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Study and analysis of vaccination and immunization in Brazil today

Estudo e análise da vacinação e imunização no Brasil nos dias atuais

Estudio y análisis de vacunación e inmunización en Brasil hoy

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Abstract

According to the World Health Organization, researchers estimate that the spread of vaccines has allowed worldwide life expectancy to increase by 30 years in the past two centuries. Despite these advances, there are major challenges to be overcome to expand immunization coverage. Currently, the Unified Health System (SUS) offers a total of 19 vaccines that protect against more than 40 diseases free of charge. Therefore, the objective of the study was to study and analyze the current state of Brazilian vaccination in relation to infectious diseases eradicated in the country. For the development of the work, data from the Ministry of Health, published scientific articles in the Google academic, SCIELO and PubMed databases,

epidemiological bulletins, as well as relevant studies and reports published on websites and internet portals through the descriptors, vaccination in Brazil, vaccination delay in Brazil, vaccines available in the single system were used (SUS). Through this work, it is concluded that the lack of information in a set of other factors generates the non-vaccination of the population, resulting in the return of previously eradicated diseases.

Keywords: Measles; Rubella; HPV; Prevention; Eradication; National Immunization Program (NIP).

Resumo

Segundo a Organização Mundial da Saúde, pesquisadores estimam que a disseminação das vacinas permitiu que a expectativa de vida mundial aumentasse 30 anos nos últimos dois séculos. Apesar desses avanços, há grandes desafios a serem vencidos para ampliar as coberturas de imunização. Atualmente, o Sistema Único de Saúde (SUS) oferta gratuitamente um total de 19 vacinas que protegem contra mais de 40 doenças. Sendo assim, o objetivo do trabalho foi de estudar e analisar o estado atual da vacinação brasileira com relação a doenças infecciosas erradicadas no país. Para o desenvolvimento do trabalho foram utilizados dados do Ministério da Saúde, artigos científicos publicados nas bases de dados do Google acadêmico, SCIELO e PubMed, boletins epidemiológicos, bem como, estudos e reportagem pertinentes publicados em sites e portais da internet através dos descritores da saúde: vacinação no Brasil, atraso vacinal no Brasil, vacinas disponíveis no sistema único de saúde (SUS). Através do presente trabalho, conclui-se que a falta de informação em um conjunto de outros fatores geram a não vacinação populacional acarretando no retorno de doenças anteriormente erradicadas.

Palavras-chave: Sarampo; Rubéola; HPV; Prevenção; Erradicação; Programa Nacional de Imunização (PNI).

Resumen

Según la Organización Mundial de la Salud, los investigadores estiman que la difusión de las vacunas ha permitido que la esperanza de vida en todo el mundo aumente en 30 años en los últimos dos siglos. A pesar de estos avances, existen importantes desafíos que superar para ampliar la cobertura de inmunización. Actualmente, el Sistema Único de Salud (SUS) ofrece un total de 19 vacunas que protegen contra más de 40 enfermedades de forma gratuita. Así, el objetivo del estudio fue estudiar y analizar el estado actual de la vacunación brasileña con respecto a las enfermedades infecciosas erradicadas en el país. Para el desarrollo del trabajo se

utilizaron datos del Ministerio de Salud, artículos científicos publicados en las bases de datos académicas de Google, SCIELO y PubMed, boletines epidemiológicos, así como estudios e informes relevantes publicados en sitios web y portales de internet a través de descriptores de salud. : vacunación en Brasil, demora de vacunación en Brasil, vacunas disponibles en el Sistema Único de Salud (SUS). A través de este trabajo, se concluye que la falta de información en un conjunto de otros factores genera la no vacunación de la población, resultando en el retorno de enfermedades previamente erradicadas.

Palabras clave: Sarampión; Rubéola; VPH; Prevención; Erradicación; Programa Nacional de Inmunizaciones (PNI).

