Impact of the Family Health Program on Infant Mortality in Brazilian Municipalities

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Objectives. We evaluated the effects of the Family Health Program (FHP), a strategy for reorganization of primary health care at a nationwide level in Brazil, on infant mortality at a municipality level.

Methods. We collected data on FHP coverage and infant mortality rates for 771 of 5561 Brazilian municipalities from 1996 to 2004. We performed a multivariable regression analysis for panel data with a negative binomial response by using fixed-effects models that controlled for demographic, social, and economic variables.

Results. We observed a statistically significant negative association between FHP coverage and infant mortality rate. After we controlled for potential confounders, the reduction in the infant mortality rate was 13.0%, 16.0%, and 22.0%, respectively for the 3 levels of FHP coverage. The effect of the FHP was greater in municipalities with a higher infant mortality rate and lower human development index at the beginning of the study period.

Conclusions. The FHP had an important effect on reducing the infant mortality rate in Brazilian municipalities from 1996 to 2004. The FHP may also contribute toward reducing health inequalities. (*Am J Public Health.* 2008;99:87–93. doi: 10.2105/AJPH.2007.127480)

Despite stagnation in economic growth, civil wars, and the HIV/AIDS epidemic, with the exception of a few countries in Africa and Asia, infant mortality continued to decline throughout the 1990s in developing countries, although the rate of decline was less than in the 2 previous decades.[1] Although social and economic factors are still fundamental determinants of these trends, even in contexts of recession and economic crisis, the persistent reduction in infant mortality draws attention to other factors. Support is increasing for the idea that the decline in infant mortality is the result of a broad range of determinants, many of which result from social policies that were implemented during this period.[2–4] However, although different actions by health systems affect infant mortality, few studies have evaluated the total impact of programs, such as primary health care ones, that combine a set of interventions aimed at various risk factors.[5]

In Brazil, infant mortality rates have shown important declines in recent decades but are still higher than expected when compared with other countries with similar economies.[6–8] Concerning the principal determinants of the observed downward trends, studies have pointed to the importance of implementing public policies in basic sanitation and nutrition; the sharp drop in fertility, especially in the 1980s; and the expansion of primary care services, especially maternal and child health programs.[6,9–11]

Since 1994, the Family Health Program (FHP) has been an important pillar in the reorganization of the Unified National Health System, whose organizational principles include universality and equity. By 2004, the program had been implemented in 82% of Brazil's 5561 municipalities, covering some 40% of the total national population. The FHP is centered on a family and community approach in which multiprofessional teams (including physicians, nurses, community health agents, and oral health professionals) work under the principles of comprehensive care.[12]

Each FHP team is responsible for permanent and systematic follow-up of a given number of families residing in a circumscribed area and for establishing ties of commitment and shared responsibility.[12] Priority actions in the FHP include promotion, prevention, and care for mothers and children, such as the promotion of breastfeeding, prenatal care, neonatal and under-5 care, immunization and other actions toward prevention, and management of infectious diseases such as diarrhea.[12]

The year 2008 marks the 30th anniversary of the Alma–Ata Declaration, which advocated primary health care based on the principles of community participation and the use of appropriated technology in health promotion and disease prevention and control. Worldwide, primary health care principles have received great attention, and the need to renew and adapt these principles in different contexts has been stressed. Several international initiatives provide opportunities to discuss and evaluate countries' efforts to provide health for all and produce recommendations about the role of primary health care given the complexity of today's health challenges.[13–15]

In our study, we evaluated the effect of the implementation of the FHP on infant mortality rates in Brazilian municipalities from 1996 to 2004. The FHP strategy in Brazil and the availability of nationwide data provide a unique opportunity for evaluating the impact of a comprehensive program, rather than merely isolated health measures.

