

# Rapid Monitoring of Vaccination to prevent measles in Ceará State, Brazil, 2015

doi: 10.5123/S1679-49742018000200017

Ana Débora Assis Moura<sup>1</sup> –  orcid.org/0000-0003-1002-2871

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

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

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

Camila Maria Marques Bastos<sup>1</sup>

Iara Holanda Nunes<sup>1</sup>

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

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

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

Antonia Maria da Silva Teixeira<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>Ministério da Saúde, Coordenação do Programa Nacional de Imunizações, Brasília, DF, Brasil

## Abstract

**Objective:** to describe the results of Rapid Monitoring Vaccination monitoring conducted with the aim of interrupting the measles outbreak in the State of Ceará, Brazil, in 2015. **Methods:** this was a descriptive study using data taken from 52,216 vaccination cards of children aged from 6 months to less than 5 years and data on vaccination coverage, homogeneity, and reasons for non-vaccination extracted from the National Immunization Program Information System (SI-PNI). **Results:** vaccination coverage against measles reached 96.7% in Ceará; of the 21 Regional Health Offices in the State, four did not reach minimum coverage of 95% for the first dose, and two for the second dose; 836 children (1.6%) were not vaccinated and 1,388 vaccine doses were not used. **Conclusion:** Measles vaccination campaigns enabled the immunization coverage goal in the State of Ceará to be surpassed, despite the considerable number of unvaccinated children found.

**Keywords:** Surveillance; Monitoring; Measles; Immunization Coverage; Epidemiology, Descriptive.

## Correspondence:

Ana Débora Assis Moura – Rua Almirante Barroso, No. 600, Bairro Praia de Iracema, Fortaleza, CE, Brasil. CEP: 60060-440  
E-mail: anadeboraam@hotmail.com

## Introduction

Measles is an acute, serious, communicable and highly contagious viral disease. It has universal distribution and with seasonal variation. The behavior of this disease depends on the relationship between immunity and susceptibility of the population, as well as on virus circulation. Although a safe and low-cost vaccine is available, measles is one of the main causes of morbidity and mortality in children under the age of 5, especially those who are malnourished and live in low-income countries. Measles incidence, clinical evolution and mortality are influenced by socioeconomic conditions, nutritional status and immune system of the patient, aggravated by agglomeration situations in public places and in small homes.<sup>1</sup>

*The rapid monitoring of immunization coverage (RMC), this being an important tool for checking the vaccination status of a given population in a short period of time, with low requirement of financial resources and broad applicability nationwide.*

In Brazil, measles notification has been compulsory since 1968. In the period from 1968 to 1991, the country faced nine epidemics; approximately one every two years.<sup>2</sup> Although the vaccine has been licensed since 1961, it was used in a one-off and irregular manner in the country before being officially included on the first national calendar of obligatory vaccination following the publication of Ministerial Ordinance No. 452/1977.<sup>3</sup> In the 1980s, a gradual decline in the registration of deaths resulting from infection was observed, this being attributed to increased vaccination coverage and improved medical care.<sup>1</sup>

More comprehensive actions were put into place with effect from the 1990s, in particular the mass vaccination campaign for children aged between nine months and 14 years of age and the intensification of epidemiological surveillance actions, these being lines of action of the Plan for Measles Control and Elimination implanted in 1992. The campaign was a success: 48 million vaccinated and 96% immunization coverage. Since then, several efforts have been undertaken in the countries of the Region of the Americas. In Brazil,

certain target groups were included in vaccination initiatives, such as, for example, children up to 11 years of age and women of childbearing age.<sup>4</sup>

The result of these actions was the sharp drop in the incidence of measles by autochthonous transmission in the Brazil, with fewer than 97 cases per 100,000 inhabitants, reaching zero incidence in the year 2001. Imported cases, in general, have occurred sporadically throughout the decade of 2000. With effect from the middle of the same decade, there were three outbreaks of considerable epidemiological importance: (i) in 2006, 57 cases in the semi-arid region of Bahia; (ii) in 2010, 57 cases in the metropolitan region of Paraíba; and (iii) in 2013/2014, 220 cases in Pernambuco.<sup>1</sup> Between 2013 and 2015, 38 municipalities in Ceará state registered 1,052 cases of the disease, as well as isolated cases detected in other Brazilian cities.

