

# Vaccination strategies and results for tackling the measles outbreak in Ceará State, Brazil, 2013-2015

doi: 10.5123/S1679-49742018000100010

Ana Débora Assis Moura<sup>1</sup> –  [orcid.org/0000-0003-1002-2871](https://orcid.org/0000-0003-1002-2871)

Ana Karine Borges Carneiro<sup>1</sup>

Ana Vilma Leite Braga<sup>1</sup>

Elaine Cristina da Silva Alves Bastos<sup>1</sup>

Surama Valena Elarrat Canto<sup>1</sup>

Tereza Wilma Silva Figueiredo<sup>1</sup>

Márcio Henrique de Oliveira Garcia<sup>1</sup>

Daniele Rocha Queiroz Lemos<sup>1</sup>

Regina Duron Andino<sup>2</sup>

<sup>1</sup>Secretaria da Saúde do Estado do Ceará, Coordenadoria de Promoção e Proteção à Saúde, Fortaleza, CE, Brasil

<sup>2</sup>Organização Pan-Americana da Saúde, Unidade de Imunizações, Tegucigalpa, Francisco Morazan, Honduras

## Abstract

This study describes the experience and results of the vaccination strategies developed for tackling the measles outbreak in Ceará State, Brazil, from December 2013 to September 2015. Strategies of routine vaccination, community immunity, and vaccination campaigns were conducted, along with searching of unvaccinated people, through rapid monitoring of immunization coverage and scanning. To describe the results, primary data collected in field activities and secondary data on vaccination in a population aged from six months to 49 years, available at the Information System of the National Immunization Program (IS-NIP), were used. The immunization coverage achieved was of >95%. However, this coverage is only administrative and may not represent reality, hence the importance of implementing the nominal information system of the National Immunization Program.

**Keywords:** Measles; Strategies; Immunization; Disease Outbreaks; Epidemiological Surveillance.

## Correspondence:

Ana Débora Assis Moura – Rua Costa Sousa, No. 100, T1, apto 2003, Bairro Benfica, Fortaleza-CE, Brasil. CEP: 60020-300  
E-mail: [anadeboraam@hotmail.com](mailto:anadeboraam@hotmail.com)

## Introduction

Measles is a viral disease. It is one of the main causes of morbidity and mortality in children under the age of 5, especially those malnourished and who live in low-income countries. The behavior of this disease depends on the relationship between immunity and susceptibility of the population, as well as on virus circulation, which presents seasonal variation.<sup>1</sup>

Between March 2013 and March 2014, 224 cases of measles were confirmed in Pernambuco State, Brazil. In Ceará State, from December 2013 to May 2014, 174 cases were confirmed.<sup>2</sup> In 2014, there were 114,900 deaths worldwide due to measles complications, around 314 deaths/day or 13 deaths/hour.<sup>3</sup> In Brazil, measles notification has been compulsory since 1968. Until 1991, the country faced nine epidemics, approximately one every two years. The highest number of case notifications occurred in 1986 (n=129,942), representing an incidence rate of 97.7/100 thousand inhabitants.<sup>2</sup>

*The routine vaccination must be conducted according to the NIP guidelines, following the vaccination calendar established by the Ministry of Health: one dose of MMR vaccine at 12 months of age; one dose of MMRV at 15 months of age; two doses of MMR between two and 29 years of age.*

The Global Strategic Plan Against Measles and Rubella (2012-2020)<sup>4</sup> provides a set of strategies to achieve the tackling goals of those diseases. In accordance to the plan and guidelines of the National Immunization Program (NIP), Ceará State reinforces the vaccination strategies, based on the principles of Primary Health Care, which aims at achieving the expected impact with universal access to immunization. In this context, the State intensifies the measles vaccination strategies recommended by the Pan American Health Organization (PAHO): routine vaccination; rapid monitoring of immunization coverage (RMC); community immunity, screening; and finally, intensification of vaccination.<sup>5</sup>