METHODS

We adopted an ecological and longitudinal approach in which we used a panel data or longitudinal data model. A panel data set[16] contains observations on multiple entities (e.g., individuals, cities, counties), for which each entity is observed at 2 or more points in time. In our study, the municipality (county) was the unit of analysis, and time-series data were assembled from several databases for 1996 to 2004.

We analyzed the quality of information on births and deaths for all 5561 Brazilian municipalities and included municipalities in the study only if they presented adequate information on infant deaths for the period 1996 to

1998 according to all of the following 5 previously recommended criteria[17]: had an age-standardized mortality rate greater than 6.75 deaths per 1000 inhabitants, had a birth rate greater than 16 per 1000 inhabitants, the percentage of ill-defined infant deaths was less than 20.0%, the mean deviation of the age-standardized mortality rate was less than 10.0%, and the mean deviation of the birth rate was less than 10.0%.

The total infant mortality rate (i.e., the number of deaths under 1 year of age per number of live births × 1000) and the neonatal and postneonatal infant mortality rates were obtained by direct calculation for each municipality and study year. The intervention (FHP coverage) was measured for each year and municipality by an index composed of the proportion of the population covered by the program and the duration in years of the program since its start in that specific municipality. We classified FHP coverage as follows: without FHP coverage, incipient coverage (coverage of <30.0% of the population), intermediate coverage (coverage of 30.0% to 69.9% or coverage of ≥70.0% and duration of <4 years), and consolidate coverage (coverage of ≥70.0% and duration of ≥4 years).

Based on an extensive literature review,[2,4–11,18,19] we identified a set of covariates as determinants of infant mortality given their potential to confound the effect of the principal independent variable. The following covariates were used in the analysis: total fertility rate (stratified as ≤ 2.4 and > 2.4 children per childbearing-age woman), per capita income (in Brazilian real [BR$], stratified as < BR$258 and ≥ BR$258), percentage of functional illiterates among persons older than 15 years (stratified as > 26.0% and ≤ 26.0%), percentage of persons living in households with running water (stratified as < 96.0% and ≥ 96.0%), local hospitalizations (hospitalization registered in the municipality per 1000 inhabitants, stratified as yes or no), and Gini index (stratified as > 0.55 and ≤ 0.55). The Gini index is a measure of statistical dispersion and was used here as a measure of inequality of income distribution. It varies from 0 to 1, where a value of 0 corresponds to perfect equality and a value of 1 corresponds to perfect inequality.[20]

Data Sources

The study used data made available by the Brazilian Ministry of Health (Mortality Information System, Primary Care Information System, Immunization Program Evaluation System, Information System on Live Births, Outpatient Information System, and Hospital Information System),[21] the Brazilian Institute of Geography and Statistics or National Census Bureau (1991 and 2000 National Demographic Censuses and inter-census estimates),[22] and the Human Development Atlas, Brazil.[23] Because the socioeconomic and demographic covariates were collected from the 1991 and 2000 national censuses, annual values were estimated by linear interpolation for the period 1996 to 1999 and linear extrapolation for the period 2001 to 2004. Linear interpolation was used to obtain population estimates for a time reference between 2 known years, assuming that the relation between the 2 known points (in our case 1991 and 2000) was a linear function.[24] For the extrapolation, the same linear function was used to obtain annual values for a posterior period (2001 to 2004).

Data Analysis

We performed a multivariable regression analysis for panel data by using a negative binomial response and fixed-effects models. In the models, the municipalities were represented by subscript i and the available years (1996 to 2004) by subscript t. The model included the following: the infant mortality rate as the dependent variable, coverage level of the FHP as the main independent variable, and the set of covariates described as potential confounders, all assuming values in municipality i in year t. The model also included 2 terms: the first to control for the unobserved time-invariant characteristics in municipality i, and the second, the disturbance or error term, to control for time-varying characteristics in municipality i in year t that can affect infant mortality rates.

