

Vaccination in patients with diabetes mellitus in primary health care: coverage and associated factors



Vacinação em pacientes com diabetes mellitus na atenção primária à saúde: cobertura e fatores associados

Vacunación en pacientes con diabetes mellitus en la atención primaria a la salud: cobertura y factores asociados

Clarissa Cordeiro Alves Arrelias^a
 Fernando Bellissimo-Rodrigues^b
 Letícia Cristina Lourenço de Lima^c
 Flávia Fernanda Luchetti Rodrigues^a
 Carla Regina de Sousa Teixeira^d
 Maria Lucia Zanetti^d

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ABSTRACT

Objective: To verify the vaccination coverage of patients with diabetes mellitus for the vaccines recommended by the National Immunization Program and associated variables.

Method: Cross-sectional study with 255 patients of a primary care unit in the Southeastern region of Brazil, conducted in 2015. The Health Management Information System was used to verify whether patients were vaccinated against influenza, pneumococcus, hepatitis B, yellow fever, measles/mumps/rubella and diphtheria/tetanus. Multivariate statistical analysis was used.

Results: 78.8% were vaccinated against yellow fever, 65.5% against diphtheria/tetanus, 27.8% against pneumococcus, 27.5% against hepatitis B, 14.9% against measles/mumps/rubella, and 14.5% against influenza. Association was found between being a woman and vaccination against hepatitis B, yellow fever and diphtheria/tetanus; a higher level of education and vaccination against hepatitis B; and a lower median age and vaccination against measles/mumps/rubella.

Conclusion: In general, vaccination coverage was low. Factors such as gender, age and education should be considered when recommending vaccines and proposing immunization strategies.

Keywords: Immunization programs. Diabetes mellitus. Vaccination coverage. Nursing.

RESUMO

Objetivo: Analisar a cobertura vacinal de pacientes com diabetes mellitus para as vacinas recomendadas pelo Programa Nacional de Imunizações e as variáveis associadas.

Método: Estudo transversal, com 255 pacientes de unidade básica de saúde, da região sudeste do Brasil, realizado em 2015. Utilizou-se o Sistema Informatizado de Gestão em Saúde para identificação da vacinação contra influenza, pneumococo, hepatite B, febre amarela, sarampo/caxumba/rubéola e difteria/tétano. Realizou-se análise estatística multivariada.

Resultados: 78,8% foram vacinados contra febre amarela, 65,5% contra difteria/tétano, 27,8% contra pneumococo, 27,5% contra hepatite B, 14,9% contra sarampo/caxumba/rubéola e 14,5% contra influenza. Encontrou-se associação entre sexo feminino e vacinação contra hepatite B, febre amarela e difteria/tétano; maior nível de escolaridade e vacinação contra hepatite B, e menor mediana de idade e vacinação contra sarampo/caxumba/rubéola.

Conclusão: A cobertura vacinal, em geral, foi baixa. Fatores como sexo, idade e escolaridade devem ser considerados nas recomendações de vacinas e na proposição de estratégias de imunização.

Palavras-chave: Programas de imunização. Diabetes mellitus. Cobertura vacinal. Enfermagem.

RESUMEN

Objetivo: Evaluar la cobertura de vacunación de los pacientes con diabetes mellitus para las vacunas recomendadas por el Programa Nacional de Vacunación y las variables asociadas.

Método: Estudio transversal con 255 pacientes de la unidad de atención primaria, de la región sudeste de Brasil, realizado en 2015. Se utilizó el Sistema Informatizado de Gestión de la Salud para la identificación de vacunación contra la influenza, neumococo, hepatitis B, fiebre amarilla, el sarampión/paperas/rubéola y la difteria/tétanos. Se realizó el análisis estadístico multivariado.

Resultados: 78,8% fueron vacunados contra la fiebre amarilla, 65,5% de la difteria/tétanos, 27,8% contra el neumococo, 27,5% contra la hepatitis B, 14,9% contra el sarampión/paperas/rubéola y 14,5% contra la influenza. Se encontró una asociación entre la hembra y vacunación contra la hepatitis B, la fiebre amarilla y la difteria/tétanos; la educación y la vacunación contra la hepatitis B, y la edad y la vacunación contra el sarampión/paperas/rubéola.