A peculiarity of Ceará state was the duration of the epidemic, as it continued uninterrupted for 81 epidemiological weeks from December 2013 to September 2015, despite the adoption of strategies to identify further outbreaks. In all there was a record 4,631 suspected cases. The initial strategies adopted were not sufficient to halt the advance of the epidemic and thus more intensive and localized measures were adopted. In addition to the adoption of these measures, intensified vaccination was undertaken among individuals aged 5 to 29 years of age, while maintaining intensified vaccination of children aged 6 months to under 5 years old.<sup>5</sup>

One of the strategies used in the measles epidemic in Ceará state was the rapid monitoring of immunization coverage (RMC), this being an important tool for checking the vaccination status of a given population in a short period of time, with low requirement of financial resources and broad applicability nationwide. In this context, local particularities stand out such as the presence of physical and social frontiers, these being factors capable of influencing access to vaccination and, consequently, also influencing the ratios and the proportion of children with their vaccinations up-to-date.<sup>6</sup>

The experience and the results of the rapid monitoring of immunization coverage, carried out with the purpose of stopping the outbreak of measles in Ceará state in 2015 are described below.

## Vaccination Strategies

Several vaccination strategies were adopted in Ceará state in order to reach susceptible populations. These included:

- a) routine vaccination, which consists of systematic vaccination aimed at controlling vaccine-preventable diseases by means of large-scale vaccination coverage;<sup>7</sup>
- b) follow-up campaigns, which comprise vaccination activities performed periodically and indiscriminately;<sup>8</sup>
- c) rapid monitoring of immunization coverage (RMC), to verify vaccination coverage and identify non-vaccinated members of the susceptible population, based on proof of vaccination as per child vaccination cards checked during household visits;<sup>9</sup>
- d) entire community vaccination, performed when there is one or more suspected cases of the disease;
- e) cleaning or screening operation, when there are still cases of the disease, by checking vaccination status and vaccinating those who have not been vaccinated on a house to house basis;<sup>10</sup> and finally,
- f) vaccination intensification, which consists of vaccinating people who have not been vaccinated or have not had all the doses of the vaccine.<sup>11</sup>

The vaccination follow-up campaign was carried out indiscriminately in November 2014, administering the MMR and MMRV vaccines among children aged 6 months to 5 years old, followed by rapid monitoring of immunization coverage (RMC) which was completed in the first half of 2015. Vaccination intensification used the double viral vaccine (measles and rubella - MR) for people aged 5 to 29 years of age, between the months of May and August of 2015.

The Ceará state health care system has 22 microregions and five macroregions (Fortaleza, Sobral, Cariri, Sertão Central and East Coast/Jaguaribe). RMC encompassed the state's 22 microregions and 184 municipalities. Regionalization, is one of the Brazilian National Health System (SUS) guidelines for the health care action and service decentralization process, as well as guiding negotiation and agreements between health service managers.<sup>12</sup> In 2015 the Cascavel (22<sup>nd</sup>) Regional Health Coordination Offices (CRES) was incorporated into the Fortaleza (1<sup>st</sup>) CRES whereby both became subordinated to one single administration.

### Rapid Monitoring of Immunization Coverage

RMC is a vaccination action supervision activity recommended by the Pan American Health Organization (PAHO) since the 1980s and adopted in several countries of the Americas. It is characterized by seeking to achieve vaccination coverage by means of household

visits to check vaccination certificates. It is a very useful method for checking vaccination status. Its results are extremely important as an aid to decision-making about the definition or redefinition of additional vaccination strategies, aiming to improve vaccination coverage and its homogeneity.<sup>9</sup>

The number of households visited was based on the size of the target population and on the number of vaccination rooms in each municipality. In municipalities with a large population (>50,000 inhabitants), 2% of the target population (6 months to less than 5 years of age) were included. For smaller municipalities - with up to 50,000 inhabitants -, the recommendation is to follow the target population and vaccination rooms criteria, i.e., the number of RMC should correspond to the number of vaccination rooms; it is important to highlight that the RMC area must be selected randomly (by drawing lots).<sup>11</sup>

### Data sources and analysis

Data on vaccination coverage, homogeneity and reasons for non-vaccination were extracted from the National Immunization Program Information System (SI-PNI), available at the Brazilian National Health System IT Department (DATASUS) website ([sipni.datasus.gov.br](http://sipni.datasus.gov.br)). Tabwin 32 version 2008 applications and Microsoft Office® Excel® were used to tabulate the data.