Panel data models use fixed or random effects as estimators. The difference between random-effects and fixed-effects models is the relation between the error term (v_i) and the independent variables. The first will be appropriated if it can be assumed that they are uncorrelated. The second must be used if the error term (v_i) is correlated with some of the independent variables, because their estimators will be consistent in this case. The Hausman test was used to assess these correlations, and the null hypothesis was rejected in all models. Therefore, the fixed-effects models were used in the analysis.[16,25]

Negative binomial regression is recommended for analyzing numerical data that involve counting, especially for rare events, such as infant deaths in a given municipal population in 1 year, which present greater dispersion than expected under the Poisson model.[26] The measure of association between FHP coverage and infant mortality rate used was the infant mortality rate ratio, both crude and adjusted for the covariates, with respective 95% confidence intervals.

Brazilian municipalities present huge disparities regarding social and economic conditions, health system organization, and infant mortality rate. For this reason, models were estimated for subsets of municipalities. The municipalities were stratified by municipal human development index, which measures the average achievements in life expectancy, education, and standard of living[15] (≤0.766 and >0.766; 0.766 was the Brazilian national mean in 2000), and the infant mortality rate in 1996 (<24.1 and ≥24.1; 24.1 was the mean infant mortality rate in 1996).

Additionally, with the aim of evaluating the effect of FHP coverage on the supply of different primary care services, bivariate association models were fitted for the period 1996 to 2004. The following dependent variables were analyzed: number of basic medical consultations per inhabitant-year; diphtheria, polio, and measles vaccine coverage among infants (i.e., aged <1 year); number of health educational activities per inhabitant; and percentage of pregnant women with at least 1 prenatal consultation.

For database processing and analysis, Stata software version 9.1 was used.[25,27]

RESULTS

After we applied the criteria for inclusion,[17] we selected 721 (14.6%) municipalities with adequate recording of infant mortality data for the analysis. During 1996 to 2004, there was a major expansion of the FHP in Brazil. In 1996, the FHP had been implemented in only 1% of

the studied municipalities, but by 2004 it had reached more than 80% of these municipalities. This expansion was accompanied by a rapid increase in the percentages of municipalities with intermediate (from 0.1% to 39.3%) and consolidate (from 0% to 18.9%) levels of coverage.

From 1996 to 2004, the infant mortality rate decreased from 24.1 to 16.1 per 1000 live births (Table 1). There were also reductions in the total fertility rate (from 2.6 to 2.2 children per woman), the percentage of functionally illiterate persons aged 15 years or more who have completed less than 4 years of school (from 31.4% to 22.4%), and the local hospitalization rate (from 78.4 to 61.3 per 1000 inhabitants). Increases were seen in monthly per capita income (from BR$240.80 to BR$300.25), the percentage of persons living in households with running water (from 88.6% to 97.0%), and the Gini index (from 0.54 to 0.56).

Table 2 shows the crude and adjusted infant mortality ratio, by FHP coverage levels, with municipalities without FHP coverage as the reference category. The unadjusted model showed significant reductions in infant mortality rates. Percentage reductions were 16.0%, 23.0%, and 32.0% in municipalities with incipient, intermediate, and consolidate FHP levels, respectively. In the model adjusted for the covariates, the observed reductions were smaller (13.0%, 16.0%, and 22.0%, respectively) but were still statistically significant.

When we compared neonatal and postneonatal (number of deaths of infants aged 28 days to 1 year per 1600 live births in a given year) mortality rates, we found that the effect of the FHP was greater on postneonatal mortality rate ratios (18%, 22%, and 31%) than on neonatal mortality rate ratios (10%, 14%, and 19%).

Table 3 shows the estimated models for the municipalities, stratified by infant mortality rate, at the beginning of the study period (greater than or equal to versus less than the national mean for 1996), and the human development index (less than or equal to versus greater than the national mean for 2000). The effect of FHP coverage was greater among the group of municipalities with baseline infant mortality rates higher than the mean and with baseline human development index lower than the national mean.

