Morbidity Risk and Health-Insurance Coverage

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Abstract

We access Brazilian data and test whether agents covered by health-insurance plans are more likely to report suffering from 12 different health conditions—namely, arthritis or rheumatism, bronchitis or asthma, cancer, chronic renal disease, cirrhosis, depression, diabetes, heart disease, hypertension, lumbar pain, tendinitis, and tuberculosis. Our econometric strategy relies on the country's regulatory system which restricts risk-based premium to depend exclusively on seven pre-determined age categories. We estimate the risk-coverage relationship for each of the 12 diseases and 7 age categories. We do not find significant effects for the vast majority groups.

Keywords: Health problems, PNAD, risk, coverage. JEL Classification: C52, D82, G22, I11.

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1 Introduction

There is evidence from different countries suggesting that agents covered by health-insurance policies overuse healthcare services and are more likely to present a poor health condition.[1] We access data from Brazil to test whether individuals covered by health-insurance plans are more likely to report suffering from a list of twelve different health problems, namely: arthritis or rheumatism, bronchitis or asthma, cancer, chronic renal disease, cirrhosis, depression, diabetes, heart disease, hypertension, lumbar pain, tendinitis, and tuberculosis. Our analysis is possible thanks to a complementary health schedule included in the 2003 PNAD survey, conducted by the Brazilian Institute of Geography and Statistics (IBGE). This complementary schedule contains self-reported information on individual health-insurance coverage and incidence of these medical conditions. We do not find a positive correlation between self-reported morbidity and insurance coverage.[2]

The Brazilian institutional context is relatively standard. Residents are eligible to a free public health service which, in principle, offers comprehensive coverage. Like in many other countries, the public system presents structural problems that reduce its effective coverage. Around 24.5% of the Brazilian population held private health coverage in 2003, and this rate grows up to about 50% for elderly living in large metropolitan regions. Health-insurance carriers are mostly private, and they are not allowed to refuse agents based on perceived risk.

A regulatory reform approved in 1998 restricted risk-based premium to depend exclusively on seven pre-determined age categories. Carriers became legally responsible for most treatment expenditures of any health problem recognized by World

[1] To mention a few works within this extensive literature, see Bertranou [1998] for evidence from Argentina; Cameron et al. [1988] for Australia; Sapelli and Vial [2003] for Chile; Chiappori et al. [1998] for France; Holly et al. [1998] and Gardiol et al. [2006] for Switzerland; and Manning et al. [1987], Dowd et al. [1991], Browne [1992], Browne and Doerpinghaus [1993], Ettner [1997], and Cardon and Hendel [2001] among many others for data from the USA.

[2] This result is in line with Resende and Zeidan [2010], who analyze the same data source used here and do not find strong positive correlation between insurance coverage and individual hospitalization.

Health Organization. They can offer only five different types of plans, which differed in their coverage to outpatient treatments, hospitalization, obstetrics procedures, and dental treatments.[3] Insurance companies can also discriminate the quality of the health treatment as insured patients must contract health treatments from a pre-specified list hospitals and doctors.

There is no information in the database about the type of coverage of the insurance policies. However, the data allows us to divide health-insurance contracts in two groups: (i) the individual policies, which are paid by the agent or some relative directly to the carrier; and (ii) the employer-contracted policies, which are contracted through an employer. In principle, adverse selection should act more intensively in individual policies than in employer-contracted plans, since the choice of the latter type of policy depends on many other factors besides *ex ante* individual risk. On the other hand, morbidity risk caused by moral hazard should affect both types of policies equally, given that they present the same coverage level and, then, the same incentive structure.

Since the quality of private and public hospitals varies considerably across the country, we focus on the two major markets: the metropolitan areas of *Sao Paulo* and *Rio de Janeiro*. We regress morbidity status against a constant term and dummies for individual and employer-contracted policies, for each of the twelve health problems, each of the seven age categories, and each of the two metropolitan regions (a total of 168 regressions). This econometric strategy controls for heterogeneity between the *Sao Paulo* and *Rio* areas as well as for the seven age groups which carriers are officially allowed to discriminate upon. Our results show that the correlations between morbidity risk and each of the two types of health-insurance coverages are not statistically positive for the vast majority of those regressions.