1. Introduction

The picture of Brazilian vaccination has changed in recent years in a drastic and extreme way. Brazilian morbidity and mortality showed a difference in relation to infectious and parasitic diseases, due to the distinctions of control measures, one of which being immunization through vaccines (Moraes, & Ribeiro, 2008). The vaccine, like any medicine or drug, needs more attention, since, despite being considered safe and providing numerous benefits in the control of infectious diseases (Alexandre et al., 2020), they can also cause harmful events, whether large or small, regular or unusual, which, if not identified and followed up, have the power to impair the volume and adherence to the immunization program through vaccines (Kimmel, 2002; Chen, & Orenstein, 1996).

With the growth of the Brazilian population, there was an increase in the number of doses of vaccines applied and, consequently, the incidence of adverse events after vaccination (AEFI) (Bisetto, Cubas, & Malucelli, 2011). An epidemiological bulletin published by the Health Surveillance Secretariat, linked to the Ministry of Health (MS), published in November 2018, recorded the incidence of 15,371 suspected cases of AEFI in Brazil in 2016, of which 19% were classified as error of immunization. Of the total immunization errors, 2,740 did not culminate in AEFV and in 157 cases the immunization error led to the occurrence of some undesirable event in the immunized patient. The flow chart below details this Picture (Brasil, 2019a).

According to the World Health Organization (WHO), vaccines save up to 3 million lives per year worldwide. In addition, the agency estimates that the spread of vaccines has allowed the worldwide life expectancy to rise by 30 years in the past two centuries, but that,

despite these advances, there are major challenges to be overcome to expand immunization coverage (EBC, 2019).

Data from the United Nations Children's Fund (UNICEF) (2018), around 13.5 million children under 1 year of age did not have access to vaccines in 2018. In the past two years, however, immunization goals they were only beaten for BCG, which immunized about 96% of newborns in 2017 and 2018. The triple viral that prevents diseases such as rubella, mumps and measles, had a drop in immunization to 90% in the first dose, and the second dose remained well below the target, with 75% coverage (EBC, 2019).

The Oswaldo Cruz Foundation (FIOCRUZ), a research institute linked to the Ministry of Health, carried out a study on deaths caused by infectious diseases in Brazil, which concluded that such deaths represented about 20% of the total deaths in the country in 2017, before 45.7% in the 1930s (Araújo, 2015).

The National Council of Health Secretaries (NCHS) (2018) reports that in the 1980s, diseases such as measles, polio, rubella, congenital rubella syndrome, meningitis, tetanus, whooping cough and diphtheria caused 5,500 deaths in children up to 5 years in Brazil. In 2009, that number dropped to just 50 cases.

Most of the diseases that can be prevented by vaccines are transmitted by contact with contaminated objects or when the patient sneezes, coughs or talks, because in this way, small droplets containing infectious agents are expelled (Pfizer, 2019; Alexandre et al., 2020). Thus, the individual is infected, thus being able to transmit the disease to other people who possibly have not been immunized. Through vaccination, a decrease of about 25% was obtained in cases of diseases that used to lead to that obtained such as whooping cough, measles, polio and rubella. However, even being under control, such diseases can become epidemic again if the population stops wavering (Pfizer, 2019).

Therefore, the objective of the present study was to conduct a study on immunization and vaccination in the country and how the lack of it has been affecting public health as a whole.

2. Methodology

A narrative and exploratory bibliographic review was carried out, with a qualitative research on vaccine adherence by the population in Brazil. To this end, an electronic consultation was carried out, using the databases of SCIELO (*Scientific Electronic Library Online*), books, vaccine package inserts and magazines of the Regional Pharmacy Council

(RPC), Google academic® and PubMed (*National Center for Biotechnology Information - NCBI, US National Library of Medicine*).

To search for articles, the following combinations of words and descriptors of the Health Sciences Descriptors (DeCS) were used: vaccination, vaccination in Brazil, immunization in Brazil, importance of vaccination, history of vaccine. As this is a narrative review, an evaluation of the scientific quality of the articles found was not carried out.