When we analyzed the evolution of a series of basic health actions (i.e., number of basic medical consultations per inhabitant-year; number of educational activities per inhabitant-year; percentage of pregnant women with at least 1 prenatal visit; and oral polio, diphtheria, and measles vaccine coverage greater than 95% among children aged <1 year) taken at the municipal level from 1996 to 2004, the municipalities with the FHP showed higher coverage rates for these various actions than did those without the FHP, and the coverage rates for these basic health actions increased with the increase in FHP coverage (Table 4).

TABLE 1—Mean Infant Mortality Rates and Covariates Among 771 Municipalities: Brazil, 1996–2004

Variables	1996	1997	1998	1999	2000	2001	2002	2003	2004
Infant mortality rate per 1000 live births	24.1	22.9	21.0	20.9	19.8	18.7	17.8	17.3	16.1
Total fertility rate, no. of children per childbearing-age woman	2.6	2.6	2.5	2.5	2.4	2.4	2.3	2.3	2.2
Per capita income, Brazilian real	240.80	248.27	255.70	263.12	270.55	277.97	285.40	292.82	300.25
Percentage of functional illiterates among persons older than 15 years	31.4	30.2	29.1	28.0	26.9	25.7	24.6	23.5	22.4
Percentage of persons living in households with running water	88.6	89.7	90.7	91.8	92.8	93.8	94.9	95.9	97.0
Gini index[a]	0.54	0.54	0.54	0.55	0.55	0.55	0.55	0.55	0.56
Rate of local hospitalizations per 1000 inhabitants	78.4	77.3	74.5	74.1	69.5	68.1	65.5	63.3	61.3

[a]The Gini index is a measure of statistical dispersion and was used here as a measure of inequality of income distribution. It varies from 0 to 1, where a value of 0 corresponds to perfect equality and a value of 1 corresponds to perfect inequality.

DISCUSSION

Our results show that the implementation of the FHP in Brazilian municipalities from 1996 to 2004 was associated with significant reductions in the infant mortality rate at the municipal level. It is important to point out that previous studies aimed at explaining the decreasing trend in the infant mortality rate highlighted the importance of a set of social and economic determinants that were considered in our study to be potential confounders of the FHP effect.[18,19] However, the effect remained statistically significant after we controlled for these determinants, and it increased in parallel with the level of FHP coverage. The stratified analysis showed a greater effect of the FHP on the subgroup of municipalities with a lower human development index and a higher IMR in the first year of the study period. Also, it showed a greater effect on postneonatal than on neonatal infant mortality.

The FHP includes a wide set of actions (breastfeeding promotion, prenatal care, neonatal and under-5 care, and actions toward the prevention and management of childhood illness) identified as effective health interventions to reduce infant and under-5 mortality.[3,4,28] In addition, in Brazil, strategies like the Integrated Management of Childhood Illness, which combines the training of health professionals, improvement of services, supply of essential medicines, and community activities,[28] have been implemented as priorities by the family health teams, thereby contributing to the improved quality of health services. Our results showed that municipalities in which the FHP had been implemented (compared with those without) showed increases in the coverage rates for basic health actions (i.e., basic medical consultations, vaccine coverage, educational activities, and the percentage of pregnant women with at least 1 prenatal visit), and that such actions increased with the FHP coverage level.

