THE POLITICAL ECONOMY OF HEALTH SERVICES PROVISION AND ACCESS IN BRAZIL

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1. Introduction

In developing countries, health care is often subsidized by the government. This occurs in part because of the positive externalities associated with disease control, but also to redistribute income and to assure that the poor receive at least some minimum level of health services. A notable example is Brazil's "Unified and Decentralized Healthcare System" (SUS), established in 1988 with the goal of providing access to health care for all citizens, regardless of income. Financed by transfers from the federal government, as well as contributions from states and counties, the SUS delivers both basic and more complex health care and is the main source of medical treatment for the poor.

This paper addresses two questions that are essential to evaluating the success of public health care provision: (1) How do politics and government structure influence the distribution of public health services—doctors, nurses and clinics—across counties? (2) How do politics and the decentralization of public health services affect the likelihood that the poor and the uninsured actually receive health care? We answer the first question by estimating a model to explain variation in the number of public clinics and health care workers (doctors and nurses) per capita across counties (*municipios*) in Brazil in 1998. To answer the second question we use a large household survey (the 1998 *Pesquisa Nacional por Amostra de Domicilios* (PNAD)) to see whether people who rely on publicly financed health care (people without private health insurance) are more likely to receive medical attention in counties with more public clinics and health care workers per capita. Because decentralization in the administration of health services may also affect their placement within a county and the types of services offered, we examine the impact

of decentralization variables on the likelihood that the uninsured receive medical care, in addition to the level of health care services themselves.

We use a probabilistic voting model (Grossman and Helpman 2001; Foster and Rosenzweig 2001) to provide a theoretical foundation for the provision of public health care. Two parties compete for the votes of citizens who favor public provision of health care (e.g., the uninsured) and those who do not (e.g., the insured). The probability that a citizen votes for party A over party B depends on his utility from the public good (and tax rate) chosen by party A compared to that chosen by party B. In a voting equilibrium, the level of public health care provided reflects the shares of the two groups of citizens in the voting population, and is limited by the size of the public budget.

The model has four implications for the provision of public health care: (1) Provision of public health care should increase with average income in a county since this raises the level of tax revenues in the public budget constraint; (2) If the uninsured receive greater utility from the provision of public health care than the insured, one should expect to see higher levels of public health care in counties with a greater share of uninsured persons, *ceteris paribus*; (3) Since what matters for public goods provision is the share of each group in the population of *voters*, areas in which a higher percent of the uninsured vote should receive a higher level of public health care services, *ceteris paribus* (4) Provision of public health care should be greater in counties that are able, through negotiations with the state and federal governments, to receive higher grants (transfers) for health care.

The model thus implies that the political power of local officials and their influence with state and federal officials should increase the public provision of health

care, as should higher voter turnout by persons favoring publicly provided health care. We find empirical support for both effects.

The extent to which decisions regarding public health are decentralized—i.e., made at the local rather than at the state level—is also likely to play a role in the amount of health services provided and where they are located within the county. The traditional arguments in favor of decentralization are that (a) local governments are likely to be more responsive to local needs (i.e., to choose allocations that more closely reflect local preferences) than are state governments (Oates 1972; Besley and Coate 1999), and (b) decentralization promotes government accountability (Bardhan and Mookherjee 2000). This should improve the targeting of public health services (e.g., where clinics are located or the types of services offered), and may also improve their delivery to people that need them most.

We model decentralization in the provision of health services as a variable that affects the effective level of health services provided by a given vector of health care inputs (doctors, nurses, clinic consultation rooms). The theoretical impact of decentralization on the quantity of health care inputs chosen is ambiguous, and we find that decentralization of authority over public health care by itself does not affect the level of health care personnel and clinics provided. Counties with full authority over health care provision that also have a governance plan do, however, provide more health care services per capita than decentralized counties that lack a governance plan.

In the second stage of our analysis we study the impact of public service provision on individuals' ease of access to health care. The effective level of health services per capita depends on the number of doctors, nurses and clinic consultation rooms per capita

but also on their placement. We examine the impact of health care inputs—the dependent variables in stage one of our analysis—as well as other factors that may affect where such inputs are located—on the probability that an uninsured person both sought and received health care when ill. We find that households living in counties with more public health service provision are more likely to be able to see a health professional when they need to. The impact of decentralization on control over health care resources depends on the governance capacity of the county. The probability of an uninsured individual receiving medical attention is no higher in counties with full control over the allocation of health care resources than in counties with only partial control. However, the probability of receiving attention is lower under decentralization if the county does not have a governance plan.

By creating county level indicators of political participation, competition and connections, and examining their impacts on local public service provision and individuals' access to health care, this paper contributes to a well developed literature on the impact of democracy on economic performance (e.g. Rodrik 2000, Bardhan 1993). In particular, we find that political patronage and participation matter. Citizens can attract better public services by going to the polls to effectively threaten politicians, while local politicians can provide their constituents better services if they are more "connected" to state legislators. We also add to the literature on decentralization by clarifying the relationships that link governance, decentralization and public service provision. Decentralization is unlikely to result in better service delivery unless it is accompanied by the required governing capacity.

The next section discusses the administrative structure of the health care system in Brazil and recent reforms. Section 3 presents our theoretical model, section 4 our data and section 5 our estimation results. Section 6 concludes.

2. The Healthcare System and Political Context in Brazil

Under the military regime (1964 to 1985), public health care provision in Brazil was heavily concentrated in the rich areas of the South and Southeast, with preferential access openly granted to certain professionals and public sector employees (Lobato 2001). The 1988 "Citizens' Constitution"—which marked the new period of democratic rule and was heavily focused on equity—decreed that all citizens should have "universal and equal access to [health] actions and services" regardless of income or occupation (Vajda et al.1998). To fulfill constitutional requirements, a new system of publicly financed healthcare was set up in 1990. This new "Unified and Decentralized Healthcare System" (SUS) aimed to make health care available free of charge to all users.

Currently, a fully private system co-exists with SUS. It is funded mostly through private health insurance plans and provides much higher quality care than the public SUS system (Alves and Timmins 2001). Premiums for private insurance plans are relatively costly for most Brazilians, and only about 25% of the population (mostly those with higher incomes or with employer-provided coverage) had access to this private system in 1998-99 (Alvarez 1998). These richer individuals generally make little use of the SUS system unless they require highly complex health care services that private plans do not cover.

This paper focuses on health care provision through the SUS system, which is publicly financed. The following sections discuss the ownership and administration of facilities in the SUS system and how public health care is financed.[1]

A. Ownership and Administration of Facilities in the SUS System

Although the SUS system is fully publicly financed, many health care establishments providing SUS services are privately owned. The remainder are federal, state and county facilities. In 1999 67% of all SUS hospitals were privately owned; the remainder were owned primarily by either state (8%) or county governments (23%). Only 27% of clinics were privately owned in 1999, with state and county governments owning 3% and 69% of clinics, respectively.[2]

Regardless of ownership, all SUS facilities are administered by either state or county governments. The 1988 Constitution required that the *administration* of public health care provision should gradually devolve to county governments, with financial and technical assistance provided by the federal and state governments (Lobato and Burlandy 2001). Currently, each county is classified into one of the following three categories, in order of increasing levels of administrative decentralization: (i) Full State Management; (ii) Basic Assistance Management, where the county manages the provision of basic or primary health care,[3] and the state manages more complex types of provision; and (iii)

[1] Much of the discussion of the SUS system is based on Lobato and Burlandy (2001), Lobato (2001), World Bank (1999) and World Bank (2003).
[2] These data are from the 1999 *Pesquisa Assistencia Medico-Sanitaria* survey of all health facilities in Brazil.
[3] Visits to family doctors as well as some other types of clinical care are included in this category; complex procedures and visits to specialists are not.

Full County System Management, where the county manages the provision of basic as well as complex care.

A county government that wishes to attain the Basic Assistance or Full Management status must negotiate this with the federal government. Full Management status is awarded only if the county government asks for it, and if the federal government judges it capable of handling this enhanced administrative role. At the start of 1999, 8% of all counties had attained Full County System Management status, while 80% had attained Basic Assistance Management status.

B. Financing of the SUS System

About 70% of health care services provided under SUS are ultimately financed by transfers from the federal government, of which there are two types: those for basic health care and those for complex care. The basic care transfers are administered by those county governments with either Basic Assistance or Full Management status. These transfers are divided into two categories: (i) "fixed" population-based transfers where the per capita amount transferred is the same for most counties; and (ii) various types of "variable" transfers for primary health programs tailored to the poor, often requiring additional payments or co-financing by states or counties.

The transfers for complex care are handled by the county government only in the case of Full County System Management. These transfers are meant solely for the reimbursement of SUS providers for services rendered. There are two main constraints on these federally financed reimbursements: (i) they have to be done using a fee-for-service schedule maintained by the federal government, and: (ii) there is an annual ceiling

on the total amount of transfers that each sub-national government can disburse. The amount of the ceiling is determined by political negotiations between the federal and sub-national governments. Political factors that affect the nature of these negotiations thus may play a key role in determining provision patterns for complex care. For example, SUS allocations may be favorable for counties that are politically important or politically allied to the state in some form.

Each state and county government managing these federal transfers imposes, in turn, a ceiling on transfers to each licensed SUS provider in its jurisdiction. The government in charge also has the right to determine which provider qualifies to participate in the SUS system. The sub-national governments may supplement these federal transfers with their own funds (and, in the case of Full County Management, sometimes also from state funds). About 30% of the transfers to SUS providers come from sub-national government revenues.

3. Theoretical Model

In Brazil publicly financed health care is, effectively, a local public good. The level of basic health care provision is chosen by the county,[4] as is the level of complex health care services in the case of full decentralization (Full System Management). Because county officials in Brazil are democratically elected, it is natural to use a voting model of public goods provision as a framework for our empirical analysis. We adapt the two-party strategic voting model outlined in Grossman and Helpman (2001) for this purpose.

[4] This is true for 88% of counties, i.e., those who have attained Basic Assistance or Full System Management status.

The population of each county is normalized to 1. A fraction r of the county population are "rich" people, while the remaining (1-r) are "poor". Our aim here is to draw a distinction between two classes of people who enjoy differential benefits from public health services. We could also characterize the two groups as "insured" and "uninsured." Throughout, the superscript u represents the "upper" income group, and the subscript l the "lower" income group. y^g, $g = u,l$, denotes the income of each group. All individuals within an income group have identical incomes.