The present study allows us to deepen the main themes addressed, making a compilation of the data according to the methodology of Pereira et al. (2018) in the development of the study. Articles in English, Portuguese and Spanish from the last few years were analyzed.

3. Results and Discussion

3.1 Imunizacion

Several vaccines were created based on inactive antigens, polysaccharides, proteins and microbial agents in the late 19th century and early 20th century. Since the 1960s, with the advancement of cell culture technology *in vitro*, many vaccines have been developed as inactivated (Salk) and attenuated (Sabin) polio, measles, rubella and mumps (Homma, Martins, & Jessouroum, 2003).

Vaccine formulations have also been refined using combined formulas, such as bacterial triple (diphtheria, tetanus, whooping cough), viral triple (measles, mumps, rubella), pentavalent (DTP, hepatitis B and *Haemophillus influenzae*, type b), and heptavalent formulations are emerging. The old multidose vaccine presentations of 200, 100, 50, 20 are being abandoned, giving way to presentations with fewer doses. Currently, there is a worldwide trend towards single dose presentations, especially for high-cost vaccines (Homma, Martins, & Fernandes, 2011).

In 1973, the National Immunization Program (NIP) was initiated, as determined by the Ministry of Health (MS), with the objective of coordinating immunization actions that were characterized, until then, by discontinuity, by episodic nature and by the small area coverage. In 1975, the NIP was institutionalized, resulting from the sum of factors, of national and international scope, that converged to stimulate and expand the use of immunizing agents, seeking the integrality of the immunization actions carried out in the country (Brasil, 2014).

Since the 1990s, the rate of Brazilian vaccination coverage has risen sharply. The Health Surveillance secretariat, linked to the Ministry of Health, published in 2015 the report on vaccination coverage, referring to the period from 2010 to 2014. This report informs that such index was found in an average of 63.7% of Brazilian municipalities, considering all vaccines, routine and extraordinary, for all types of diseases that have this type of immunization (Brasil, 2014). NIP recommends that states maintain minimum vaccine coverage between 90 and 95% (Lisboa, Freire, & Figueiredo, 2019).

After the introduction of the Chikungunya virus in 2004 in the Americas, in the period from 2014 to 2019, Brazil had 589,076 probable cases reported and confirmation of 495 deaths, 2016 and 2017 being the years with the highest incidence coefficients, 114.0 and 89.4 cases per 100 thousand inhabitants. Between 2003 and 2018, 39,674 cases of whooping cough were confirmed, in the parents of which 22,777 of the cases occurred in the period from 2011 to 2014. In the year 2015, a decrease in cases can be observed in the cases believed that the inclusion of the Triple Acellular Bacterial Adult vaccine (dtpa) for pregnant women and health professionals may have contributed to the drop in numbers (Brasil, 2019b).

Malaria is still making victims around the world, making it a public health problem. In 2015, Brazil had achieved a 75% reduction in cases compared to the 2000s, but in 2018, 194,513 cases were reported (Brasil, 2019b).

In 2014, the yellow fever virus advanced through Brazilian territory, reaching areas where vaccination coverage was low or not achieved. Monitoring was carried out in 2019 where 327 suspected human cases were reported, from all regions of the country, 51 (15.6%) remained under investigation, there was only 1 confirmed case of death in the period in July 2019 (Brasil, 2019d).

Between 2013 and 2015, 1,310 measles cases were recorded in the states of Ceará and Pernambuco. In 2018, these epidemics returned in the states of Roraima and Amazonas with more than 1,500 confirmed cases (Sato, 2018).

In Brazil, vaccination schedules, guaranteed by the Ministry of Health throughout the national territory, are systematically updated through reports and technical notes. The following vaccines are provided by the NIP for adults (20-59 years): hepatitis B, diphtheria and tetanus, triple viral (measles, mumps and rubella) and the yellow fever vaccine (Brasil, 2018).

For health professionals, in addition to these, vaccination against hepatitis A and B, chickenpox, influenza and meningococcal disease B is recommended by the Brazilian Society of Immunization (BSIM) (BSIM, 2016).