Conclusión: La cobertura de vacunación en general fue baja. Factores como el género, la edad y la educación deben ser considerados en las recomendaciones de vacunación y proponer estrategias de inmunización.

Palabras clave: Programas de inmunización. Diabetes mellitus. Cobertura de vacunación. Enfermería.

^a Universidade de São Paulo (USP), Escola de Enfermagem de Ribeirão Preto, Programa de Pós-Graduação Enfermagem Fundamental. Ribeirão Preto, São Paulo, Brasil.

^b Universidade de São Paulo (USP), Faculdade de Medicina de Ribeirão Preto, Departamento de Medicina Social. Ribeirão Preto, São Paulo, Brasil.

^c Universidade de São Paulo (USP), Escola de Enfermagem de Ribeirão Preto. Ribeirão Preto, São Paulo, Brasil.

^d Universidade de São Paulo (USP), Escola de Enfermagem de Ribeirão Preto, Departamento de Enfermagem Geral e Especializada. Ribeirão Preto, São Paulo, Brasil.

■ INTRODUCTION

Diabetes mellitus (DM) is a metabolic disease that significantly interferes in the effectiveness of the innate and adaptive immune systems, especially when decompensated, making its carriers more susceptible to certain infectious diseases or aggravating their clinical manifestations⁽¹⁾.

Influenza and pneumococcal diseases are potentially preventable infections related to many complications among patients with DM, including hospitalization and death⁽²⁻³⁾. DM patients of a working age present a greater incidence of hospitalizations caused by influenza, approximately 6%, when compared to individuals not affected by the disease. This represents six additional hospitalizations for every 1,000 people with DM a year⁽²⁾. In regard to pneumococcal infection, one study shows that hospitalized DM patients are almost twice as likely to acquire a pneumococcal infection compared to individuals not affected by the disease⁽³⁾.

Patients with DM are also potentially exposed to the hepatitis B virus (HBV) due to procedures related to DM treatment and control, especially blood glucose monitoring⁽⁴⁾. One study reports that adult patients with DM are 1.5 to 2 times more likely to contract hepatitis B when compared to individuals of the same age without the disease⁽⁴⁾.

For these reasons, the immunization of patients with DM is an essential strategy to decrease morbidity and mortality due to infectious diseases. In the same line, the Centers for Disease Control and Prevention (CDC) in the United States recommends, through its Advisory Committee on Immunization Practices, that patients with diabetes are immunized against influenza, 23-valent pneumococcal polysaccharide (PPSV23), and hepatitis B⁽⁵⁾. The Brazilian Society of Immunizations (SBIIm) recommends that patients with diabetes be vaccinated against *Haemophilus influenzae* type b, influenza, pneumococcus (together with 13-valent and 23-valent polysaccharide), hepatitis B, and varicella⁽⁶⁾.

Note that the Brazilian Immunization Program provides, free of charge, vaccines against hepatitis B, yellow fever, triple viral or MMR (measles, mumps and rubella), and diphtheria and tetanus for adults (Td), for individuals aged between 20 and 59 years old and those 60 years old or older. Influenza and PPSV23 are available in Reference Centers for Special Immunobiologicals (Cries)⁽⁶⁾.

Nonetheless, international studies assessing the immunization coverage of adult patients with DM report that adherence to vaccination is low⁽⁷⁻¹²⁾. One study conducted with 519 patients with DM from 2011 to 2012 in Switzerland reports an adherence of 63.5% to vaccination against influenza⁽⁷⁾. In 2008, in the USA, 60% reported vaccination

against the flu and 49% against pneumococcus⁽⁸⁾. In 2010, in Spain, 65% reported vaccination for influenza⁽⁹⁾. In Ireland, 64.5% were vaccinated against influenza and 22% against pneumococcus⁽¹⁰⁾. Positive results concerning the coverage of vaccines for influenza and pneumococcus were associated with ages equal to or greater than 60 years of age, the presence of other associated chronic conditions, and orientation regarding immunization on the part of health workers. One study conducted in 2009, in the United States, reported immunization coverage for hepatitis B at 16.6% for patients with DM⁽¹¹⁾. Another study conducted in 2015 reports a prevalence of immunization against hepatitis B of 26.3% in individuals with DM aged between 10 and 59 years old, and of 13.9% among individuals aged 60 years old or older⁽¹²⁾. The aforementioned higher coverage rates may be a result of recommendations for patients with DM to vaccinate against hepatitis B promoted in 2011 in the USA. In general, however, coverage remains low.