Our results confirm the findings of previous studies,[29,30] which also showed an association between FHP coverage and reduction in infant mortality from 1990 to 2002. In the previous studies, however, the analysis was based on data aggregated by state (of which there are 27 in Brazil)[29] or microregions (of which there are 557 in Brazil),[30] and IMRs were obtained by indirect estimates, thus posing a series of

TABLE 2—Fixed-Effects Models for the Bivariate Association Between Infant Mortality Rate and Family Health Program Coverage: Brazil, 1996–2004

Variables	Infant Mortality Rate		Neonatal Mortality Rate, RR (95% CI)	Postneonatal Mortality Rate, RR (95% CI)
	Crude RR (95% CI)	Adjusted RR (95% CI)		
FHP coverage				
No FHP[a] (Ref)	1.00	1.00	1.00	1.00
Incipient FHP[b]	0.84 (0.82, 0.85)	0.87 (0.86, 0.89)	0.90 (0.89, 0.92)	0.82 (0.80, 0.84)
Intermediate FHP[c]	0.77 (0.75, 0.79)	0.84 (0.82, 0.86)	0.86 (0.84, 0.89)	0.78 (0.75, 0.81)
Consolidate FHP[d]	0.68 (0.64, 0.73)	0.78 (0.73, 0.83)	0.81 (0.76, 0.88)	0.69 (0.62, 0.76)
Total fertility rate ≤2.4 children per childbearing-age woman		0.90 (0.87, 0.93)	0.92 (0.88, 0.95)	0.88 (0.84, 0.92)
Per capita income ≥BR$258.00		0.92 (0.89, 0.94)	0.93 (0.89, 0.96)	0.89 (0.85, 0.93)
Functional illiterates rate ≤26.0% of individuals aged ≥15 y		0.87 (0.84, 0.89)	0.89 (0.86, 0.92)	0.83 (0.79, 0.87)
Percentage of persons living in households with running water ≥96.0%		0.91 (0.89, 0.93)	0.93 (0.90, 0.95)	0.88 (0.85, 0.91)
Gini index[e] ≤0.55		1.18 (1.14, 1.22)	1.21 (1.16, 1.26)	1.10 (1.05, 1.16)
Local hospitalization		0.88 (0.82, 0.96)	0.88 (0.80, 0.96)	0.94 (0.84, 1.06)

Note. CI = confidence interval; FHP = Family Health Program; RR = rate ratio. For infant mortality rate and neonatal mortality rate there were 6489 observations made in 721 municipalities. For postneonatal mortality rate, there were 6444 observations made in 716 municipalities.
[a]Defined as coverage equal to 0% of the population.
[b]Defined as coverage of less than 30.0% of the municipal population.
[c]Defined as coverage of 30.0% to 69.9% of the municipal population or coverage of 70.0% or more and time of implementation in the municipality of fewer than 4 years.
[d]Defined as coverage of 70.0% or more of the municipal population and time of implementation in the municipality of 4 years or longer.
[e]The Gini index is a measure of statistical dispersion and was used here as a measure of inequality of income distribution. It varies from 0 to 1, where a value of 0 corresponds to perfect equality and a value of 1 corresponds to perfect inequality.

methodological limitations. The main difference in our study was that we analyzed the effects of the FHP by using the actual intervention level (municipalities) as the analytic unit and obtained infant mortality data by the direct method. This approach made our study methodologically rigorous and reduced the chance of potential ecological bias.

The choice of the municipal level as our unit of analysis is justified by the fact that it is more in keeping with the decentralized National Health System model in Brazil, in which the municipality is the true locus for health policy implementation. In the Brazilian health system regulations, all decisions concerning the local health system, including the decision to implement the FHP, is the responsibility of the municipal administration. Previous evaluative

TABLE 3—Fixed-Effects Models for the Association Between Infant Mortality Rate and Family Health Program Coverage, by Baseline Infant Mortality Rate and Human Development Index: Brazil, 1996–2004

	No FHP coverage[a] (Ref)	Incipient FHP coverage[b] RR (95% CI)	Intermediate FHP coverage[c] RR (95% CI)	Consolidate FHP coverage[d] RR (95% CI)
Baseline infant mortality rate[e]				
≥24.1[f]	1.00	0.83 (0.81, 0.85)	0.77 (0.74, 0.80)	0.66 (0.60, 0.74)
<24.1[g]	1.00	0.90 (0.88, 0.91)	0.91 (0.88, 0.94)	0.86 (0.80, 0.93)
Human development index[h]				
≤0.766[f]	1.00	0.85 (0.82, 0.89)	0.89 (0.85, 0.93)	0.73 (0.65, 0.80)
>0.766[g]	1.00	0.88 (0.86, 0.89)	0.82 (0.79, 0.84)	0.80 (0.74, 0.87)

