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Evaluating the impact of contracting out basic health care services in the state of São Paulo, Brazil

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Abstract

As a means of dealing with shortcomings in the coverage, quality and efficiency of the public health care sector, several municipalities in the state of São Paulo, Brazil, have started to contract pre-certified non-profit or non-governmental organizations to take part in the delivery of health care services.

This paper explores the impact of introducing these contracts in the primary health care sector. Using data on the 645 municipalities in the state of São Paulo and difference-in-differences methods, we estimate the effect of contracting out in the primary health care sector on various dimensions of mortality and health care use. The results show that implementation of the contracting out strategy significantly increases the number of primary health care appointments by approximately one appointment per user of the national health care system per year. Point estimates indicate a reducing effect on hospitalization for preventable diseases.

Keywords: Brazil, child health, contracting out, difference-in-differences, health care service delivery, health care use, health systems development and reform, national health care system, impact evaluation, SUS, universal health care

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Key Messages

- The results of our analysis show that implementation of the contracting out strategy in the state of São Paulo, Brazil, significantly increased the number of primary health care appointments by approximately one appointment per user of the national health care system per year. The point estimates indicate no effects on mortality but a reducing effect on hospitalization for preventable diseases.
- The results from the impact evaluation have some limitations. First, we cannot rule out that the significant increase in primary health care appointments is partly due to a tendency to report the deliveries more accurately when contracting out is introduced. Second, the results have only external validity. Thus, introducing the contracting out strategy in more municipalities in the state of São Paulo might not have the same effect, whereas introducing the strategy in other states of Brazil might well have a positive impact on health and health care supply.

Introduction

Since 1989, all Brazilians have been entitled to free health care at primary, secondary and tertiary level through the national health care system—in Portuguese, 'Sistema Único de Saúde' (SUS)—and today approximately 70% of the population uses SUS. As SUS has developed, the health status of the population has improved. Yet the task of improving Brazil's health and health care services is still subject to many challenges. Despite improvements in health status over the last 30 years, life expectancy in Brazil is still below average and the under-5 mortality rate is still above average when the seven largest countries in Latin America are compared (Victora *et al.* 2011a). Meanwhile, SUS has been criticized for failing to deliver sufficient health care to the population. In particular, it has been claimed that SUS has been underfunded, that SUS administration has been inefficient, and that the quality of services provided through SUS has been below par (Victora *et al.* 2011b).

One proposed approach to improve coverage and quality of health care for all citizens in a public health care system is to contract with NGOs or other not-for-profit organizations to deliver specific services that are pre-defined by health authorities. One argument for this approach is that it incentivizes innovations and improved performance among non-state providers as they compete to obtain and retain contracts. Another argument is that contracting out services increases flexibility in the administration of health care services. In the last 15 years, an increasing number of countries have initiated contracts with NGOs to deliver services as a means of dealing with lack of motivation, as well as shortcomings in coverage, quality and efficiency, in their public health care sectors (England 2004; OECD 2004).

In Brazil the public health care system may be recognized as a multi-provider health care system administrated by public authorities. In the 1990s the primary care system changed when municipalities implemented a community-based program to deliver primary health care services—the Family Health Program. To implement the program a number of municipalities made large use of contracted out services (Departamento de Assistência Básica 2002). The Brazilian experience is quite different from what is being described in empirical studies of contracting-out and in the more widespread literature in the field of public administration. In Brazil, the private sector strictly speaking has not been subject to contracted and a systematic policy of payment for outcomes has not been adopted here. Instead, in Brazil, non-profit entities have been engaged under contract to operate within the public sector, supplying health personnel who provide services at public facilities (Coelho and Greve 2016; Ireland *et al.* 2016). In the 2000s, this strategy was extended when the Government of São Paulo State launched a major initiative to test the use of performance-related contracts. In these contracts the government disburses funds for a non-for-profit-organization to manage a public health unit and deliver the tasks specified in a mutually agreed plan (Medici 2011; Levi 2009; Sano and Abrucio 2008).

Home to 40 million people, São Paulo state holds 20% of Brazil's total population and has the largest public health care system in the country. In 2011, almost 25% of public health expenditures in basic care in the São Paulo state were spent with NGOs or other non-profit entities. In addition, 206 out of the 645 municipalities were contracting out services in the primary health care sector.

This paper explores the impact of contracting out non-for profit-organizations using data on the 645 municipalities in the state of São Paulo. As contracts with non-governmental organizations are often made in an attempt to improve the delivery of health care, we examine the impact of contracting out on the number of primary health care appointments per SUS user per year. Although an increase in primary health care appointments might reflect an improvement in the delivery of health care, it is uncertain whether this increase reflects an efficient use of health care services.

We also evaluate the impact of contracting out primary health care services on a number of health and health care indicators. These include infant and child mortality, child hospitalization rate for respiratory diseases, and hospitalization rate for preventable diseases. Although infant and child mortality and child hospitalization for respiratory diseases have declined significantly in Brazil in the last three decades (Victora *et al.* 2011a; Victora *et al.* 2011b) these health parameters remain important indicators for child health in Brazil. Furthermore, previous literature shows a significant and negative relationship between the number of primary health care appointments and infant mortality and respiratory infections (Caldeira *et al.* 2005; Macinko *et al.* 2007; Shi 2012), indicating that these factors are important to evaluate in relation to proposed organizational changes in the primary health care sector.

All things being equal, a more effective basic health care system would reduce the number of hospitalizations for diseases that could be prevented and treated by primary health care services. For this reason we also evaluate the effects of contracting out primary health care services on the rate of hospitalization for preventable diseases.