Public revenues for the county come from two sources: Transfers from the state government, $T(n)$, which are a function of political negotiations (n) between the county and the state, and local tax revenues from taxing the incomes of the rich and the poor at a common rate t. These revenues are used solely to finance public health services. Each unit of "effective health service per capita" is denoted h,[5] and it is delivered at a per-unit cost p. The public budget constraint is thus:

$$T(n) + t(1-r)y^l + t \cdot r \cdot y^u - p \cdot h = 0 \qquad (1)$$

Two parties, denoted A and B, have fixed positions on a set of issues, and choose the amount of effective health service (h) and tax rate (t) to offer, in order to compete for the votes of both rich and poor households. The parties can credibly commit to carry out their platforms in the event that they win the election. Each voter recognizes that his vote will slightly increase the subjective probability that the party he has chosen will win the election. His dominant strategy is to vote for the party he prefers, since this slightly

[5] This "effective health service" should be interpreted as the actual service received by the consumer. It incorporates not just the amount of services offered (e.g. the number of clinics), but also their placement within a county and the types of procedures offered at that location. h is of course a function of health *inputs* such as clinics, doctors and nurses.

raises his expected welfare. We assume that all rich people vote, while a fraction v of the poor (uninsured) vote.[6]

Voters receive utility $W^g(h,c)$ from the public health service (h) and a private consumption good, c. Since all after-tax income is spent on c, the utility of a voter in group g is given by: $W^g\left(h, y^g(1-t)\right)$. W^g is assumed to be increasing and concave in both arguments, and additively separable in the two arguments. We expect $W_h^u(\cdot) < W_h^l(\cdot)$, which means that the poor (uninsured) enjoy greater marginal benefits from public health services than do the rich. Each voter's welfare from voting for a particular party depends on the (h, t) combination offered by that party as well as his preferences over the fixed (e.g. ideological) positions of that party. A person i in income group g votes for party A over party B if:

$$W^g\left(h_A, y^g(1-t_A)\right) - W^g\left(h_B, y^g(1-t_B)\right) + \delta\varepsilon_{Ai} - \delta\varepsilon_{Bi} \geq 0 \qquad (2)$$

ε_i is the individual-specific preference for the fixed platforms of each party, and δ is the relative weight placed on such ideological considerations. If $(\varepsilon_{Ai} - \varepsilon_{Bi})$, which is the relative ideological preference of a voter for party A over party B, is distributed uniformly over the interval $\left[-\frac{1}{2}, \frac{1}{2}\right]$, then the expected number of votes for party A is given by:

$$EV_A = r\left[\frac{1}{2} - \frac{W^u\left(h_B, y^u(1-t_B)\right) - W^u\left(h_A, y^u(1-t_A)\right)}{\delta}\right] + v(1-r)\left[\frac{1}{2} - \frac{W^l\left(h_B, y^l(1-t_B)\right) - W^l\left(h_A, y^l(1-t_A)\right)}{\delta}\right] \qquad (3)$$

Each party proposes a tax rate (t_A or t_B) and an amount of effective public health service (per capita) to be delivered (h_A or h_B) to maximize its chances of winning the

[6] This assumption is not crucial to the results, but it reflects empirical observations about voting patterns in Brazil. Voting is compulsory in Brazil; however people who are less likely to have insurance (due to a lack of formal sector work), are also more likely to escape being fined if they do not vote.

election (EV_A or EV_B), given the (h,t) choice of the other party, and subject to the public budget constraint. The first order condition for h from the Lagrangian of this maximization problem is $r\frac{\partial W^u}{\partial h_A} + v(1-r)\frac{\partial W^l}{\partial h_A} - \lambda \cdot p = 0$, where λ is the Lagrange multiplier associated with the public budget constraint. This states that the party's choice of h is such that the weighted marginal utility of the two groups is equated to the marginal cost of provision, where the weights are the proportions of each group in the voting population.

It is instructive to substitute an expression for h_A in terms of t_A from the budget constraint (1) into party A's maximand (3), and solve the resulting one-variable unconstrained optimization problem for party A:

$$\max_{t_A} \quad r\left[\frac{1}{2} - \frac{W^u\left(h_B(t_B), y^u(1-t_B)\right) - W^u\left(h_A(t_A), y^u(1-t_A)\right)}{\delta}\right] + v(1-r)\left[\frac{1}{2} - \frac{W^l\left(h_B(t_B), y^l(1-t_B)\right) - W^l\left(h_A(t_A), y^l(1-t_A)\right)}{\delta}\right]$$

This results in the following first-order condition for party A:

$$r\frac{\partial W^u}{\partial h_A} + v(1-r)\frac{\partial W^l}{\partial h_A} = \frac{p}{\bar{y}}\left[ry^u\frac{\partial W^u}{\partial c_A} + v(1-r)y^l\frac{\partial W^l}{\partial c_A}\right] \tag{4}$$

where $\bar{y} = ry^u + (1-r)y^l$, is the population-weighted average income. Equation (4) shows that party A chooses h to equate the weighted marginal utility of h to its weighted marginal tax cost, where the weights are the proportion of voters in each group. Party B's maximization problem and first-order conditions are identical, which implies that in the unique Nash equilibrium, both parties offer the same tax–public health service policy.

The h that emerges in equilibrium is the same regardless of which party wins the election.

By totally differentiating (4), it is possible to examine the impacts of changes in the parameters of the model on the quantity of effective per capita health service (*h*) delivered in equilibrium. For example, an increase in r (proportion of people who are rich) has an ambiguous effect on h:

$$\frac{dh}{dr} = \left[\left(W_h^u - \nu W_h^l \right) \cdot \frac{\bar{y}}{p} + \left(\frac{y^u - y^l}{p} \right) \cdot \left(r W_h^u + \nu (1-r) W_h^l \right) - \left(y^u W_c^u - y^l W_c^l \right) \right] \cdot X \qquad (5)$$

X is a positive number that equals $-(p/\bar{y})/[rW_{hh}^u + \nu(1-r)W_{hh}^l]$. If the marginal benefits of public health accruing to the poor are sufficiently larger than those accruing to the rich, then the first term on the RHS of (5) is negative, which causes *h* to decrease with *r*. This is an effect of the party platforms: with an increase in the proportion of rich people in the population, the (*h,t*) combination offered by each party caters more to the preferences of the rich segment of the population. The positive second term is due to a relaxation of the public budget constraint. An increase in r raises average incomes and tax revenues, and the parties can afford to offer a larger amount of public health care. With an increase in *r*, more rich people are now taxed, and the third term reflects the possibly greater consumption cost of the tax on the rich compared to the poor.

The two distinct and opposite impacts of an increase in r on h are (1) the effect of a changing composition of the voting population, which alters policy in favor of the rich, and (2) the effect of increasing average income, which leads to greater public service delivery. In our empirical work, we seek to distinguish these two effects by measuring the proportion of poor/uninsured in the population separately from average

incomes. Holding the proportion poor constant, the model predicts that an increase in average income should have a positive impact on the amount of effective health care (per capita) delivered by the county. And, holding average income constant, the proportion poor/uninsured in the population should also have a positive impact.

The model predicts that an increase in the voting rate of the poor (v) will increase public health-care provision as long as the marginal benefits to the poor of an extra dollar of tax (in terms of the extra health services that tax dollar will provide) exceed its marginal consumption cost: $\frac{dh}{dv} = \left[\frac{\bar{y}}{p} W_h^l - y^l W_c^l \right] \cdot (1-r)X$. An increase in v causes politicians to alter policy in favor of poor people's preferences, and if the poor prefer that tax rates be raised to fund more public health-care, then that is what will happen.

Finally, the effect of greater transfers from the state to the county [*T(n)*] is straightforward: it simply relaxes the public budget constraint and allows the political parties to offer more public health-care for any given level of tax revenues. For every extra dollar that the county is able to bring in from the state through the inter-governmental political negotiations process, h increases by *1/p* units.

The effective level of health care per capita, h, is unobservable. What we can observe are the levels of inputs—doctors, nurses and clinics—used to produce health care. Suppose that health services per capita are produced under constant returns to scale. The amount of effective health care per capita is, however, dependent on the placement of health inputs vis-à-vis the population, as well as on how efficiently these inputs are managed. We therefore assume that h is a function of doctors, nurses and clinics (or clinic rooms) per capita, as well as descriptors of the geographic distribution of the population (P) and measures of the decentralization of health care (d):

$$h = f(D, N, C; P, d) \quad (6)$$

Once h is determined as an outcome of the political process, we assume that health care inputs are chosen to minimize the cost of achieving h. This implies that doctors, nurses and clinics per capita will depend on the factors affecting h in the voting model, as well as on measures of decentralization and the geographic distribution of the population, which affect the amount of effective health care provided by a given vector of health inputs. In our empirical models, we explain variation in health care inputs across counties as a function of the determinants of h from the voting model, as well as variables P and d.

4. Empirical Models

We estimate the impact of political variables and government structure on access to health care in two stages. The first stage explains variation in the level of public health inputs—SUS doctors, nurses and clinics (or clinic rooms) per capita—across counties. The second stage models the probability that an uninsured individual receives access to health care when ill, taking into account the level of public health inputs (the dependent variables in the first stage) and variables that may directly influence the location of health care facilities (such as decentralization). This section describes the variables included in the two sets of models. Further details on data sources appear in the Appendix.

A. Dependent Variables in the Models of Public Health Inputs

The dependent variables in these models are four inputs into the provision of public health care. The four inputs (each expressed per 1000 residents) are: (i) the number of doctors (including specialists), (ii) nurses, (iii) clinics and (iv) clinic

consultation rooms in the SUS system.[7] The measure of nurses includes those classified as "nursing auxiliaries" and "nursing technicians". Clinics are defined as all units providing medical care without inpatient facilities (pharmacies and facilities providing purely diagnostic services, such as laboratories, are not included). We do not use hospitals or hospital beds as provision measures because hospitals are "lumpy" units that are located in a limited number of counties. They are meant to serve residents from a fairly large geographical area that includes several counties. Thus, the county is not the appropriate unit of analysis.

B. Voter Preferences and Incomes

In the model of section 3, the amount of public health care provided depends on the size of the public budget constraint and on the distribution of voter preferences within the community. Because public health care is financed in part out of local tax revenues, we expect the quantity of health services provided to increase with per capita income in the county ($\bar{y}$). It should also increase with the size of transfers received from state and federal governments. These may depend on political factors (e.g., whether the mayor of the county is of the same party as the governor of the state) which are discussed more fully below.