Note. CI = confidence interval; FHP = Family Health Program; RR = rate ratio. Models were adjusted for total fertility rate, per capita income, percentage of functional illiterates, percentage of persons living in households with running water, Gini index, and local hospitalization.
[a]Defined as coverage equal to 0% of the population.
[b]Defined as coverage of less than 30.0% of the municipal population.
[c]Defined as coverage of 30.0% to 69.9% of the municipal population or coverage of 70.0% or more and time of implementation in the municipality of fewer than 4 years.
[d]Defined as coverage of 70.0% or more of the municipal population and time of implementation in the municipality of 4 years or longer.
[e]The mean infant mortality rate was 24.1 in 1996.
[f]Municipalities with <100 000 inhabitants; 2457 observations were made in 273 municipalities.
[g]Municipalities with ≥100 000 inhabitants; 4032 observations made in 448 municipalities.
[h]Measurement of the average achievements in life expectancy, education, and standard of living. The national mean was 0.766 in 2000.

TABLE 4—Models for the Bivariate Association Between Family Health Program (FHP) Level of Implementation and Primary Care Indicators: Brazil, 1996–2004

Variables	No. of Basic Medical Consultations per Inhabitant-Year, RR[a] (95% CI)	No. of Educational Activities per Inhabitant-Year, RR[a] (95% CI)	% Pregnant Women With At Least 1 Prenatal Visit, RR[b] (95% CI)	Oral Polio Vaccine Coverage Over 95% Among Children Younger Than 1 Year, OR[c] (95% CI)	DPT Vaccine Coverage Over 95% Among Children Younger Than 1 Year, OR[c] (95% CI)	Measles Vaccine Coverage Over 95% Among Children Younger Than 1 Year, OR[c] (95% CI)
FHP coverage						
No FHP[d] (Ref)	1.00	1.00	1.00	1.00	1.00	1.00
Incipient FHP[e]	2.24 (2.24, 2.24)	1.76 (1.76, 1.76)	1.42 (1.39, 1.45)	2.34 (1.93, 2.83)	2.51 (2.07, 3.04)	2.21 (1.82, 2.69)
Intermediate FHP[f]	2.35 (2.35, 2.35)	2.24 (2.24, 2.24)	1.62 (1.57, 1.68)	2.46 (2.08, 2.90)	2.70 (2.28, 3.18)	2.06 (1.75, 2.42)
Consolidate FHP[g]	2.62 (2.62, 2.62)	3.39 (3.38, 3.39)	1.89 (1.75, 2.03)	2.55 (1.80, 3.61)	3.18 (2.24, 4.52)	2.56 (1.79, 3.65)
Number of observations	6489	4809	6471	5841	5877	5814
Number of municipalities	721	703	719	649	653	646

Note. RR = rate ratio; CI = confidence interval; OR = odds ratio; DPT = diphtheria.
[a]Estimated by Poisson regression.
[b]Estimated by negative binominal model.
[c]Estimated by logistic regression.
[d]Defined as coverage equal to 0% of the population.
[e]Defined as coverage of less than 30.0% of the municipal population.
[f]Defined as coverage of 30.0% to 69.9% of the municipal population or coverage of 70.0% or more and time of implementation in the municipality of fewer than 4 years.
[g]Defined as coverage of 70.0% or more of the municipal population and time of implementation in the municipality of 4 years or longer.

studies of the FHP at this level generally used qualitative methods, especially case studies,[31,32] which are adequate for analyzing the intervention's implementation in local and specific contexts but cannot establish national patterns or trends.