This paper offers a new approach to the subject of contracting out health care services and contributes new data to the literature. Firstly, while previous studies of contracted out services in Brazil have focused on the hospital level (Ibanez *et al.* 2001; Barradas and Mendes 2006; LaForgia and Couttolenc 2008; Sano and Abrucio 2008; Quinhões 2009; Levi 2009; Barbosa and Elias 2010; Medici 2011), no other study has investigated the effects of contracting out at a primary health care level. Secondly, while previous studies have only investigated the association between performance contracts and health care, our study is the first in Brazil to evaluate its impact using a difference-in-differences identification strategy.

Thirdly, we have collected information on different contracts from various sources and have compared our measurements with results from a qualitative study on these contracts in a number of São Paulo municipalities (Coelho *et al.* 2014). Thus, the variable we use to measure whether or not a municipality contract out primary health care services is thoroughly validated, enabling this kind of study to be carried out in Brazil for the first time. Finally, we show the trends in health and health care use several years before treatment—for both treatment and control municipalities—and prove the common trend assumption, which validates the difference-in-differences strategy.

Previous literature and hypothesis

Much of the literature that favours contracting out models is influenced by New Public Management, a concept that combines principles of managerialism with ideas from the theoretical field of microeconomics. New Public Management advocates that contracting out health care services increases flexibility in the public sector while ensuring results-based control because public officials are empowered to plan, monitor and provide rewards to outstanding suppliers. These practices in turn provide incentives for competition between providers interested in maintaining and gaining new contracts. The expectation from introducing these mechanisms is to solve some of the problems that are characteristic of bureaucratic administration, particularly inefficiency as a result of excessive

procedures and procedural controls, as well as a lack of accountability on the part of bureaucrats and health personnel (Walsh 1995). Ireland *et al.* (2016) call attention to the fact that the flexibility allowed by contracting out strategies can also help in solving the difficulties experienced in attracting health professionals (especially doctors and nurses) to work at the primary health care level and in rural and remote areas.

Mills (1998) highlights that the success of a contracting out strategy depends in large part on aspects related to its implementation. This suggests that the ability of these kinds of contracts to improve the performance of a health care system depends not only on greater flexibility in managing services and competition between providers, but also on changes to the dynamics intrinsic to the planning and monitoring processes found in the public sector.

However, there are also several potential risks associated with contracting out services. According to England (2004:14) 'Service-based payment systems may create incentives to over provide in order to maximize income. For this reason, purchasers usually introduce a maximum number of services to be provided. Because they require data on the number and type of services delivered, service-based contracts invariably incur higher transaction costs. Definition of service types can also be manipulated by providers by, for example, giving preference to simpler cases within any service category, or by minimizing treatment.' Moreover, corruption can happen in the process of selecting providers. Furthermore, it has been claimed that too much focus on financial incentives may dilute health professionals' motivation related to status and altruism (Witter *et al.* 2012).

Loevinsohn and Harding (2004) reviewed 10 experiences of contracting with NGOs in which some coherent form of evaluation was carried out. They conclude: 'It appears that in developing countries, contracting with non-state providers to deliver primary health or nutrition services can be very effective and that improvements can be rapid.' For example, in Pakistan, a program that contracted an NGO to deliver health care services in rural areas showed an almost fourfold increase in outpatient visits. In Bangladesh, rural areas that received services contracted with NGOs experienced a decline of 18% in malnutrition rates, while comparable control areas experienced a decline of only 13%. In 2008, Liu *et al.* published a review of studies on the effectiveness of indirect contracting of basic health care services in low and medium income countries. Their review points to evidence suggesting that in many cases contracting out services does promote expanded access to health care services and better quality. More recently, Witter *et al.* (2012) in a systematic literature review on performance incentives 'Paying for performance to improve the delivery of health interventions in low-and middle-income countries' concluded, that the current evidence base on performance-based funding is too weak to draw general conclusions and that more robust and also comprehensive studies in this area are needed.

In Brazil, descriptive studies by Sano and Abrucio (2008) and Barbosa and Elias (2010) highlight that greater operational flexibility in the non-for-profit health organization tends to result in a higher volume of services provided. This is especially due to their greater agility in contracting resources in general, and in managing human resources in particular. A study by Médici (2011) points to the gains in health organization efficiency achieved by reducing the cost per procedure, resulting in increased rates of bed occupancy and reduced cost of services. However, Levi (2009) points out that the São Paulo State Secretary of Health had been unable to build parameters on which to base the financial disbursements made to private entities in a manner compatible with the idea of results-based management. In particular, arrangements based on contract models presuppose an expertise in setting prices that tend to be far removed from the activities normally performed by health secretariats.

In short, the literature review indicates that despite the growing attention received by service agreements and performance contracts there is currently a lack of strong evidence on the effectiveness of these strategies in improving health and health care services. Based on the assessment studies discussed here, it is important to investigate not only whether adopting indirect contracting processes in basic care is contributing to the expansion in the supply of service, but also whether it is contributing to an increase in the quality of these services.

To confront this set of issues, the hypothesis specified to guide this study is: Adoption of the contracting out strategy has contributed to increasing the supply of basic services offered by SUS and to improving health and conditions that are sensible to primary care interventions.

Materials and methods

Data

To examine the impact of implementing a contracting out strategy on health and health care use, we have collected data on the 645 municipalities in the state of São Paulo from several sources.