Notwithstanding the strategies of vaccination adopted in Brazil, from March 2013 to March 2014, 224 cases of measles were confirmed in Pernambuco State, and

from December 2013 to May 2014, 174 cases were confirmed in Ceará.<sup>2</sup>

From December 2013 to September 2015, the epidemiological surveillance of Ceará State Health Department identified 4,631 suspected cases of measles, from which 23% (1,052) were confirmed and 77% (3,559) discarded.<sup>6</sup> From March to November 2014, it was registered the highest incidence of the disease, with 8.6 cases/100 thousand population. The virus was identified in 38 (20.7%) of the 184 municipalities of the State, and the transmission occurred for 20 months, from December 2013 to September 2015.<sup>6</sup>

The experience and the results of the vaccination strategies developed for tackling the measles outbreak in Ceará State are described below.

## Vaccination Strategies

In health services, routine vaccination must be conducted according to the NIP guidelines, according to the vaccination calendar established by the Ministry of Health: one dose of MMR vaccine at 12 months of age; one dose of MMRV at 15 months of age; two doses of MMR between two and 29 years of age; and one dose of MMR from 30 to 49 years of age, in accordance with the vaccination status.<sup>7</sup>

Among the several vaccination strategies used, the following stand out:

- a) routine vaccination – it consists of systematic vaccination, aiming at the control of vaccine-preventable diseases by means of large vaccination coverages, so that the population can be provided with adequate vaccine protection for the diseases covered by the program –;<sup>8</sup>
- b) rapid monitoring of immunization coverage (RMC) – it is characterized by the assessment of the vaccination status in a short period of time, based on the information of the resident's certificate of vaccination in a determined geographic area, through household visits; the RMC has as its main purpose to rescue not vaccinated individuals, reducing potential susceptible individuals –;<sup>9</sup>
- c) community immunity – it is an activity provided by the system of epidemiological surveillance along with the immunization team, executed when there is one or more suspected cases of the disease; held in up to 72 hours maximum after the notification of the case, aiming to interrupt the chain of transmission and consequently, eliminate the susceptibility as soon as possible –;<sup>9</sup> and

d) vaccination intensification – it consists of vaccinating with the purpose of achieving people in any age group that were not vaccinated or did not complete the vaccination scheme.<sup>8</sup>

Ceará State, during the measles outbreak period (December 2013 to September 2015), adopted several vaccination strategies, including (i) searching for the susceptible population, (ii) campaigns in the municipality of Fortaleza and metropolitan region, (iii) follow-up campaigns in the 184 municipalities of the State, (iv) vaccination of risk population, and (v) reorientation and systematization of blocking and screening actions in the whole state.

**Data source**

To describe the results of the vaccination strategies developed for tackling the measles epidemic in Ceará, primary and secondary data were used

The primary data came from house-to-house screening and vaccination activities. They were collected by professionals from the Family Health Strategy (nurse, nurse technician and community health workers), who

used an instrument standardized by Ceará State Health Department to the population from 6 months to 49 years of age, including the following variables: place of residence; full name; age; measles vaccination status (yes/no); measles vaccination in the moment of screening (yes/no); reasons to not be vaccinated (refuse to vaccination; absent of the household; pregnant; immunosuppressed).

