on health outcomes on a lack of appropriate data. Scott and Aguilera (2010) point out that it is impossible to estimate the effects of a fairly recently established program on long-term health outcomes. A similar point is made by Victoria and Peters (2009). In particular, Giedion, Díaz, Alfonso, and Savedoff (2009), studying the case of the Colombian health insurance, are not able to find any significant impact of access to health care on child survival. The authors use three rounds of Demographic and Health Survey (DHS) data, comparing simple means between treatment and control observations and applying propensity score matching (PSM), and attribute their non-finding principally to data limitations. Other studies limit themselves to simple before–after comparisons. For example, several authors (Baptista-Menezes, Hallal, dos Santos, Victoria, & Barros, 2005; Barros et al., 2005; Barros, Santos, & Bertoldi, 2008) have argued that the observed decline in child mortality in the southern Brazilian city of Pelotas can be attributed to the introduction of universal health care in the country in the late 1980s, and the subsequent improvement in services. The dataset analyzed contains information on close to all births in the city in 1982, 1993, and 2004, but does not allow for a distinction between treatment and control observations. Using vital statistics at the municipal level, Victoria et al. (2011) find that a higher coverage of Brazil's Family Health Program (PSF) [1] is associated with a reduced gap in the incidence of infant mortality between the richest and poorest income quintiles. Cercone et al. (2010) report that the insured population in Costa Rica have a better self-perceived health status than their uninsured counterpart. To my knowledge the only other paper that finds a positively significant effect of access to health insurance on the health of newborns in a middle-income country by employing robust identification techniques is Camacho and Conover (2013). The authors analyze data from a single metropolitan area in Colombia, using a regression discontinuity around the eligibility threshold. Their estimates show that the program significantly reduced the incidence of a low birth weight and increased the Apgar score.

Concerning other health outcomes, Barros (2008) finds that Seguro Popular did not improve the incidence of hypertension nor self-reported health status. A lack of improvements in health outcomes is also the result in Duval-Hernández and Smith-Ramírez (2011), who conclude that the program's costs are therefore not justified. During the early implementation of Seguro Popular, King et al. (2009) conducted an assessment of the program over a 10 month period in 2005–06 by randomizing roll-out between 74 matched pairs of "health clusters" (based on access to health facilities). No significant effect on health outcomes was found. Using data for 2002–04, Knox (2008) does not find any significant effect on self-reported health status or the ability to perform activities of daily living. However, Ruvalcaba and Parker (2010) find that while Seguro Popular does not reduce the incidence of chronic diseases such as diabetes, it did have a significant effect on the reduction in cholesterol, and, in some case, high blood pressure. Likewise, Bleich, Cutler, Adams, Lozano, and Murray (2007) finds, employing propensity score matching methods, that the program significantly reduced hypertension.

With respect to access and financial protection, Barros (2008) finds that Seguro Popular decreased beneficiaries out of pocket expenses on health services. Similarly, Grogger, Arnold, León, Ome, and Triyana (2010) also find that the program did reduce household expenditures on health, but differently in urban and rural areas. Whereas in the former the reduction is mostly due to savings on prescription drugs, in the latter the results are driven by fewer expenses on catastrophic events. Knox (2008) reports that it had a positive impact on health care utilization, but not on spending. A few studies have looked at Seguro Popular's impact on the availability, and use of, particular interventions known to reduce mortality risks. A commissioned process evaluation (Muñoz Hernández, Cortes-Gallo, Pérez-Cuevas, Jasso-Gutiérrez, & Walsh, 2010) focuses on the available care for premature births at providers accredited by Seguro Popular, and also provides some general estimates on neonatal mortality in Mexico. Sosa-Rubi, Galarraga, and Harris (2009) find that the program increased the proportions of babies delivered at Seguro Popular accredited clinics, reducing such deliveries at non-accredited private and public clinics. In a purely descriptive exercise, Gakidou et al. (2006) reports that the implementation of Seguro Popular has resulted in a reduction in catastrophic health expenditures for the now covered population, as well as, an increase in the use of health services. The program also resulted in more equitable public expenditures on heath and effective coverage across states and income groups. Similarly, Knaul et al. (2006) show descriptive data that indicate a decline in the incidence of catastrophic health expenditures in Mexico after the introduction of Seguro Popular. In the aforementioned randomized assessment by King et al. (2009), a significant reduction in general and catastrophic health spending by poor households is reported. However, the study finds no evidence for reduced spending on medication, nor increased utilization of health services.

For outcomes in countries other than Mexico, Cercone et al. (2010) finds no significant difference in utilization of health services or expenditures between the insured and uninsured population in Costa Rica. This result may, however, be an artifact of the country's policy to provide emergency health services to the uninsured free of charge. More in line with the rest of the literature, Bitrán et al. (2010) report that the population insured by Peru's Integral Health Insurance (SIS) utilize a variety of health services more often and have much lower levels of out-of-pocket expenditures than the uninsured. Giedion et al. (2009) also find a higher rate of health service utilization for the insured under Colombia's subsidized regime. For the case of Brazil, Barros et al. (2008) reports that more than 80% of child births were paid for by the SUS in 2004.

This paper has five sections. The next one explains in greater detail the Seguro Popular program and puts it into the Mexican context. Section 3 discusses the data and empirical strategy. It also provides a detailed discussion on the choice-based sampling estimator used. Section 4 presents the result, including robustness checks, and Section 5 concludes.

2. BACKGROUND AND DESCRIPTION OF THE PROGRAM

Over the course of the last two decades, Mexico's mortality rates for children under 5 years of age have been on a slow decline. Using United Nations Children's Fund (UNICEF) data, [2] Figure 1 shows the evolution of child, infant and neonatal mortality since 1990. While it would be interesting