Data on the implementation of external contracts with NGOs on a municipal level has been collected from the National Register of Health Service Establishments—in Portuguese, 'Cadastro Nacional de Estabelecimentos de Saúde' (CNES).[1] We have used a measure based on the percentage of health professionals on external contracts in the primary health care sector to indicate whether a municipality is using the contracting out strategy or not. This decision was made based on data availability. The Health Ministry has a national dataset of health establishments and their health professionals (CNES). This is the most complete available information for infrastructure and human resources in the health sector. In this data set, we can find information for the nature of contracts used to hire health professionals, that is to say, if they are contracted directly by the state, or indirectly by NGOs or by other type arrangement. Nevertheless, the dataset does not present information about the provider or the kind of contract (performance contract or agreement) used in a given health unit. Given this limitation, we decided to use the % of health professionals on external contracts as a measure of implementation of external contracts with NGOs and to treat both types of contracts as a single category: personnel engaged by NGOs.[2]

In 2011, 206 municipalities had one or more employees on external contracts in the primary health care. As we do not expect municipalities with very few employees on these external contracts to affect the overall outcome for the whole municipality, we categorize 'treated' municipalities as municipalities with >10% of employees on external contracts in the primary health care sector. According to this categorization 101 or 16% of the municipalities in the state of São Paulo were using external performance contracts in the primary health care sector in 2011.

The period covered in our analysis is constrained by data availability. While we have only reliable information from 2011 on which municipalities were contracting out, we have information on both outcome and additional control variables from 2001 through 2012 except income per capita, which only exists in 2000 and 2010. Thus we use the measure of contracting out in 2011 as a treatment

variable on health and health care services in 2012. We assume that none of the municipalities were contracting out before 2005 and thus that none of the municipalities were affected by treatment in the year 2004. This assumption is based on the extensive use of external contracts in basic health care when implementing the Family Health Program. While São Paulo Municipal Health Secretariat, began using these contracts in 2001 (Dowbor and Houtzager 2014), intensive use and diffusion of these contracts to other municipalities in the state of São Paulo mainly began after 2004 (Coelho *et al.* 2014).

Data on infant and child mortality are available from 'Fundação Sistema Estadual da Análise de Dados' (SEADE). Data on hospitalization for preventable and respiratory diseases are available from the database 'Sistema de Informacões Hospitalares'. Infant and child mortality rates are measured as the number of deaths among children below 1 year and above 1 and below 5 years, respectively, divided by the number of living births and multiplied by 1,000. Hospitalization of children for respiratory diseases is measured as the number of children below 1 year hospitalized with this disease divided by the number of children in this age group multiplied by 100.

Hospitalization for preventable diseases has previously been used as an indicator of primary health care performance and includes asthma, congestive heart failure, and gastroenteritis and related complications (Alfradique *et al.* 2009). Data on the number of primary health care (PHC) appointments is available from the Health Ministry. We divide the number of PHC appointments by the number of SUS users in the municipality. The number of hospitalizations for preventable diseases is also measured by the SUS population and divided by 1,000.[3,4]

Information on mortality and hospitalization is missing or has an unlikely value for a number of small municipalities mainly because the number of incidences is very low when the population is small.[5] Thus, we include an indicator for small municipalities in the estimations to take into account the difference in the outcome variables that might exist for smaller and larger municipalities.

We include the following socioeconomic indicators: the percentage of the population of black or mixed race and per capita income. As children and the elderly are more likely to use the health care system we include variables for the percentage of the population below 15 years of age and above 60. Furthermore, as implementation of the contracting out strategy may depend on the size of the health administration, and therefore the size and degree of urbanization of the municipalities, we include variables measuring urbanization, number of SUS users, and an indicator for municipalities with <10 000 inhabitants. We also include primary health care expenditure and the number of teams related to the Family Health Program. The data sources for all variables included in our econometric models are shown in Supplementary Material, Table S1, http://goo.gl/281Kv4.

Finally, the implementation of the contracting out strategy may depend on the political environment in the municipality, as well as on local policies. We therefore include dummy variables indicating the political party of the mayor in the municipality. Furthermore, we include an index (IFGF) which measures municipal managerial capacity in the following areas: municipal revenue, staff costs, investments, liquidity, and debt costs.[6]

Table 1 shows the means of outcome and control variables for the treatment and control groups in 2004, the year before most municipalities implemented the contracting out strategy (i.e. before assumed treatment).

The results in Table 1 show that in 2004, the municipalities that chose the contracting out strategy had a lower initial rate of child mortality and hospitalization and a lower number of PHC appointments per SUS user compared to the group of control municipalities. The group of municipalities that are contracting out also have a significantly higher income per capita, a lower percentage of black or of mixed race, a higher percentage of people aged below 15 years and a lower percentage of people aged over 60 compared to the control group. In the treated municipalities the degree of urbanization is higher and only 27% of the municipalities are small compared to the control group, of which half are small. Treated municipalities have on average fewer SUS users, but among those for which data exists, the average primary health care expenditure is significantly higher compared to the control group municipalities. There is no difference between the two groups either in regard to the number of family health teams per SUS user, or to the political party of the mayor in 2004.

Methods

Several econometric concerns arise in identifying the causal effect of contracting out on health and health care. Adoption of the contracting out strategy may depend on some specific characteristics of the municipality, and therefore the indicator for contracting out may be an endogenous variable. These characteristics could include the general socioeconomic status or the health status of the population in the municipality. Table 1 shows that the group of municipalities implementing external contracts in the primary health care sector had lower infant and child mortality rates and lower hospitalization rates for preventable and respiratory diseases. However, as long as the adoption of the contracting strategy is correlated with some pre-existing conditions, such as mortality rates in previous years, the difference-in-differences (DD) strategy resolves this problem.

Still, the adoption of a contracting out strategy could depend on dynamic characteristics, such as recent changes in mortality or hospitalization rates. For example, municipalities may adopt a contracting out strategy as a reaction to large negative health changes. In this case, the DD approach cannot resolve this problem.

An indirect way to assess the importance of changes in health and health care use in the population is to estimate the probability of contracting out primary health care services in 2011 on lagged mortality and health care use and changes in mortality and health care use. We do this in section 5.1.