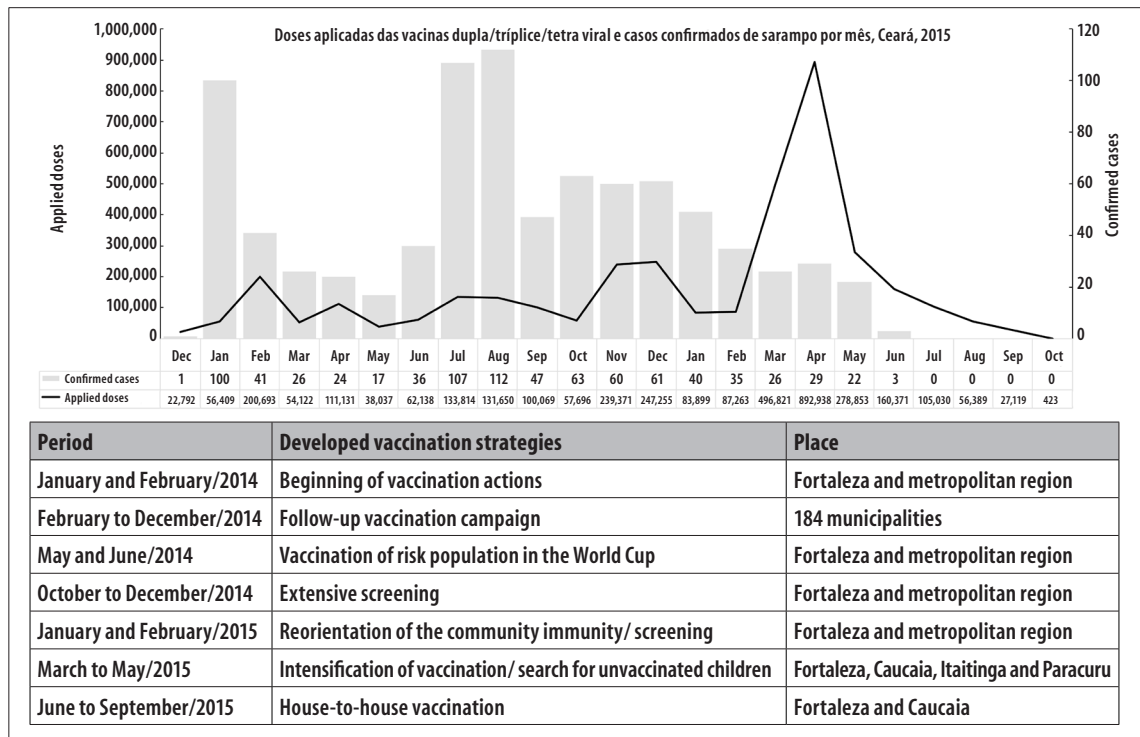
The secondary data were obtained from the Information System of the National Immunization Program (IS-NIP).

The data were consolidated in spreadsheet and analyzed by descriptive statistics, using the Microsoft Office Excel 2010® software.

The study project was not submitted to the Ethics Research Committee, because it is an experience report developed in the scope of health surveillance actions during the measles outbreak in Ceará State.

**Results of vaccination strategies**

The different strategies used consolidated a total of 1,232,368 doses applied of MR, MMR and MMRV vaccines in the intensification target population (Figure 1).



Source: National Immunization Program (NIP/ Health Department of Ceará State (SESA).

**Figure 1 – Applied doses of MR/MMR/MMRV vaccines and confirmed measles cases per month, Ceará, 2015**

## Routine Vaccination

In analyzing the MMR vaccination coverage (VC) on the routine strategy of the years 2013, 2014 and 2015, in the 184 municipalities of the State, it was verified that 19, 3 and 75 municipalities respectively, presented a coverage lower than 95%, goal established by the NIP for the VC in the target population. From those municipalities Martinópolis and Aratuba, which presented confirmed measles cases, presented coverage lower than 95% in both 2014 and 2015. In 2013, 2014 and 2015, with regard to the VC of the second dose of MMR, 138, 26 and 101 municipalities, respectively, presented a coverage lower than the established goal. The VC with the second dose of MMR in 2013 was lower than the established goal in most of the municipalities because in that year the vaccine was implemented to children of one year of age. In 2014, the number of municipalities with VC lower than 95% reduced due to the Follow-up Measles Campaign (Figure 2).