One must be careful when interpreting our results. First, one must be suspicious whether individuals actually report their health status properly (as we rely on self-

[3]Contracts signed before January 1999 were not affected by this reform, but all carriers should offer a policy adapted to the new rules if requested by the consumer—see ANS [2005].

reported data). A major misreporting problem is related to the fact that insured individuals could be more aware of their health problems if they visited doctors more frequently (diagnosis bias). This, however, should bias the results towards a positive risk-coverage correlation (and therefore against our main findings). A second and more important problem derives from the fact that companies can attempt to select less risky consumers by offering services that are more valuable to them (cream-skim). It is not possible to econometrically control for this practice as it is typically based on unobserved variables, such as service quality. In principle, cream-skim should bias the results towards a negative risk-coverage correlation. Therefore, one cannot rule out this practice as being behind our findings. Finally, there is a serious concern in this sector about an extreme form of adverse selection in which individuals only join a plan after learning about pre-existing medical conditions. Our zero-correlation results suggest that either this problem is not pervasive in the Brazilian economy or its effects are compensated by cream-skim practices.

The remainder of the paper is organized as follows. Section 2 describes the data; Section 3 presents the empirical analysis, and Section 4 serves as a brief conclusion.

2 Data

We use data from the 2003 Brazilian National Household Survey (*Pesquisa Nacional por Amostra de Domicílios*—PNAD), conducted by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*—IBGE). The PNAD is a complex survey whose sample design is intended to represent the entire Brazilian population (i.e., about 175.4 million people in 2003). It is conducted every year and contains questions about general characteristics of the household and the socioeconomic condition of each of its members. The 2003 survey includes a supplementary schedule on individual health which contains questions on whether the individuals suffer from each of the following medical conditions: lumbar pain (PNAD variable named v1309); arthritis or rheumatism (v1310); cancer (v1311);

diabetes (v1312); bronchitis or asthma (v1313); hypertension (v1314); heart disease (v1315); chronic renal disease (v1316); depression (v1317); tuberculosis (v1318); tendinitis (v1319); cirrhosis (v1320). This supplementary health schedule also reports whether each individual was covered by a health-insurance plan that was purchased directly from an insurance carrier (individual policy) or through an employer (employer-contracted plan).[4] We also use information about individual age (v8005) and geographical regions of the country (uf and v4727).

In most areas of the statistical science, the inference analysis is constructed under the assumption that observations are independently withdrawn from an identical unknown distribution. In complex surveys like PNAD, the sampling procedure introduces randomness into the data according to previously designed probabilities. The 2003 PNAD survey contains approximately 383,467 interviews sampled from different primary sampling units (v4618), which were previously selected from different strata (v4617). Inverse probability weights (v4729) were computed by the IBGE, considering the population pattern projected from the 1991 and 2000 demographic censuses, under usual assumptions about the paths for fertility, mortality, and migration rates. For details on the sampling procedure, see IBGE [2003].

Our econometric exercises focus on two subpopulations surveyed, namely, the individuals living in the two largest metropolitan areas of the country. Since subpopulations in complex surveys present random sample size, one must keep the entire sample in the analysis and assign zero weight to observations out of the subpopulation. The survey package from the Stata software was used to incorporate the sampling design and to compute results for subpopulations.

Table 1 present the fraction of insured agents in each age group in the two metropolitan areas studied. It is interesting to note that the fraction of the population holding health-insurance plans is very high and increases with age. For instance, for children and teenagers, it amounts to about 36% in Sao Paulo and 28% in Rio;

[4]These dummy variables were constructed from the PNAD variables v1321 and v1332.

and for individuals over 50 years old, these rates rise to about 50% and 40%, respectively. Moreover, employer-contracted plans are more common than individual policies, especially for young individuals.

