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Article

Rollout of community-based family health strategy (programa de saude de familia) is associated with large reductions in neonatal mortality in São Paulo, Brazil



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ABSTRACT

Rationale: Several recent studies suggest that Brazil's Estratégia Saude de Familia (Family Health Strategy-FHS) has contributed to declines in mortality at the national and regional level. Comparatively little is known whether this approach is effective in urban populations with relatively easy access to health services.

Objectives: To use detailed medical data collected as part of São Paulo's Western Region project to examine whether the FHS program had an impact on child health in São Paulo, Brazil.

Results: No associations were found between FHS and birth weight (OR 1.03, 95% CI 0.93–1.29), gestational length (OR 0.98, 95% CI 0.83–1.15) or stillbirth (OR 1.51, 95% CI 0.75–3.03). FHS eligibility was associated with a 42% reduction in the odds of child mortality (OR 0.58, 95% CI 0.34, 0.91), with largest effect sizes for the early neonatal period (OR 0.18, 95% CI 0.04–0.79).

Conclusions: Community based health delivery platforms may be a highly effective way to reduce neonatal mortality in urban areas of low and middle income countries, even when access to general health services is almost universal.

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Introduction

Neonatal health continues to be a primary concern for policy makers in low- and middle income countries, with the millennium development goal maternal mortality targets being missed in many countries (Walker, Yenokyan, Friberg, & Bryce, 2013), and close to 3 million neonatal deaths every year (Bhutta et al., 2014; Oestergaard et al., 2011). One increasingly considered strategy to reduce neonatal mortality is community-based home visiting programs, which have been shown to lead to reductions in infant mortality of up to 40% (Baqui et al., 2009; Bhutta et al., 2011; Lassi, Haider, & Bhutta, 2010). Relatively little is known regarding the effectiveness of community-based home-visiting programs outside of South-East

Asia, and in particular in settings where access to health services is common and affordable for poor populations as it is generally the case in urban areas of middle income countries. Brazil's current transition from a center to a home based primary care system offers an ideal setting to directly assess the effectiveness of community-based models.

First proposed in 1991 and created in 1994, Brazil's Family Health Strategy (FHS) (programa de saúde da família) was initially deployed in small municipalities and became one of the primary health care strategies pursued by the Ministry of Health in 2000 (Sampaio, Mendonça, & Lermen, 2012). The FHS is intensive from a human resource and financial perspective. Under the FHS, areas comprising populations of 3000–4500 people are assigned to and supported by a family health team. Each family health team consists of six community health workers (CHWs), one nurse, two nurse assistants and one general practitioner. Households under the FHS receive a monthly visit by a CHW, who refers members to local health centers whenever needed. During their visits, CHWs are charged with monitoring a range of health conditions including pregnancy, hypertension, diabetes, and communicable diseases such as dengue, tuberculosis and leprosy. For pregnant women,

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CHWs monitor and encourage pre-natal care attendance, and visit mothers at home within the first few days after their hospital release post-delivery (Aquino, de Oliveira, & Barreto, 2009). This is different from the model traditionally used in Brazil, which primarily relies on patient initiative and offers targeted programs only to special populations based on epidemiological patterns of disease, vulnerability or risk (Morosini & Corbo, 2007).

Both under the FHS and the traditional model, a wide range of services are available at primary health care centers and public hospitals. Each primary health care zone (primary health care unit coverage area) provides basic services for a population of 20,000–40,000 individuals. Under the FHS, each zone is divided into multiple FHS teams, with each community agent responsible for approximately 150 households (Macinko & Harris, 2015). Brazil's traditional public health care model also offers comprehensive pediatric services, with appointments routinely scheduled one week after birth, and then at 1, 2, 4, 6, 9 and 12 months of age (Ministério da Saúde, 2008). The main difference of the FHS model is that it allows for home-based detection of health problems, as well as home-based support and promotion of access to publicly available services that are often not used due to lack of awareness, lack of time or lack of resources (Bassani, Surkan, & Olinto, 2009; Goldbaum, Gianini, Novaes, & Cesar, 2005), with large resulting differences in birth outcomes across socioeconomic groups (Macinko, de Fátima Marinho de Souza, Guanais, & da Silva Simões, 2007; Vettore, Gama, Lamarca, Schilithz, & Leal, 2010). Due to large social inequities and the high concentration of specialized health services, scaling up of the FHS model has been slow in São Paulo as well as other (and in particular urban) part of Brazil, resulting in a highly heterogeneous primary care systems within relatively close and highly similar geographic and socioeconomic strata (d'Avila Viana, Rocha, Elias, Ibanez, & Bousquat, 2008). At the national level, partial FHS coverage has been achieved in over 95% of all municipalities, with an estimated 62% of the total population covered by the program in 2014 (Departamento de Atenção Básica, 2015; Macinko & Harris, 2015).

