

The Health Effects Of Decentralizing Primary Care In Brazil

When ambulatory care facilities are turned over to local control, a locality's infant mortality rate appears to improve.

by **Frederico C. Guanais and James Macinko**

ABSTRACT: A renewed focus on primary health care could lead to improved health outcomes in developing countries. Moving more control to local authorities, or decentralization, is one approach to expanding primary care's reach. Proponents argue that it increases responsiveness to local needs and helps local resources reach those in need. Critics argue that it might increase fragmentation and disparities and provide opportunities for local economic and political gains that do not improve population health. We explore questions surrounding decentralization using the example of infant mortality in Brazil. Our study of two programs identified positive effects on health outcomes in the context of infant mortality. [*Health Affairs* 28, no. 4 (2009): 1127-1135; 10.1377/hlthaff.28.4.1127]

THERE IS CONSIDERABLE INTEREST WORLDWIDE in revitalizing primary health care to strengthen health systems, particularly in low- and middle-income countries.¹ Recent reports suggest the need for both expansion of access to primary care services and organizational reforms to attain "close-to-client" approaches to make services more relevant and responsive to the needs of populations.²

Decentralization, in particular, has been promoted as a means for improving the responsiveness and effectiveness of health systems in developing countries.³ Advocates argue that shifting financial and administrative control of health services to local authorities can improve efficiency in allocation ("doing the right things," as distinct from technical efficiency ("doing things right"), increase accountability and responsiveness to the users of health services, and facilitate the mobilization of local resources.⁴ In the case of primary health care, further arguments for decentralization include potentially improved community participation and integration with specialty and hospital care, and more effective collaboration between health

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and nonhealth sectors.⁵

Conversely, critics point out that decentralization may instead lead to increased fragmentation of services, management practices that provide political or financial gains for local authorities, weakening of central ministries of health, and increased inequities in health care among regions.⁶

Few empirical investigations have examined how decentralization affects primary care services; even less is known about the impact of such reforms on health outcomes.⁷ To test some of these propositions empirically, we examine the ongoing decentralization of primary care services in Brazil.

The Brazilian Context

In 1988 Brazil adopted a new federal constitution that called for a nationally unified health system and facilitated the process of municipalization, whereby municipal governments took on increasing levels of responsibility for a range of health and other services, based in part on evaluations of their managerial capacities.⁸ A Brazilian municipality is the smallest autonomous political and geographic unit within a federal system made up of the central government, twenty-six states, one federal district, and 5,563 municipalities. Municipal mayors, directly elected by the population to serve four-year terms, are the heads of the executive branch of government at the local level.

Beginning in 1996 there was considerable expansion in the implementation of two decentralized primary care programs: the Family Health Program (known as PSF in Portuguese), which provides a broad range of primary care services through health teams that include a physician, a nurse, and community health workers; and the Community Health Agents Program (known as PACS in Portuguese), which provides a more restricted package of services delivered primarily by community health workers. As these programs were being expanded, the responsibilities for managing existing primary care clinics, health centers, and health posts (ambulatory care facilities) were also being transferred to municipal government control.

Study Data And Methods

The objective of this study was to assess the relationship between decentralization, expansion of primary care services, and population health in Brazil. We aimed to identify key policy lessons for the implementation of reforms aimed at decentralization of health services.

■ **Data sources.** The unit of analysis is the municipality. Municipal-level data were collected from publicly available databases at the Brazilian Ministry of Health (MoH), Ministry of Finance, Institute for Applied Economic Research, and Census Bureau.

The main dependent variable was the postneonatal mortality rate (PNMR): deaths to infants ages thirty days to one year, calculated from MoH vital statistics

data. This outcome is thought to be one of the most sensitive to primary care actions such as immunization, treatment of diarrhea and respiratory infections, and household practices such as breastfeeding.⁹

To ensure the reliability of the data, we included only municipalities with at least 10,000 people that had mortality data considered to be of good quality. After the introduction of these criteria, the final sample used in the analysis included 2,700 municipalities, containing 89 percent of the Brazilian population.¹⁰

■ **Measuring decentralization.** Administrative decentralization was measured as the proportion of ambulatory care facilities directly under control of the municipal government.¹¹ The variable was divided into quartiles by year and transformed into dummy variables.