We assume that preferences for publicly provided health care should increase with the percent of uninsured people in the county. This should be correlated with the percent of households falling below a given income level. Holding mean income constant, the percent of households below a given income threshold is increasing in the

[7] These data were obtained from were obtained from the *Pesquisa Assistencia Medico-Sanitaria*, a survey of all health facilities in Brazil conducted in 1999.

Gini coefficient for the county. Other variables that might be correlated with the demand for public health care include the percent of households living in slums and the racial composition of the population (e.g., the percent of population that is indigenous, and the percent of the population that is non-white).

Voters' desires for redistribution may also play a role in determining outcomes. If this desire is strong and if governments respond accordingly, provision levels and access—especially for the poor—may be higher. Our (albeit imperfect) measure for this is the proportion of county residents who voted for either of the two clearly left-leaning candidates in the 1998 Presidential elections (Lula and Ciro Gomes).[8] These two candidates accounted for about 35% of the votes (on average) across the sample counties.

According to the model of section 3, the amount of public health care provided depends not only the proportion of households in a county that favor public health care, but on the proportion of *voters* that do. Although by law voting is compulsory for literates in all elections, in practice the penalties for non-compliance are not large, and average voter turnout (77% in the 1996 elections) is significantly less than 100%. Our proxy for political participation by persons favoring public health care (ν) is the proportion of residents in each county who voted in the 1996 county elections. Because people employed in the informal sector are more likely to be able to escape the penalty for not voting, variation in participation rates is likely a result of variation in the proportion of poor in the county population (the segment of the population who is likely to use SUS services). To control for that fact that variation in the voting rate may reflect

[8] Lula—Brazil's current president—has been a key figure in the Worker's Party, a party that has fashioned itself as left-leaning. Aside from Lula, the only candidate in the 1998 Presidential elections who ran on a clearly leftist platform was Ciro Gomes, of the ex-communist Popular Socialist Party.

the proportion of the population that is illiterate, we also include this variable in the empirical models.

C. Factors Affecting Transfers (T(n))

Political factors play a key role in determining the size of transfers to counties from the state and federal governments. SUS allocations and other transfers may be favorable for counties that are politically important or that have close ties to the state capital (Lima 2002). These counties may also be favored in other ways, for example through special training programs, preferential access to the services of medical staff, and better state-owned health care facilities located in the county. As a proxy for this effect, we include the distance of each county from the state capital. Due to the dispersion in the size distribution of states in Brazil, there is a high degree of variation in this measure.

Local or regional political alliances may influence the degree to which the system favors a particular county. An alliance between key officials in the state and county government—such as the mayor and governor—may, for example, lead to favors granted to the county concerned. Unfortunately, political alliances in Brazil are not easy to analyze; there are several major political parties,[9] and a variety of formal as well as informal alliances are often formed at the national, state and local level (Fleischer 1995). In our models we include a political alliance measure that is admittedly limited due to informational constraints: an indicator for whether the mayor of the county elected in

[9] According to US Library of Congress (2000), there were seven major political parties in 1997, accounting for 92.6% of all members in the Chamber of Deputies (Brazil's equivalent of the US House of Representatives).

1996 and the state governor elected in 1994 were from the same party.[10] This occurred in only 588 (13.6%) of the counties in our sample.[11] We expanded this "political connections" indicator to include those cases where the county mayor's party and state governor's party formed a "coalition" in that state in that particular year, but the qualitative results do not change under this broader definition.

An additional measure of political power is the winner's vote share in the 1996 mayoral election. Locally elected officials with a strong popularity base possibly have greater political capital to expend in their negotiations with state legislators over fund transfers. It is probably important for state politicians to keep strong local leaders happy. We interact the winner's vote share variable with whether the mayor and state governor are from the same political party, since we expect the effect of a popular local politician on fund transfers to be stronger when the state and county politicians are in a coalition.

D. Variables Influencing the Effectiveness of Health Care Inputs

The effective level of public health care received by residents of a county for a given per capita number of doctors, nurses or clinics, depends on the geographic distribution of these services within the county. Other things equal, a given number of doctors per person is likely to be less effective the more dispersed is the population. Geographic controls added to capture this phenomenon include (i) the proportion of

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[10] We do not use 1998 gubernatorial election results, because the new governor elected in 1998 would take office in 1999. Since our dependent variables are measured in 1998 and 1999, we are allowing for a time lag since we expect political actions to have a delayed rather than immediate impact on provision.

[11] If state dummies were excluded, one could introduce state level political variables—such as whether the President and governor are from the same party—into the models. We experimented with this approach, but found that the regression fit was significantly reduced. There are likely many state-specific factors that cannot be adequately captured by observable state level variables. By introducing state dummies we control for these factors, and examine differences across counties within each state.

county residents living in urban areas; (ii) population density; and (iii) dummy for counties officially classified as belonging to a major metropolitan area.

The effective level of public health care is also likely to be affected by the decentralization of health care administration. Section 2 highlighted the fact that the government—state or local—in charge of the provision of *complex* health services plays a key role in determining funding allocations and outcomes. For this reason, our measure of decentralization is a dummy variable for counties that had Full County Management status (where the management of both basic and complex care provision has been decentralized to county governments) in 1998. No differentiation is made between counties with Basic Assistance Management (BAM) status (where the management of only basic care provision has been decentralized) and those under Full State Management. According to our definition, only 415 of the 4338 counties in the sample (9.6%) are decentralized. Unlike decentralization measures used in most of the literature, which are based on the relative sizes of the state versus local government budgets, we construct our measure based on clear information about the government that is in charge of administering health services and regulating health care providers.

The impact of decentralization in the administration of health care on service delivery should depend on the quality of governance at the local level. Our measure of governance is derived from the *Pesquisa de Informações Basicas Municipais*, a questionnaire regarding planning capacity, management ability and organizational structure that was administered to all Brazilian counties in 1999. One question asks whether the county has a plan or set of directives for governing, and the length of time that such a directive has been in effect. More specifically, this is defined as an "explicit

set of objectives and general line of actions oriented towards local development and improving residents' living conditions." Our "good governance" measure indicates whether the answer to this question is "Yes." According to this definition, 36% of all counties have "good governance." Although this fraction varies somewhat between decentralized and non-decentralized counties (43% and 33% respectively), there is no indication that a strong relationship between decentralization and governance quality exists (the correlation between the two variables is only 0.06).[12]

E. Variables from the PNAD household survey

The models estimated using PNAD data explain whether or not an individual dependent on the SUS had adequate access to health care in 1998. In addition to individual household characteristics, these models control for the quantity of both public health inputs (dependent variables in the first set of models) as well as factors (P and d) that affect the effectiveness of these inputs.[13]

The individual data are obtained from the 1998 *Pesquisa Nacional por Amostra de Domicilios* (PNAD), a survey of 344,886 individuals from 112,434 households. The survey is representative of all of Brazil except for certain rural areas in the North. The survey is conducted annually, and in 1998 a special module was included to obtain detailed information on the population's health status and usage of health services.

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[12] We constructed two alternative governance measures based on two other survey questions: (i) whether the county had a "strategic plan", or a specific plan laying out "strategies for sustainable socioeconomic development", and (ii) whether it had a "community health council"—a body separate from the government consisting of public officials and members of civil society—that specifically oversaw health provision policy in the county. It was specified that the health council had to be more than just advisory in nature; it had to have "deliberative" powers, i.e. some control over policies, decisions and funding. Approximately 50% of all counties have health councils, while only 6% had a strategic plan.

[13] Measures of private health inputs—the number of private doctors, nurses and clinic rooms per capita—are also included, since the uninsured may elect to use these services.

Survey respondents were asked whether they had a health problem during the previous two weeks that required medical attention. Our sample consists of individuals who answered "yes" to this question and who did not have private health insurance, i.e., who are likely to use the SUS system. A subset of these individuals reported that they either were not able to obtain treatment when they sought it (e.g., because the doctor was not available when they visited the health facility) or that they did not bother seeking treatment because of difficulty accessing a health facility (e.g., it was too far away). These individuals are classified as not having access to health care. [Details on the relevant survey questions and responses are provided in the *Data Appendix*.] Of the 33,541 individuals in our sample, 24% (8,077) did not have adequate access to healthcare.

The effort that an individual invests in seeking health care is likely to depend on the nature and severity of his illness. We include dummy variables describing the nature of the individual's illness, including diarrhea, respiratory disease and diabetes. For two of these conditions—diarrhea and respiratory disease—an interaction term with the individual's age is included as a separate variable, to account for the fact that these diseases can be much more harmful in children than in adults. Severity of the illness is captured by the number of days within the two-week period when the individual could not function properly due to the illness. Other individual and household level controls include measures of per capita household income, age, sex, household size, education level and race dummies.

5. Empirical Results

A. Sample Characteristics

Table 1 presents summary statistics both for the counties used to estimate our health care input models and for the individuals in our access to health care equation. Our county sample consists of all counties for which data on the variables in column (1) were available (4338 out of the approximately 5000 counties in Brazil). The average county in our sample has about 1 doctor and 1.4 nursing professionals working at SUS facilities, and approximately 2 SUS clinic consultation rooms per thousand residents (see column 1). Average county per capita GDP is R$3020. The average Gini coefficient, 0.53, reflects the high degree of income inequality in the Brazilian population. The average county is approximately 50% white, with 59% of the population living in urban areas, but is located outside of a major metropolitan area.

The 33,541 persons in our PNAD sample live in 752 of the 793 counties sampled in the 1998 PNAD survey.[14] Compared to the 4,338 counties in column (1), the 752 PNAD counties are more urbanized and have more SUS doctors and nurses, but fewer clinic consultation rooms, per thousand residents. Health care is fully decentralized in a higher percent of these counties than in the sample in column (1).

On average, 76% of the uninsured persons in the PNAD who were ill in the two weeks prior to the survey both sought and obtained medical attention. Comparing sample means across survey respondents who report that they did receive medical attention when required with those who did not, people who have health care access are on average a little younger, are from smaller households and are more likely to be female, although

[14] These counties are distributed across all states except Brasilia.

these differences are not statistically significant. People with access enjoy significantly higher household per capita income, are more likely to be educated, white and urban, and were seeking treatment for an illness of longer duration.

