Original article

Vaccination coverage and use of the Brazilian Health System for vaccination against influenza and pneumonia in adults and elderly with self-reported diabetes, municipality of São Paulo, 2003, 2008 and 2015*

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Camila Nascimento Monteiro[1] – orcid.org/0000-0002-0121-0398
Reinaldo José Gianini[2]
Sheila Rizzato Stopa[3]
Neuber José Segri[4]
Marilisa Berti de Azevedo Barros[5]
Chester Luiz Galvão Cesar[3]
Moisés Goldbaum[2]

[1]Hospital Israelita Albert Einstein, Núcleo de Indicadores e Sistemas de Informação, São Paulo, SP, Brasil
[2]Universidade de São Paulo, Faculdade de Medicina, São Paulo, SP, Brasil
[3]Universidade de São Paulo, Faculdade de Saúde Pública, São Paulo, SP, Brasil
[4]Universidade Federal do Mato Grosso, Departamento de Estatística, Cuiabá, MT, Brasil
[5]Universidade Estadual de Campinas, Faculdade de Ciências Médicas, Campinas, SP, Brasil

Abstract

Objective: to estimate vaccination coverage against influenza and pneumonia and to analyze the use of the Brazilian National Health System (SUS) for vaccination in adults and elderly with self-reported diabetes in São Paulo, Brazil, in 2003, 2008 and 2015. **Methods**: Cross-sectional studies using ISA-Capital data (population-based household health surveys). **Results**: 3,357, 3,271 and 4,043 people were interviewed in 2003, 2008 and 2015 respectively; diabetes *mellitus* prevalence was 5.0% (2003), 6.4% (2008) and 7.7% (2015); less than half of people with diabetes vaccinated against influenza (47.2%) and pneumonia (17.9%) in 2003, with a small increase in 2015 (59.2% and 26.1%, respectively); the majority of people who are vaccinated against influenza and pneumonia used SUS, 88.7% (2003) and 97.2% (2015) for influenza; 84.7% (2003) and 94.5% (2015) for pneumonia, without difference among age, sex, education level and ethnicity. **Conclusion**: despite the low vaccination coverage against influenza and pneumonia in the population with diabetes *mellitus* since 2003 the use of SUS to get vaccinated against them has been progressively expanding.

Keywords: Vaccination; Brazilian National Health System; Cross-sectional studies; Diabetes *Mellitus*.

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Correspondence:
Camila Nascimento Monteiro – Hospital Israelita Albert Einstein, Av. Brigadeiro Faria Lima, 1188, Jardim Paulistano, São Paulo, SP, Brazil. CEP: 01451-001
E-mail: c.nascimentomonteiro@gmail.com

Introduction

Immunization policies have become increasingly complex in their global and national dimensions.[1] The culture of immunization in Brazil, expressed by the adherence of the population to immunization programs and demand for new vaccines offered by the public sector, dates back to the process of introduction of vaccines in the 19th century and the mass vaccination campaigns undertaken by the Brazilian State.[2] In Brazil, which is a reference for many other countries in the area of immunization, vaccination occupies a prominent place among Public Health actions.[3]

Established in 1973, the Brazilian National Immunization Program (*Programa Nacional de Imunizações-PNI*) has reached high vaccination coverage nationwide,[3,4] this being of great importance for controlling preventable diseases using immunobiological products.[5] Following the creation of the Brazilian National Health System (SUS) in 1988,[6] PNI has been strengthened. The national vaccination campaigns, aimed at different age groups – according to the occasion –, have resulted in the growth of social awareness about the culture of immunization.[4,5]

Vaccination against influenza and pneumonia in vulnerable populations is provided for in the immunization schedule.[3,4] Among its target groups is the population with diabetes *mellitus*, a disease with a high global burden and high prevalence, and one of the challenges of Public Health agenda.[6] The 2013 National Health Survey (Pesquisa Nacional de Saúde-PNS) estimated prevalence of self-reported diabetes in Brazil as being 6.2%.[7] There is little data on vaccination coverage in special populations in the country, as is the case of people with diabetics.