In Brazil, studies predominantly conducted in the southeast, which assessed immunization coverage against influenza among individuals aged 60 years old or older, report coverage is below 75%⁽¹³⁻¹⁶⁾, while there are gaps concerning the coverage of pneumococcus and hepatitis B both for the adult population in general and among patients with DM.

A previous study conducted in 2014 in a healthcare unit in the interior of São Paulo investigated factors associated with full immunization against hepatitis B (3 doses) among 255 patients with DM. It reports that 13.5% of the patients completed immunization against hepatitis B⁽¹⁷⁾. In this study, the patients with incomplete or no hepatitis B vaccination received clarification concerning the importance of the vaccine and either initiated or completed this vaccine schedule. However, adherence to hepatitis B vaccination after instructions were provided, were not considered in the study. Based on this previous study, other questions emerged, such as: what is the overall vaccination coverage of patients with DM considering the vaccines recommended by the National Immunization Program, including hepatitis B, and variables associated with such coverage?

Given the previous discussion, this study's objective was to analyze the immunization coverage of patients with DM for the vaccines recommended by the National Immunization Program and associated variables. Therefore, this study expands and deepens the assessment of the previous study⁽¹⁷⁾. It expands the previous study because it assesses immunization coverage and identifies the variables associated with adherence to the remaining vaccines recommended by the National Immunization Program.

It deepens the previous study because coverage of hepatitis B is reassessed after one year.

■ METHOD

Cross-sectional study conducted in 2015, in a primary health care unit, in the southeast of Brazil. The unit provides primary care to its area of coverage and is a reference center for approximately 164,567 inhabitants for both emergency care and specialties. In 2014, approximately 660 patients with DM attended a medical consultation in the unit. Among other services, the unit also has facilities for immunization.

The convenience sample was composed of 255 patients with DM who were recruited in the previous study⁽¹⁷⁾. Patients with a medical diagnosis of DM, both sexes, aged 18 years old or older, in follow-up in the PHC unit, were included. Those with hearing or cognitive impairments, unable to complete the data collection instrument, were excluded.

The dependent variable was vaccination confirmed by electronic record for the following diseases or pathogens: influenza, PPSV23, hepatitis B, yellow fever, MMR (triple viral) and adult diphtheria/tetanus (Td).

Patients were considered to be immunized against influenza if they presented an electronic record of vaccination against influenza in the 12 months that preceded the study; against pneumococcus, those who had a record of at least one dose of the PPSV23; for hepatitis B, those who presented at least three doses of the hepatitis B vaccine; against yellow fever, those patients who presented a record of at least one dose of the vaccine; for measles, mumps, and rubella, those who presented at least one dose of the MMR vaccine; and against diphtheria and tetanus, those patients who presented three doses of the Td vaccine, with the last dose within the 10 years preceding the study^(5,18). The following explanatory variables were used in the analysis of associated factors: sex, age, schooling, and time since diagnosis of DM was established.

Data concerning the explanatory variables were obtained from the database of the previous study⁽¹⁷⁾ and those concerning current immunization were obtained through consultation of electronic records available in the Hygia Web (Health Management Information System) that connects all health units in the healthcare network implemented in the city in 1994.

Using this list of patients recruited in the previous study⁽¹⁷⁾, the researcher consulted the Hygia Web to obtain data concerning the number of vaccines/doses patients with DM received and dates when they were vaccinated. Data were collected from August to December 2015.

STATA® 12.0 (StataCorp LP, College Station, United States) was used to perform the statistical analysis. Data were descriptively analyzed and presented in terms of the absolute number and percentages. For the multivariate analysis of potential associations between explanatory variables and the situation of each vaccine, a logistic regression model was performed in which all the four explanatory variables were included. P-values below 5% were considered significant for all the analyses ($\alpha=0.05$). The project was approved by the Institutional Review Board at the University of São Paulo at Ribeirão Preto, College of Nursing (CAAE) No. 46550915.0.0000.5393 and followed the guidelines established by Resolution 466 from 2012 concerning ethical standards of research with human subjects.