The RMC protocol was used to inform data analysis. The protocol was drawn up with the aim of supporting the team in the field work.

The study project was not submitted to an Ethics Research Committee because it used secondary public domain data with no identification of persons and institutions.

### Results

In November 2014, 1,232,368 doses of MR, MMR and MMRV vaccines were administered during the indiscriminate measles vaccination campaign in Ceará state. After this period, by means of RMC, 52,216 vaccination cards of children from 6 months to 5 years of age living in the state were checked, and 1,679 doses of MMR and MMRV vaccines were administered as at June 2015 (Table 1).

Of the 21 CRES, only four (Baturité, Itapipoca, Brejo Santo and Crato) did not reach the minimum

vaccination coverage of 95% for the first dose, and two CRES (Itapipoca and Russas) did not reach the minimum vaccination coverage for the second dose (Table 1).

RMC identified 836 (1.6%) children who had not been vaccinated against measles and 1,388 doses of vaccine that had not been administered for various reasons. More than one reason for non-vaccination was given for each child. Standing out among the 1,388 reported reasons for non-vaccination were the lack of parent/guardian time (n=219; 15.8%), lack of vaccine (n=135; 9.7%), lack of scheduling (n=110; 7.9%), and difficulty in getting to the place where vaccination was being done (n=36; 2.6%) (Table 2).

## Discussion

RMC revealed that Ceará state surpassed the goal for MMR and MMRV vaccination coverage. However,

four CRES did not reach minimum vaccination coverage of 95% for the first dose (Baturité, Itapipoca, Brejo Santo and Crato) and two did not reach the goal for the second dose (Itapipoca and Russas).

Vaccination coverage exceeding 100% found by RMC for the second dose of the MMR vaccine is explained by the fact that in 2015 Ceará state experienced MMRV (MMR and varicella) vaccine stockout, which corresponds to the second dose of MMR vaccine. As such, in the absence of the MMRV vaccine 2,879 children aged 15 months to less than 5 years old, received MMR vaccine and, subsequently, in order not to lose the opportunity to be vaccinated against varicella, and owing to the absence of monovalent varicella vaccine, they received a further dose using MMRV vaccine.

As part of the RMC strategy, all of Ceará's 184 municipalities conducted monitoring activities with

**Table 1 – Rapid Monitoring of Immunization Coverage (RMC) and number of first and second doses of MMR and MMRV vaccines administered, according to the regional health coordination offices, Ceará, 2015**

Regional Health Coordination	Doses applied (N)	RMC vaccination coverage (%)	
		Dose 1	Dose 2
1 <sup>st</sup> Fortaleza/22nd Cascavel	237	98.1	95.3
2 <sup>nd</sup> Caucaia	24	99.5	97.8
3 <sup>rd</sup> Maracanaú	155	97.8	96.1
4 <sup>th</sup> Baturité	67	92.0	119.3
5 <sup>th</sup> Canindé	19	99.6	149.0
6 <sup>th</sup> Itapipoca	214	90.8	84.2
7 <sup>th</sup> Aracati	–	100.0	100.0
8 <sup>th</sup> Quixadá	83	96.0	134.5
9 <sup>th</sup> Russas	48	97.3	93.9
10 <sup>th</sup> Limoeiro do Norte	–	100.0	98.4
11 <sup>th</sup> Sobral	7	96.8	118.1
12 <sup>th</sup> Acaraú	25	99.2	98.9
13 <sup>th</sup> Tianguá	13	95.1	119.7
14 <sup>th</sup> Tauá	51	94.9	138.3
15 <sup>th</sup> Crateús	100	96.7	119.8
16 <sup>th</sup> Camocim	32	100.0	103.1
17 <sup>th</sup> Icó	50	95.9	96.7
18 <sup>th</sup> Iguatu	47	99.3	99.6
19 <sup>th</sup> Brejo Santo	121	94.9	111.3
20 <sup>th</sup> Crato	140	93.2	104.9
21 <sup>th</sup> Juazeiro do Norte	246	95.1	99.6
<b>Ceará State</b>	<b>1,679</b>	<b>96.7</b>	<b>106.6</b>