> *Vaccination against influenza and pneumonia in vulnerable populations is provided for in the immunization schedule.Among its target groups is the population with diabetes mellitus.*

The objective of this study was to analyze vaccination against influenza and pneumonia and the use of SUS for obtaining this vaccination, according to sociodemographic and socioeconomic variables, among adults with self-reported diabetes in the municipality of São Paulo in the years 2003, 2008 and 2015.

Methods

This is a panel of cross-sectional studies using data from population-based household health surveys (ISA-Capital) in São Paulo City, held in 2003, 2008 and 2015, obtained from household interviews.

The main focus of the ISA-Capital survey is to diagnose the living and health conditions of the population and their use of health care services. ISA-Capital 2003 data collection occurred from February 2003 to January 2004; ISA-Capital 2008 from April 2008 to May 2009, and ISA-Capital 2015 from September 2014 to December 2015.

Individuals with self-reported diabetes and age equal to or greater than 20 years old were selected from among the total number of participants for each one of the surveys, by means of probability sampling by conglomerates in two stages: census tracks and households. The list of census tracks was obtained from the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*).

The calculation of the sample size of the ISA-Capital surveys was similar in the three surveys, with differences in the number of census tracks selected, in sampling errors and design effect. The sample size calculated for each survey was 4,270 individuals in 2003, 4,024 in 2008 and 4,250 in 2015.[8-10]

Survey data collection was performed using a questionnaire with closed-ended questions, administered by interviewers who had been trained beforehand and who were evaluated throughout the survey period. The ISA-Capital survey methodology is described in the literature,[8-10] and available at www.fsp.usp.br/isa-sp/

The demographic and socioeconomic variables selected were:

- sex (male; female);
- age (in age ranges: 20-59; 60 years or more);
- education level (in years of schooling: 0-3; 4-7; 8-11; 12 or more);
- ethnicity/skin color (white, black, brown).

The other variables studied were:

- self-reported diabetes (yes, no, don't know/not answered);
- self-reported vaccination against influenza and pneumonia in the year of the study (yes, no, don't know/not answered);
- type of health service used for vaccination against influenza (SUS, not SUS, don't know/not answered); and

- type of health service used for vaccination against pneumonia (SUS, not SUS, don't know/not answered)

Information about the type of service used for vaccination against influenza and pneumonia was obtained in response to the following question:

Was the service where you were vaccinated public or private?

Prevalence and its intervals were estimated with 95% confidence (95%CI) for self-reported diabetes and coverage of vaccination against influenza and pneumonia, according to the demographic and socioeconomic characteristics selected and the years in which the survey took place. Diabetes prevalence was calculated taking the total number of interviewees in each year as the denominator. Differences were considered significant when there was absence of confidence interval overlap; association was estimated using Pearson's chi-square test, with a significance level of 5%. Vaccination prevalence rates and 95%CI were also estimated according to demographic and socioeconomic variables, in addition to the type of service used (SUS; not SUS). Individuals with lack of data on education level and ethnicity/skin color (missing data) were excluded from the sample. ISA-Capital data were weighted to compensate for the different probabilities of selection. The analysis of these data was conducted using Stata 11.0, applying the command survey, which considers the complex sampling effects.

The study project was approved by the Research Ethics Committee of the University of São Paulo Faculty of Medicine *Hospital de Clínicas*, and by the Ethics Committee of the University of São Paulo School of Public Health: Report No. 357/2013 and Report No. 719.661/2014, approved on 09/17/2013 and 16/07/2014, respectively.

Results

The total number of interviewees was 3,357 in 2003, 3,271 in 2008 and 4,043 in 2015. The response rate in 2003, 2008 and 2015 was 75%, 76% and 74%, respectively.