[Table 1]

3 Empirical Analysis

We test for the existence of a positive correlation between risk and insurance coverage. Our risk metric is the incidence of twelve different types of health problems. For each type of health problem, let y_i be a dummy variable that equals 1 if individual i suffers from that specific condition. Moreover, let x_i be a vector with a constant term and two dummy variables describing whether the agent holds an individual policy or a employer-contracted plan. For each of the two major metropolitan areas of the country (namely, *Sao Paulo* and *Rio de Janeiro*) and each of the seven age categories defined by the sector legislation, we estimate survey regressions of y_i against x_i. In each regression, the constant term defines the fraction of the uninsured agents suffering from that specific health problem; while the sum of each dummy coefficient and the constant term describes that same rate for agents holding, respectively, individual and employer-contracted plans. These coefficients identify the conditional correlations but not causal relations. In other words, we do not suggest that the variables in the right-hand side cause y_i. In fact, the opposite is expected to happen in the presence of adverse selection, where exogenous morbidity risk determines the contract choice.

Pure moral hazard implies that both dummy coefficients should be equal (since both contracts present the same coverage level) and positive (since their effective coverage level is higher than that of the free-public system).[5] On the other hand,

[5]Since our risk metric relies on self-reported morbidity condition, pure moral hazard effects could not be disentangled from diagnosis bias. In other words, identical positive coefficients associated with the dummies for individual and employer-contracted plans could also occur if insured agents, who tend to visit doctors more frequently, were also better informed about their health problems.

differences in morbidity risk caused by adverse selection in *ex ante* individual risk should be stronger in individual contracts (since many other factors besides individual risk affect the selection of employer-contracted plans). Therefore, under standard adverse selection, the coefficient of the individual-insurance dummy should be positive and larger than the coefficient of the employer-contracted-plan dummy.[6]

The regression results for the metropolitan areas of *Sao Paulo* and *Rio de Janeiro* are presented, respectively, in tables 2 and 3. Each of these tables presents the estimated coefficients for each of the 12 health problems and each of the 7 age groups (a total of 84 regressions in each table). Except for a few cases appropriately marked in the tables, the correlation between risk and coverage is not statistically positive.

[Tables 2-3]

4 Conclusion

We use two subpopulations of the 2003 PNAD survey to test whether the decision of holding a health-insurance policy is correlated to self-reported incidence of twelve different types of health problems. Our econometric procedure is based on a linear probability model that incorporates the survey design to compute the standard errors. We do not control for individual characteristics in our regressions since contracts signed after the 1998 regulatory reform cannot price discriminate individuals (except for the 7 age groups used in the econometric exercise). Our results do not support the existence of a positive correlation between risk and insurance coverage.

[6] Different from the the pure moral hazard case, this prediction is robust to potential diagnosis bias, given that agents covered by individual and employer-contracted plans face the same incetives to visit doctors.

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Table 1. Fraction of Insured Agents per Age Group

	Age Category						
	0-17	**18-29**	**30-39**	**40-49**	**50-59**	**60-69**	**≥ 70**
***São Paulo* Metropolitan Area**							
Individual Coverage	3.12%*	5.19%*	8.86%*	10.62%*	16.26%*	22.28%*	27.11%*
Employer-Contracted Plan	33.56%*	33.34%*	37.84%*	32.40%*	31.10%*	26.11%*	24.75%*
Subpopulation Observations	*6,597*	*4,871*	*3,441*	*2,966*	*1,974*	*1,149*	*889*
Expanded Subpop. Size (in million)	*5.7*	*4.2*	*3.0*	*2.6*	*1.7*	*1.0*	*0.8*
***Rio de Janeiro* Metropolitan Area**							
Individual Coverage	2.13%*	3.84%*	6.48%*	7.31%*	9.84%*	11.93%*	14.50%*
Employer-Contracted Plan	26.00%*	26.30%*	25.21%*	26.88%*	24.47%*	22.40%*	24.62%*
Subpopulation Observations	*4,373*	*3,281*	*2,392*	*2,489*	*1,900*	*1,174*	*1,048*
Expanded Subpop. Size (in million)	*3.0*	*2.2*	*1.6*	*1.7*	*1.3*	*0.8*	*0.7*

Note: Estimated subpopulation means from the 2003 PNAD survey (with 383,467 observations representing 1.75e+08 individuals). Survey design incorporated in the significance tests; * indicates significance at the 5% level.

