



# Influenza vaccine uptake among older adults in Brazil: Socioeconomic equality and the role of preventive policies and public services

Ana Paula Sayuri Sato<sup>a,\*</sup>, José Leopoldo Ferreira Antunes<sup>a</sup>,  
Maria Fernanda Furtado Lima-Costa<sup>b</sup>, Fabíola Bof de Andrade<sup>b</sup>

<sup>a</sup> School of Public Health of the University of São Paulo, Department of Epidemiology, Av. Doutor Arnaldo, 715 – Consolação, São Paulo, SP 01246-904, Brazil

<sup>b</sup> Rene Rachou Research Institute, Oswaldo Cruz Foundation (FIOCRUZ), Av. Augusto de Lima, 1715, Barro Preto, Belo Horizonte, MG 70910-900, Brazil

## ARTICLE INFO

### Article history:

Received 16 November 2018  
Received in revised form 20 July 2019  
Accepted 25 July 2019

### Keywords:

Influenza vaccines  
Influenza  
Human  
Vaccination coverage  
Socioeconomic factors  
Aged

## ABSTRACT

**Background:** Influenza is a significant cause of morbidity and mortality worldwide. Since 1999, influenza vaccine is provided free-of-charge to adults aged 60 years or more in Brazil. Although vaccination coverage is high, previous studies have shown that socioeconomic and lifestyle factors play an essential role in predicting vaccine uptake. This study aimed to investigate whether previous knowledge of factors that constrain influenza vaccine uptake among older adults contributed to increasing the access to vaccination in 2015–16.

**Methods:** This cross-sectional study assessed data from the baseline of the Brazilian Longitudinal Study of Aging. This national representative sample encompassed individuals aged 60 and older (n=5221). Vaccination status was the outcome variable; covariates included socio-demographic and behavioral characteristics, health status, and access to healthcare. Logistic regression fitted the association between vaccine uptake and covariates.

**Results:** The coverage of influenza vaccination was 73.0% (95% confidence interval: 70.6–75.2); ranking lower than the goal of 80% set up by the national health authority. The most frequent reasons to justify the option of skipping vaccination were cultural beliefs about the lack of efficacy and possible side effects of the vaccine. The coverage of vaccination did not differ by socioeconomic characteristics. Older individuals, never smokers, having two or more chronic diseases, and being registered in the Family Health Program were positively associated with influenza vaccine uptake.

**Conclusions:** Absent socioeconomic inequalities point out changes in the barriers to vaccination. These findings provide insights into tailoring public health strategies, targeting professional recommendations and public perceptions of the vaccine.

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## Introduction

Influenza is a significant cause of morbidity, hospitalization, and mortality worldwide, and it involves high economic and social costs. Influenza epidemics cause 3–5 million cases of severe illness and 290,000–650,000 deaths annually [1,2]. However, the disease is preventable, and vaccination protects against severe influenza illness, especially in susceptible populations. In Latin America, vaccine effectiveness against influenza severe acute respiratory

infections (SARI) among old adults was 48%, against influenza A(H1N1)pdm09 was 54%, against influenza A(H3N2) was 43%, and against B viruses associated SARI was 34% [3].

Brazil has one of the most extensive immunization programs worldwide. Since 1999, influenza vaccine is provided free-of-charge to older adults (aged 60 years or more) in the whole country [4]. Vaccination campaigns are nationwide and have high media involvement. These campaigns take place every year for two weeks, previously to the colder season, in all primary healthcare units. The trivalent and inactivated influenza vaccine is produced by a national laboratory (Instituto Butantan), and it is also administered in private health establishments [4].

Vaccination coverage remained close to the target of 75% proposed by the World Health Organization [5]. The most relevant factors influencing vaccination have been health-related measures

\* Corresponding author.

E-mail addresses: [sah@usp.br](mailto:sah@usp.br) (A.P.S. Sato), [leopoldo@usp.br](mailto:leopoldo@usp.br) (J.L.F. Antunes), [lima-costa@minas.fiocruz.br](mailto:lima-costa@minas.fiocruz.br) (M.F.F. Lima-Costa), [fabiola.andrade@cpqrr.fiocruz.br](mailto:fabiola.andrade@cpqrr.fiocruz.br) (F. Bof de Andrade).

