ABSTRACT

Objective: to analyze the impact of vaccination against Pertussis on the number of pertussis cases. Method: cross-sectional, documentary, quantitative approach. Results: There were 656 pertussis cases, 154 (23%) cases in 2013; 264 (40%) cases, in 2014, and 37 cases (6%) in the Information System for Notifiable Diseases from 2005 to 2015. Results: in 2015. In 2005 and 2007, there was vaccine coverage above 95%; 2012 presented the lowest coverage against whooping cough (58%). The most affected age group was less than one year with 55% of the cases. In 2014 there was the highest incidence of the disease (7.95 / 100 thousand inhabitants). In the period, there were five deaths, 60% (03) in the year 2014. Conclusion: reemergence of whooping cough was noticed. The introduction of dTpa in the National Vaccination Calendar of pregnant women had a significant impact on the reduction of cases. Descriptors: Whooping Cough; Immunization; Epidemiology.

RESUMEN

INTRODUCTION

Pertussis is an acute infectious disease of high transmissibility and universal distribution. Its etiological agent is the bacteria *Bordetella pertussis*, and the man, its only natural reservoir. It, specifically, compromises the respiratory tract (trachea and bronchi) and is spread by nasopharyngeal droplets when the infected person coughs, sneezes and talks. It is important to note that, until 1940, it was the largest cause of infant mortality in the world. In Brazil, whooping cough is a notifiable illness. The data related to the notification and investigation of this disease are stored in the Notification of Injury Information System (NIIS).¹⁻³

The disease is immunopreventable and there are two types of pertussis vaccine: the vaccine based on dead *B. pertussis* organisms (whole cell vaccine); and the acellular vaccine, based on highly purified components of *B. pertussis*. The immunity conferred by the vaccine is long-lasting, but not permanent, decreasing over time until its protection is shown to be quite reduced or none, which is on average within five to ten years after the last administered dose. For pertussis prevention, the National Immunization Program (NIP) offers the vaccine with the Pertussis component since its inception in 1973.¹⁻⁴

Since the 1990s, there has been a significant reduction in the incidence of pertussis cases in Brazil, due to the expansion of tetravalent and triple bacterial vaccination coverage. But by mid-2011, there was a sudden increase in the number of cases of the disease. In 2012, the number of cases reported per epidemiological week remained at levels higher than expected, making it evident that pertussis remains endemic in the country.¹⁻⁵

Epidemic outbreaks occur every three to five years, and pertussis has now been considered a reemerging condition, being the worst-controlled vaccine-preventable diseases. Some hypotheses pointed to explain the resurgence of the disease are: the gradual loss of immunity acquired through the vaccine; Genetic change of bacteria; The increase in the number of asymptomatic carriers and selection of vaccine-resistant variants; Combining other factors such as the use of new diagnostic methods and the improvement of epidemiological surveillance systems.⁵ Thus, in order to reduce the incidence of pertussis cases in Brazil, the strategy chosen for disease prevention was also to vaccinate pregnant women and professionals (Anesthesiologist, gynecologist, obstetrician, neonatologist, pediatrician, nurse and nursing technician) who attend newborns in maternity hospitals and neonatal ICUs with the adult type vaccine.¹⁻⁶

The objective of the introduction of the acellular vaccine against diphtheria, tetanus and pertussis (dTpa) was to induce the production of high titers of antibodies against pertussis in the pregnant woman, allowing the transplacental transfer of these antibodies to the fetus, resulting in the protection of the newborns in the first Months of life until the vaccination schedule recommended in the National Vaccination Calendar is completed. On the other hand, health professionals, because of the increased risk of whooping cough when compared to the general population, can transmit the disease to the susceptible ones. So vaccination of these professionals is one of the measures to control the disease, especially in neonatal nurseries / ICU.⁶

The age group of children under one year of age is the main cause of whooping cough, especially those under six months. At that age, infants have not yet received the complete vaccination schedule. In addition, the occurrence of complications, hospitalization rate and pertussis lethality are four times higher among children younger than six months than in other age groups. Therefore pertussis is still a public health problem.⁶

In the world, pertussis is still a major cause of death in childhood and continues to be a public health concern even in countries with high vaccination coverage. In 2008, more than 80% of newborns worldwide received three doses of pertussis vaccine, as it shows that vaccination campaigns have had positive results. Despite this, 15 million cases of this disease have been registered worldwide: 95% of them in developing countries, leading to the deaths of around 200 thousand children.⁷