Prevalence of self-reported diabetes was 5.0% (95%CI; 3.9;6.2) (N=170) in 2003, 6.4% (95%CI; 5.4;7.5) (N=246) in 2008 and 7.7% (95%CI; 6.8;8.7) (N=348) in 2015, as can be observed in Table 1.

Table 1 also presents the prevalence of diabetes *mellitus* according to demographic and socioeconomic characteristics. Prevalence of diabetes increased with age and according to education level, in the three years studied. There was no difference between the female and male sex in 2003 and 2008. In 2015 prevalence was higher in females. There was no difference between diabetes prevalence and ethnicity/white, black or brown skin color in the three years studied.

Less than half of people with diabetes *mellitus* vaccinated against influenza in 2003 (47.2%: 95%CI; 37.6;57.0) and in 2008 (43%: 95%CI; 35.6;50.7]), with a small increase in 2015 (59.2% -[95%CI; 52.2;65.9]) (Table 2). In 2003, the frequency of vaccination against pneumonia was 17.9% (95%CI; 11.1;27.6), and in 2008, 13.2% (95%CI; 9.4;18.3), with a slight increase in 2015, 26.1% (95%CI; 20.1;33.0). The elderly (>60 years) vaccinated more than other adults (20-59 years), both against influenza and against pneumonia, in the three years studied. There was no difference in vaccination according to sex, ethnicity/skin color and education level, in 2003, 2008 and 2015 (Table 2).

The majority of people that were vaccinated did so on the SUS. In the case of influenza, the proportion of people vaccinated on the SUS was 88.7% in 2003, 80.7% in 2008 and 97.2% in 2015; with regard to pneumonia, this proportion was 84.7% in 2003, 76,2% in 2008 and 94.5% in 2015 (Table 3).

There was no statistically significant difference regarding the use of SUS for vaccination according to education level, ethnicity/skin color and sex (data not shown).

Discussion

Less than half of people with diabetes *mellitus* were vaccinated against influenza and pneumonia in 2003 and 2008, with a slight increase in 2015. The majority of those vaccinated against influenza and pneumonia used SUS in all years studied, with no difference regarding age, sex, education level and ethnicity/skin color. Diabetes prevalence grew as aged increased and as education level decreased.

This study has some limitations such as the small sample size of self-reported diabetes, which may have influenced the statistical analyses, particularly in the case of vaccination against pneumonia. Identification of diabetes *mellitus* and vaccination against influenza and pneumonia in all three surveys was self-reported.

Table 1 – Prevalence of diabetes *mellitus* according to sociodemographic characteristics of the studied samples in the municipality of São Paulo, 2003 (N=3,357), 2008 (N=3,271) and 2015 (N=4,043)

Variables	2003				2008				2015			
	n	Prevalence (%)	95%CI[a]	p value	n	Prevalence (%)	95%CI[a]	p value	n	Prevalence (%)	95%CI[a]	p value
Age group (in years)				<0.001				<0.001				<0.001
20-59	19	2.6	1.7;3.9		44	3.7	2.8;4.9		110	4.4	3.5;5.4	
≥60	151	17.4	14.7;20.3		199	20.0	17.3;23.1		238	22.5	20.0;25.2	
Sex				0.628				0.084				0.003
Male	76	4.4	2.9;6.6		91	5.4	4.1;7.1		125	5.4	4.5;6.6	
Female	94	5.3	4.0;7.1		152	7.2	5.9;8.8		227	7.8	6.7;9.2	
Education level[b] (in years of schooling)				0.008				0.004				<0.001
0-3	70	11.1	8.5;14.5		80	14.7	11.4;18.7		73	15.9	12.3;20.5	
4-7	62	5.9	4.1;8.5		94	9.7	7.5;12.5		163	10.1	84.0;12.1	
8-11	22	2.6	1.5;4.5		53	5.1	3.6;7.1		64	4.1	3.3;5.1	
≥12	13	3.7	1.7;7.8		14	2.7	1.5;4.8		50	4.3	3.0;6.1	
Ethnicity/skin color[b]				0.386				0.463				0.271
White	117	3.4	2.6;4.4		185	4.6	3.7;5.8		65	4.6	3.4;6.3	
Black	14	4.4	1.9;9.6		17	4.0	3.0;5.3		11	3.0	1.5;5.7	
Brown	38	2.4	1.5;3.9		85	4.3	3.7;5.2		35	3.5	2.5;4.9	
Total	170	5.0	3.9;6.2		246	6.4	5.4;7.5		348	7.7	6.8;8.7	