[6]; lifestyle and socioeconomic status [7] also played an important role in predicting vaccine uptake.

The National Health Survey in 2013 depicted black individuals and those with lower educational level as being less likely to uptake the vaccine. Vaccination associated positively with non-smoking status, having chronic diseases, and enrolment in the Family Health Program [7]. Previous findings on factors that contribute to vaccination pose the challenge of assessing how much they instructed the planning of vaccination programs in the subsequent years.

This study used data from the baseline of the Brazilian Longitudinal Study of Aging to investigate whether the factors associated to influenza vaccine uptake among older adults have remained the same or whether the previous knowledge on the main contributing or impeding factors instructed public actions and programs directed towards increased access to vaccination.

## Methods

This cross-sectional study assessed data from the baseline of the Brazilian Longitudinal Study of Aging (ELSI-Brazil) in 2015–16. This population-based study used a probabilistic sample of Brazilian adults aged 50 and older, residing in 70 municipalities from different Brazilian regions. The sample observed geographic stratification and clustering in three stages (municipalities, census tracts, and households). Specially trained professionals interviewed the participants at their households. A previous report detailed the study methods and sample design [8].

The present study used data from individuals 60 and older ( $n = 5221$ ), the target population for the immunization program in Brazil, who answered the question about influenza vaccine uptake.

The following question informed vaccine uptake: “Have you taken the flu shot in the past 12 months?” Those who answered negatively also informed why not, with the following options: (1) rarely gets the flu; (2) did not know the vaccine was necessary; (3) did not know where to take the vaccine; (4) was afraid of the reaction of the vaccine; (5) was afraid of the injection; (6) did not have a companion to go to the health unit; (7) had financial difficulties; (8) had transportation difficulties; (9) lives far away from the health unit; (10) the flu vaccine was not available at the health unit; (11) had some medical contraindication; (12) did not believe that the flu vaccine protects against the flu; and (13) other reason.

Previous studies about vaccine uptake in Brazil [7] informed the selection of covariates: demographic factors [age (60–69 years, 70–79 years, 80+ years), sex (male, female), skin color (white, black, brown, others), and current marital relationship (yes, no)]; socioeconomic status [education (0–3, 4–7, 8–11, and 12 years or more of formal education) and income (Brazilian minimum wages: 0–1.9, 2–4.9, 5–7.9, 8–10.9, 11 or more)]; behavior [tobacco smoking (never, former and current smoker) and physical activity (yes, no)]; health status [self-reported comorbidities (0–1 chronic disease, and 2 or more chronic diseases, including hypertension, diabetes, cardiovascular disease, stroke, asthma, pulmonary disease, arthritis and kidney disease); and access to healthcare [health insurance (yes, no), and enrolment in the Family Health Strategy (yes, no, do not know)].

Income was assessed in terms of the Brazilian minimum wage. This national standard for measuring wage ranked 788 Brazilian Real (BRL) during the period of data gathering, which corresponds to nearly 240 United States Dollars (USD) per month.

The short form of the International Physical Activity Questionnaire (IPAQ) assessed physical activity. This tool was previously validated for the Brazilian population [9]. Individuals were considered physically active if they reported at least either 150 min or more of mild to moderate physical activity per week, or 75 min of vigorous activity per week [10]. This covariate is an index of com-

**Table 1**

Reasons for not taking the influenza vaccine. Old individuals in Brazil, 2015–16 (N = 1331).

Reasons	%
Was afraid of the reaction of the vaccine	26.7
Rarely gets the flu	14.6
Did not believe that the flu vaccine protects against the flu	8.7
Was afraid of the injection	5.4
Had some medical contraindication	3.9
The flu vaccine was not available at the health unit	2.6
Did not know the vaccine was necessary	0.8
Lives far away from the health unit	0.7
Did not know where to take the vaccine	0.4
Had transportation difficulties	0.4
Did not have a companion to go to the health unit	0.3
Had financial difficulties	0.3
Other reason	35.2

Not Answered = 28.

mitment to healthy behaviors and may be a predictive factor for influenza vaccine uptake.