Pertussis is an acute respiratory disease with clinical presentation that, in general, presents characteristics that can distinguish it from other etiologies. Most of the time, the diagnosis is made during the paroxysmal phase, when there are coughing crises that can be accompanied by vomiting, cyanosis and apneas lasting from one to six weeks. The most severe conditions are observed in young infants not yet fully immunized.⁸

The transmission of whooping cough is through direct contact of the sick person with susceptible person (droplets of secretion eliminated by coughing, sneezing or speaking). Transmission by newly infected...
Hemorrhages, subdural hemorrhage, strabismus and deafness), among others (subconjunctival haemorrhages, B. pertussis otitis media, epistaxis, face edema, lingual frenulum ulcer, hernias, conjunctivitis, dehydration and / or malnutrition).

Diagnosis is made by isolating B. pertussis by culture of harvested nasopharynx material, with appropriate technique or by real-time polymerase chain reaction (PCR) technique. The clinical specimen collection must be performed before antibiotic therapy or, at most, up to three days after its initiation.1,9

The first-choice treatment and chemoprophylaxis of pertussis is azithromycin, which should be given once daily for five days, and the second choice is clarithromycin every 12 hours for seven days. In cases of contraindication to the use of these macrolides, the sulfamethoxazole associated with trimethoprim is recommended. These new therapeutic regimens facilitate patient adherence to treatment and especially to chemoprophylaxis of intimate contacts.1,11

The measure of prevention and control of practical interest in public health is the vaccination of the susceptible ones, in the routine of the basic health network. Pentavalent (DTP + Hib + Hepatitis B) and triple bacterial (DTP) vaccines should be used in children, even when those responsible report a history of the disease. The DTPa (acellular) vaccine is recommended for children at increased risk of developing or who have developed severe adverse events to the whole-cell vaccine, available from the Special Immunobiological Referral Centers (CRIE). Another strategy used to prevent whooping cough is to vaccinate all pregnant women with the adult vaccine - DTPa.1,9

In the late 1920s, the first tests began with a cellular vaccine composed of a suspension of B. pertussis. These tests proved pertussis to be immunopreventable. In the late 1930s, the pertussis vaccine was combined with the diphtheria and tetanus vaccine giving rise to the DTP vaccine. This vaccine has been used in vaccination programs since the 1950s, causing the number of cases of whooping cough to decline significantly worldwide. But the cellular vaccine is associated with adverse reactions, which led to population resistance to immunization. As a result, scientists set out to search for a less reathogenic vaccine, and an acellular vaccine was developed.12

In Brazil, the National Immunization Program aims to achieve a national vaccination coverage of at least 95%, enough to reduce morbidity and mortality from immunopreventable diseases. However,
pertussis occurred even in populations with high coverage, becoming the most frequent immunoprevalent disease.\(^\text{12-13}\)

Data from the Monitoring System for Health Pact Indicators (SisPacto) indicate that the vaccination coverage rate for the diphtheria, tetanus and pertussis (DTP) vaccine has decreased from 103.1 to 91.8% between 2007 and 2011 (DTP + Hib), which was replaced by the tetravalent vaccine (DTP + Hib). In 2012, the pentavalent vaccine (DTP, hepatitis B and Hib) was introduced in the child's immunization schedule.\(^\text{4,14}\)

It is also worth mentioning that from the knowledge of the vaccination coverage it is possible to monitor the number of individuals susceptible to pertussis and to evaluate if the immunization has been effective to interrupt the transmission of the disease.\(^\text{1}\)

As of mid-2011, there was a sudden increase in the number of cases of pertussis in Brazil, whose incidence quadrupled in relation to 2010. In 2013, the epidemic level remained with an incidence of 2.8 / 100 thousand inhabitants.\(^\text{11}\)

Considering the epidemiological situation of whooping cough and the need to protect against the disease, the mother-to-child binomial, the diphtheria, tetanus and pertussis vaccine, was introduced as of November 2014 in the National Vaccination Calendar for pregnant women and health professionals who newborns in the maternityes and neonatal ICUs, as reinforcement or complementation of the double adult vaccine (diphtheria and tetanus).\(^\text{6}\)