Other independent variables included the number of community health workers per 1,000 population, percentage of the population covered by the PSF, and number of ambulatory care facilities per 1,000 population (all of these were collected from the MoH); logarithm of government health spending per capita (from the Ministry of Finance; including expenditures from all levels of government); illiteracy rates, access to clean water, and per capita income (from the Institute for Applied Economic Research); and municipal population size (from the Census Bureau).¹²

■ **Analytic design.** The analytical framework was implemented with a longitudinal ecological analysis using panel data at the municipal level. This design approximates a natural experiment by comparing changes in health outcomes over time across a panel of municipalities that have different rates and levels of decentralization and primary care provision.¹³

We develop a reduced-form health outcome determination model, based on previous literature.¹⁴ A two-way fixed-effects specification was used as an extension of a difference-in-differences design.¹⁵

Study Findings

Between 1998 and 2006, postneonatal mortality fell to nearly half its initial value, while PSF coverage, availability of community health workers, and administrative decentralization all increased significantly. At the same time, all other risk factors (such as illiteracy, access to clean water, and income) improved (Exhibit 1).

■ **Factors associated with lower postneonatal mortality.** Exhibit 2 shows how various variables influence postneonatal mortality rates (these results are based on our fixed-effects regression models that allow us to predict changes in these rates over time). As the exhibit shows, expansion of the PSF is associated with lower postneonatal mortality over time, as are the increases in the number of ambulatory care facilities per capita, improvements in clean water supply, and lower illiteracy rates.

The results on administrative decentralization suggest that municipalities in the initial stages of decentralization do worse than those in the later stages. Fi-

EXHIBIT 1 **Characteristics Of Brazilian Municipalities (Descriptive Statistics), Selected Years** **1998–2006**

Variable	1998	2002	2006	Change, 1998–2006*
Postneonatal mortality rate per 1,000 live births				
Mean	14.24	8.68	6.92	–51%
SD	20.84	6.19	4.66	
Percent coverage of Family Health Program				
Mean	8.74	42.91	60.90	597%
SD	18.79	36.33	30.79	
Community health workers per 1,000 population				
Mean	0.79	1.41	1.72	117%
SD	0.76	0.78	0.90	
Administrative decentralization (percent of ambulatory facilities under municipal control)				
Mean	72.20	80.38	86.22	19%
SD	25.44	25.06	14.33	
Government health spending per capita (Brazilian reais)				
Mean	66.33	85.98	120.74	82%
SD	50.84	43.91	48.08	
Ambulatory facilities per 1,000 population				
Mean	0.42	0.49	0.46	8%
SD	0.27	0.27	0.23	
Percent adult illiteracy rate				
Mean	23.12	19.01	17.18	–26%
SD	14.36	12.00	11.27	
Percent of population with access to clean water				
Mean	68.08	73.03	77.01	13%
SD	28.34	26.18	25.29	
Income per capita (Brazilian reais)				
Mean	215.86	196.19	308.44	43%
SD	139.82	117.48	217.63	
Population (thousands)				
Mean	61.79	66.88	71.92	16%
SD	277.36	297.10	311.53	

SOURCES: Data from Brazilian Ministries of Health and Finance, Brazilian Institute for Applied Economic Research, and Brazilian Census Bureau.

NOTES: All financial measures are in constant 2000 Brazilian reais. N = 2,700. SD is standard deviation.

*All variable changes between 1998–2006, 1998–2002, and 2002–2006 were statistically significant ($p < 0.001$), except for changes in population size ($p > 0.10$).

nally, independent of the variables included in the model, postneonatal mortality declined over time during the study period (Exhibit 2).

■ **Magnitude of change.** To compare the magnitude of change associated with the main independent variables, Exhibit 3 contains marginal effects. These refer to the predicted change in postneonatal mortality associated with a unit or percentage change in each independent variable, while holding all other control variables at their means.