Another econometric concern arises if unobserved characteristics that are not fixed over time affect the probability of contracting out. This could be the case if, for example, municipalities change governmental arrangements and become more likely to contract out health care services. In this case, the contracting out variable is potentially endogenous and the DD strategy cannot resolve this problem. A recent qualitative study shows that municipalities with more experience in innovative health care delivery solutions tend to perform better when contracting out services (Matzuda *et al.* 2008). Although nothing indicates that it is *changes* in experience of innovation that correlates with a tendency to contract out services we cannot rule out that this could affect the parameter estimates in our estimated models. To control for dimensions of local policy, we include a list of dummies for the mayor's political party in our empirical models.

To investigate the impact of contracting out on health (mortality) and health care use we use the 645 municipalities in São Paulo as units and a DD methodology (see Angrist and Pischke 2009;

Table 1. Means of outcome and control variables for the treatment and control groups

	Treatment group		Control group	
	# of obs	Mean	# of obs	Mean
Dependent				
Infant mortality rate[a]	94	16.28	425	19.84
Child mortality rate[a]	96	18.69	442	22.29
Number of primary health care appointments[a]	101	3.19	543	3.51
Child hospitalization rate, respiratory[a]	100	8.09	526	9.10
Hospitalization rate for preventable diseases[a]	101	23.75	544	25.46
Independent				
% of population black or mixed race[a]	101	25.41	544	26.35
% of population <15 years[a]	101	26.44	544	25.77
% of population >60 years[a]	101	10.18	544	11.14
Urbanization degree[a]	101	83.01	544	81.07
% of population SUS users[a]	101	79.14	544	83.07
Municipality <10,000 inhabitants[a]	101	0.27	544	0.49
Number of family health teams per SUS user	101	0.012	544	0.017
Primary health care expenditure (mil reais)[a]	69	14.16	392	7.08
Missing information on primary health care expenditure	101	0.32	544	0.28
Per capita income 2000[a]	101	593.70	544	538.95
Per capita income 2010[a]	101	738.69	544	709.33
IFGF	101	0.5631	543	0.5533
Political party of the mayor				
Workers Party (PT)	101	0.10	544	0.05
Social Democrat Party (PSDB)				
Brazilian Labor Party (PTB)	101	0.10	544	0.11
Progressive Party (PP)	101	0.04	544	0.06
Liberal Front Party (PFL)	101	0.15	544	0.14
Democratic Labor Party (PDT)	101	0.03	544	0.03
Liberal Party (PL)	101	0.06	544	0.05
Green Party (PV)	101	0.01	544	0.01
Popular Socialist Party (PPS)	101	0.06	544	0.05
Socialist Party (PSB)	101	0.01	544	0.02
Other party	101	0.17	544	0.21

Note: All variables are measured in 2004 except for income per capita which is measured in 2000.

[a]Two-sided *t* test rejects the hypothesis that the two means are equal at the 5% level. IFGF (an indicator for municipal managerial capacity, data available from 2006 on.), ten dummies for political party of the mayor.

Imbens and Wooldridge 2009). We define a treatment dummy variable (Z), which is 1 in 2012 for the municipalities that contract out in 2011 and 0 otherwise, and estimate on a panel data from 2004 and 2012 the following model:

$$Y_{st} = \alpha + \beta d_t + \gamma T_s + \tau Z_{st} + \delta X_{st} + \varepsilon_{st} \qquad (1)$$

In Equation (1), Y_{st} is the outcome (e.g. child mortality rate or number of primary health care appointments) for municipality *s* at time *t*. β is the coefficient of a time dummy, d_t, γ is the coefficient on treated municipalities and τ, the coefficient of Z_{st}, is the parameter of interest, where $Z_{st} = T*d$ (i.e. the interaction between year and treatment). X_{st} is a vector of additional control variables.

The DD approach in Equation (1) controls for initial differences in outcome variables between treatment and control municipalities. However, when applying this approach, the common trends assumption must be fulfilled. This means that the trend in the outcome variable should be the same in the treated and non-treated municipalities if contracting out were not implemented in the state of São Paulo.

We investigate the common trends assumption using data from 2001 to 2012 in Figs 1–5.[7] Although there are substantial year-to-year variations in some of the variables before 2005, it appears in Figs 1–5 that these trends are similar for the treated and non-treated municipalities before contracting out were implemented (up until
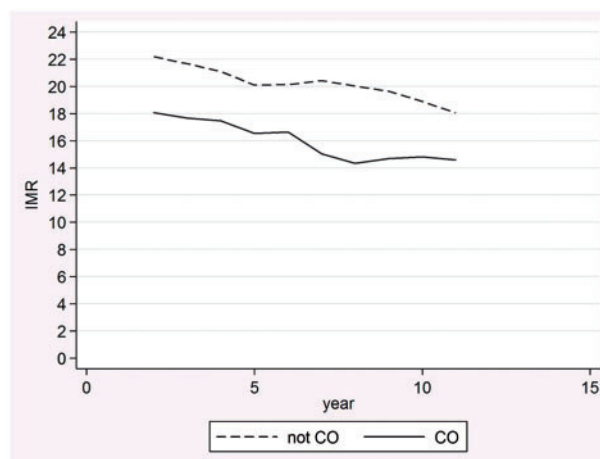
Figure 1. Infant mortality rate (IMR).Years 2002–2011

the year 2005). Consequently the common trend assumption is fulfilled and we can use the DD approach to investigate the impact of contracting out.