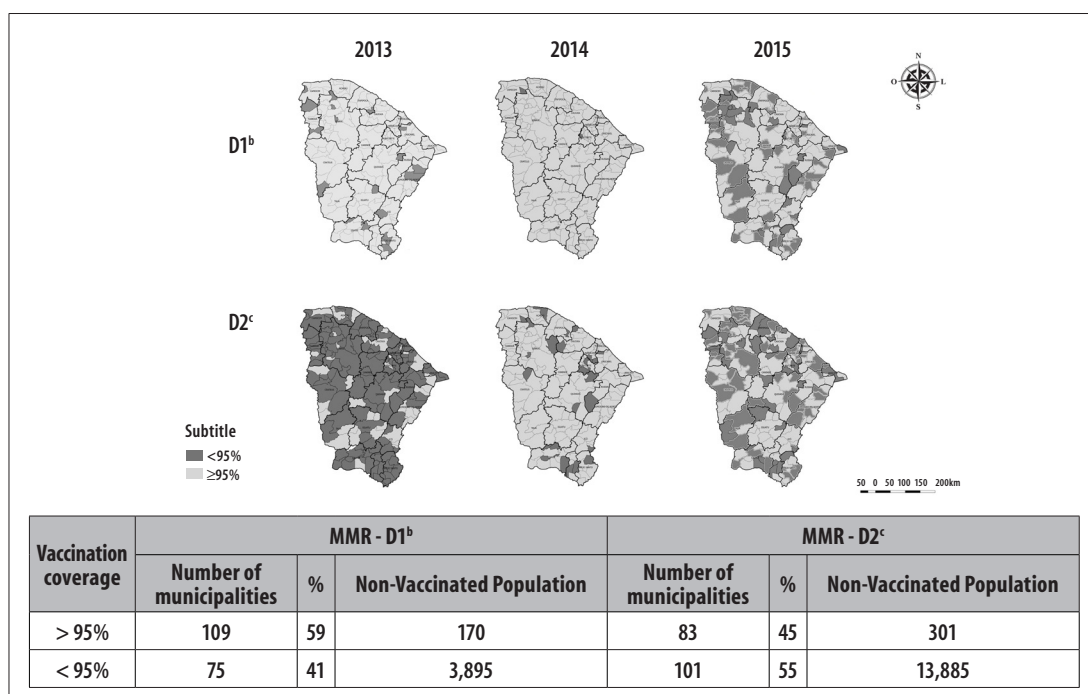
From the 36 municipalities that presented confirmed measles cases, 4, 1 and 12 municipalities did not achieve the goal of 95% of MMR coverage in 2013, 2014 and 2015, respectively.

The follow-up campaign conducted periodically, universally, with the objective of vaccinating susceptible children, was anticipated due to the epidemic.

To the general population, and for the target population from six months to five years of age, the campaign was designed to happen between February and April 2014; however, it was extended up to December 2014, being concluded when the municipalities achieved the established VC of 95%. The vaccination coverage was superior to 100%. From the 184 municipalities, 99% (n=182) achieved the goal; however just 56% (n=102) municipalities achieved 95% of coverage to each age group (Figure 3).

## Rapid Monitoring of Immunization Coverage (RMC)

After the follow-up vaccination campaign, the municipalities conducted the RMC in order to measure the achieved VC and rescue unvaccinated children. Although 99% of the municipalities had achieved VC >95%, during the RMC, it was identified that 42 (23%) and 53 (29%) out of 184, did not achieve the coverage of 95% in the first and second doses of the MMR, respectively.