Before receiving the pertussis vaccine, infants depend on maternal antibodies transferred by the transplacental route. However, pregnant women vaccinated only in childhood have low concentrations of antibodies against B. pertussis, which are insufficient for protection of the infant after birth. The application of the dTpa vaccine in pregnant women stimulates the production of maternal antibodies against pertussis that will pass through the placenta and the child will have direct protection during the first months of life and indirect protection by reducing the risk of infection of the mother. Vaccination of dTpa women during gestation is expected to provide protection against pertussis to newborns until they are old enough to receive routine vaccination. The dTpa vaccine can be administered at any time during pregnancy, but vaccination closer to delivery during the third trimester provides the highest concentration of maternal antibodies to be transferred to the fetus.\(^\text{6,15}\)

The acellular pertussis vaccine consists of purified components of the Bordetella pertussis antigens: pertussis toxin (PT), filamentous haemagglutinin (FHA), pertactin (PRN) and fimbriae (FIM) types 1, 2 and 3. This acellular pertussis vaccine can be less effective than whole cells and the universal use of pertussis vaccines has led to genetic changes in the circulating strains of B. pertussis. Available circulating strains and vaccines need to be evaluated and developed continuously.\(^\text{7,16}\)

The pillars of pertussis work are effective vaccines and wide-ranging vaccination campaigns. In the future, booster doses should be considered throughout life, not only to prevent disease in adults, but also the transmission of disease from adults to neonates.\(^\text{7}\)

**OBJECTIVE**

- To analyze the impact of vaccination against Pertussis on the number of pertussis cases.

**METHOD**

This is a cross-sectional, non-experimental, descriptive study, that analyzed the impact of pertussis vaccination in Alagoas from 2005 to 2015. For the beginning of the study, the Immunopreventable Diseases Center (IPDC) Authorization to carry out the research. After authorization, the data were collected from the reports and epidemiological bulletins of the nucleus and the Information System of Notifiable Diseases.

The data used in the elaboration of the research were obtained from the online database and free access of NIIS, available in the Department of Information Technology of UHS (DATASUS), of the epidemiological reports and bulletins of the NDIP of free access and available on the SESAU / AL portal, which justifies the absence of submission of the project to the Research Ethics Committee, since the data were obtained from secondary sources, without the nominal identification of the patients.

After data collection, these data were tabulated and the results analyzed. For the analysis of the information collected, we used the statistical and descriptive technique of the data through the program TabWin and Microsoft Office Excel that will be presented through graphic representation.

**RESULTS**

According to SINAN data, there were 656 pertussis cases in Alagoas between 2005 and
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2015. Of these, 154 (23%) occurred in the year 2013 and 264 (40%), in the year 2014. With this, it was observed a significant increase in the number of cases in these years compared to previous years. Evidence that the State showed a tendency to reemergence from pertussis. In 2015, 37 (6%) cases were confirmed, showing a significant reduction in the incidence of the disease when compared to the year 2014 (Figure I).

Regarding Vaccine Coverage, we can observe that in the years 2005 to 2007, coverage was reached above 95%, while the year 2012 showed the lowest coverage against whooping cough (58%). Between 2013 and 2015, there was an increase in vaccination coverage, but the goal of 95%, was not reached as recommended by the National Immunization Program (Figure 1).

The age group most affected by whooping cough was less than one year, registering 55% (306) of the cases. Followed by the age of 1-4 years, with 19% (123), 5-9 years with 12% (81), 10-14 years with 8% (51) and 20-34, with 4% (8) cases. The least affected age groups were 15-19 and 35-49, both with 1% (8) of the cases. The bands above 50 years of age did not present reported cases of pertussis in Alagoas, between 2005 and 2015 (Figure 2).

In the analyzed period, the year with the highest incidence of the disease was 2014 (7.95 / 100 thousand inhabitants); and the year 2007, which had the lowest incidence (0.03 / 100 thousand inhabitants) (Figure 3).
Of the 102 municipalities of Alagoas, 77 (75%) municipalities had confirmed cases of pertussis between 2005 and 2015. The municipality of Maceió presented 200 (30%) cases, followed by União dos Palmares 61 (9%); Palestine, with 32 (4.8%) and Santana do Mundaú with 31 (4.7%) cases. In the analyzed period, 25 (25%) municipalities did not report pertussis cases (Map I).