B. Estimation of County Public Health Provision Models

Table 2 reports equations for the four public health inputs: SUS doctors, nurses, clinics and clinic consultation rooms (per capita), estimated by ordinary least squares. We expect some spatial autocorrelation in errors in the cross-sectional county sample, since region-specific unobserved factors are likely to affect the demand for health services in similar ways in counties located close to one another. The spatial patterns of the four public health inputs across counties in Brazil are clearly visible in Figure 2. There are, likewise, clearly decipherable spatial patterns in some of the independent variables of interest (see Figure 3), which suggests that omitted variables may also be spatially correlated.

When Moran's I statistic (Anselin 1988) is computed to test for spatial autocorrelation in the errors in Table 2, the null hypothesis of no spatial autocorrelation is rejected for each equation for two forms of the spatial weighting matrix—one in which the neighbors of each county are defined to be those counties with which it shares a border, and one in which the neighbors are all counties within a certain radius of the county in question. This leads us to estimate spatial autoregressive errors models of the form

$$y = X\beta + u, \qquad u = \lambda Wu + \varepsilon; \varepsilon \sim N(0, \sigma^2 I) \tag{7}$$

using a generalized moments estimator (Kelejian and Prucha 1999). Once the spatial autocorrelation in the errors is accounted for, coefficient estimates are typically smaller

(and standard errors larger) compared to the Table 2 OLS results, particularly for independent variables which exhibit some spatial dependence.

Table 3 presents the results of estimating (7) with a distance-based weighting matrix W.[15] Four results stand out. First, voter preferences matter. Holding per capita income constant, counties with a less equal distribution of income—suggesting a greater proportion of persons relying on the SUS—are likely to have more SUS clinic rooms, and especially more doctors and nurses. A one standard deviation change in the Gini coefficient increases SUS doctors by about 4% and nurses by about 5%.[16] Counties with a greater percent of voters voting for a left-leaning candidate in the 1998 Presidential election are more likely to have more SUS inputs, although this effect is statistically significant only for nurses.

Second, the provision of SUS doctors, nurses and clinics is greater in counties where a higher fraction of persons who are likely to favor public health care vote. A one standard deviation increase in the percent of persons voting in the 1996 mayoral election increases clinics (and clinic consultation rooms) by about 8%. As we argue above, variation in the voting rate (holding literacy constant) is likely to reflect an increase in the percent of uninsured persons voting, since persons in the informal sector (who are less likely to be insured) are less likely to be penalized for not voting. Voter turnout is not significant in the equations for doctors and nurses; however, in counties with a greater

[15] Figure 1, which shows county boundaries, suggests that it is preferable to define a county's neighbors based on distance rather than contiguity, given the great variation in county area.

[16] As expected, counties with higher average incomes have more SUS doctors, nurses and clinics per capita. This effect is large: a one standard deviation increase in per capita income increases doctors and nurses per capita by about 11% and clinic rooms per capita by 7%.

proportion of illiterates (who are likely to use the SUS but are less likely to vote), provision of doctors and nurses is lower.

Third, our proxies for political leverage in negotiations with higher levels of government are often significant and increase the level of public health inputs. The higher the winner's share of the vote in the 1996 county mayoral elections, the stronger the mayor's power in negotiating transfers from federal and state governments. This effect is statistically significant in all four equations. The fact that the county mayor and state governor are of the same party may also increase the county's leverage in negotiations with the state. This holds in the equation for doctors and nurses, and increases the provision of doctors by 11% and nurses by 12%. We hypothesized that the benefits of being a popular mayor would increase if the state governor were of the same political party; however, the results for this interaction effect (which should be positive in sign) are mixed. This is also true for Distance to the State Capital, which, as expected, is negative in three out of four equations, but positive in the case of nurses.

Finally, decentralization in the administration of health care services has an ambiguous effect on the level of public health care services. There is no evidence that decentralized counties provide higher levels of public health services. However, once the set of decentralized counties is subdivided into two groups—those that have a governance plan and those that do not—some interesting results emerge. In each of the four equations, the coefficient on the indicator for decentralized counties with a plan for governance is more positive than the coefficient on the indicator for decentralized counties without a governance plan. Further, in the doctors and nurses regressions, the former is positive and statistically significant, suggesting that decentralized counties with

the required governing capacity have 3% more doctors and 4% more nurses than counties that are not decentralized.

C. A Logit Model of Individual Access to Health Care

The models presented in Table 4 investigate whether the SUS doctors, nurses and clinics whose provision we study in Tables 2 and 3 reach their target audience. Since SUS services are free of charge, high income individuals with health insurance plans rely on SUS for complex, high cost procedures not covered by their insurance. This can possibly crowd out the basic services that the uninsured poor are more interested in, particularly if local politicians and administrators are not responsive to the needs of the poor. Medici (2002) writes: "*Those who do not have private plans continue to face the scarcity of services available to care for their pathologies, the long lines waiting for medical assistance, public hospitals without funds or drug supply, and the difficulties in accessing basic services.*" It is therefore important to determine the impact of SUS doctors, nurses and clinic consultation rooms, together with the geographic and decentralization variables that may influence their placement on access to health care by the uninsured.

Table 4 reports the results of estimating a logit model to explain whether an individual obtained health care when ill as a function of individual and household characteristics, measures of public and private doctors and nurses and clinic consultation rooms (per capita), geographic variables and measures of decentralization and good governance. The coefficients of individual characteristics indicate that females, whites, richer and better educated people (the omitted education category is less than primary education) are significantly more likely to have sought and received health care when ill.

Women are 3.7 percentage points more likely to seek and receive attention than men, and a person with a college education is 7.2 percentage points more likely to seek and receive attention than a person with a less than primary school education. For every R$160 increase in per-capita monthly household income (which is a large increase for Brazilians in the PNAD sample), the probability of receiving medical attention increases by 6.3 percentage points.

The duration and nature of illness also influence the probability of seeking and receiving health care. An additional day of illness increases the probability of seeking health care by 1 percentage point. Curiously, people with back/spine problems, arthritis and kidney disease are less likely, while people with heart/blood pressure problems and diabetics are more likely, to report seeking and receiving treatment when compared to individuals not suffering from any chronic afflictions.

Measures of the supply of public (SUS) health service inputs have strong positive impacts on individual access. An increase in SUS doctors by 1 per 1,000 increases the probability of receiving health care by 5 percentage points, while an increase in clinic consultation rooms by 1 per thousand residents leads to a 3 percentage point increase in the probability that individuals will receive treatment when required. Increases in the non-SUS private provision of health professionals or clinics have no statistically significant effect on access. This is not surprising, since our sample consists only of uninsured individuals who typically would not seek private health care.

Measures of the spatial distribution of population included in Tables 2 and 3 are not significant here; however, respondents living in urban areas are almost 10 percentage points more likely to seek and receive health care than those in rural areas.

Decentralization of service delivery actually reduces the chances of receiving health care if it is not accompanied by good governing capacity. Individuals living in decentralized counties that lack the governing capacity are 4.6 percentage points less likely to be treated by a health professional than individuals living in counties where the administration of SUS is still under state control. On the other hand, individuals in decentralized counties with a governance plan are no more likely to report adequate access compared to individuals in counties where health-care is administered by the state.[17]

6. Conclusions

The purpose of this paper is to examine factors that affect (a) the level of public health services provided in counties in Brazil, and (b) the probability that people without health insurance receive medical attention when they are ill. The latter may depend on the per capita supply of clinics and health care workers, but is also likely to depend on how well these services are targeted at people in need of them. We have emphasized the role that political variables—such as the fraction of the electorate that votes and the power of the county mayor in negotiating with state and federal governments—play in answering these questions. We have also examined the impact of the decentralization of the administration of health services on health care delivery.

Our models suggest that the preferences of voters matter in explaining variation in public health services across counties. Counties with a higher proportion of voters who

[17] When we replace the governance plan measure with the two alternative indicators of governance (whether the county has a strategic plan and whether it has a health policy council), we continue to observe that living in a decentralized county without the requisite governing capacity has a significant negative impact on access.

are likely to rely on the SUS system have more SUS doctors, nurses and clinics. This is consistent with the results of Foster and Rosenzweig (2001) who find that districts in India with a higher proportion of poor voters receive more pro-poor public goods. We also find that political participation matters—counties with a higher proportion of people voting in the 1996 mayoral election have more SUS services—a finding consistent with Besley and Burgess (2003) and Betancourt and Gleason (2001). Political variables that proxy the power of the county mayor—his share of the vote in the mayoral election; whether he is of the same party as the state governor—also tend to be positively related to provision of SUS health services. Most importantly, the level of these services is positively correlated with the probability that an uninsured person seeks and obtains health care when he needs it.

In Brazil the role of decentralization in the provision of health care services has both an administrative aspect and a fiscal one. One might expect that local control over the administration of health care services would improve the targeting of these services to those who need them the most, holding the level of service provision constant. Decentralization of complex health services might also increase the budget for such services, compared to state management. It appears from our analyses that decentralization, when accompanied by good governance, increases the amount of public health services provided in a county.[18] Our second stage results however suggest that, holding constant the level of SUS doctors, nurses and clinics, decentralization does not increase that chances that an uninsured person receives health care.

[18] Faguet (2004) finds a similar result in Bolivia. He examines patterns of government investment by sector following the transfer of authority to county governments and finds that more investment occurs in counties that need it most (e.g., there is more investment in education in counties with greater illiteracy).

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Data Appendix

A. Data Sources for County Level Variables

Data on the number of doctors (including specialists), nurses, clinics and clinic consultation rooms (SUS as well as non-SUS) came from the *Pesquisa Assistencia Medico-Sanitaria*, a survey of all health facilities in Brazil conducted in 1998-99. For county-level GDP data, we rely on estimates for the year 1996 constructed by IPEA (2001) on the basis of the Censuses of Population, Industry, Agriculture and Services. These censuses are administered by the Brazilian national statistical institute (IBGE).

The geographic boundaries of some counties do not stay constant over time. The system of transfers from federal to local governments – with a fixed component given to each county regardless of size – has created strong incentives for counties to split over time and create additional counties. We are mindful of this, and normalize all relevant variables by population data (obtained from IBGE) for the exact time frame for which the numerator was obtained.