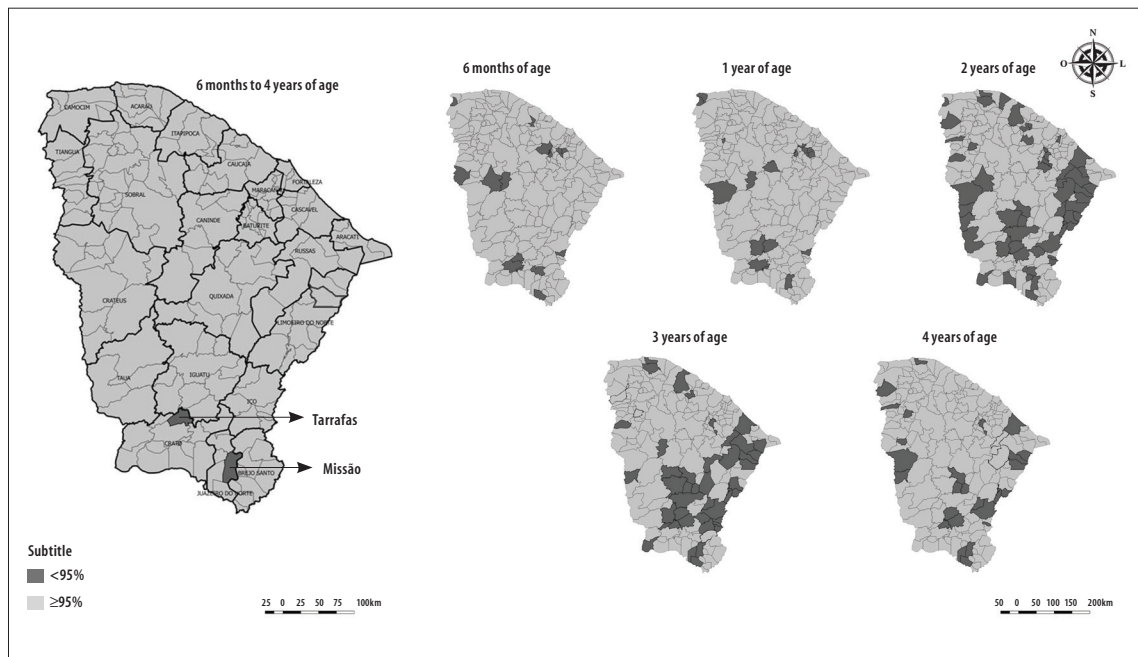
a) Routine coverage from January to August 2015.

b) Dose 1.

c) Dose 2.

Source: National Immunization Program (NIP/ Health Department of Ceará State (SESA).

**Figure 2 – Vaccination coverage<sup>a</sup> of MMR (D1<sup>b</sup> and D2<sup>c</sup>) in the population of 1 year of age, Ceará, 2013-2015**



**Figure 3 – Vaccination coverage of MMR in the Follow-up Measles Campaign, Ceará, 2014**

From February to March 2015, other RMC was conducted with the objective of evaluating the vaccination status with the component 'measles and poliomyelitis' in the population from six months to five years of age. Thus, 52,216 vaccination booklets were revised. Just 1.6% (836) did not have the first dose of the MMR; 40 (21.5%) and 130 (71%) municipalities presented VC lower than 95% to first and second dose, respectively.

As a result of this strategy, 836 children from six months to five years of age did not have register of the first dose of MMR. A total of 741 doses were applied at the moment of the RMC. It was also shown that one parcel of those children were not vaccinated, in spite of the strategies adopted in the course of the outbreak, what would justify the necessity to prioritize and intensify the actions of active search of the unvaccinated population in the 184 municipalities and incorporate the vaccination strategies that would facilitate the access of the non-vaccinated population. Out of the 184 municipalities, just only Caucaia, which presented confirmed cases, did not conduct the RMC.

### Community immunity

The community immunity was restricted to household contacts in suspect cases and not-timely conducted, in

2014, being inefficient in the prevention of new cases. In light of this, from January to March 2015, this strategy was adjusted and conducted in an extended way, searching for contacts of the previous 21 days, according to the travels of each suspected case. In the municipality of Fortaleza 11,410 doses were applied in the community. From those, 10,611 doses (93%) corresponded to the population from five to 49 years of age. In the municipality of Caucaia, 5,538 doses were applied in the community, of which 4,652 (84%) corresponded to the population of the same age group.

### Intensification of the measles vaccination

Uruburetama, with 62 confirmed measles cases in 2014, was the second municipality of the state in incidence of cases. The massive vaccination was conducted, targeted mainly to factory workers, aiming to contain the transmission of the virus. A total of 21,460 doses of MMR were applied.

The Regional Health of Sobral presented 257 confirmed cases of measles, in 13/24 municipalities, from which the municipality of Massapê presented the highest incidence of cases. In the period from June to December 2014, after the intensification of measles vaccination, more than 22 thousand factory workers were vaccinated.