Table 2. Morbidity Incidence and Insurance Coverage in the *São Paulo* Metropolitan Area

	Age Group						
	0-17	**18-29**	**30-39**	**40-49**	**50-59**	**60-69**	**≥ 70**
Arthritis or Rheumatism							
Individual Coverage	0.73%	0.25%	-0.70%	0.77%	-2.47%	-0.45%	7.94%*
Employer-Contracted Plan	-0.06%	-0.26%	-1.06%*	-0.58%	0.90%	1.98%	3.68%
Constant	0.24%*	0.94%*	2.67%*	5.27%*	12.13%*	15.68%*	23.60%*
Bronchitis or Asthma							
Individual Coverage	4.83%*	1.25%	0.83%	0.22%	-0.14%	-3.35%*	-1.98%
Employer-Contracted Plan	0.01%	0.87%	0.58%	0.36%	-0.09%	-0.92%	-0.18%
Constant	7.30%*	4.68%*	3.11%*	3.91%*	4.81%*	7.25%*	6.54%*
Cancer							
Individual Coverage	0.00%	0.26%	0.00%	0.86%	1.43%	2.89%*	0.46%
Employer-Contracted Plan	0.14%	-0.01%	-0.17%	0.31%	-0.24%	1.99%	-0.54%
Constant	0.00%	0.13%*	0.33%*	0.41%*	1.06%*	1.01%*	3.27%*
Chronic Renal Disease							
Individual Coverage	-0.24%*	0.26%	0.49%	1.52%	-0.34%	-0.41%	1.06%
Employer-Contracted Plan	-0.19%*	-0.35%	-0.15%	-0.20%	-1.07%	-2.21%*	-0.32%
Constant	0.24%*	0.53%*	1.15%*	1.66%*	2.21%*	3.54%*	3.50%*
Cirrhosis							
Individual Coverage	0.00%	0.00%	-0.11%	0.26%	0.05%	-0.12%	-0.29%
Employer-Contracted Plan	0.05%	0.12%	-0.03%	-0.06%	-0.25%	-0.51%	-0.70%
Constant	0.00%	0.00%	0.11%	0.06%	0.58%*	0.51%	0.70%
Depression							
Individual Coverage	0.15%	-0.01%	1.37%	1.20%	-1.28%	0.11%	4.58%
Employer-Contracted Plan	-0.06%	-0.19%	-0.44%	-2.07%*	-0.29%	-0.09%	-0.48%
Constant	0.34%*	2.77%*	4.20%*	7.69%*	8.76%*	8.09%*	9.11%*
Diabetes							
Individual Coverage	0.37%	-0.24%	-1.42%*	0.12%	-1.76%	-3.74%	-0.30%
Employer-Contracted Plan	-0.07%	-0.08%	-1.07%*	-1.61%*	-0.28%	-5.18%*	0.25%
Constant	0.12%*	0.63%*	2.07%*	4.32%*	9.24%*	15.85%*	15.65%*
Heart Disease							
Individual Coverage	0.04%	0.61%	-0.27%	1.67%	-0.04%	-7.50%*	1.87%
Employer-Contracted Plan	0.01%	0.02%	-0.39%	-0.93%	-1.92%	-9.05%*	0.53%
Constant	0.93%*	0.97%*	2.24%*	4.67%*	8.76%*	18.05%*	22.20%*
Hypertension							
Individual Coverage	-0.36%*	2.29%	-1.51%	0.11%	-6.94%*	-9.46%*	1.01%
Employer-Contracted Plan	-0.04%	-0.90%	-2.41%*	-3.06%	-4.20%	-7.75%*	-0.74%
Constant	0.36%*	3.24%*	9.71%*	21.48%*	38.40%*	50.08%*	52.10%*
Lumbar Pain							
Individual Coverage	0.36%	6.48%*	5.44%*	7.10%*	-0.74%	-0.45%	7.36%
Employer-Contracted Plan	0.21%	2.47%*	0.23%	2.08%	2.60%	-0.37%	3.43%
Constant	1.10%*	5.78%*	13.90%*	19.88%*	27.53%*	31.70%*	32.48%*
Tendonitis							
Individual Coverage	0.42%	3.78%*	6.18%*	2.11%	3.14%	3.69%	0.02%
Employer-Contracted Plan	0.49%	3.71%*	4.09%*	6.15%*	4.89%*	1.60%	-0.37%
Constant	0.55%*	2.94%*	3.98%*	5.50%*	6.83%*	6.07%*	5.37%*
Tuberculosis							
Individual Coverage	-0.07%	-0.17%*	-0.16%	-0.10%	-0.19%	-0.51%	0.18%
Employer-Contracted Plan	-0.03%	-0.04%	-0.01%	0.00%	0.62%	-0.51%	0.68%
Constant	0.07%	0.17%*	0.16%	0.41%*	0.19%	0.51%	0.23%
Subpopulation Observations	*6,597*	*4,871*	*3,441*	*2,966*	*1,974*	*1,149*	*889*
Expanded Subpop. Size	*5.7e+06*	*4.2e+06*	*3.0e+06*	*2.6e+06*	*1.7e+06*	*1.0e+06*	*0.8e+06*