3.2 Vaccines available in the Unified Health System (SUS)

The best way to prevent infectious diseases is through vaccination. Currently, the Unified Health System (SUS) offers a total of 19 vaccines that protect against more than 40 diseases free of charge. The population should go to the health center for the neighborhood where they live and ask the health professional to update their vaccines (Brasil, 2019c; Brasil, 2019e; Brasil, 2019f).

The MS promotes two annual vaccination campaigns, together with the Health Departments of the states and municipalities, such as the flu campaign, carried out in the first semester, preceding the winter season. In addition, every four years, all children under the age of five are targeted by the measles vaccination campaign (Brasil, 2019c; Brasil, 2019e; Brasil, 2019f).

Most of the vaccines available in the National Vaccination Calendar (Table 1) are for children, totaling 15 vaccines, being applied before 10 years of age. In addition, delayed doses can also be updated, as well as the doses that are recommended for reinforcement (Brasil, 2019g).

Table 1. Immunization schedule available in the Unified Health System (SUS) in Brazil for the year 2020.

Age group (months and years)	Vaccines available in SUS
Newborn (0 months)	**Bacillus Calmette-Guerin (BCG) (single dose)**
	Hepatitis B
2 months	Pentavalent 1st dose (Tetravalent and Hepatitis B 2nd dose)
	Poliomyelitis 1st dose - Polio inactivated vaccine (VIP)
	Pneumococcal conjugate 1st dose
	Rotavirus 1st dose
3 months	Meningococcal C conjugated 1st dose
4 months	Pentavalent 2nd dose (Tetravalent and Hepatitis B 2nd dose)
	Poliomyelitis 2nd dose - Polio inactivated

	vaccine (VIP)
	Pneumococcal conjugate 2nd dose
	Rotavirus 2nd dose
5 months	Meningococcal C conjugated 2nd dose
6 months	Pentavalent 3rd dose (Tetravalent and Hepatitis B 3rd dose)
	Poliomyelitis 3rd dose - Polio inactivated vaccine (VIP)
	Influenza (1 or 2 doses per year)
9 months	Yellow Fever (single dose)
	Influenza (1 or 2 doses per year)
12 months	Pneumococcal conjugated reinforcement
	Meningococcal C conjugated reinforcement
	Triple Viral 1st dose
	Influenza (1 or 2 doses per year)
15 months	Triple bacterial vaccine (DTP) 1st booster (included in pentavalent)
	Poliomyelitis 1st reinforcement
	Attenuated poliomyelitis vaccine (OPV)
	Hepatitis A (1 dose from 15 months to 5 years)
	Viral tetra (Triple Viral 2nd dose and Varicella)
	Influenza (1 or 2 doses per year)
4 years	Triple bacterial vaccine (DTP) 2nd booster Triple bacterial vaccine (DTP) 2nd booster (included in pentavalent)
	Poliomyelitis 2nd reinforcement
	Attenuated poliomyelitis vaccine (OPV)
	Chickenpox (1 serving)
	Influenza (1 or 2 doses per year)
9-14 years	Human papillomavirus (HPV) 3 doses

	Meningococcal C (booster or single dose)
Over 14 years	Hepatitis B (3 doses depending on vaccination status) Yellow Fever (single dose for those not vaccinated or without proof of vaccination) Triple Viral (2 doses up to 29 years old or 1 dose over 30 years old. Maximum age: 49 years old) Double adult bacterial vaccine (DT) (Reinforced every 10 years) Triple acellular bacterial vaccine of the adult type (dTpa) (for pregnant women from the 20th week, who missed the opportunity to be vaccinated)
Elderly (over 60 years)	Hepatitis B - 3 doses (check previous vaccination status) Yellow Fever - single dose (check previous vaccination status) Double Adult (dT) - (prevents diphtheria and tetanus) - Reinforcement every 10 years Pneumococcal 23 Valente (prevents pneumonia, otitis, meningitis and other diseases caused by *Pneumococcus*) - reinforcement (depending on previous vaccination status) - The vaccine is indicated for indigenous populations and specific target groups, such as people aged 60 and over who are not vaccinated who live in bed and / or in closed institutions. Influenza - One dose (annual)

Legend: SUS: Unified Health System. Source: PEBMED, 2019.