**Table 2 – Reasons for non-vaccination against measles in children, according to the results of the Rapid Monitoring of Immunization Coverage, Ceará, 2015**

Reasons	N	%
Other reasons	820	59.1
Lack of time	219	15.8
Lack of vaccine	135	9.7
Lack of scheduling	110	7.9
Difficulty in going to the place of vaccination	36	2.6
Multiple injections at the same time	24	1.7
Loss/absence of vaccination proof	16	1.2
Refusal to be vaccinated	13	1.0
Primary Health Care unit closed	7	0.5
Medical contraindication	6	0.4
Adverse event in previous dose	2	0.1
<b>Total</b>	<b>1,388</b>	<b>100.0</b>

the aim of interrupting the epidemic. As coverage by Itapipoca CRES was less than 95%, it was advised to intensify vaccination in the following period with the aim of reaching all those not vaccinated against measles.

RMC enables one to know the vaccination status of the population in a short space of time, through information on proof of vaccination people living in a particular geographic area during household visits. The primary purpose of RMC is to reach those who have not been vaccinated and reduce the number those who are probably susceptible.<sup>12</sup> RMC actions have contributed to the reduction of morbidity and mortality from measles.

In Brazil, RMC began to be conducted on a larger scale in 2008. By 2012, three national RMC experiments had been performed following national vaccination campaigns: in 2008, with the aim of eliminating rubella and congenital rubella syndrome in people aged 12 to 39 years old; in 2011, after follow-up campaigns to maintain the elimination of measles and rubella in children aged 1 to 6 years old; and in 2012, after the child multivaccination campaign, to bring the vaccination status of children under 5 years of age up to date.<sup>12</sup>

A large number of unvaccinated children were found in Ceará in 2015, forming a pocket of individuals susceptible to infection. The reasons for non-vaccination were diverse, some of them being the fault of children's caregivers, such as lack of commitment to vaccination - either by simple refusal, loss of vaccination

cards or even lack of time alleged by parents/guardians. Other reasons for non-vaccination point to health service management shortcomings, including (i) difficult service user access to vaccination services, (ii) failures related to management of vaccination rooms - such as the lack of vaccination scheduling, which is a fundamental determinant for the guidance of parents/guardians, (iii) no immunobiological product stock assurance mechanism - since there have never been stockouts in Brazil, as well as (iv) lack of flexibility in health centre opening hours.

These results were similar to those presented in previous studies. Lack of parent time and difficult access were the main reasons reported for non-vaccination, according to the RMC carried out in Extended Western Health Region in the state of Minas Gerais, in 2012.<sup>13</sup> In another study conducted in Minas Gerais in 2013 in the municipality of Vespasiano, the reasons for non-vaccination were the same as those found in our study, such as lack of time, forgetfulness and refusal by parents; similarly, the Vespasiano student found that some children were sick during the monitoring implementation period, others had no proof of vaccination status and finally there were those who had experienced adverse events when receiving previous doses.<sup>14</sup>

A considerable number of other reasons were observed, but it is not possible to describe them since this information was not provided by data source used. We suggest that this limitation should be corrected in



future monitoring. It is also recommended that RMC data should be analyzed by each primary health care centre in order for local interventions to be implemented aimed at minimizing the factors indicated as reasons for non-vaccination of children at the place where they occurred.

In the Region of the Americas, the last case of endemic measles was reported in November 2002, eight years after the definition of the strategy for eliminating measles in the countries of the continent. Subsequent cases were imported, or occurred in people related to these imported cases.<sup>1</sup> Notwithstanding, Brazil has intensified its actions against the disease, focused on the goal of eradicating this disease.