When estimating the impact of contracting out we subject the point estimates from the DD we subject the point estimates from the
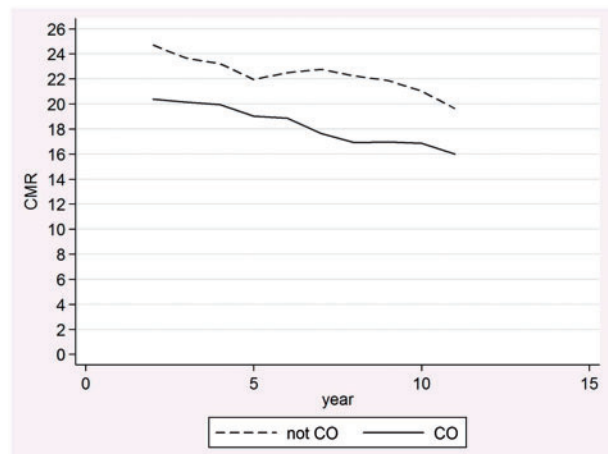
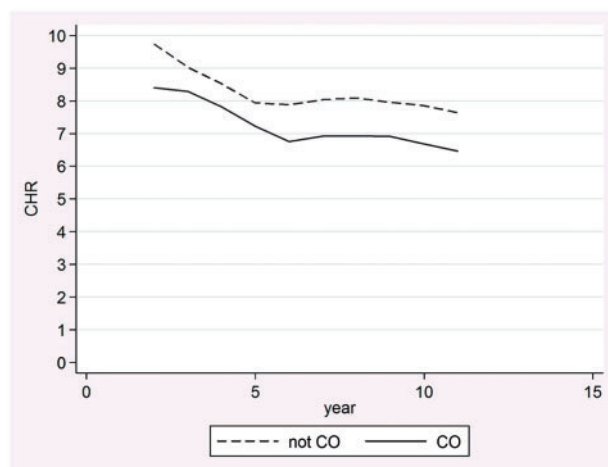**Figure 2.** Child mortality rate (CMR). Years 2002–2011

Figure 4. Hospitalization for preventable diseases (HPD) per SUS user (*100 000). Years 2001–2012

Figure 3. Hospitalization rate of children (CHR) for respiratory diseases. Years 2002–2011
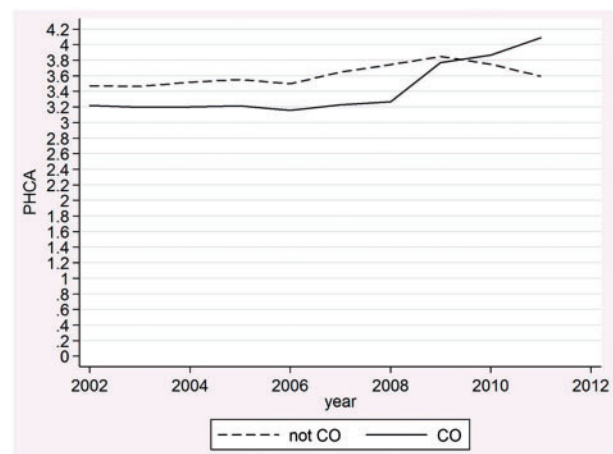
Figure 5. Primary health care appointments (PHCA) per SUS user. Years 2002–2011

models to a series of robustness checks: 1) models that control for unobserved and time-invariant fixed effects within the municipality, applying municipality fixed-effects, 2) models that control for initial conditions in the fixed effects model, 3) models that test the definition of contracting out using other indicators for implementation of the contracting out strategy based on different thresholds for the number of employees as well as a continuous measure, 4) models that test leaving out São Paulo municipality, home of the state capital, 5) models that test excluding municipalities with <5,000 inhabitants.

Results

The association between municipal characteristics and implementation of the contracting out strategy

To examine the importance of selection and the issue of dynamic endogeneity, we estimate the determinants of the implementation of the contracting out strategy using a simple probit model. The outcome in Table 2 is a dummy variable indicating whether the municipality implemented the contracting out strategy or not in the primary health care sector (i.e. the municipality has >10% of employees on external contracts in the primary health care sector in
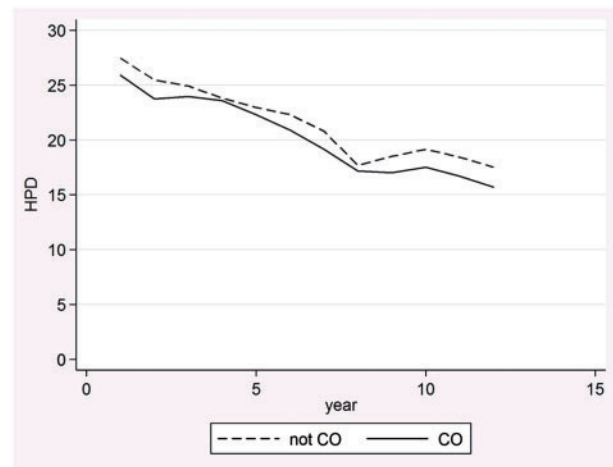
2011). In this model, we include lagged variables—i.e. data from 2010—and variables measuring changes from 2007 to 2010.

The results in Table 2, Model 2, indicate that municipalities with <10 000 inhabitants, with a high percentage of SUS users, and with a high percentage of black and mixed race people (the latter is not significant at 10%) are less likely to implement the contracting out strategy. None of the other coefficients are close to being significant.

In Model 1, we added health and health care use variables with missing observations, which reduces the sample by approximately 20%. In Model 1, compared to Model 2, the parameter estimate on the variable 'municipalities with <10 000 inhabitants' change only little while the standard errors increase, leaving these variables less significant. The signs of the parameter estimates on the percentage of black and mixed race, municipalities with <10 000 inhabitants, and a high percentage of SUS users all remain negative. The fact that municipalities with a higher percentage of black and mixed races and a higher percentage of SUS users are less likely to implement the contracting out strategy indicates that there is a non-random selection into the treatment group, with more wealthy municipalities in this group. These results may be signalling both that NGOs are concentrated in more populated areas, as well as that smaller municipalities have less financial and managerial capacity to contract NGOs.