a) 95%CI: 95% confidence interval.
b) Missing data excluded.

An important factor to be considered in studies on morbidity is the individual's perception about their health, which can vary according to factors related to each person's social experiences and the availability of health care services.[11] This was not considered in this study. In addition, there may be information bias owing to fact of vaccination being self-reported, since it was not possible to consult the vaccination card of each interviewee.

Information about the use of public or private services for vaccination was also self-reported. In Brazil, there are many private services providing health care funded by SUS and as such it is difficult to categorize 'SUS' service and 'not SUS' service in health surveys and the possibility exists of information about the nature of the service being biased. It was not possible to analyze the population's income owing to the excess of missing data on this variable; education level and ethnicity/skin color were used as proxy variables when analyzing vaccination according to socioeconomic characteristics.

In the case of diabetes *mellitus*, vaccination against influenza and pneumonia is an important Public Health preventive intervention.[4,12-15] Vaccination against influenza in people e with diabetes is recommended annually, before the onset of winter; vaccine against pneumonia is administered once during lifetime, with a booster after 65 years of age, according to Brazilian Ministry of Health guideline specifications for the elderly and people with diabetes.[12,13] The National Immunization Program (PNI) recommendation is different: one dose of pneumococcal vaccine followed by a second dose five years later, regardless of age.[14] Although it is important, estimated coverage in this study falls short of health expectations: a low percentage of people with diabetes who are vaccinated against influenza and pneumonia was estimated in 2003 and 2008. Even in 2015, despite the increase, the proportion of vaccination in this segment of the population remained low, especially in adults, despite its being indicated for vulnerable people regardless of age, as is the case of people with diabetes. Possible causes of low adherence may be suggested. For example, the lack of recommendation of vaccination against pneumonia and influenza on the part of health professionals caring for people with diabetes. Moreover, the fact of diabetes being

Table 2 – Vaccination against influenza and pneumonia in people with self-reported diabetes *mellitus* according to demographic and socioeconomic variables in the municipality of São Paulo, 2003, 2008 and 2015