Results described the distribution of the sample according to the outcome variable (vaccine uptake), and covariates. The unadjusted assessment of associations between vaccine uptake and covariates used the Rao-Scott chi-square test, which takes into consideration the complex sample design. A multiple logistic regression model fitted the association between vaccine uptake and covariates. Covariates with a  $p < 0.20$  in the unadjusted analysis were included in the model; those with a  $p < 0.05$  in the adjusted analysis remained in the final model.

Data analysis used the “survey” mode of analysis of the Stata 15.0 software (Stata Corporation 2017, College Station, TX, USA), which considers the complex sample design.

The 2015 ELSI-Brazil conformed to international standards and the national legislation on ethics in research involving human beings. All participants provided informed consent, and the ethics board of the Fundação Instituto Oswaldo Cruz - FIOCRUZ, Minas Gerais, Brazil approved the study protocol (CAAE: 34649814.3.0000.5091).

## Results

The vaccination coverage among old individuals (60 years and older) in Brazil was 73.0% (95%CI: 70.6–75.2), in 2015–16. **Table 1** depicts the main reasons for not taking the influenza vaccine. The most common reason was the fear of vaccine reaction (26.7%), followed by the report that they rarely get the flu (14.6%) and do not believe that the vaccine effectively protects against flu (8.7%).

**Table 2** describes the distribution of vaccination according to demographic factors, socioeconomic status, behavioral characteristics, health status, and access to healthcare. The unadjusted assessment showed a lower vaccination coverage among individuals aged 60–69 (69.9%) and current smokers (63.3%), as compared to those with 70 or more years of age and never or former smokers, respectively. Those reporting having two or more chronic diseases (77.6%) and those enrolled in the Family Health Program (75.1%) were more likely to having been vaccinated.

**Table 2** also reveals that no significant difference in vaccination coverage occurred between the genders, among skin colors and across socioeconomic strata (income and education) ( $p > 0.05$ ).

**Table 3** shows the adjusted odds ratios (OR) obtained in the final model of logistic regression. Individuals with 70 years old or more had 30% higher odds for having uptake influenza vaccine. Current smokers had a 32% lower odds of vaccination in comparison with never smokers [OR = 0.68 (0.54–0.85)]. Having two or more chronic diseases was associated with a higher chance of vaccina-

**Table 2**  
Influenza vaccination coverage according to demographic factors, socioeconomic status, behavior, health status, and access to healthcare. Brazil, 2015–16 (N = 5221).

Variables	Influenza vaccine uptake		
	%	Yes (%)	p-Value*
<b>Demographic factors</b>			
Gender			0.499
Male	44.5	72.3	
Female	55.5	73.5	
Age (years)			<0.001
60–69	57.2	69.9	
70–79	29.8	77.2	
80 or more	13.0	76.8	
Skin color			0.493
White	43.0	74.4	
Black	10.0	70.0	
Brown	40.2	72.3	
Others	2.8	69.9	
Marital relationship			0.528
No	41.7	73.5	
Yes	58.3	72.6	
<b>Socioeconomic status</b>			
Education (years)			0.762
0–3	41.9	74.0	
4–7	30.4	72.5	
8–11	20.1	72.3	
12 or more	7.6	71.3	
Income (minimum wage)			0.177
0–1.9	29.8	71.8	
2–4.9	49.9	74.3	
5–7.9	11.8	68.9	
8–10.9	3.1	76.2	
11 or more	5.4	75.4	
<b>Behavior</b>			
Smoking			<0.001
Never smoker	46.0	73.5	
Former smoker	40.0	75.8	
Current smoker	14.0	63.3	
Physical activity			0.434
No	60.7	73.5	
Yes	39.3	72.2	
<b>Health status</b>			
Number of chronic diseases			<0.001
0–1 disease	55.9	69.3	
2 or more diseases	44.1	77.6	
<b>Access to healthcare</b>			
Health insurance			0.122
No	72.5	72.1	
Yes	27.5	75.2	
Enrolment in the Family Health Program			0.004
No	26.7	68.8	
Yes	66.6	75.1	
Don't know	6.7	68.3	

\* Rao-Scott test.

tion [OR = 1.48 (1.20–1.81)]. Moreover, the enrollment in the Family Health Program also associated with higher odds of vaccination.