Table 2. The probability of contracting out, year 2011. Parameter estimates. Standard errors in parentheses

	(1)		(2)	
Infant mortality rate, 2010	−0.029	(0.036)		
Child mortality rate, 2010	0.008	(0.033)		
Female mortality rate 15–59 years 2010	0.076	(0.142)		
Female mortality rate ≥60 years 2010	0.000	(0.013)		
Primary health care appoint./SUS pop, 2010	−0.017	(0.046)	−0.027	(0.042)
Hospitalization rate of preventable diseases, 2010	−0.006	(0.007)	−0.003	(0.006)
Infant mortality rate, Δ(2010–2007)	0.021	(0.026)		
Child mortality rate, Δ(2010–2007)	−0.007	(0.025)		
Female mortality rate 15–59 years, Δ(2010–2007)	0.018	(0.097)		
Female mortality rate ≥60 years, Δ(2010–2007)	0.000	(0.010)		
Primary health care appoint./SUS pop, Δ(2010–2007)	0.035	(0.047)	0.047	(0.043)
Hospitalization rate of preventable diseases, Δ(2010–2007)	−0.005	(0.009)	−0.002	(0.008)
Log of income, 2010	−0.616	(0.518)	−0.467	(0.477)
% of black and mixed race, 2010	−0.012	(0.010)	−0.013	(0.009)
% of pop <15 years, 2010	0.012	(0.048)	0.018	(0.040)
% of pop >60 years, 2010	−0.031	(0.045)	−0.039	(0.038)
Urbanization degree, 2010	−0.006	(0.007)	−0.002	(0.006)
% of population covered by SUS	−0.013 *	(0.007)	−0.011 *	(0.006)
Municipality <10,000 inhab. 2010	−0.263	(0.219)	−0.371 **	(0.182)
Number of family health teams 2010	−0.709	(4.861)	−0.264	(4.034)
Log of PHC exp. in mill reais, 2010	0.053	(0.083)	0.075	(0.080)
Missing inf. on PHC expenditures	−1.569	(1.777)	−1.925	(1.727)
Distance to SP	−0.067	(0.167)	0.022	(0.153)
Distance to SP squared	0.015	(0.024)	−0.003	(0.021)
Political party of the mayor, 2010				
Workers Party (PT)	−0.159	(0.244)	−0.106	(0.228)
Brazilian Labor Party (PTB)	−0.016	(0.260)	0.127	(0.233)
Progressive Party (PP)	0.011	(0.387)	0.006	(0.369)
Democratic Labor Party (PDT)	−0.331	(0.362)	−0.101	(0.323)
Green Party (PV)	−0.095	(0.352)	−0.059	(0.341)
Popular Socialist Party (PPS)	0.011	(0.350)	0.039	(0.306)
Socialist Party (PSB)	−0.260	(0.367)	−0.203	(0.352)
Other party	0.029	(0.175)	0.056	(0.163)
Constant	5.640	(4.270)	3.791	(3.779)
Observations	521		642	

Notes: Probit estimates with >10% of employees on external contracts as outcome. Infant and child mortality rate is measured per 1,000 live births and hospitalization rates of children are only for children below 1 year and are measured per 100 living children below 1 year. In column (1) we include more variables on health care, which reduces sample size compared to column (2). Municipalities with missing observation on primary health care expenditures get the value 0. Reference category for political party is the Social Democrat Party (psdb). Indicators for significance level: *$P<0.10$, **$P<0.05$. IFGF (an indicator for municipal managerial capacity, data available from 2006 on.), ten dummies for political party of the mayor.

As long as these characteristics are fixed over time they do not affect the estimated results when we apply the DD approach. Nevertheless, if implementation works better in wealthier municipalities, this suggests that we might overestimate the impact of the contracting out strategy.

Important for the issue of dynamic endogeneity, and the validation of our DD approach, we find that in both Models 1 and 2 neither previous health status nor previous health care use, nor changes in these health and health care use variables, are significantly different from zero.[8,9] Furthermore, income per capita, number of family health teams and mayor's political party are not significantly correlated with the probability of contracting out in any of the estimated models.

The impact of adopting the contracting out strategy

Table 3 presents the results of estimating the DD model (equation 1) using pre- and post-treatment observations and including additional covariates.

In Table 3, infant and child mortality and hospitalization of child outcomes are in logs. Thus, we can interpret them as changes in the percentage of these rates. The point estimates on the treatment variable Z for the mortality and hospitalization rates are all negative but not significantly different from zero. The point estimate on the number of PHC appointments indicate that implementation of the contracting out strategy significantly increases the number of PHC appointments per SUS user by 0.934 appointments per SUS user.[10] The results in Table 3 also include additional control variables. We conducted several robustness tests presented at http://goo.gl/281Kv4 (Supplementary Material, Annex 2, Tables A1, A2 and A3).[11] The full set of results is available from the author upon request.

Discussion and conclusion

During the 2000s, several municipalities in the São Paulo state began to reorganize their health care provisions to improve the delivery of their services. Central to this reorganization has been the introduction of contracts between public authorities and NGOs, as well as

Table 3. DID estimates including control variables. Infant mortality rate (IMR), Child mortality rate (CMR), Primary health care appointments per SUS user (PHC appoint.), Hospitalization rate of preventable diseases (hosp. prev.), and Hospitalization rate of children with respiratory diseases (hosp. rate resp.). All outcome variables in 2012