During the study period, there were five deaths from pertussis in Alagoas, being 60% (03) in the year 2014, 20% (01) in 2010 and 20% (01) in 2013. All deaths recorded were in less than one year.

DISCUSSION

In Brazil, pertussis morbidity has already been high. At the beginning of the 1980s, more than 40 thousand cases were reported annually and the incidence rate was higher than 30 / 100 thousand inhabitants. This number fell abruptly from 1983 onwards, maintaining a downward trend since then. Thus, whooping cough since the 1990s in Brazil, presented a significant reduction in the incidence of cases as there was an increase in tetravalent and DTP vaccination coverage. However, as of mid-2011, there was a sudden increase in the number of cases of the disease in the country, whose incidence quadrupled in relation to the previous year (2010). By 2013, the epidemic level had been maintained with an incidence of 2.8 / 100 thousand inhabitants.1,17

Other epidemiological studies demonstrated that the pattern of increase and maintenance in the number of cases of pertussis occurred in several Brazilian States, not being exclusive to the state of Alagoas,
which presented a significant increase in the number of cases in the years of 2013 with an incidence of 4.6 /100 thousand inhabitants and 2014, with an incidence of 7.9 / 100 thousand inhabitants when compared with previous years. In contrast, the percentage of vaccination coverage in Brazil was above 90% for tetravalent (DTP + Hib) and in Alagoas vaccine coverage was close to 90% for the aforementioned period. 

In Alagoas, during the study period, the age group most affected by whooping cough was less than one year, registering 55% (306) of the cases. The finding in relation to the age group is in agreement with the notifications of the cases occurred nationally. In Brazil, between 2007 and 2013, 17,532 cases of pertussis were confirmed, of which 11,316 (64%) occurred in children under one year of age. It is worth noting that the age group up to three months of life concentrates 8,032 cases (71%).

In relation to pertussis mortality in the country, it is noteworthy that approximately 98% of pertussis deaths occurred in children under one year of age, being more frequent in the age group up to three months of life. Similar results were found in Alagoas, where 100% of the deaths occurred in less than one year.

In view of this scenario, as of November 2014, the vaccination of women of childbearing age with the dT vaccine (double diphtheria-type diphtheria and tetanus) was replaced by dTpa in the vaccination of pregnant women, Since women vaccinated during gestation offer indirect vaccination protection to their newborn infants, contributing to the reduction of pertussis cases and deaths in this age group. 

In the State the impact of the vaccination of pregnant women with dTpa can be observed when comparing the years 2014 and 2015. In 2014 the incidence coefficient of whooping cough was approximately 8 / 100,000 inhabitants that represents 264 cases and three deaths in less than one Year by whooping cough. In the following year (2015), after the introduction of dTpa in the National Vaccination Calendar of the pregnant woman, as a reinforcement or complementation of the dT vaccine scheme, the incidence reduced to 1 / 100 thousand inhabitants, which represents 37 cases, and no deaths Whooping cough in Alagoas.

CONCLUSION

Through this study, it was possible to notice that there was reemergence of pertussis in Alagoas, and this finding followed the national trend. However, the introduction of dTpa in the National Vaccination Calendar of the pregnant woman, as of November 2014, had a significant impact on the reduction of cases of pertussis in the State.

The study showed that after about five to ten years of the last vaccine dose, there is loss of protection making young people susceptible to infection. From these youngsters the disease is contracted by the newborns, which justifies the adoption of the World Health Organization recommendation to vaccinate all pregnant women with the acellular pertussis component, from the 27th week until the 36th week of gestation and the professionals of Health care services for newborns in maternity hospitals and neonatal ICUs.

The importance of epidemiological surveillance actions is also emphasized, with immediate notification and investigation of any suspected case of the disease, with subsequent control measures and adequate assistance. It is important to emphasize that control of pertussis was only obtained through the recognition of the role that the disease was having in the state, in terms of morbidity and increased health costs for research, hospitalization and treatment of cases. Thus, it is imperative that health professionals remain engaged in measures to prevent pertussis in Alagoas.

REFERENCES


19. Ministério da Saúde (BR), Secretaria de Vigilância em Saúde, Departamento de Impact of vaccination against pertussis...
Impact of vaccination against pertussis...