In the municipality of Fortaleza, the goal defined to the vaccination of the population from five to 29 years of age was of 1,125,085 people. Until July 4<sup>th</sup> 2015, the VC of 90% had been achieved. This coverage was distributed homogeneously among the Health Regionals.

Strategies of vaccination were adopted in the institutionalized population (schools, universities, companies, industries, hospitals) and in places with high concentration of people, taking advantage of the agglomeration spots such as shopping malls, bus stops, squares, markets, churches, popular markets, among others. Moreover it was promoted evening, weekends and holidays house-to-house search. The Primary Health Care Units (PHU) were open on Saturdays and Sundays, and in extended hours.

In the municipality of Caucaia, the VC achieved in the population from five to 29 years of age, until March 2015, was lower than 65%, and the coverage was lower than 95% for the MMR (all doses) in the population from six months to one year. A great number of susceptible individuals between six months and 49 years of age was identified. With the support and intervention of the Pan-American Health Organization and of the Ministry of Health, the municipality achieved 85% of coverage for an estimated population of 325,441 inhabitants.

In the municipality of Itaitinga, in face of the presence of confirmed cases in the local prison, the vaccination targeting the population from five to 29 years of age was intensified in places of high concentration of people, companies and schools. The municipality achieved a coverage of 65% in two weeks, vaccinating around 11,973 people from 5 to 29 years of age.

In the municipality of Paracuru, with confirmed cases, the intensification of vaccination was incorporated as a strategy of control of the disease. The goal established was of 20,011 vaccinated people in the population from five to 39 years of age. Thanks to the political priority and the availability of logistical resources, in two weeks, more than 95% of the population was vaccinated.

## Discussion

The massive vaccination actions, as well as the intensification in mobile units and screening, along with an active community search of unvaccinated individuals, the call for local, municipal and state managers, and

also the creation of rapid response teams, allowed the achievement of vaccination coverages higher than 95% in the whole territory of Ceará.

The awareness and incorporation of new actors to the scenario of the epidemic, such as scientific societies, public and private schools and universities, allowed new actions and vaccination strategies, achieving population sectors of harder access, as administrative staff and professors.

The intensification of vaccination allowed the application of local innovations, both for the active search of suspect cases and of the pending susceptible population. They are innovations that can be used for the strengthening of immunization programs and epidemiological surveillance, the two pillars to the sustainability of measles tackling.

Before the epidemic, that started in 2013, the measles endemic transmission had been interrupted in Brazil in the year 2000, as a result of the intensification of surveillance actions and elevation of the disease vaccination coverage.<sup>10</sup>

The virus circulation in Ceará State was interrupted in September 2015. However, it is necessary to maintain high and homogenous VC of the MR, MMR and MMRV in individuals from 12 months to 49 years of age. It is important to highlight that more than 90% of the confirmed cases and 40% of the suspect cases from six months to 29 years of age did not have vaccination antecedents, which indicates that the VC above 95% was just administrative.

The National Immunization Program – NIP – has promoted multiple advances, such as the ongoing modernization of the NIP Information System (IS-NIP). It will make it possible to register the vaccine applied per person and per origin of the vaccinated person, allowing a more complete and accurate analysis of the information.<sup>11</sup> Therefore, it will be possible to obtain VC estimates that are not just administrative.

The search for unvaccinated individuals demands vaccination strategies to know the population attached to the health services and search, among them, the floating population, being necessary the immediate implementation of IS-NIP in all municipalities of the state, besides the analysis and surveillance of the areas to identify the vaccinated population and the concentrations of susceptible individuals, contributing to a more thorough evaluation of the vaccination coverage and rapid location of unvaccinated individuals.

## Authors' Contributions

Moura ADA and Carneiro AKB participated in the conception and design of the study, data collection, analysis and interpretation, drafting and critical review of the manuscript, and drafting of the final version to

be published. Braga AVL, Garcia MHO, Lemos DRQ, Andino RD, Bastos ECSA, Canto SVE and Figueiredo TWS contributed in the conception and design of the study and the critical review of the manuscript. All the authors revised and approved the final version of the manuscript, ensuring its accuracy and integrity.