■ RESULTS

The demographic and clinical characteristics of the 255 patients with diabetes are presented in Table 1.

A total of 212 (83.1%), out of 255 patients, presented the recording of at least one dose of the Td vaccine; 201 (78.8%) of the yellow fever vaccine; 182 (71.4%) of the influenza vaccine; 98 (38.4%) of the hepatitis B vaccine; 71 (27.8%) of the PPSV23; and 38 (14.9%) of the MMR vaccine. The percentage of patients with an up-to-date or complete immunization scheme concerning the vaccines addressed in this study is described in Table 2.

The logistic regression analysis of variables associated with vaccination revealed that vaccination against hepatitis B, yellow fever, and diphtheria/tetanus was significantly associated with being a woman (OR=1.26; CI95%: 1.03-1.53), (OR: 2.05; CI95%: 1.09-3.86), (OR: 2.46; CI95%: 1.41-4.31), respectively. Vaccination against hepatitis B was also directly associated with level of education (OR:1.21; CI95%: 1.05-1.40); and MMR vaccination was inversely associated with age (OR:0.86; CI95%: 0.81-0.91) (Table 3).

■ DISCUSSION

In regard to vaccination against influenza in patients with DM, the results show that 71.4% presented a record of at least one dose of the vaccine, but only 14.5% were up-to-date in their influenza vaccination schedule. This percentage is lower in studies conducted in Switzerland, the United States, Spain, and Ireland; these studies show that rates of vaccination against influenza among patients with DM ranged from 60% in the United States to 65% in Spain⁽⁷⁻¹⁰⁾. The low percentage of patients with up-to-date vaccinations for influenza suggests that most patients had

Table 1 – Distribution of patients with DM according to sex, age, education and duration of diabetes. Ribeirão Preto, SP, Brazil, 2015 (n=255)

Variables	n	%
Sex		
Male	85	33.3
Female	170	66.7
Age (years)		
Median (p25-p75)	63 (55-71)	
<60	83	32.5
≥60	172	67.5
Education		
Up to middle school	188	73.7
High school	47	18.4
College	20	7.8
Duration of diabetes (years)		
Median (25 th -75 th percentile)	10 (4-20)	
≤10	138	54.1
>10	117	45.9

Source: Research data, 2015.

Table 2 – Distribution of patients with DM according to vaccination against influenza, PPSV23, hepatitis B, yellow fever, MMR, and Td. Ribeirão Preto, SP, Brazil, 2015 (n=255)

Vaccine	N	%
Yellow fever	201	78.8
Td	167	65.5
PPSV23	71	27.8
Hepatitis B	70	27.5
MMR	38	14.9
Influenza	37	14.5

Source: Research data, 2015.

been vaccinated in the past, however, did not adhere to the recommended annual vaccination. This fact may be related to decreased emphasis given to diabetes as one of the priority groups for vaccination. This statement is supported by the fact that the influenza vaccine was extended, between 2010 and 2011, to patients with chronic diseases and data from the National Immunization Program show that the coverage of the vaccine for influenza among patients with chronic diseases in 2010, that is, after a vacci-

Table 3 – Multivariate analysis of the association between vaccination against influenza, pneumococcus, hepatitis B, yellow fever, MMR and Td, and clinical and demographic variables of patients with DM. Ribeirão Preto, SP, Brazil, 2015 (n=255)

	OR	CI95%	p
Influenza			
Sex female	0.90	0.43-1.92	0.793
Age	1.00	0.97-1.04	0.852
Education	0.99	0.83-1.19	0.923
Duration of DM	0.99	0.96-1.04	0.973
PPSV23			
Sex female	0.98	0.54-1.80	0.955
Age	1.02	0.99-1.05	0.095
Education	1.05	0.91-1.21	0.492
Duration of DM	1.02	0.99-1.05	0.201
Hepatitis B			
Sex female	1.98	1.03-3.82	0.040
Age	0.98	0.95-1.01	0.156
Education	1.21	1.05-1.40	0.011
Duration of DM	1.00	0.97-1.03	0.935
Yellow fever			
Sex female	2.05	1.09-3.86	0.026
Age	1.01	0.98-1.04	0.709
Education	0.91	0.78-1.06	0.212
Duration of DM	1.01	0.97-1.04	0.618
MMR			
Sex female	1.96	0.71-5.46	0.196
Age	0.86	0.81-0.91	<0.001
Education	1.18	0.93-1.50	0.181
Duration of DM	0.97	0.92-1.02	0.234
Td			
Sex female	2.46	1.41-4.31	0.002
Age	1.01	0.99-1.04	0.282
Education	1.00	0.87-1.15	0.962
Duration of DM	1.00	0.97-1.03	0.979

Source: Research data, 2015.