## Discussion

Influenza vaccination coverage was below 80%, and the main constraints for influenza vaccine uptake were cultural beliefs about the lack of efficacy and side effects of the vaccine. The coverage of influenza vaccination did not differ across socioeconomic strata, which suggests equitable access to the program. However, demographic characteristics, behavior, and access to health services remained associated with vaccination. These results are the most relevant findings of this study.

In Brazil, the systematic assessment of administered doses in the health units allowed estimating vaccination coverage to be 89.1% in 2015, and 97.1% in 2016. This method, however, is limited by

**Table 3**  
Adjusted odds ratio (OR) for factors related to influenza vaccination among older adults (n = 5221). Brazil, 2015–16.

Variables	Adjusted OR (95% CI)
<b>Demographic factors</b>	
Age (years)	
60–69	1.00
70–79	1.37 (1.17–1.61)***
80 or more	1.33 (1.04–1.70)*
<b>Behavior</b>	
Smoking	
Never smoker	1.00
Former smoker	1.12 (0.94–1.32)
Current smoker	0.68 (0.54–0.85)**
<b>Health status</b>	
Number of chronic diseases	
0–1 disease	1.00
2 or more diseases	1.48 (1.20–1.81)***
<b>Access to healthcare</b>	
Enrolment in the Family Health Program	
No	1.00
Yes	1.36 (1.10–1.69)**
Don't know	0.97 (0.68–1.37)

\* p < 0.050.

\*\* p < 0.010.

\*\*\* p < 0.001.

inaccurate estimates both in the numerator and the denominator and can overestimate vaccination coverage [11]. The proportion of 73.0% may be a closer estimate of the actual prevalence.

This coverage is close to the target of 75% proposed by the World Health Organization [5]. However, it is lower than the goal of 80% recommended by the Brazilian health authority [4]. Previous studies conducted in Brazil showed similar coverage, suggesting that previous knowledge about associated factors did not result in higher vaccination coverage in the country [6,7].

Reasons for skipping the vaccine remained the same previously reported in Brazil [7]. The fear of vaccine reaction and the lack of awareness of the need for vaccination were also the most frequently reported reason in different countries [12–17], thereby highlighting the need for strategies of communication to provide health information and strengthen the participation of the population in the immunization program. Corroborating this hypothesis, in Singapore, a community-based intervention achieved improvements in knowledge and attitudes about vaccine uptake, after providing informative education to older adults about influenza and pneumococcal vaccination [18].

The continuous assessment of factors associated with the uptake of the shot is relevant to monitor the impact of factors already known to interfere in the likelihood of vaccination in Brazil [7]. Predictors previously reported should have instructed the planning of the vaccination program, since actions are expected to follow knowledge. Nonetheless, demographic characteristics, behavior, and access to health services remained to influence vaccination. This observation poses a challenge to the program.

Interestingly, socioeconomic status (education and income), gender, and skin color have not associated with the outcome. This finding differs from a study conducted in 2013, which also assessed a nationwide representative sample of older adults [7]. This previous report depicted lower vaccination coverage in deprived regions of the country, and among less schooled individuals. Also, a lower proportion of black individuals had taken the shot than their white counterparts. The different result obtained in this study is compatible with the hypothesis that the vaccination program may have improved in the promotion of health equity.

Several studies pointed out high education and income as predictors of influenza vaccine uptake, especially in low-income

settings [13,15,19–21]. The National Immunization Program provides free-of-charge vaccination for all old individuals in Brazil. Therefore, socioeconomic inequalities in this outcome would not be expected. However, inequalities may persist [22] because the decision to take the vaccine depends on knowledge and beliefs, which are both influenced by education [23–26].