The proportion of 'white' and 'indigenous' in the population and the Gini coefficient measure of income inequality were computed using data from the 1991 Demographic Census. Data on the proportion of residents living in temporary housing or slum areas, proportion urban and population density are from the *Base do Informações Municipais (BIM) 1996* produced by IBGE. The distance from each county to the state capital was computed from latitude and longitude coordinates for the "center" of each county also taken from *BIM*. It was assumed that each degree of latitude or longitude spans the same length of about 110 km. This is approximately correct for Brazil where all points are located less than 20 degrees from the Equator, although the exact correspondence between a degree of longitude or latitude and distance in kilometers differs slightly at different geographical locations (Meeus, 1999).

Our measures of governance are taken from a survey of all counties conducted in 1999 by IBGE (*Pesquisa de Informações Basicas Municipais*). The decentralization dummy variable is calculated based on which counties have Full County Management status in 1998, as reported by SUS. All political variables were computed from the database maintained by Brazil's Superior Election Court (TSE). This database reports the names and basic characteristics of all candidates running for office, and the number of

votes received by each candidate in each county for Presidential, state gubernatorial and county mayoral elections held since 1992. Elections are held at four-year intervals, and county elections are staggered by two years (1992, 1996, 2000) relative to state and federal elections (1994, 1998). Constrained by the years for which health data are available, we concentrate on the 1994 and 1996 elections.

Our political participation variable is calculated as the number of votes cast in the mayor 1996 elections (excluding null and blank votes) in each county, as a fraction of the county population. We chose to normalize by population rather than by the number of registered voters, because the former definition gives us a accurate measure of voting rates among the those (the poor, uninsured who are more likely to not be employed in the formal sector) who would benefit from public health services.

B. Details on the PNAD Individual and Household Survey Variables

The *Pesquisa Nacional por Amostra de Domicilios* (PNAD) is a household and individual survey conducted almost every year, representative for all of Brazil except for sparsely populated rural areas in the Northern states of Rondonia, Acre, Amazonas, Roraima, Para and Amapa. PNAD is a stratified sample, where included counties are divided into two groups: key counties (including those in the large urban areas) and second-tier ones. Households in each of the key counties are sampled, while a subset of second-tier counties are selected by stratification. The 1998 PNAD included households from 793 out of a total of 5008 Brazilian counties.

The 1998 PNAD consists of a basic questionnaire and an additional health module which asked detailed questions about health status and usage of health services. A total of 112,434 households (344,886 individuals) were surveyed in PNAD 1998. Our regression sample consists of a subset of those individuals, selected (as explained below) on the basis of their healthcare needs over a two-week recall.

C. Measuring Individual Access to Health Care

Figure A1 below outlines the process for the construction of the individual health-access variable based on the 1998 PNAD survey questions. The following survey questions were create this variable:

(1) "During the past 2 weeks, have you looked for any health service or professional for treatment related to your own health?" (Yes/No)

Individuals who responded "yes" to the question above were then asked:

(2) "When you looked for this treatment, were you treated?" (Yes/No)

Individual who responded "no" to question 2 were asked:

(3) "… why not?" The possible multiple choice responses for question 3 were: (a) There was no available vacancy; (b) there was no attending doctor; (c) the required service or specialized professional was not available; (d) the required equipment was out of order; (e) could not afford payment;[19] (f) waited too long and gave up; and (g) other reasons.

Those who answered "no" to question 1 (i.e. did not seek healthcare over the two-week recall) also had to answer the following question:

(4) "During the past 2 weeks, why did you not look for health services?" Possible responses were: (a) It was not necessary; (b) did not have money; (c) the health facility is far away or access is difficult; (d) there were difficulties with transportation; (e) very long waiting time; (f) the necessary specialist was not available at the health facility; (g) nobody was available to accompany you; (h) other reasons; (i) unknown.

Those who answered (a) to Question 4 (286,885) were dropped from the analysis because they did not require health services. Those responding with (h) and (i) were also dropped, since these responses do not provide adequate information for us to judge their health-care access status. Among the remaining respondents (53,584, i.e. all respondents aside from those dropped), the following were classified as not having adequate health care access:

- Those who answered "No" to question 2 (i.e. those who were not treated when they sought healthcare, totaling 1800 individuals), and
- Those responding with (b), (c), (e) or (f) to question 3 (i.e. individuals who did not bother seeking care due to difficulties in access, totaling 7985).

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[19] Multiple choice options relating to payment for services - (e) for Question 3 and (b) for Question 4 – were provided because: (i) the survey includes potential users of non-SUS facilities where services are not free of charge, (ii) SUS may have to pay for prescription drugs out-of-pocket; and (iii) users may have to pay for their own transport to the health facilities.

All remaining individuals (43,799) were classified as having adequate health care access. All individuals with private health insurance were dropped from the analysis. This – as well as exclusion of persons with missing or inadequate responses for other survey questions or missing county information – resulted in the final sample of 25464 individuals classified as having health care access, and 8077 persons (24.1%) classified as not having it.

Figure A1: Construction of Individual Health Access Variable

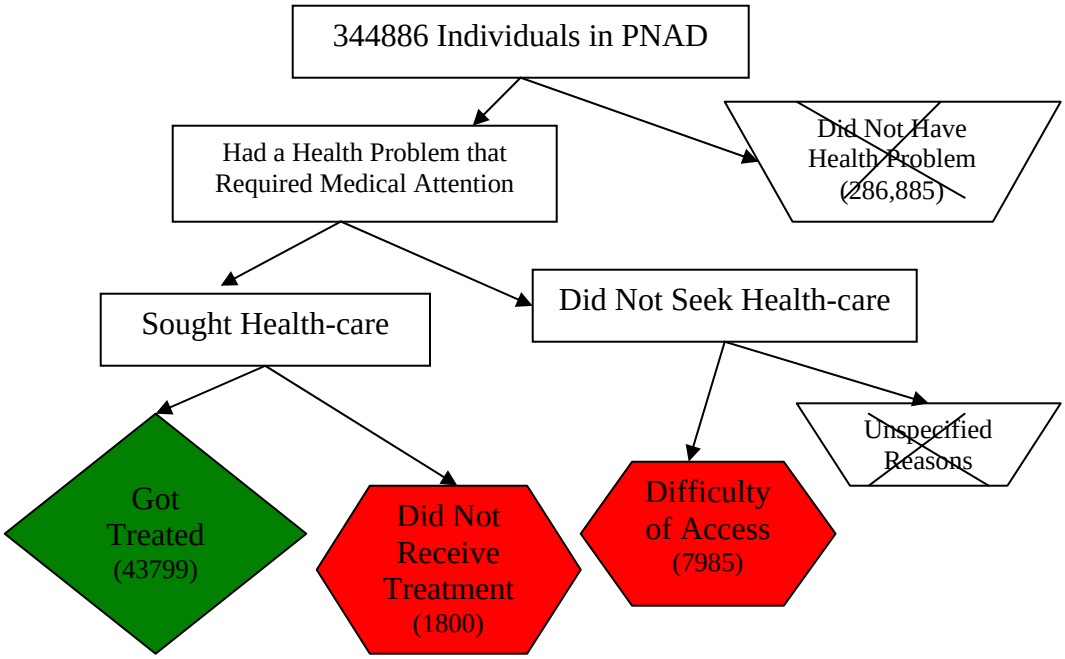


Figure 1: Map of Municipio (County) and State Boundaries

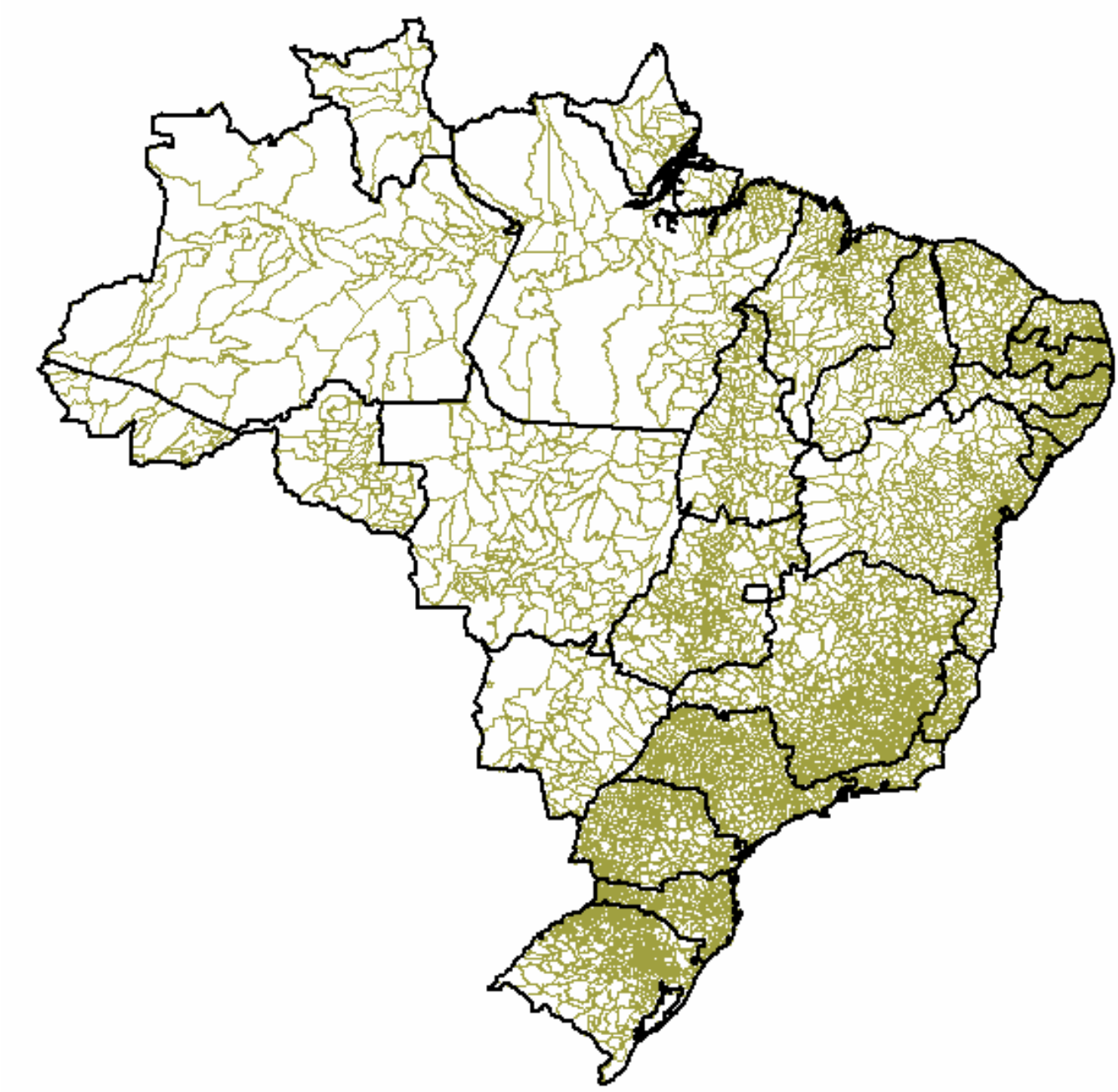
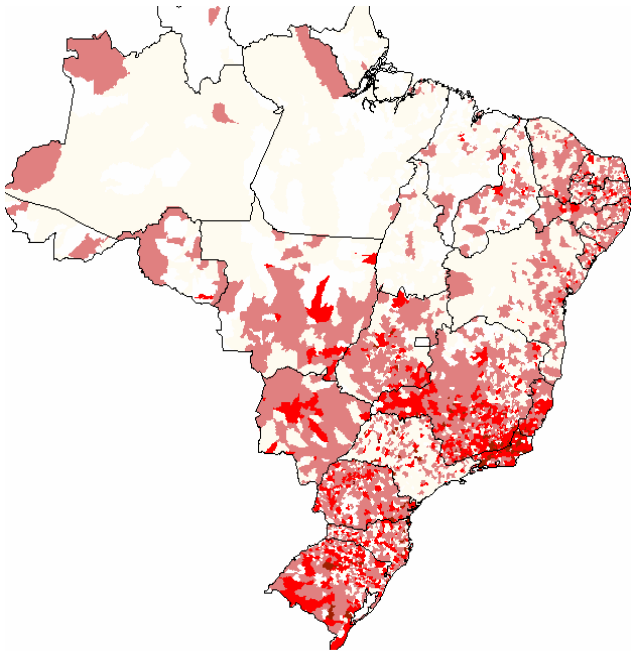