Note: Each variable was adjusted for the other three.

nation campaign, was 131.9%, above estimates for priority groups⁽¹³⁾. Hence, broadly disseminating the inclusion of chronic diseases, among which is DM, to priority groups in that year may have favored a greater pursuit of vaccination

among patients and intensified recommendations on the part of health workers⁽¹⁹⁾.

Other Brazilian studies addressing elderly individuals report the results of immunization coverage against influenza, ranging from 62.6% to 74.6%, greater than those found in this study⁽¹⁴⁻¹⁶⁾. This difference may be related to the fact that these studies addressed patients aged older than 60 years. Note that in Brazil the vaccine against influenza has been available in the public health network for individuals aged 65 years old or older since 1999, and was expanded to individuals older than 60 years beginning in 2000⁽¹⁹⁾.

Despite gaps concerning immunization coverage among patients with diabetes, a population-based study conducted in Campinas, SP, Brazil reports an association between diabetes and annual vaccination against influenza, suggesting advancements concerning immunization coverage for this group of patients⁽¹⁴⁾.

In regard to variables related to vaccination against influenza, no differences were found in this study concerning sex, age, education or duration of diabetes. Although, other studies addressing elderly patients report that age, education and other factors, such as lifestyle and seeking health services, are related to immunization coverage of influenza⁽¹⁴⁻¹⁶⁾.

It should also be considered that in clinical practice the importance of immunization is not much emphasized among elderly individuals as a preventive measure and also that people hold misconceptions related to the vaccine's side effects⁽¹⁴⁾. In this context, adherence to the vaccine for influenza may improve over time, if qualified health workers provide orientation. Such orientation should emphasize the importance of immunization coverage as a measure to protect the elderly population and clarify doubts concerning health beliefs.

In regard to immunization against pneumococcus, 27.8% of the patients with DM had recorded at least one dose of PPSV23. This result is higher than that reported by a study conducted in Ireland, where the prevalence of vaccination against pneumococcus was 22%⁽¹⁰⁾, but lower than the result found in the United States, where the prevalence was 49%⁽⁸⁾.

There are two types of pneumococcal vaccines available in Brazil and PPSV23 is available for individuals in special situations, such as DM⁽⁶⁾. Recommendation for this vaccine, however, is seldom discussed. Additionally, there is a lack of Brazilian studies addressing immunization against pneumococcal infection in the adult and elderly population, with or without diabetes. Along this line, it is necessary to advance knowledge in this subject and reinforce the importance of prescribing the vaccine for pneumo-

coccal infection in health services with a large demand of elderly patients, patients with immunosuppression conditions, and/or chronic diseases such as DM.

In regard to variables related to vaccination against pneumococcal infection, these findings show there are no differences in the immunization situation according to the variables under study. This may suggest the existence of other variables not considered in this investigation and the need for future research to identify other variables that may be related to this vaccine in order to provide evidence for the proposition of effective interventions addressing patients with DM. One study conducted in Ireland identified the following variables associated with vaccination against pneumococcal infection: focus on immunization among priority groups and the presence of chronic kidney disease⁽¹⁰⁾.

In regard to vaccination against hepatitis B, 27.5% had completed the vaccine schedule. Note that 13.5% of the patients had completed their immunization schedule in 2014⁽¹⁷⁾. The results are positive and show an increase of 14% in the number of patients with completed immunization. The increase observed in this study may be explained by the orientation and recommendations given to patients with incomplete or no immunization for hepatitis B at the end of the study conducted in 2014.

One study conducted in the United States in 2009, before vaccination against hepatitis B was recommended for patients with DM, reports there was a vaccination adherence of 16.6%⁽¹¹⁾. Another study, conducted in 2013, reports coverage of 26.3% in individuals with DM aged between 10 and 59 years old and 13.9% among those 60 years old or older⁽¹²⁾.