Note: Survey-adjusted OLS regressions; full sample used in all regressions (383,467 observations representing 1.75e+08 individuals). Dependent variable: each of the 12 types of health problems; independent variables: individual and Employer-Contracted plan dummies and a constant term. Robust (linearized) standard errors, which incorporate the survey design, were used in the significance tests; * indicates significance at the 5% level; statistically positive dummy coefficients are shadowed.

Table 3. Morbidity Incidence and Insurance Coverage in the *Rio de Janeiro* Metropolitan Area

	Age Group						
	0-17	**18-29**	**30-39**	**40-49**	**50-59**	**60-69**	**≥ 70**
Arthritis or Rheumatism							
Individual Coverage	-0.35%*	0.45%	-0.05%	-4.52%*	-1.80%	9.90%*	-2.25%
Employer-Contracted Plan	-0.17%	-0.44%	-0.14%	-2.28%*	0.83%	1.57%	-0.56%
Constant	0.35%*	1.13%*	2.63%*	6.17%*	12.50%*	25.81%*	37.77%*
Bronchitis or Asthma							
Individual Coverage	4.86%	0.82%	1.61%	0.55%	-1.07%	0.46%	-2.42%
Employer-Contracted Plan	1.06%	2.51%*	-0.11%	1.04%	-0.84%	3.35%*	2.20%
Constant	5.89%*	2.36%*	2.26%*	1.65%*	3.21%*	3.11%*	4.39%*
Cancer							
Individual Coverage	-0.03%	-0.17%*	-0.06%	1.10%	0.05%	0.85%	1.38%
Employer-Contracted Plan	-0.03%	0.17%	-0.06%	-0.40%	0.59%	0.60%	2.62%*
Constant	0.03%	0.17%*	0.06%	0.55%*	0.48%*	1.30%*	1.25%*
Chronic Renal Disease							
Individual Coverage	0.98%	-0.52%*	-0.40%	0.06%	-2.11%*	1.63%	-1.66%
Employer-Contracted Plan	0.08%	-0.41%*	-0.38%	-0.24%	-0.92%	-0.04%	0.90%
Constant	0.10%	0.52%*	1.04%*	1.59%*	2.64%*	1.95%*	2.98%*
Cirrhosis							
Individual Coverage	-0.06%	0.00%	-0.06%	-0.24%*	0.37%	-0.52%*	-0.31%
Employer-Contracted Plan	-0.06%	0.00%	0.10%	-0.24%*	0.05%	0.24%	-0.31%
Constant	0.06%	0.00%	0.06%	0.24%*	0.16%	0.52%*	0.31%
Depression							
Individual Coverage	-0.16%	1.56%	-0.47%	3.79%	0.06%	5.08%	2.16%
Employer-Contracted Plan	-0.16%	-0.80%*	-0.20%	-0.52%	-1.51%	4.77%	4.19%
Constant	0.16%	1.61%*	4.35%*	5.01%*	6.89%*	7.78%*	7.05%*