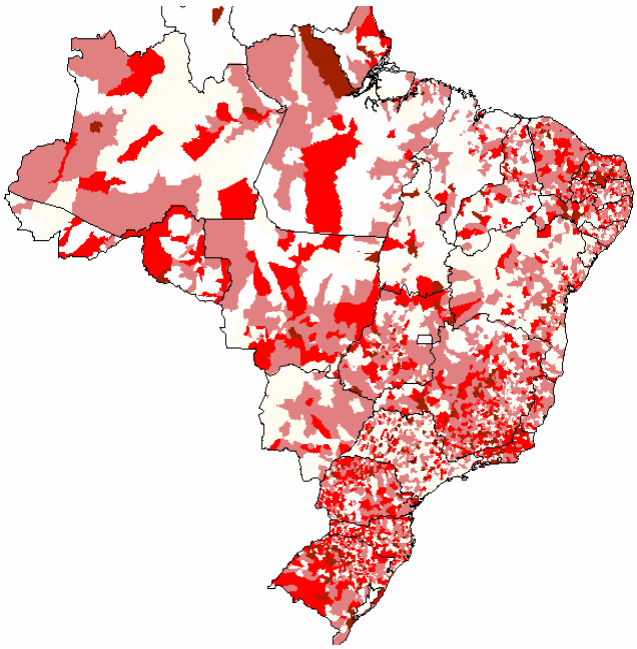
Figure 2. Spatial Patterns in Public Health Service Provision (per 1000 people)

Key: Darker colors imply more health services

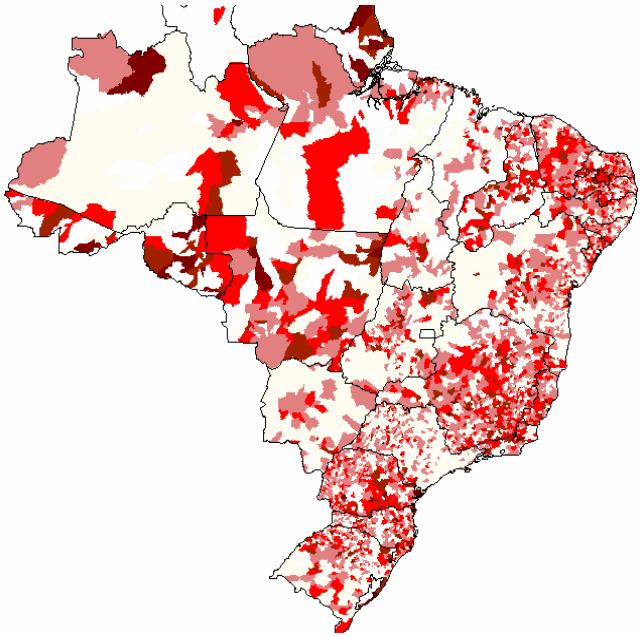
Doctors



Nurses



Clinics



Clinic Consultation Rooms

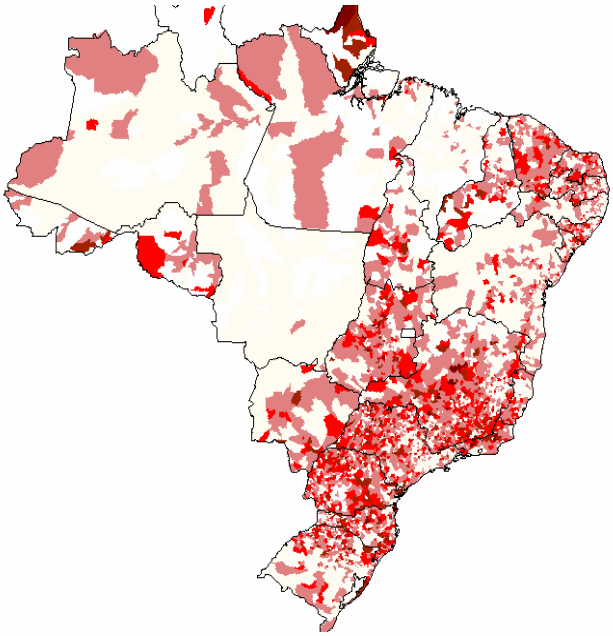
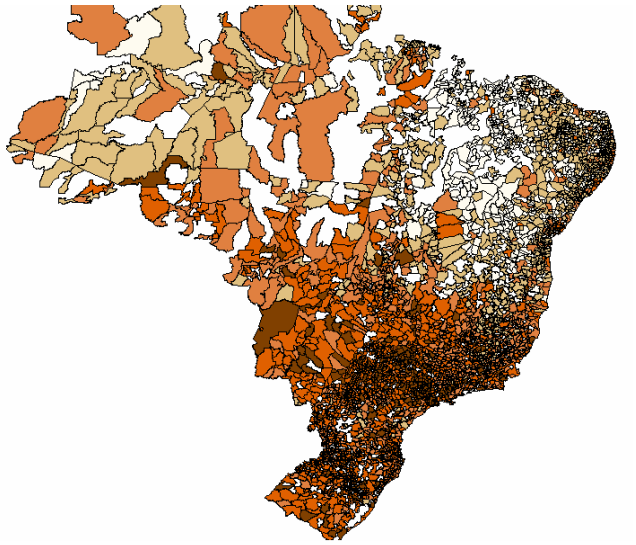


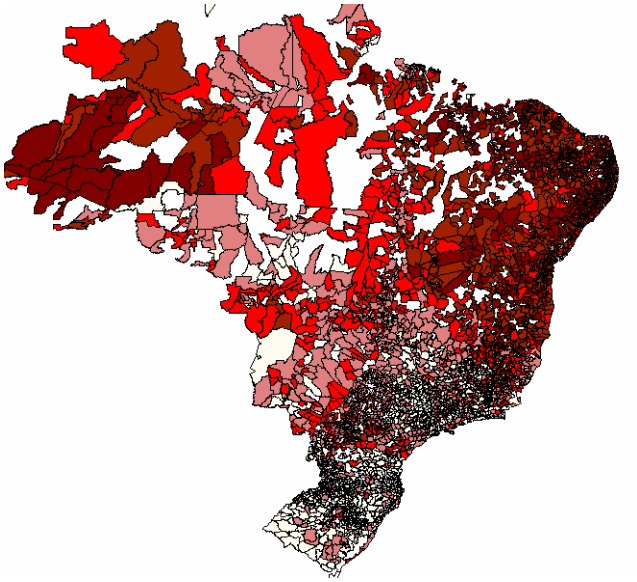
Figure 3. Spatial Patterns in Independent Variables