There is a lack of studies addressing immunization coverage for hepatitis B among patients with diabetes in the Brazilian literature, which may be related to the fact that this vaccine in the public health system only recently became available to individuals regardless of age or health condition⁽¹⁹⁾. Nonetheless, it is necessary to emphasize the importance of immunization against hepatitis B for patients with DM and encourage health workers to recommend it⁽²⁰⁾.

An analysis of the variables related to immunization against hepatitis B showed that being a woman and higher educational level are positively associated with vaccination against hepatitis B. Studies conducted in the United States have not found differences in immunization rates according to sex⁽¹¹⁻¹²⁾. One study, though, does report that education is directly associated with coverage of immunization against hepatitis B, in agreement with the results presented here⁽¹¹⁾. This result reveals the important role of providing orienta-

tion to patients with DM to prevent infections, while such orientation should be reinforced among those with low levels of education. The immunization schedule for hepatitis B, composed of three doses, is difficult to understand and comply with on the part of patients, who often abandon it. Thus, the immunization schedule for hepatitis B needs to be reinforced among patients with DM during consultations provided by health workers until it is completed.

In regard to the vaccination against yellow fever, 78.8% of the patients with DM had recorded at least one dose. This vaccine was introduced in Brazil in 1937, with the goal of obtaining 100% coverage in areas where the vaccination was recommended⁽¹⁹⁾. One study addressing immunization coverage for yellow fever in the general population between 2002 and 2011, in areas where the vaccine was recommended, reports its coverage was 64.5%⁽¹³⁾. Nonetheless, a lack of studies addressing vaccines against yellow fever in the population with DM hinders comparisons. In this study, women presented better immunization against yellow fever than men. Recommendation of this vaccine provided by the Brazilian Health System is not specific for sex so that the difference found in this study, i.e., the higher frequency with which women present complete immunization, may be related to the fact that women show greater interest and are more likely to seek out health services.

In regard to immunization against measles, mumps and rubella, 14.9% of the patients with DM presented at least one dose of MMR, while it was associated with younger patients. The Ministry of Health recommends MMR for adults up to 49 years of age who do not present evidence of immunization, which may explain the small number of patients with DM and younger patients recording vaccination⁽¹⁸⁾.

In regard to the Td vaccine, 65.5% of the patients with DM present an up-to-date schedule, that is, three doses and boosters. This vaccine was associated with being a woman, a result that is explained by the fact that this vaccine is recommended for women aged between 12 and 49 years old⁽¹⁸⁾.

■ CONCLUSION

This study's results allow us to conclude that the coverage of patients with DM for the vaccines recommended by the National Immunization Program is below the recommended levels, if we consider these are vaccines provided free of charge by the Brazilian Health System.

These results are of concern because they reveal the vulnerability of this large population of potentially immunosuppressed patients to a large range of contagious and

infectious diseases that are preventable through vaccination. This study is expected to support the identification of the immunization status of this specific population, as well as the discussion of strategies to vaccinate these patients. These results highlight the need for nursing workers, who are in direct contact with patients, to pay attention to another aspect in the follow up of DM patients that needs to be emphasized and monitored.

Given the previous discussion, it is recommended that the immunization status of patients with DM be monitored and considered a priority in the service provided in the health network, especially the vaccines for influenza, pneumococcus and hepatitis B. In this sense, the role of health workers, especially that of nurses, in providing guidance, orientation and monitoring the immunization of patients with DM, is essential to preventing infectious diseases, hospitalizations and deaths.

We acknowledge that the data source used, the Management Health Information System, may have biased the results because patients with DM who were vaccinated before 1994 or in other cities and did not present a vaccination card were considered as not being covered by the vaccines included in the study, in which case, coverage was underestimated. The system, however, was essential for conducting this study and to ensure the quality of data because it considers data that were effectively recorded, rather than relying on patients' memories, which would have compromised the reliability of data.

Another limitation is the study's design, which does not allow for the establishment of cause and effect between immunization coverage and the variables under study. Nonetheless, the results allow establishing whether patients with DM received the vaccines recommended by the National Immunization Program and to signal the need for health workers and services better understand and overcome the challenge of providing broad immunization coverage to this population, ensuring their health and life.

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■ **Corresponding author:**

Clarissa Cordeiro Alves Arrelias
E-mail: claarrelias@usp.br

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