Between 2001 and 2010, there were 135 confirmed cases of measles in Brazil, all of which were imported, laboratory-confirmed and with virus isolation. In 2010, there were three outbreaks of measles: (I) 3 cases in Pará state, (ii) 8 cases in Rio Grande do Sul state, and (iii) 57 cases in Paraíba state, with identification of the D4, B3 and B3 genotypes, respectively. All confirmed cases were caused by imported viruses. In 2010, during the outbreak in the state of Paraíba, 391 suspected cases were reported, of which 57 (14.6%) were confirmed and 334 (85.4%) discarded using laboratory criteria. Just one virus genotype (B3) was found in this outbreak.

The epidemiological analysis showed that between January and July 2011, 17 cases of measles were confirmed in Brazil, with identification of the D4 genotype, the genetic sequencing of which is similar to the genotype in circulation on the European continent. The age group affected ranged from 1 to 43 years of age, with average age of 5 years; 6 cases (31%) occurred in children aged under 5 years, showing a group of susceptible individuals in this age range.<sup>4</sup> The D8 genotype was found in Ceará state. This same genotype

was found in Latin America and the Caribbean between 2010 and 2015 in different years and countries.<sup>15</sup>

Eradication of measles is a Brazilian and International Public Health commitment. RMC needs to be carried out following vaccination campaigns in order to identify areas with lower vaccination coverage and to find out the reasons why children do not access vaccination. The importance of data quality must be emphasized in this process.

The national vaccination campaign strategies have shown excellent results over the years, whereby the first follow-up campaign against measles took place in 1995.<sup>4</sup> Thanks to the mobilization efforts of all health professionals involved, it has been possible to increase vaccine coverage. It is expected that regular vaccination campaigns, added to routine vaccination, will continue to ensure immunity among the population, thus minimizing the risks of an outbreak. Their success will depend on the continued commitment of all involved and whose support has been shown to be essential for the elimination of measles in Brazil and in the entire Region of the Americas.

### Authors' contributions

Moura ADA, Braga AVL, Carneiro AKB, Alves ECS and Canto EVS participated in the conception and design of the study, data collection, analysis and interpretation, writing and critical review of the manuscript, and wording of the final version to be published. Bastos CMM, Nunes IH, Figueiredo TWS, Garcia MHO and Teixeira AMS contributed to the conception and design of the study and critical review of the manuscript. All the authors have approved the final version and declared themselves to be responsible for all aspects of the study, ensuring its accuracy and integrity.

### References

1. Rosa FM, Melo FC, Pacheco FC, Siqueira GAM, Elídio GA, Grando IM, et al. Sarampo. In: Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Coordenação-Geral de Desenvolvimento da Epidemiologia em Serviços. Guia de Vigilância em Saúde [Internet]. Brasília: Ministério da Saúde; 2017 [citado 2018 fev 28]. v. 1. p. 119-34. Disponível em: <http://portalarquivos.saude.gov.br/images/pdf/2017/outubro/06/Volume-Unico-2017.pdf>
2. Ministério da Saúde (BR). Informe técnico da campanha de seguimento contra o sarampo. Brasília: Ministério da Saúde; 2011. 16 p.
3. Ministério da Administração Interna (PT). Portaria nº 452, de 22 de julho de 1977. Altera o quadro orgânico da PSP da Madeira [Internet]. Diário da República, Lisboa, 1977 jul 22, Série I [citado 2017 out 2]. Disponível em: <http://www.leideportugal.com/primeira-serie/portaria-n-o-452-77-interna-administracao-considerando-documento-50275>
4. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças Transmissíveis. Programa nacional de imunizações