Key: Darker colors indicate higher levels of each variable

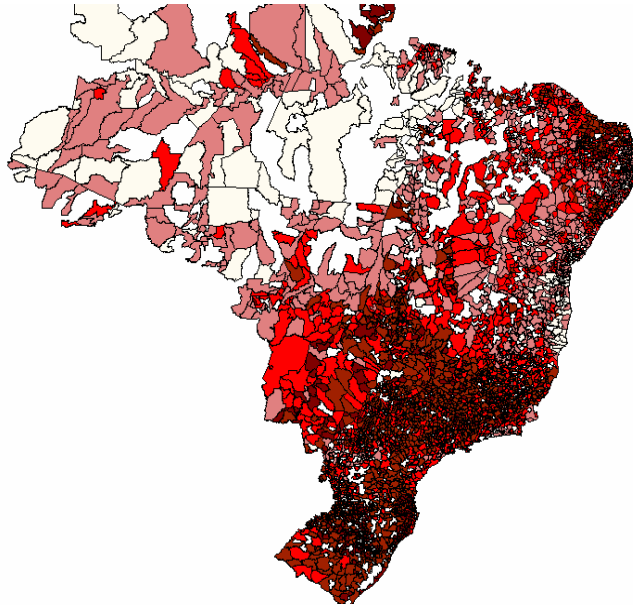
GDP per Capita



Illiteracy Rate



Political Participation (Voting) Rate



Winner's Vote Share in County Mayor Election

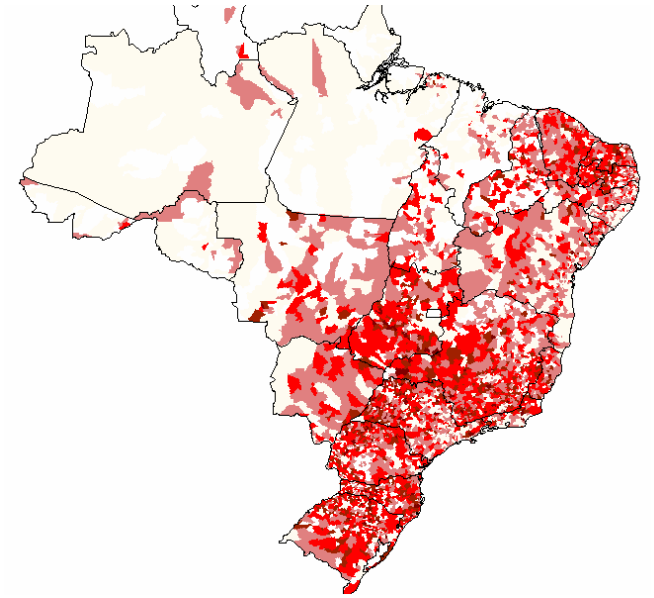


Table 1. Summary Statistics

	County Sample (4338 Obs.)		Individuals With Health Access (25464 Obs.)		Individuals Without Health Access (8077 Obs.)		All Individuals (33541 Obs.)	
	Mean (Std. Dev.)	Range	Mean (Std. Dev.)	Range	Mean (Std. Dev.)	Range	Mean (Std. Dev.)	Range
Public Doctors and Specialists per Thousand People	0.972 (0.954)	(0-21.55)	1.225 (0.979)	(0-21.55)	1.043 (0.665)	(0-21.55)	1.181 (0.916)	(0-21.55)
Public Nurses per Thousand People	1.358 (1.114)	(0-16.81)	2.097 (1.534)	(0-7.18)	1.807 (1.409)	(0-7.18)	2.027 (1.51)	(0-7.18)
Public Clinics per 1000 people	0.345 (0.26)	(0-2.67)						
Public Clinic Consultation Rooms per 1000 people	2.34 (1.472)	(0-13.02)	1.317 (1.167)	(0-8.8)	1.29 (1.021)	(0-8.8)	1.311 (1.133)	(0-8.8)
County GDP per Capita (logged)	7.694 (0.813)	(4.77-11.34)						
Gini Coefficient of Income	0.541 (0.064)	(0.32-0.84)						
Share of 1998 Presidential Election Votes Cast for a Left-Leaning Candidate	0.352 (0.14)	(0.06-0.91)						
% of Population Living in Slums (Improvised Housing)	0.004 (0.013)	(0-0.38)						
Proportion of County Population that is White	0.506 (0.28)	(0-1)						
Proportion of County Population that is Indigenous	0.003 (0.023)	(0-0.74)						
Political Participation in 1996 Mayoral Election	0.771 (0.086)	(0.34-0.96)						
Proportion of the County Population that is Illiterate	0.351 (0.179)	(0.02-0.87)						
Winner's Vote Share in 1996 Mayoral Election (Popularity of Elected Mayor)	0.299 (0.089)	(0.08-0.78)						
Counties Where the State Governor and County Mayor are from the Same Party	0.136 (0.342)	(0-1)						
Interaction: (Mayor's Vote Share) * (Mayor and Governor from Same Party)	0.04 (0.107)	(0-0.78)						
Distance to the State Capital	2.287 (1.505)	(0-13.32)						
Decentralized Counties (Healthcare County-Run) Without a Governance Plan	0.054 (0.226)	(0-1)	0.121 (0.326)	(0-1)	0.129 (0.335)	(0-1)	0.123 (0.328)	(0-1)
Decentralized Counties (Healthcare County-Run) With a Governance Plan	0.042 (0.2)	(0-1)	0.193 (0.395)	(0-1)	0.153 (0.36)	(0-1)	0.183 (0.387)	(0-1)
Indicator for Counties with a Governance Plan	0.342 (0.474)	(0-1)	0.547 (0.498)	(0-1)	0.49 (0.5)	(0-1)	0.533 (0.499)	(0-1)
Population Density	0.098 (0.526)	(0-12.41)	1.327 (2.161)	(0-12.41)	1.016 (1.891)	(0-12.41)	1.252 (2.104)	(0-12.41)
% of County Population Living in Urban Areas	0.587 (0.224)	(0.02-1)	0.796 (0.221)	(0.1-1)	0.727 (0.249)	(0.1-1)	0.78 (0.23)	(0.1-1)
Dummy for Major Metropolitan Region	0.041 (0.199)	(0-1)	0.369 (0.483)	(0-1)	0.291 (0.454)	(0-1)	0.35 (0.477)	(0-1)
Private Doctors and Specialists per Thousand People			0.428 (0.536)	(0-2.74)	0.316 (0.451)	(0-2.36)	0.401 (0.519)	(0-2.74)
Private Nurses per Thousand People			0.346 (0.475)	(0-2.12)	0.261 (0.41)	(0-2.12)	0.326 (0.461)	(0-2.12)
Private Clinic Consultation Rooms per 1000 people			0.254 (0.379)	(0-2.49)	0.209 (0.337)	(0-2.49)	0.243 (0.37)	(0-2.49)

Table 1. (cont.) Summary Statistics

	County Sample (4338 Obs.)		Individuals With Health Access (25464 Obs.)		Individuals Without Health Access (8077 Obs.)		All Individuals (33541 Obs.)	
	Mean (Std. Dev.)	Range	Mean (Std. Dev.)	Range	Mean (Std. Dev.)	Range	Mean (Std. Dev.)	Range
Access to Health Care							0.759 (0.428)	(0-1)
Indicator for Female Respondent			0.613 (0.487)	(0-1)	0.581 (0.493)	(0-1)	0.605 (0.489)	(0-1)
Respondent's Age			31.479 (22.602)	(0-98)	36.072 (22.066)	(0-107)	32.585 (22.56)	(0-107)
Respondent's Age Squared / 100			15.018 (17.123)	(0-96.04)	17.881 (17.886)	(0-114.49)	15.707 (17.353)	(0-114.49)
No. of Household Inhabitants Aged 9 or less			1.024 (1.209)	(0-12)	1.121 (1.348)	(0-11)	1.047 (1.244)	(0-12)
No. of Household Inhabitants Aged 10 Years or More			3.562 (1.799)	(1-16)	3.656 (1.852)	(1-15)	3.584 (1.813)	(1-16)
Highest Level of Education Completed by Respondent is Primary			0.122 (0.328)	(0-1)	0.081 (0.274)	(0-1)	0.113 (0.316)	(0-1)
Highest Level of Education Completed by Respondent is Secondary			0.139 (0.346)	(0-1)	0.087 (0.282)	(0-1)	0.126 (0.332)	(0-1)
Highest Level of Education Completed by Respondent is Tertiary			0.032 (0.176)	(0-1)	0.01 (0.098)	(0-1)	0.027 (0.161)	(0-1)
Respondent is Black			0.064 (0.245)	(0-1)	0.077 (0.266)	(0-1)	0.067 (0.25)	(0-1)
Respondent is Colored (but not Oriental or Indigenous)			0.444 (0.497)	(0-1)	0.543 (0.498)	(0-1)	0.467 (0.499)	(0-1)
Respondent is Indigenous			0.003 (0.056)	(0-1)	0.003 (0.057)	(0-1)	0.003 (0.056)	(0-1)
Household Income (logged)			4.655 (0.905)	(-0.18-9.26)	4.263 (0.908)	(0.69-7.98)	4.56 (0.921)	(-0.18-9.26)
Household Resides in Urban Area			0.815 (0.388)	(0-1)	0.658 (0.475)	(0-1)	0.777 (0.416)	(0-1)
No. of Days Respondent could not Engage in Usual Activities due to Illness			1.814 (3.648)	(0-14)	1.322 (3.161)	(0-14)	1.696 (3.543)	(0-14)
Respondent could not Engage in Usual Activities due to Diarrhoea/Vomiting			0.021 (0.145)	(0-1)	0.019 (0.135)	(0-1)	0.021 (0.143)	(0-1)
Interaction of Age and Preceding Diarrhoea Variable			0.401 (4.131)	(0-89)	0.527 (5.09)	(0-94)	0.431 (4.381)	(0-94)
Respondent could not Engage in Usual Activities due to Respiratory Illness			0.042 (0.2)	(0-1)	0.026 (0.16)	(0-1)	0.038 (0.192)	(0-1)
Interaction of Age and Preceding Respiratory Illness Variable			1.02 (7.038)	(0-98)	0.756 (5.97)	(0-95)	0.957 (6.797)	(0-98)
Respondent could not Engage in Usual Activities due to Heart/Blood Pressure Prob			0.036 (0.187)	(0-1)	0.025 (0.157)	(0-1)	0.034 (0.18)	(0-1)
Respondent could not Engage in Usual Activities due to Mental/Emotional Prob.			0.013 (0.115)	(0-1)	0.012 (0.111)	(0-1)	0.013 (0.114)	(0-1)
Indicator for Respondents with Back Problems			0.284 (0.451)	(0-1)	0.389 (0.488)	(0-1)	0.31 (0.462)	(0-1)
Indicator for Respondents with Arthritis or Rheumatism			0.17 (0.375)	(0-1)	0.252 (0.434)	(0-1)	0.19 (0.392)	(0-1)
Indicator for Respondents with Diabetes			0.051 (0.22)	(0-1)	0.042 (0.201)	(0-1)	0.049 (0.216)	(0-1)
Indicator for Respondents with Chronic Kidney Disease			0.06 (0.238)	(0-1)	0.086 (0.281)	(0-1)	0.066 (0.249)	(0-1)