Diabetes							
Individual Coverage	-0.22%*	-0.35%*	-0.21%	1.53%	-0.50%	6.31%	0.49%
Employer-Contracted Plan	-0.22%*	0.00%	-0.36%	-1.63%*	-2.29%	0.24%	-0.72%
Constant	0.22%*	0.35%*	0.86%*	3.42%*	7.45%*	11.54%*	16.61%*
Heart Disease							
Individual Coverage	-0.45%*	0.67%	0.38%	0.00%	1.32%	0.08%	2.34%
Employer-Contracted Plan	-0.01%	-0.34%	-0.38%	-1.91%*	-0.34%	1.43%	2.18%
Constant	0.45%*	0.92%*	2.20%*	5.49%*	9.38%*	14.92%*	20.69%*
Hypertension							
Individual Coverage	-0.29%*	-0.24%	-1.13%	-2.44%	4.93%	5.71%	-6.33%
Employer-Contracted Plan	-0.11%	-0.30%	-2.70%*	0.26%	-4.31%	-7.46%*	3.12%
Constant	0.29%*	2.62%*	10.16%*	19.48%*	36.78%*	49.29%*	55.02%*
Lumbar Pain							
Individual Coverage	0.31%	6.54%*	-4.80%*	-2.93%	1.16%	6.80%	2.70%
Employer-Contracted Plan	0.38%	1.93%	-1.06%	-0.34%	-0.07%	5.01%	1.45%
Constant	0.76%*	5.37%*	13.83%*	22.16%*	30.39%*	36.06%*	38.09%*
Tendonitis							
Individual Coverage	-0.22%*	0.68%	6.06%*	1.04%	6.29%*	8.84%*	-2.42%
Employer-Contracted Plan	0.57%*	0.96%	1.99%*	3.42%*	6.01%*	3.96%*	-0.13%
Constant	0.22%*	1.70%*	2.33%*	2.26%*	2.80%*	4.02%*	4.39%*
Tuberculosis							
Individual Coverage	0.00%	-0.17%*	0.40%	0.12%	-0.08%	-0.32%	-0.47%
Employer-Contracted Plan	0.00%	-0.17%*	-0.24%*	-0.28%	0.35%	-1.04%*	-0.47%
Constant	0.00%	0.17%*	0.24%*	0.43%*	0.08%	1.04%*	0.47%
Subpopulation Observations	*4,373*	*3,281*	*2,392*	*2,489*	*1,900*	*1,174*	*1,048*
Expanded Subpop. Size	*3.0e+06*	*2.2e+06*	*1.6e+06*	*1.7e+06*	*1.3e+06*	*0.8e+06*	*0.7e+06*

Note: Survey-adjusted OLS regressions; full sample used in all regressions (383,467 observations representing 1.75e+08 individuals). Dependent variable: each of the 12 types of health problems; independent variables: individual and Employer-Contracted plan dummies and a constant term. Robust (linearized) standard errors, which incorporate the survey design, were used in the significance tests; * indicates significance at the 5% level; statistically positive dummy coefficients are shadowed.