The results show that, compared to municipalities in the lowest quartiles, those

EXHIBIT 2**Effects Of Primary Care, Decentralization, And Other Variables On Postneonatal Mortality Rates Per 1,000 Live Births, 1998–2006**

Variable	Coefficient	Robust SE
Percent Family Health Program coverage	–0.009**	0.004
Log government health spending per capita	–0.264	0.236
Ambulatory care facilities (per 1,000)	–1.347***	0.621
Administrative decentralization, quartile 1	0.944***	0.305
Administrative decentralization, quartile 2	0.767***	0.264
Administrative decentralization, quartile 3	0.256	0.935
Administrative decentralization, quartile 4	Ref	Ref
Adult illiteracy rate (percent of population)	0.169****	0.027
Percent of population with access to clean water	–0.047***	0.014
Constant	11.510****	1.665
Number of observations	17,153	
Number of municipalities	2,700	
R ²	0.497	

SOURCES: Data from Brazilian Ministries of Health and Finance, Brazilian Institute for Applied Economic Research, and Brazilian Census Bureau.

NOTES: All results based on fixed-effects regressions for Brazilian municipalities, 1998–2006. Year dummy variables from 1999 to 2006 (reference = 1998) were all significant at $\alpha = 0.001$. They declined monotonically from –1.320 (1999) to –5.199 (2006), all with robust standard errors (SE) between 0.306 and 0.370. Analyses also controlled for inflation-adjusted income per capita, community health workers per 1,000 population, municipal population size, and municipal fixed effects.

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

EXHIBIT 3**Primary Care, Decentralization, And Postneonatal Mortality Rates Per 1,000 Live Births: Marginal Effects**

Variable	Marginal effects: predicted change in postneonatal mortality rate ^a
High Family Health Program coverage	–0.86 ^b (–1.31 to –0.42)
Ambulatory care facilities (per 1,000)	–0.60 ^c (–1.18 to –0.03)
High administrative decentralization	–0.80 ^b (–1.28 to –0.32)
Percent of population illiterate	0.17 ^b (0.12 to 0.22)
Percent of population with access to clean water	–0.04 ^b (–0.07 to –0.02)

SOURCE: Authors' calculations using data from Brazilian Ministries of Health and Finance, Brazilian Institute for Applied Economic Research, and Brazilian Census Bureau.

NOTES: 95% confidence intervals in parentheses. Analysis controlled for income per capita, municipal population size, municipal fixed effects, and year fixed effects (not shown). All variables are significant ($p < 0.05$). High Family Health Program coverage defined as population coverage 75% or more; high administrative decentralization defined as municipal government control of 85% of ambulatory care facilities or more.

^a Marginal effects refer to the predicted change in the postneonatal mortality rate per 1,000 live births associated with a one-unit change (note b) or a 1 percent increase (note c) in the independent variable, while holding all other control variables at their mean values.

where more than 75 percent of the population is covered by the PSF have 0.86 lower postneonatal mortality per thousand live births, while a 10 percent increase in ambulatory care facilities is associated with six fewer neonatal deaths per thousand live births. Municipalities in the top two quartiles of administrative decentralization (that is, those with control over 85 percent or more of their ambulatory care facilities) had about 0.80 fewer postneonatal deaths per thousand live births (Exhibit 3).

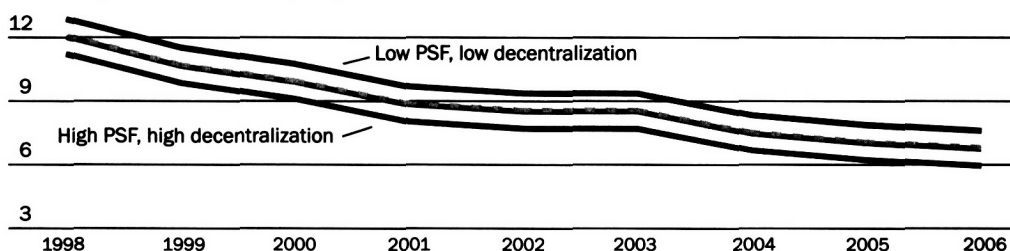
■ Postneonatal mortality, decentralization, and primary care coverage.