## References

1. Engleitner F, Moreira AC. Incidência de rubéola, caxumba e sarampo no município de Ijuí/RS entre os anos de 1995 e 2007. *Rev Contexto Saúde*. 2008 jan-jun;7(14):37-44.
2. Ministério da Saúde (BR). Situação epidemiológica/dados [Internet]. Brasil: Ministério da Saúde; 2014 [citado 2017 maio 09]. Disponível em: <http://portalsaude.saude.gov.br/index.php/situacao-epidemiologica-dados-sarampo>
3. Organização das Nações Unidas do Brasil. OMS alerta sobre epidemia de sarampo [Internet]. Organização das Nações Unidas; 2014 [citado 2017 maio 10]. Disponível em: <https://nacoesunidas.org/oms-alerta-sobre-epidemia-de-sarampo/>
4. Organización Mundial de la Salud. Plan de acción mundial sobre vacunas 2011–2020 [Internet]. Washington: Organización Mundial de la Salud; 2013 [citado 2017 ago 28]. 148 p. Disponible: [http://apps.who.int/iris/bitstream/10665/85398/1/9789243504988\\_spa.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/85398/1/9789243504988_spa.pdf?ua=1)
5. Organización Panamericana de la Salud. Eliminación del sarampión: guía práctica. Publicación científica y técnica n° 605 [Internet]. Washington: Organización Panamericana de la Salud; 2007 [citado 2017 ago 28]. 117 p. Disponible: [http://www1.paho.org/hq/dmdocuments/2009/guiapractica\\_sarampion%20ESP.pdf](http://www1.paho.org/hq/dmdocuments/2009/guiapractica_sarampion%20ESP.pdf)
6. Secretaria da Saúde do Estado (CE). Núcleo de Vigilância Epidemiológica. Nota técnica: sarampo [Internet]. Fortaleza: Secretaria da Saúde do Estado; 2014 [citado 2017 ago 28]. 6 p. Disponível em: <http://www.saude.ce.gov.br/index.php/notas-tecnicas?download=1523%3Anota-tecnica-sarampo-conduta-jan-2014>.
7. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças Transmissíveis. Nota informativa n° 384, de 2016. Sobre mudanças no calendário nacional de vacinação para o ano de 2017 [Internet]. Brasília: Ministério da Saúde; 2016 [citado 2017 ago 28]. 10 p. Disponível em: <http://portalarquivos.saude.gov.br/images/pdf/2016/dezembro/28/Nota-Informativa-384-Calendario-Nacional-de-Vacinacao-2017.pdf>
8. Ministério da Saúde (BR). Fundação Nacional de Saúde. Manual de normas de vacinação [Internet]. 3. ed. Brasília: Ministério da Saúde; 2001 [citado 2017 ago 28]. 58 p. Disponível em: [http://bvsms.saude.gov.br/bvs/publicacoes/funasa/manu\\_normas\\_vac.pdf](http://bvsms.saude.gov.br/bvs/publicacoes/funasa/manu_normas_vac.pdf)
9. Teixeira AMS, Domingues CMAS. Monitoramento rápido de coberturas vacinais pós-campanhas de vacinação no Brasil: 2008, 2011 e 2012. *Epidemiol Serv Saúde*. 2013 out-dez;22(4):565-78.
10. Fernandes EG, Oliveira MEB, Fred J, Carelli LA, Lima GDF, Sato HK, et al. Surto de sarampo na região metropolitana de Campinas, SP. *Rev Saúde Pública*. 2013 ago;47(6):1213-7.
11. Teixeira AMS, Rocha CMV. Vigilância das coberturas de vacinação: uma metodologia para detecção e intervenção em situações de risco. *Epidemiol Serv Saúde*. 2010 set;19(3):217-26.

Received on 08/01/2017  
Approved on 04/08/2017