While several recent studies have shown positive correlations between FHS coverage at the population level and child health outcomes (Brandao, Gianini, Novaes, & Goldbaum, 2011; Macinko et al., 2007; Rasella, Aquino, & Barreto, 2010a, 2010b; Reis, 2014; Rocha & Soares, 2010), the existing literature primarily relies on comparing changes in health outcomes across administrative areas or changes in outcomes within administrative areas over time using panel models. Most of this work builds on the assumption that the rollout and scaling up of the FHS is random, and that population level associations in this setting are representative of the associations between health outcomes and FHS exposure at the individual level, which is not obvious in this setting.

In this paper, we analyze the program in the smaller and more tightly controlled region of São Paulo municipality, where the timing of FHS rollout for each neighborhood was centrally determined based on an initial needs assessment.

Methods

Study setting

The study was conducted in the Butantã-Jaguarié (BJ) region, which is located in the Western Region of São Paulo (see [Supplemental Material Figure S1](#)). The area has an estimated population of approximately 380,000, which corresponds to about 3% of the total São Paulo municipality population. São Paulo had an estimated infant mortality rate of 11.49 per 1000 in 2012, substantially below the Brazilian national average of 17 (Ministry of Health of Brazil, 2014). The six administrative districts in the Butantã-Jaguarié region are slightly above the SP average in terms of socioeconomic status as well as child health outcomes, with infant mortality rates varying

between 4.4 (Morumbi District) and 10.3 (Villa Sonia) deaths per 1000 live births (Ministry of Health of Brazil, 2014; Prefeitura do Município de São Paulo, 2014).

Study population

The study population comprised all infants born at the University Hospital between April 1, 2003 (when electronic records were introduced) and November 30, 2012. The University Hospital (HU-USP) is the main public general hospital of the Butantã-Jaguarié region, covering 82% of the births by women covered exclusively by the public national health system (SUS) and about 40% of all births in the region in 2012 (Prefeitura de SP Saúde, 2012).

Hospital birth records

We retrieved detailed electronic records for all deliveries from the hospital's electronic system, including gestational length, birth weight, delivery mode, APGAR scores and survival status at birth. Births were classified as low birth weight if birth weight was less than 2500 g. Births were classified as pre-term if the estimated gestational length was less than 37 weeks.

Child mortality outcomes

Death records from all children born in São Paulo between 2003 and 2012 were obtained from the national vital registration system as well as the Municipality's mortality information improvement program (PROAIM). According to the district health' offices internal estimates, these systems capture over 99% of all child deaths (excluding stillbirths) in São Paulo. All records of child deaths among children born in São Paulo Municipality between 2003 and 2012 were extracted, and matched to the births recorded in the hospital's electronic data system based on children's birth date and the child's name. Given the name-based matching, it is possible that some cases were not matched. This could lead to a potential underestimation of overall child mortality levels in our sample, but should not bias our estimation results as long as mismatching occurred systematically which seems rather unlikely. As defined by the PROAIM, we classify neonatal deaths as those that occurred between 0 and 27 days of life; early neonatal death as those occurring between 0 and 6 days and late neonatal as deaths between 7 and 27 days. Deaths occurring between 28 and 364 days of life were classified as post neonatal deaths.

Determining FHS eligibility

To determine whether a birth was covered by the FHS program, mothers' residential addresses were retrieved from the University Hospital's electronic system and geocoded. Geocoded addresses were then cross-referenced against period-specific FHS coverage maps provided by the health district office (Secretaria Municipal de Saúde). In the study area, FHS coverage was gradually scaled up in the region between 2001 and 2012 (see [Supplemental Information Figures S2 and S3](#) for details), reaching about 40% the study population by 2012. Births were considered as eligible for FHS if the mother's home address at the time the child was conceived fell within an area covered by operational FHS teams.

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