Our analysis allows us to predict postneonatal mortality rates based on various assumptions. Using these relationships, the highest predicted postneonatal mortality rates are for municipalities that have low levels of both decentralization and primary care coverage (between 1998 and 2006, the average predicted postneonatal mortality per thousand live births declined monotonically from 12.87 to 7.57 for this group), while the best outcomes are obtained by municipalities that have high levels of both decentralization and coverage (between 1998 and 2006, the average predicted postneonatal mortality per thousand live births declined monotonically from 11.2 to 5.9 for this group). Interestingly, the effect on postneonatal mortality of moving from low to high decentralization results in an effect that is similar to that of moving from lower to higher levels of PSF coverage, which suggests an additive effect (predicted values for both combinations dropped monotonically from about 12 in 1998 to about 7 in 2006): either approach can improve outcomes to a certain point, but both may be necessary to achieve the greatest reductions in mortality (Exhibit 4).

EXHIBIT 4

Average Predicted Postneonatal Mortality Rates Per 1,000 Live Births In Brazil, At Different Levels Of Administrative Decentralization And Family Health Program (PSF) Coverage, 1998–2006

Predicted postneonatal deaths per 1,000 live births



SOURCE: Authors' calculations using data from Brazilian Ministries of Health and Finance, Brazilian Institute for Applied Economic Research, and Brazilian Census Bureau.

NOTES: Predicted values for postneonatal infant mortality, controlling for all other control variables (see Exhibit 2). High level of PSF coverage is defined as population coverage of 75 percent or more; high administrative decentralization is defined as the top fiftieth percentile of municipal control of ambulatory control facilities. Low PSF, high decentralization and high PSF, low decentralization are so close in value that the two graph lines are indistinguishable from each other. Low PSF, high decentralization is plotted as a gray dotted line; high PSF, low decentralization, as a solid gray line.

Discussion

This study has shown that increased population coverage of the PSF is significantly associated with lower postneonatal mortality rates. A similar case can be made for administrative decentralization. This effect appears to be additive, in that municipalities that both pursued the decentralization of ambulatory care facilities and invested in expanding primary care reduced their postneonatal mortality rates by about 25 percent more than municipalities that took neither action. These results were robust to a number of different specifications and included controls for municipal and year fixed effects, and a range of important determinants of infant mortality such as water, illiteracy, income per capita, health spending, and ambulatory care facilities.

Several recent studies have found similar relationships between PSF expansion in Brazil and better health outcomes, including postneonatal mortality.¹⁶ However, this is the first study to assess the impact of devolution of control over ambulatory care facilities to the local level, above and beyond the expansion of the family health strategy.

■ **Study limitations.** Some limitations are relevant to the interpretation of our results. First, because ecological measures were used at the municipal level, it may be that reductions in postneonatal mortality were observed among families that were not served by the PSF or by ambulatory care facilities under municipal management. However, given the broad spread of both the PSF and decentralization, it is plausible that a good proportion of the population actually accessed these facilities.

The adoption of the PSF and the decentralization of municipal ambulatory care facilities are, to a large extent, choices made by municipal administrations, and it is possible that municipalities that make different choices are different in some unobserved way. For this reason, we included both municipal and year dummies (a variable for each municipality and one for each year), to control for such unobserved variables.

Our approach to including only municipalities with adequate data could have introduced bias. However, we studied the municipalities where almost 90 percent of the Brazilian population lives. Because we excluded some municipalities where vital statistics and other systems are weak, we believe that we have provided a conservative estimate of the effects of the PSF on infant health.

Despite the existence of federal guidelines for the organization of the program, variations in the quality and completeness of program implementation throughout the country are likely, although these were not captured in this study. Similarly, even though the decentralization of ambulatory care facilities was found to be negatively associated with postneonatal infant mortality, the actual process of transfer of control over facilities may have varied considerably from one municipality to the other. If this were the case, then quantitative measures of decentralization would not have accurately reflected the process of decentralization. This

“There may be little improvement in outcomes until the municipality gains enough skill to manage facilities on its own.”

limitation indicates an important line of future investigation into the process of decentralization, which could be explored from a qualitative perspective.

■ **Potential policy lessons.** This study, which provides evidence that the effectiveness of a community-based primary care approach (the PSF) on child health can be enhanced by administrative decentralization, might also suggest some potential policy lessons for other countries considering such reforms. First, the effects of administrative decentralization suggest that there is an important learning curve along the process of implementation: there may be little improvement in outcomes until the municipality gains enough skill to manage the majority of the ambulatory care facilities on its own. Therefore, an appropriate policy framework should be considered for the implementation of decentralization reforms, which includes a monitoring system with proper indicators (such as postneonatal mortality), effective referral systems to higher levels of complexity of care, and adequate support, especially during the initial stages of decentralization. Furthermore, it is important to have realistic expectations about the amount of time it will take before such reforms yield major improvements in health outcomes.