Table 2. OLS Regressions of Health Service Provision per Thousand People

		(1) Doctors	(2) Nurses	(3) Clinics	(4) Consultation Rooms
Voter Preferences and Incomes (y_u, y_l, r)	County GDP per Capita (logged)	0.133***	0.173***	0.019**	0.194***
		(5.59)	(5.39)	(2.38)	(4.51)
	Gini Coefficient of Income	0.599***	1.025***	0.041	0.717**
		(3.48)	(3.87)	(0.61)	(2.11)
	Share of 1998 Presidential Election Votes Cast for a Left-Leaning Candidate	0.245*	0.453***	0.097***	0.117
		(1.69)	(2.87)	(2.60)	(0.58)
	% of Population Living in Slums (Improvised Housing)	-0.755*	-1.474*	0.013	2.078
		(1.81)	(1.70)	(0.06)	(1.51)
	Proportion of County Population that is White	0.128	-0.186*	-0.065**	-0.312*
		(1.46)	(1.67)	(2.26)	(1.96)
	Proportion of County Population that is Indigenous	0.137	0.423	0.446*	2.442***
		(0.48)	(0.63)	(1.84)	(2.68)
Voting Rate (v)	Political Participation in 1996 Mayoral Election	0.303*	0.009	0.355***	2.234***
		(1.95)	(0.03)	(5.79)	(6.94)
	Proportion of the County Population that is Illiterate	-0.970***	-1.065***	-0.139**	-0.703***
		(7.11)	(5.03)	(2.54)	(2.66)
Transfers from State $T(n)$	Winner's Vote Share in 1996 Mayoral Election (Popularity of Elected Mayor)	0.736***	0.443*	0.603***	5.135***
		(3.77)	(1.83)	(10.33)	(14.84)
	Counties Where the State Governor and County Mayor are from the Same Party	0.264***	0.452***	-0.056	-0.285
		(2.85)	(2.82)	(1.43)	(0.93)
	Interaction: (Mayor's Vote Share) * (Mayor and Governor from Same Party)	-0.654*	-1.349***	0.212	1.209
		(1.72)	(2.58)	(1.50)	(1.08)
	Distance to the State Capital	-0.018**	0.028**	-0.010***	-0.018
		(2.03)	(2.54)	(3.69)	(1.35)
Health Production Function Shifters (d, P)	Decentralized Counties (Healthcare County-Run) Without a Governance Plan	-0.009	0.100	-0.028**	-0.204***
		(0.17)	(1.39)	(2.33)	(2.92)
	Decentralized Counties (Healthcare County-Run) With a Governance Plan	0.104*	0.242**	-0.018	-0.165*
		(1.74)	(2.55)	(1.33)	(1.95)
	Indicator for Counties with a Governance Plan	-0.016	0.066*	-0.019**	-0.080*
		(0.61)	(1.76)	(2.39)	(1.90)
	Population Density	-0.049***	0.021	-0.016***	-0.174***
		(3.08)	(0.46)	(3.59)	(5.11)
	% of County Population Living in Urban Areas	0.230***	0.285***	-0.314***	-0.763***
		(2.86)	(3.08)	(13.52)	(5.97)
	Dummy for Major Metropolitan Region	-0.177***	-0.271***	-0.067***	-0.386***
		(3.09)	(2.60)	(4.93)	(4.24)
	Constant	-1.268***	-0.780	-0.287	-3.516**
		(3.25)	(0.80)	(1.46)	(2.54)
	Observations	4338	4338	4338	4338
	Adjusted R-squared	0.20	0.19	0.26	0.30
	F-stat for Equality of Decentralization [with/without governance plan] Coefficients	2.47	1.66	0.33	0.15
	Prob > F	0.12	0.20	0.56	0.70

Heterskedasticity-corrected t statistics in parentheses; State Dummies included in all Specifications

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3. Regressions of County Health Service Provision With Spatially Correlated Errors

		(1)	(2)	(3)	(4)
		Doctors	Nurses	Clinics	Consultation Rooms
Voter Preferences and Incomes (y_u, y_l, r)	County GDP per Capita (logged)	0.133***	0.179***	0.026***	0.201***
		(4.48)	(5.12)	(3.37)	(4.71)
	Gini Coefficient of Income	0.579**	0.999***	0.002	0.581*
		(2.43)	(3.58)	(0.03)	(1.69)
	Share of 1998 Presidential Election Votes Cast for a Left-Leaning Candidate	0.178	0.397**	0.061	0.007
		(1.29)	(2.51)	(1.63)	(0.03)
	% of Population Living in Slums (Improvised Housing)	-0.673	-1.493	0.045	1.92
		(0.64)	(1.2)	(0.16)	(1.27)
	Proportion of County Population that is White	0.133	-0.176	-0.052*	-0.263*
		(1.25)	(1.45)	(1.82)	(1.67)
	Proportion of County Population that is Indigenous	-0.041	0.384	0.394**	1.955**
		(0.06)	(0.51)	(2.34)	(2.11)
Voting Rate (v)	Political Participation in 1996 Mayoral Election	0.29	0.006	0.318***	2.174***
		(1.38)	(0.02)	(5.78)	(7.16)
	Proportion of the County Population that is Illiterate	-1.013***	-1.145***	-0.088	-0.491
		(4.9)	(4.83)	(1.59)	(1.61)
Transfers from State ($T(n)$)	Winner's Vote Share in 1996 Mayoral Election (Popularity of Elected Mayor)	0.701***	0.394*	0.579***	4.823***
		(3.67)	(1.75)	(11.65)	(17.56)
	Counties Where the State Governor and County Mayor are from the Same Party	0.305**	0.474***	-0.028	-0.24
		(2.3)	(3.03)	(0.83)	(1.27)
	Interaction: (Mayor's Vote Share) * (Mayor and Governor from Same Party)	-0.75*	-1.41***	0.124	1.033*
		(1.76)	(2.8)	(1.12)	(1.7)
	Distance to the State Capital	-0.015	0.03**	-0.009**	-0.014
		(1.27)	(2.27)	(2.46)	(0.74)
Health Production Function Shifters (d, P)	Decentralized Counties (Healthcare County-Run) Without a Governance Plan	0.005	0.109	-0.027	-0.148
		(0.07)	(1.44)	(1.63)	(1.62)
	Decentralized Counties (Healthcare County-Run) With a Governance Plan	0.124*	0.265***	-0.012	-0.115
		(1.74)	(3.15)	(0.66)	(1.13)
	Indicator for Counties with a Governance Plan	-0.021	0.063*	-0.02***	-0.082*
		(0.72)	(1.8)	(2.67)	(1.94)
	Population Density	-0.039	0.027	-0.016**	-0.17***
		(1.29)	(0.79)	(2)	(3.86)
	% of County Population Living in Urban Areas	0.208**	0.262***	-0.322***	-0.857***
		(2.47)	(2.67)	(14.44)	(6.97)
	Dummy for Major Metropolitan Region	-0.148*	-0.248**	-0.051**	-0.286**
		(1.73)	(2.56)	(2.18)	(2.22)
	Constant	-1.175*	-0.695	-0.37**	-3.54***
		(1.85)	(0.95)	(2.19)	(3.8)
	Parameter for Spatial Lag in Errors (λ)	0.185***	0.109***	0.292***	0.275***
		(18.17)	(17.23)	(17.44)	(15.14)
	Observations	4338	4338	4338	4338
	Adjusted R-squared	0.22	0.20	0.30	0.33

Heterskedasticity-corrected t statistics in parentheses; State Dummies included in all Specifications
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4. Access to Health-Care Regressions

	Individual/Household Controls	(9)	ME[a]
Respondent and Household Characteristics	Indicator for Female Respondent	0.218*** (8.58)	0.037
	Respondent's Age	-0.028*** (11.78)	-0.002
	Respondent's Age Squared / 100	0.022*** (7.04)	
	No. of Household Inhabitants Aged 9 or less	-0.013 (0.65)	-0.002
	No. of Household Inhabitants Aged 10 Years or More	0.017 (1.48)	0.003
	Highest Level of Education Completed by Respondent is Primary	0.196*** (3.37)	0.031
	Highest Level of Education Completed by Respondent is Secondary	0.165*** (2.72)	0.027
	Highest Level of Education Completed by Respondent is Tertiary	0.499*** (3.06)	0.072
	Respondent is Black	-0.200*** (2.97)	-0.035
	Respondent is Colored (but not Oriental or Indigenous)	-0.090** (2.05)	-0.015
	Respondent is Indigenous	-0.355 (1.25)	-0.065
	Household Per Capita Monthly Income (logged)	0.377*** (12.55)	0.063
	Household Resides in Urban Area	0.542*** (7.28)	0.098
Illness (2 week recall)	No. of Days Respondent could not Engage in Usual Activities due to Illness	0.061*** (11.24)	0.010
	Respondent could not Engage in Usual Activities due to Diarrhoea/Vomiting	0.185 (1.30)	0.029
	Interaction of Age and Preceding Diarrhoea Variable	-0.007 (1.61)	-0.001
	Respondent could not Engage in Usual Activities due to Respiratory Illness	0.091 (0.67)	0.015
	Interaction of Age and Preceding Respiratory Illness Variable	0.003 (1.12)	0.001
	Respondent could not Engage in Usual Activities due to Heart/Blood Pressure Prob	0.314*** (3.72)	0.048
	Respondent could not Engage in Usual Activities due to Mental/Emotional Prob.	-0.185 (1.34)	-0.032
Chronic Conditions	Indicator for Respondents with Back Problems	-0.190*** (4.83)	-0.032
	Indicator for Respondents with Arthritis or Rheumatism	-0.216*** (5.29)	-0.038
	Indicator for Respondents with Diabetes	0.262*** (3.73)	0.041
	Indicator for Respondents with Chronic Kidney Disease	-0.155*** (2.62)	-0.027
	Observations	33541	

	County Level Controls	(9) cont.	ME[a]
Health Inputs (*D, N, C*)	Public Doctors and Specialists per Thousand People	0.303*** (3.25)	0.051
	Private Doctors and Specialists per Thousand People	0.076 (0.62)	0.013
	Public Nurses per Thousand People	-0.068 (1.58)	-0.011
	Private Nurses per Thousand People	0.003 (0.02)	0.000
	Public Clinic Consultation Rooms per 1000 people	0.181*** (3.77)	0.030
	Private Clinic Consultation Rooms per 1000 people	-0.102 (1.12)	-0.017
Health Production Function Shifters (*d,P*)	Decentralized Counties Without a Governance Plan	-0.258** (2.02)	-0.046
	Decentralized Counties With a Governance Plan	0.031 (0.33)	0.005
	Indicator for Counties with a Governance Plan	-0.035 (0.40)	-0.006
	Population Density	0.010 (0.36)	0.002
	% of County Population Living in Urban Areas	0.083 (0.41)	0.014
	Dummy for Major Metropolitan Region	0.006 (0.06)	0.001
	Constant	1.338 (1.02)	
	Chi-square stat for Equality of Decentralization [with/without Governance Plan] Coefficients	4.03	
	Prob > Chi-square	0.04	

Heteroskedasticity-corrected z statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Errors Clustered by County; State Dummies included in all Specifications

[a]Marginal Effect: increase in probability that the individual reports that s/he has access to health-care in response to a unit change in the independent variable (discrete 0 to 1 change for binary variables)