- (PNI): 40 anos [Internet]. Brasília: Ministério da Saúde; 2013 [citado 2018 fev 28]. 228 p. Disponível em: [http://bvsmms.saude.gov.br/bvs/publicacoes/programa\\_nacional\\_imunizacoes\\_pni40.pdf](http://bvsmms.saude.gov.br/bvs/publicacoes/programa_nacional_imunizacoes_pni40.pdf)
5. Ministério da Saúde (BR). Departamento de Informática do SUS. Sistema de Informação de Agravos de Notificação. Sarampo: banco de dados [Internet]. 2015 [citado 2016 mai 09]. Disponível em: [www.sinan.saude.gov.br](http://www.sinan.saude.gov.br)
  6. Ministério da Saúde (BR). Fundação Nacional de Saúde. Manual de normas de vacinação [Internet]. Brasília: Ministério da Saúde; 2001 [citado 2018 fev 28]. 72 p. Disponível em: [http://bvsmms.saude.gov.br/bvs/publicacoes/funasa/manu\\_normas\\_vac.pdf](http://bvsmms.saude.gov.br/bvs/publicacoes/funasa/manu_normas_vac.pdf)
  7. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças Transmissíveis. Curso de atualização para o trabalhador da sala de vacinação: manual do monitor [Internet]. Brasília: Ministério da Saúde; 2014 [citado 2018 fev 28]. 242 p. Disponível em: [http://bvsmms.saude.gov.br/bvs/publicacoes/curso\\_atualizacao\\_sala\\_vacinacao\\_monitor.pdf](http://bvsmms.saude.gov.br/bvs/publicacoes/curso_atualizacao_sala_vacinacao_monitor.pdf)
  8. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças Transmissíveis. Protocolo de monitoramento rápido de cobertura (MRC) pós-campanha de vacinação contra a poliomielite em criança de 6 meses a menores de 5 anos de idade e pós-campanha com a vacina tríplice viral em crianças de 6 meses a menores de 5 anos de idade [Internet]. Brasília: Ministério da Saúde; 2015 [citado 2018 fev 28]. 31 p. Disponível em: [http://pni.datasus.gov.br/sipni/documentos/Protocolo\\_MRC\\_vers%E3o\\_27-01-2015.pdf](http://pni.datasus.gov.br/sipni/documentos/Protocolo_MRC_vers%E3o_27-01-2015.pdf)
  9. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Departamento de Vigilância de Doenças Transmissíveis. Curso de atualização para o trabalhador da sala de vacinação: manual do aluno [Internet]. Brasília: Ministério da Saúde; 2014 [citado 2018 fev 28]. 117 p. Disponível em: [http://bvsmms.saude.gov.br/bvs/publicacoes/curso\\_atualizacao\\_sala\\_vacinacao\\_aluno\\_3edicao.pdf](http://bvsmms.saude.gov.br/bvs/publicacoes/curso_atualizacao_sala_vacinacao_aluno_3edicao.pdf)
  10. 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.
  11. Secretaria da Saúde do Estado (CE). Secretaria do Planejamento e Gestão. Instituto de Pesquisa e Estratégia Econômica do Ceará (IPECE). Textos para discussão, nº 111. As regiões de planejamento do Estado do Ceará. Fortaleza: Secretaria da Saúde do Estado; 2015 [citado 2018 fev 28]. 58 p. Disponível em: [http://www.ipece.ce.gov.br/textos\\_discussao/TD\\_111.pdf](http://www.ipece.ce.gov.br/textos_discussao/TD_111.pdf)
  12. Teixeira AMS, Domingues CMAS. Monitoramento rápido de coberturas vacinais pós-campanhas de vacinação no Brasil: 2008, 2011 e 2012; *Epidemiol Serv Saúde*. 2013 dez;22(4):565-78.
  13. Santos GRD, Silva SS, Guimarães EAA, Cavalcante RB, Oliveira VC. Avaliação do monitoramento rápido de coberturas vacinais na Região Ampliada de Saúde Oeste de Minas Gerais, 2012. *Epidemiol Serv Saúde*. 2016 jan-mar;25(1):55-64.
  14. Castro AL, Soares ACS, Alves NC, Melo NMV, Ribeiro JGL, Rates SPM. Análise da cobertura vacinal em crianças de um a dois anos pelo Monitoramento Rápido de Cobertura em Vespasiano. *Rev Med Minas Gerais*. 2014;24(Supl 6):S15-20.
  15. Lemos DRQ. Epidemia de sarampo no Ceará em período pós-eliminação nas Américas: enfrentamento, resposta coordenada e avaliação de risco para reintrodução do vírus [tese]. Fortaleza: Universidade Estadual do Ceará; 2016.

Received on 21/12/2016  
Approved on 13/11/2017