Variables	2003				2008				2015			
	n	Prevalence (%)	95%CI[a]	p value	n	Prevalence (%)	95%CI[a]	p value	n	Prevalence (%)	95%CI[a]	p value
Influenza												
Age group (in years)				<0.001				<0.001				<0.001
20-59	2	14.8	59.2;95.8		7	17.9	8.9;32.7		44	38.7	28.4;50.1	
≥60	106	70.7	61.8;78.2		138	66.9	59.1;73.9		184	77.2	68.4;84.1	
Sex				0.336				0.785				0.860
Male	46	39.9	27.6;53.6		58	43.9	30.9;57.9		80	58.6	48.8;67.7	
Female	62	50.5	35.7;65.1		87	41.6	32.7;51.1		148	59.6	50.9;67.8	
Education level[b] (in years of schooling)				0.196				0.028				0.450
0-3	51	50.5	33.2;67.7		51	53.3	40.7;65.5		52	68.8	55.6;79.5	
4-7	39	48.6	33.6;63.9		63	51.9	37.9;65.5		106	58.6	49.6;67.1	
8-11	9	22.8	10.1;43.6		27	35.5	21.6;52.3		36	51.2	37.5;64.8	
≥12	7	55.8	27.9;80.4		3	15.0	4.4;40.2		33	61.7	40.2;79.4	
Ethnicity/skin color[b]				0.351				0.178				0.249
White	69	48.5	35.4;61.8		93	42.2	32.9;52.5		38	48.3	33.7;63.1	
Black	8	24.2	6.8;58.2		9	22.2	10.0;42.2		7	48.9	21.9;76.5	
Brown	27	43.5	25.3;63.6		36	46.7	32.8;61.4		24	65.5	47.0;80.3	
Total	108	47.2	37.6;57.0		145	43.0	35.6;50.7		228	59.2	52.2;65.7	
Pneumonia												
Age group (in years)				0.017				<0.001	–	–	–	0.002
20-59	1	4.5	0.6;27.8		1	1.8	0.2;11.6		19	16.2	9.7;25.8	
≥60	36	29.3	20.3;40.3		46	24.3	17.9;32.2		82	35.2	27.0;44.3	
Sex				0.844				0.890				0.527
Male	16	18.4	8.2;36.3		17	13.5	7.5;23.0		31	23.9	16.0;34.2	
Female	21	17.0	10.6;26.3		30	12.8	8.0;19.7		70	27.3	20.5;35.4	
Education level[b] (in years of schooling)				0.256				0.095				0.655
0-3	15	18.4	9.8;32.1		14	13.2	8.1;20.9		20	29.9	18.1;45.0	
4-7	17	26.4	12.9;46.4		21	19.5	11.2;31.8		44	23.7	16.8;32.5	
8-11	3	10.4	2.7;33.1		8	6.6	3.1;13.3		18	23.5	14.2;36.2	
≥12	2	7.3	1.5;34.4		4	19.6	6.6;45.8		18	31.6	17.6;50.0	
Ethnicity/skin color[b]				0.281				0.075				0.098
White	24	17.1	11.1;25.5		33	15.3	10.2;22.4		20	21.6	13.0;33.5	
Black	3	6.9	1.5;26.0		3	6.9	2.1;19.8		2	15.1	3.5;46.4	
Brown	9	26.6	9.3;55.9		8	7.1	3.1;15.5		13	38.1	23.3;55.3	
Total	37	17.9	11.1;27.6		47	13.2	9.4;18.3		101	26.1	20.1;33.0	

a) 95%CI: 95% confidence interval.
b) Missing data excluded.

self-reported suggests the possibility of individuals, especially adults, not having been vaccinated because of the requirement to provide some form of proof of having diabetes, this being a common practice in primary health care centres, these being one of the main vaccination sites.[16,17]

There was no difference between 2003 and 2008 as to the percentage of people vaccinated against influenza and pneumonia. The growth observed in 2015 suggests an increase in access to the service. Moreover, 2013 National Health Survey (PNS) data shows that from 2013 onwards, there is a significant increase in access

Table 3 – Use of health care services for vaccination against influenza and pneumonia in people with self-reported diabetes *mellitus* (n = 105 and 37 in 2003, and 47 and 145 in 2008, 229 and 101 in 2015 respectively) in the municipality of São Paulo, 2003, 2008 and 2015

Use of health services	2003			2008			2015		
	n	%	95%CI[a]	n	%	95%CI[a]	n	%	95%CI[a]
Type of health service used for vaccination against influenza[b]									
Brazilian National Health System (SUS)	92	88,7	78,9;94,3	131	80,7	68,1;89,1	224	97,2	94,2;99,1
Not SUS	13	11,3	5,7;21,1	14	19,3	10,9;31,9	5	2,3	0,9;5,8
Type of health service used for vaccination against pneumonia[c]									
SUS	35	84,7	55,1;96,2	39	76,2	57,1;88,5	96	94,5	87,0;97,8
Not SUS	2	15,3	3,8;44,9	8	23,8	11,5;42,9	5	5,5	2,2;13,0

a) 95%CI: 95% confidence interval.
b) the number (n) of those who reported having been vaccinated against influenza, is shown in the title.
c) the number (n) of those who reported having been vaccinated against pneumonia, is shown in the title.

to all segments of health care services.[18] A study conducted in 2014 in the municipality of Pelotas, RS, found that 71% of the elderly were vaccinated against influenza.[17]

The proportion of people vaccinated against influenza was much greater than the proportion vaccinated against pneumonia. The explanation for this finding may be found in the intense seasonal vaccination campaigns, in the case of influenza, while the pneumococcal vaccine is offered as part of the health care service routine.