	(1) log of IMR		(2) log of CMR		(3) PHC appointments		(4) log of hosp. prev. dis.		(5) log of hosp. rate, resp.	
nyyear	−0.205	***	−0.304	***	0.404		−0.449	***	−0.202	***
	(0.050)		(0.051)		(0.270)		(0.050)		(0.056)	
CO	0.059		0.071		−0.029		0.026		−0.049	
	(0.053)		(0.053)		(0.314)		(0.058)		(0.064)	
CO*year	−0.082		−0.093		0.935	**	−0.111		−0.021	
	(0.078)		(0.079)		(0.446)		(0.082)		(0.091)	
lrenda	−0.292	***	−0.237	***	−0.228		−0.625	***	−0.205	**
	(0.091)		(0.092)		(0.490)		(0.091)		(0.102)	
% black/mixed race	0.002		0.001		−0.020	**	0.000		−0.002	
	(0.002)		(0.002)		(0.010)		(0.002)		(0.002)	
% of pop< 15 years	−0.020	**	−0.018	*	0.080	*	−0.061	***	−0.021	**
	(0.010)		(0.010)		(0.047)		(0.009)		(0.010)	
% of pop ≥60 years	0.006		0.005		0.101	**	0.047	***	0.006	
	(0.010)		(0.010)		(0.048)		(0.009)		(0.010)	
Urban degree	−0.002		−0.002		0.001		0.009	***	0.007	***
	(0.001)		(0.001)		(0.007)		(0.001)		(0.001)	
% of pop covered by SUS	0.001		−0.000		−0.068	***	−0.005	***	0.008	***
	(0.001)		(0.001)		(0.008)		(0.001)		(0.002)	
small municipality	0.366	***	0.315	***	1.539	***	−0.345	***	−0.158	***
	(0.041)		(0.041)		(0.219)		(0.040)		(0.045)	
ESF_popsus	1.999	*	2.202	**	8.539	*	−0.232		2.082	*
	(1.027)		(1.006)		(4.898)		(0.907)		(1.094)	
log of PHC expenditure	0.011		0.015		−0.209	**	−0.053	***	0.005	
	(0.016)		(0.017)		(0.094)		(0.017)		(0.019)	
missing on PHC exp.	−0.233		−0.338		4.652	**	1.104	***	−0.062	
	(0.354)		(0.360)		(2.061)		(0.382)		(0.421)	
ifgf_	0.334	***	0.369	***	−0.535		−0.348	***	−0.100	
	(0.120)		(0.121)		(0.660)		(0.122)		(0.138)	
Workers Party (PT)	−0.001		0.005		0.185		−0.048		0.070	
	(0.059)		(0.060)		(0.332)		(0.062)		(0.068)	
Brazilian Labor Party (PTB)	0.022		0.041		0.056		0.032		−0.019	
	(0.054)		(0.054)		(0.293)		(0.054)		(0.061)	
Progressist Party (PP)	0.035		0.082		−0.441		0.086		−0.008	
	(0.075)		(0.076)		(0.404)		(0.075)		(0.084)	
Liberal Front Party (PFL)	0.003		0.025		0.504		0.018		0.129	*
	(0.066)		(0.065)		(0.351)		(0.065)		(0.074)	
Democratic Labor Party (PDT)	0.088		0.079		−0.263		−0.166	**	−0.015	
	(0.079)		(0.081)		(0.442)		(0.082)		(0.090)	
Liberal Party (PL)	−0.017		−0.000		0.283		0.058		0.052	
	(0.094)		(0.096)		(0.535)		(0.099)		(0.110)	
Green Party (PV)	−0.052		−0.057		−0.143		−0.190	*	−0.011	
	(0.100)		(0.102)		(0.575)		(0.107)		(0.117)	
Popular Socialist Party (PPS)	−0.047		−0.056		0.441		−0.006		0.049	
	(0.072)		(0.073)		(0.400)		(0.074)		(0.081)	
Socialist Party (PSB)	0.067		0.091		−0.222		−0.010		−0.121	
	(0.086)		(0.088)		(0.495)		(0.092)		(0.102)	
other	−0.032		−0.052		0.747	***	−0.000		−0.011	
	(0.041)		(0.041)		(0.219)		(0.041)		(0.046)	
_cons	4.770	***	4.607	***	7.213	*	8.050	***	2.722	***
	(0.777)		(0.781)		(3.966)		(0.735)		(0.836)	
Observations	974		995		1261		1266		1205	

Note: Infant and child mortality rate is measured per 1,000 live births and hospitalization rates of children are only for children below 1 year and are measured per 100 living children below 1 year. Antes year is 2004. Post year is 2012. Standard errors in parentheses. Indicators for significance level: *$P<0.10$, **$P<0.05$, ***$P<0.01$. The following variables are included in all models but not shown in the Table: log of income per capita, % black/mixed race, % of population <15 years, % of population >60 years, urbanization degree, % of population covered by SUS, dummy for small municipalities, number of family health teams, log of PHC expenditures, dummy for missing information on PHC expenditures, ten dummies for political party of the mayor, IFGF (an indicator for municipal managerial capacity, data available from 2006 on.), ten dummies for political party of the mayor.

other not-for-profit entities, for specific tasks in the primary health care sector. The core arguments for this contracting out strategy are that it increases flexibility in administration, that it secures focus on the achievement of measurable results from public authorities, and that it drives competitiveness and performance among health care providers. This paper examines how introducing these contracts in the primary health care sector impacts on several mortality and health care outcomes.

Our results show that introducing a contracting out strategy has a large and significant impact on the number of primary health care appointments. When we control for municipality fixed effects, point estimates show that the number of primary health care appointments per SUS user increases by approximately 1 appointment per SUS user per year.[12] Thus, the implementation of a contracting out strategy seems to increase the delivery of health care services significantly. However, the point estimate we find might be an overestimate of the effect of introducing contracting out, because it represents an average effect on the treated municipalities, a group that selected themselves to contract out. Thus, implementing contracting out across the entire state of São Paulo may not benefit all municipalities equally, and might have no effect on the health care services of those municipalities that do not need to change their organization, or do not have the capability to take advantage of the increased flexibility that contracting out offers.