Second, we could not ascertain the extent to which primary care expansion and decentralization may have improved (or exacerbated) municipal and regional inequalities in resources and health status in Brazil. Given the municipal learning curve documented here, inequalities might at first increase and then decrease if adequate support can be given to struggling municipalities. Because the greatest marginal health gains are likely to be made in the areas with the highest levels of postneonatal mortality, future efforts could be directed at encouraging program expansion in the most underserved areas.

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NOTES

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2. Ibid.; and World Bank, *World Development Report 2004: Making Services Work for Poor People* (Washington: World Bank, 2004).
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10. Smaller and more rural municipalities were more likely than large urban municipalities to have lower-quality vital statistics data. The criteria for determining whether a municipality had good-quality mortality data were implemented through an algorithm taking into account all-cause mortality rates, extreme variations in mortality and birth rates, and the proportion of deaths of infants due to unknown causes. See R. Laurenti, M.H.P.D. Mello Jorge, and S.L.D. Gotlieb, "The Accuracy of Official Mortality and Morbidity Statistics Related to Chronic Non-Communicable Diseases" (in Portuguese), *Ciência and Saúde Coletiva* 9, no. 4 (2004): 909–920; and C.L. Szwarcwald et al., "Infant Mortality Estimation in Brazil: What Do Ministry of Health Data on Deaths and Live Births Say?" (in Portuguese), *Cadernos de Saúde Pública* 18, no. 6 (2002): 1725–1736.
11. The universe of ambulatory care facilities considered in this study are all facilities within the public health system, including those administered by nonprofit organizations and private clinics under government contract. As of December 2006, this definition included 85 percent of the country's ambulatory care facilities.
12. For control variables missing for some years at the municipal level, we used an imputation procedure taking into account historic time series at the municipal level as well as changes at the state level, which were available for every year. See S. Brown, K. Hayes, and L. Taylor, *State and Local Policy, Factor Markets, and Regional Growth* (Dallas: Federal Reserve Bank of Dallas, 2002). Note that government health expenditures per capita do not take into account families' out-of-pocket expenses.
13. J. Wooldridge, *Econometric Analysis of Cross Section and Panel Data* (Cambridge, Mass.: MIT Press, 2002).
14. The overall specification was based on a health determination equation at the municipal level, with health outcomes expressed as a linear combination of the products of coefficients (estimated by the model) and the following variables: primary care programs, decentralization, health services, sociodemographics, plus municipality and year fixed effects. The year fixed effect controls for all unobserved aspects characteristic of a given year that affect all municipalities uniformly, such as changes in national health policies or nationwide shortages of essential drugs. See L. Wang, "Determinants of Child Mortality in LDCs: Empirical Findings from Demographic and Health Surveys," *Health Policy* 65, no. 3 (2003): 277–299; and A.A. Okunade, "Concepts, Measures, and Models of Technology and Technical Progress in Medical Care and Health Economics," *Quarterly Review of Economics and Finance* 44, no. 3 (2004): 363–368.
15. See C. Hsiao, *Analysis of Panel Data* (Cambridge: Cambridge University Press, 2003). The analyses were conducted using STATA Version 10.1. All analyses use robust standard errors to control for heteroskedasticity.
16. There is an increasing body of evidence showing that while the PSF has contributed to the reduction of the infant mortality rate, these decreases have been largely driven by more rapid declines in the postneonatal component of infant mortality, which is thought to be more sensitive to primary care interventions than the neonatal component. See R. Aquino, N.F. de Oliveira, and M.L. Barreto, "Impact of the Family Health Program on Infant Mortality in Brazilian Municipalities," *American Journal of Public Health* 99, no. 1 (2009): 87–93; and J. Macinko et al., "Going to Scale with Community-Based Primary Care: An Analysis of the Family Health Program and Infant Mortality in Brazil, 1999–2004," *Social Science and Medicine* 65, no. 10 (2007): 2070–2080.