The higher prevalence of vaccination against influenza in the elderly may possibly be due to the fact that those over 60 years of age use health services more, compared to other adults (20-59-year), despite vaccination campaigns being directed to other populations. The occurrence of acute diseases among elderly people with diabetes, such as influenza and pneumonia, is much more serious than in elderly patients without diabetes,[12,13] and there is a need for this population to be vaccinated.[19,20]

SUS was used more for vaccination against influenza and pneumonia than supplementary health services and this corroborates the literature.[21] Approximately 5% of the population studied did not get vaccinated via SUS and informed having used private services to get vaccinated. A study conducted in 1996 in four municipalities in the state of São Paulo,[22] indicated that even the clients of private health plans routinely use the public service for vaccination. Our study confirms this fact.

The high use of SUS for vaccination against influenza and pneumonia, as evidenced here, also occurs in cases of vaccination against other diseases.[22,23] The results of a survey conducted in 1996, the objective of which was to estimate vaccine use in children less than 1 year old in the municipalities of São Paulo, Osasco, São Francisco Morato and Guarulhos, indicated vaccination above 90% for almost all the municipalities studied. The same survey found that the use of SUS for vaccination increased as living conditions worsened,[22] this being a finding that strengthens the conclusions of this study, highlighting the role played by SUS in reducing inequalities thanks to greater access and utilization of health services by the population in worse socioeconomic conditions.

The analysis of use of SUS for vaccination according to socioeconomic and sociodemographic characteristics showed no differences regarding education level and ethnicity/skin color categories. This is in agreement with the literature.[4,5,21-23] This conclusion suggests that PNI should provide care to the general population, regardless of socioeconomic status. As a universal health system, SUS is bound to provide universal vaccination distribution[21-23]. This is partially confirmed in our study, considering that the majority of respondents have been vaccinated via SUS.

The high prevalence of diabetes in Brazil and in the world, as evidenced in this study and confirmed by consulting the literature,[24,25] justifies the effort of public health services to reduce the impacts of the disease in the population and, consequently, reduce comorbidities, including the impact of influenza and pneumonia in diabetic patients. Diabetes prevalence was found to be higher in the elderly and this

result also agrees with the literature.[14] Although no adjustments were made for age, no difference in diabetes prevalence was observed among the ethnicity/skin color categories, similarly to what was observed in the 2003 National Household Sample Survey[26] and the 2013 National Health Survey (PNS).[7] Higher diabetes prevalence was estimated in the population with less schooling. Inequalities in health, widely reported in the literature,[24,25,27,28] are evidenced in this study when taking education level and ethnicity/skin color as a proxy for socioeconomic condition.

In face of the low percentage of the population with diabetes *mellitus* who are vaccinated, it is necessary to intensify campaigns, provide clarification and promote vaccination among users of health care services – especially the young adult population – providing information about all the risks and ways of prevention of this disease and its complications.

SUS is clearly a protagonist in vaccination against influenza and pneumonia in people with diabetes *mellitus*, ratifying, in the case of vaccination, the successful experience in the universalization of the constitutional right to health by SUS.

Authors' contributions

Monteiro CN, Goldbaum M, Gianini RJ and Barros MBA contributed to the conception and design of the study, analysis and interpretation of data and writing of the manuscript. Segri NJ contributed to the design, data analysis and writing of the manuscript. Cesar CLG contributed to the conception and design of the study, and writing of the manuscript. All the authors have approved the final version and declared themselves to be responsible for all aspects of the study, ensuring its accuracy and integrity.

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