Although we find that contracting out has a positive effect on PHC appointments, it is uncertain whether this effect constitutes an effective use of the health care system. If it constitutes an effective use of the health care use we should be able to see a significant improvement in the health status of the population related to primary care. Parameter estimates indicate that contracting out reduced child mortality and hospitalization but we cannot reject that these parameter estimates are zero. The impact on hospitalization for preventable diseases also indicates a reduction with contracting out that was statistically significant at the 10% level. The results on child health and health care services are in line with previous literature, which in general finds that contracting with non-state providers to deliver primary health care brings rapid changes in the supply of health care services and, in some cases, reduces child malnutrition.

Anecdotal evidence obtained while discussing our results with public officials responsible for managing basic health care services in São Paulo state municipalities points out two mechanisms which support the positive effect of contracting out on PHC appointments per SUS user. First, adoption of indirect contracts is related to greater flexibility in contracting personnel, making it easier to replace medical staff when contracts are not working or when there is a high turnover. Second, health care providers linked to indirect contracts have more incentive to accurately report on their deliveries, as their contracts are dependent on achieving pre-defined goals (Coelho et al. 2014). Thus, part of the increase in the number of PHC appointments might reflect going from a less to a more accurate reporting system and not an actual increase in the number of PHC appointments.

Although not conclusive, these results suggest that the introduction of contracting out has positive effects on health and health care supply. Still, the effect on mortality and hospitalization are not significantly different from zero in the main analyses, and it remains uncertain if the statistical significance of the results would increase if we had more observations. Furthermore, in the present analysis, the impact of contracting out has only external validity. Thus, introducing the contracting out strategy in more municipalities in the state of São Paulo might not have the same effect, whereas introducing the strategy in other states of Brazil might well have a positive impact on health and health care supply.

Ethical Approval

All data used in this study are in anonymized form and no ethical violations have taken place in the preparation or conduction of this work.

Conflict of interest statement. This manuscript contains original unpublished work and is not being submitted for publication elsewhere at the same time. No financial or personal relationships exist between the authors and other parties that might bias this work.

Supplementary data

Supplementary data are available at *HEAPOL* online.

Notes

1. We used three sources to investigate how to measure contracting out: the number of health professionals on external performance contracts in the primary health care sector (CNES), the investigation of four municipalities from a qualitative study (Coelho and Greve 2016) and municipal spending on activities related to primary health care conducted by non-profit private institutions or corporations. Data on municipal spending are available from "Tribunal de Contas do Estado" (TCE). As data on municipal spending are missing for a significant number of municipalities in 2011, and thus only valid in year 2012, we use the number of employees on external contracts as the main treatment variable in this paper. For 2012 there is a significant correlation between number of employees on external contracts and municipal spending on activities related to primary health care conducted by non-profit private institutions or corporations. Furthermore, data on the selected municipalities from the qualitative study were in accordance with the observation of the number of employees measured by CNES.

2. To check the quality of the data and the validity of using the % of health professionals on external contracts as a measure of implementation of external contracts with NGOs we conduced case studies in six municipalities of the State of São Paulo. In the case studies we checked if our categorization of a given municipality as a "treated" or "not treated" municipality proceeded. That is to say, we checked if municipalities were hiring NGOs by agreements or performance contracts, as well as if the % of professional on external contracts reported in the dataset was accurate.

3. Information on the number of SUS users is estimated using data on the number of people with private health insurance. Information on private health insurance is available from the Agência Nacional de Saúde Suplementar.

4. In all estimated models we test the variables of hospitalization rate for preventable diseases, and number of PHC appointments, without dividing these variables by the SUS population. As these results are in line with the results of dividing the variables by the SUS population we do not include these results in this paper.

5. In 2011, 158 of the 645 municipalities in São Paulo state had less than 5,000 inhabitants.

6. More about the index can be found at: http://www.firjan.com.br/ifgf/downloads/

7. The development in infant and child mortality, hospitalization for respiratory diseases, and the number of primary health care appointments per SUS user from 2002 to 2011 are presented using weighted averages. When we use actual values for each year, and not weighted averages, the same tendencies appear, although we see more year-to-year variation in both groups. Notice that the averages in all figures might differ from official averages (see, e.g., http://portal.saude.sp.gov.br/resources/ses/perfil/gestor/homepage/gais-informa/gais_47__dezembro_2015.pdf) mainly because our data set includes information on all municipalities with available information, including very small municipalities.

8. Male mortality has been left of out the regression due to a high correlation with female mortality.

9. We have tested the probability of contracting out using as outcome the number of employees on external contracts in 2012 (instead of in year 2011) and municipal spending on activities related to primary health care conducted by non-profit private institutions or corporations in 2012. The results in these regressions confirm the tendency that municipalities with a high percentage of black and mixed races and high percentage of SUS users are less likely to contract out. Furthermore, variables that measure changes in health and health care use over time are not significantly related to the probability of contracting out when we use these alternative outcomes.

10. According to the Ministry of Health, the number of primary health care appointments should vary from 2 to 3 per inhabitant per year. The total number of appointments is usually divided into the following categories: Basic emergency visits: 12% of total visits; Basic visits: 63% of total visits; Emergency visits Pre/hosp./trauma: 3% of total visits; Specialized Medical Visits: 22% of total visits (Ministry of Health 2001).

11. First, we test the empirical model, i.e. we control for municipality fixed effects and initial conditions. Second, we test the threshold for the number of employees. Third, we included a continuous variable measuring the share of employees on external contracts. Fourth, we excluded the municipalities from the control group that might be

contracting out. Fifth, we left out municipalities with less than 5,000 inhabitants from the analyses. Sixth, we excluded São Paulo municipality and finally we tested all models choosing pre-observations from 2002 instead of from 2004. The results from all these robustness test are virtually the same as the results shown in Table 3.

12. This parameter estimate increases to 1.3 appointments when we control for initial conditions in different municipalities. This result is shown in Annex 2, Table 1, http://goo.gl/281Kv4.

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