Two studies investigated vaccine uptake across socioeconomic strata in Sao Paulo, the largest city in Brazil, and reported absent socioeconomic inequality in influenza vaccination of older people [6,27]. However, the country is quite large and heterogeneous, and the assessment of a countrywide representative sample of older adults observed differences in vaccination according to education, especially within the country macro-regions [7]. In the present study, skin color, education, income, and access to health insurance were not associated with influenza vaccine uptake. Then, the absence of socioeconomic inequalities in influenza vaccination is a major finding of this study. A similar finding in South Korea reinforced that financial aids can successfully remove barriers to vaccination of the aged population [28].

The lower uptake among current smokers, and the higher vaccination of older old individuals, of those enrolled in the Family Health Program and those with two or more chronic diseases, corroborate previous evidence from developing and developed countries [19,25,29,30]. Among the possible explanations for the associations above may be the fact that individuals with chronic diseases can consider themselves more susceptible to influenza complications, thereby their motivation to uptake the vaccine is stronger. In the same way, these individuals are more likely to attend healthcare services, having more opportunities to receive advice on influenza vaccination. Moreover, health professionals are also more likely to encourage vaccination for this at-risk group [30–32]. In this vein, the positive association between vaccine uptake and participation in the Family Health Program could be a surrogate of improved access to healthcare or more effective bonds with health professionals. Attitudes towards vaccination of healthcare providers are among the most significant influences on the decision to vaccinate.

The interpretation of individual factors associated with vaccination should consider the self-perceived susceptibility to the disease, and beliefs of vaccine efficacy. Some individuals consider themselves too frail to vaccinate and fear adverse events or to become ill. On the other hand, others feel themselves to be healthy individuals and do not expect to contract influenza, a disease they may think to be easy to overcome. One way or the other, health information and the positive influence of healthcare professionals, as well as other forms of health education, play a decisive role in the decision to vaccine uptake [18,32–34].

The main strength of this study is the use of a sizeable probabilistic sample, which was representative of old adults living in the community in Brazil, allowing for national extrapolation of the findings. The use of self-reported information without further comparison with medical or administrative records is the most relevant study limitation. Interviewers could not check the accuracy of responses; recall bias cannot be ruled out. Finally, the cross-sectional study design does not allow inferring causal relationships.

In conclusion, this study showed the absence of socioeconomic inequalities in influenza vaccine uptake. The Brazilian national immunization program had proposed this result as a goal; reaching it is a remarkable achievement. However, the primary motivation to avoid vaccination remained unchanged: lack of confidence in vaccine efficacy and fear of its side effects. This knowledge reinforces the importance of health services and professionals in their role to promote effective health education.

The continuous monitoring and surveillance of vaccination are necessary to provide updated guidance to health services. Results reported here provide insights into tailoring strategies for maxi-

mizing the coverage of health programs. Policymakers and general practitioners can use these insights to improve their communication, informing the population about the importance of the yearly vaccination against influenza for individuals aged 60 years or older.

### Author contributions

Conceived the study and designed the analysis: FBA, APSS, JLFA, MFFLC. Planned the sample and conducted the gathering of data: FBA, MFFLC. Analyzed the data: FBA, APSS, JLFA. Wrote the paper: APSS, JLFA, FBA. Edited the final version of the submitted paper: APSS, JLFA, FBA. Read and approved the final revised version: APSS, JLFA, MFFLC, FBA.

### Funding

The ELSI-Brazil baseline study was supported by the Brazilian Ministry of Health (DECIT/SCTIE - Department of Science and Technology from the Secretariat of Science, Technology, and Strategic Inputs (grant 404965/2012-1); COSAPI/DAPES/SAS—Healthcare Coordination of Older Adults, Department of Strategic and Programmatic Actions from the Secretariat of Health Care) (grants 20836, 22566, and 23700) and the Brazilian Ministry of Science, Technology, Innovation, and Communication.

### Competing interests

None declared.

### Acknowledgements

The ELSI-Brazil baseline study was supported by the Brazilian Ministry of Health [DECIT/SCTIE - Department of Science and Technology from the Secretariat of Science, Technology, and Strategic Inputs (grant 404965/2012-1); COSAPI/DAPES/SAS—Healthcare Coordination of Older Adults, Department of Strategic and Programmatic Actions from the Secretariat of Health Care (grants 20836, 22566, and 23700)] and the Brazilian Ministry of Science, Technology, Innovation, and Communication.

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