Because of the deficiency of deaths and births registration in some areas of Brazil, many previous studies of trends in the infant mortality rate were based on estimates obtained by the use of indirect techniques.[6,7,10,11,18,19,29,30] Although the methods used for indirect estimates of the infant mortality rate are valuable in areas with precarious data, they pose 2 basic problems for the evaluation of health programs. First, their reliability is greatest at more aggregate levels, such as states or provinces, than in smaller geographic areas, such as municipalities or counties. Second, and further limiting their possibilities for evaluation at the local level, the estimates are derived from forecasts based on the adjustment of observed historical trends and do not consider or evaluate the effect of short-term changes resulting from health programs and policies at the local level.[7] In our study, the application of the criteria recommended by Szwarcwald et al.[17] allowed us to identify a set of municipalities in which the data quality was considered adequate, which in turn allowed us to directly calculate IMRs and to compare municipalities with and without implementation of the FHP.

Limitations

Our study's potential limitations include the use of an ecological or aggregate approach,[33,34] albeit with methodological sophistication that allowed us to analyze a time-series for each municipality in the data set. Additionally, because of problems in the quality of nationwide data systems, only municipalities with the adequate recording of infant mortality data at the beginning of the study period were included in the analysis. This limited the generalization of the results but improved the study's internal validity because it was possible, within the selected municipalities, to compare different levels of FHP coverage. This procedure ensured that uncontrolled factors generated by the selection of a group of municipalities were not the determinants of the excess of infant mortality rate observed in those municipalities with higher FHP coverage. Another potential limitation was the linear interpolation and extrapolation of annual values for sociodemographic indicators derived from decennial census data. Although this approach is somewhat crude alternative for estimation, it is unlikely that it introduced any major bias, because sharp fluctuations in these macrostructural determinants or changes in the direction of the observed trends are not expected. Conversely, the alternative to adopting a value from either the beginning or the end of the decade to represent the entire intercensus period would also have introduced a source of error, because such variables are not constant over time.

As part of efforts to develop the National Health System (SUS), a great deal of effort and resources have been spent in Brazil on the organization of a national health information system. This system comprises several subsystems organized from the local to national levels, with standardized information flows and quality control procedures. For instance, since the mid-1990s, Brazil has made important improvements in the quality of its health statistics; several databases are accessible online in DATASUS[21] and have been extensively used in research.[35,36]

Despite the above limitations, the results of this study are robust and disentangle the contribution of recent increases in the coverage of the FHP to the reduction in the infant mortality rate in Brazil. They also indicate an effect of the FHP toward reducing health inequalities, because a greater impact was observed on

municipalities with a lower human development index and a higher infant mortality rate at the beginning of the study period.

Conclusions

These findings demonstrate in a specific country that a primary health care program based on decentralized universal access can affect an important indicator of population health. International organizations such as the World Health Organization and the Pan American Health Organization have emphasized the need to reinforce the values, principles, and approaches of primary health care as an essential condition for reaching the Millennium Development Goals. Experiences in developed and developing countries are a clear demonstration that this strategy can be implemented under various political, social, and cultural contexts. Primary health care has been considered "the best route to universal access, the best way to ensure sustainable improvements in health outcomes and the best guarantee that access to care will be fair."[14] However, more than ideological arguments, it is necessary to take a critical look to understand how this concept can be renewed as an approach to strengthening more equitable health systems. In addition, to include primary health care in the national and international political agenda, it is necessary to build up a solid body of evidence of interventions that work to change the health situation with measurable impacts on important health outcomes.[14,15] ■

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Contributors

R. Aquino and M.L. Barreto were involved in designing the study, data analysis and interpretation, and writing the article. N.F. de Olivieira participated in the design of the study, statistical analysis, and interpretation of results. All authors had access to all data in the study, approved the final version of the article, and held final responsibility for the decision to submit for publication.

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