Vaccine refusals and indecision are complex and may be related to the confluence of various sociocultural, political and personal factors, doubts about the need for applications, safety and efficacy of vaccines, insecurity or fear of possible adverse events, concerns about possible "overexposure" of the immune system" (Tertuliano, & Steinll, 2011).

In Brazil, a federal law of 1975, regulated by a decree of 1976, establishes in paragraph 27 that vaccination is mandatory throughout the national territory. That same decree, in paragraph 29, establishes the duty of every citizen to submit, and the minors of whom he has custody or responsibility, to mandatory vaccination. In addition, the Child and Adolescent Statute (CAE) establishes that it is the family's duty to ensure the realization of health rights, which includes routine vaccination (Succi, 2018).

Although the importance of maintaining vaccination status for disease prevention is recognized and access to NIP vaccines is free, some infectious diseases are in emergence such as yellow fever, measles, tuberculosis, leprosy, malaria (Araújo, Oliveira, & Pinho, 2019).

3.3 Epidemiological and etiological data on diseases and subsidies for vaccination

There are several factors that affect the success of vaccination campaigns. Resistance to vaccination by the population is a concern for MS. The danger of having low vaccination coverage is the risk of reintroducing diseases that have already been eliminated in the country, as in the case of measles that has made victims in the country since February 2018 (Brasil, 2019e).

In Brazil, the last measles cases were recorded in 2015, in outbreaks in the states of Ceará (211 cases), São Paulo (two cases) and Roraima (one case), associated with the Ceará outbreak. In 2016, Brazil received the certificate of elimination of the circulation of the measles virus by the WHO, declaring the region of the Americas free of measles. Venezuela has been experiencing a measles outbreak since July 2017, with most cases coming from the state of Bolivia. The current socio-political economic situation faced by the country has caused an intense migratory movement that contributed to the spread of the virus to other geographic areas. In 2016 and 2017, Brazil did not register confirmed cases of measles (Brasil, 2019g; Brasil, 2019h).

In 2018, Brazil faced the reintroduction of the measles virus, with outbreaks in 11 Federation Units (UFs), with a total of 10,326 confirmed cases, distributed as follows: Amazonas (9,803), Roraima (361), Pará (79), Rio Grande do Sul (46), Rio de Janeiro (20),

Sergipe (4), Pernambuco (4), São Paulo (3), Bahia (3), Rondônia (2) and the Federal District (1) (Brasil, 2019b; Brasil, 2019h).

The intense migratory movement observed in a country bordering Brazil, initially occurring in the state of Roraima, contributed to the spread of the measles virus, which circulated again in the country, especially in the states of the Northern region. More than 10,000 cases of the disease were confirmed in 2018, and 646 cases, distributed in eight states, until July 2019, which demonstrates that additional efforts should be mobilized to maintain adequate vaccine coverage (Domingues, Fantinato, & Posenato, 2019).

According to SBIM, the reduction in vaccination coverage may be due to the fact that people feel safe in relation to diseases that have apparently already been controlled, we can take into account the many false information that are released on the subject that end up raising doubts about the effects side effects and vaccine efficacy (Sanson, & Cremonese, 2018).

4. Conclusion

In view of the aspects observed, it is important to intensify vaccination campaigns, as vaccines are a form of disease prevention. It is important to make the population aware of the importance of vaccination, as they can prevent many diseases that have already been eradicated from re-existing in the country, so it is concluded that, due to the lack of immunization, unfortunately the population has already been suffering from cases of diseases that before they were considered eradications, and if measures are not taken against them the country could come to face a very serious epidemic and if measures are not taken more and more diseases could return.

In view of the results found about vaccines, more studies are needed for the population to learn about the importance of vaccination in order to eliminate some diseases.

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