Rev Soc Bras Med Trop 50(4):535-538, July-August, 2017
doi: 10.1590/0037-8682-0320-2016

Short Communication

Reemergence of mumps in São Paulo, Brazil – the urgent need for booster shot campaign to prevent a serious infectious disease

***Paulo Roberto Urbano*[1], *Dennis Minoru Fujita*[2] *and Camila Malta Romano*[1],[3]**

[1]. Instituto de Medicina Tropical de São Paulo, Universidade de São Paulo, São Paulo, SP, Brasil. [2]. Laboratório de Protozoologia, Instituto de Medicina Tropical de São Paulo, Universidade de São Paulo, São Paulo, SP, Brasil. [3]. Laboratório de Virologia, Hospital das Clinicas, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP, Brasil.

Abstract

Introduction: Neglected infectious diseases like mumps may be opportunistic in controlled areas with low vaccine coverage, particularly in developed and emerging countries. **Methods:** A retrospective analysis of mumps-related data from 2001 to 2016 for São Paulo State, Brazil was conducted. **Results:** From 2014 to 2015, there was an increase of 82% in reported mumps cases in São Paulo, with prevalence of n=49 and 297, respectively in young adults aged 15-29 years. **Conclusions:** A booster-shot campaign on MMR vaccination is recommended to prevent the spread of mumps in unvaccinated children and recipients of only the first dose.

Keywords: Mumps outbreak. São Paulo. Booster shot.

The recent mumps outbreaks in populations considered to have achieved high coverage of the vaccine, particularly in developed and emerging countries, suggest among other reasons a problem related to vaccine acceptance in these nations, which is mainly caused by a failure in booster vaccination and by individual/authorities negligence[1].

The mumps virus (MuV) is a member of the family Paramyxoviridae, subfamily Paramyxoviridae, and the genus *Rubulavirus*. Its negative-sense single-stranded ribonucleic acid (RNA) genome comprises 15,384 nucleotides that encode seven proteins, namely fusion (F) protein, hemagglutinin-neuraminidase (HN) protein, nucleocapsid-associated protein (NP), phosphoprotein (V/P/I), large (L) protein, small hydrophobic (SH) protein, and matrix (M) protein[2].

Humans are the only natural host for MuV, although other animal species, such as hamster, mouse, chicken embryo and non-human primates can be infected. However, the infection occurs only in laboratory experiments[3]. In humans, the incubation period is between 14 and 24 days, being transmissible via saliva droplets in the air from three days before to four days after the onset of parotitis[4,5].

MuV is responsible for mumps disease, characterized by unilateral or bilateral swelling of the parotid salivary glands, usually affecting children and young adolescents. Half of infected individuals develop the classic symptoms, while others may be asymptomatic or develop non-specific respiratory manifestations. The virus can also infect susceptible adults of any age, in whom the consequences can be more severe, leading to hearing loss, orchitis, oophoritis, pancreatitis, and meningo-encephalitis[6]. As a result, an increase in the incidence rates of orchitis may be observed in populations experiencing mumps outbreaks[7]. Among women who acquire mumps during the first trimester of pregnancy, more than 25% suffer a spontaneous abortion. Less common, but equally important, unilateral or bilateral deafness, the worst consequence of the infection may also occur and the rate today is about 1/20,000 cases[8].

The measles/mumps/rubella (MMR) vaccine contains live and attenuated strains of the measles, mumps, and rubella viruses. A single dose of vaccine is only partially effective (78-92%) against mumps virus, but a second dose can increase this effectiveness to 88-95%[9]. Globally, 290 cases per 100,000 population were reported between 1977 and 1985. With the introduction of the MMR vaccine in the late of 1960s, more than a 90% reduction in the incidence of mumps was achieved. In countries with no vaccination program against mumps, however, its incidence remains high, with epidemic peaks occurring every 2-5 years[10].

Nevertheless, even in countries with vaccination policies, outbreaks are reported every year. Besides the probably low acceptance of vaccine campaigns in some regions, such repeated reemergence of mumps may be attributable to several factors,

Corresponding author: Dra. Camila Malta Romano.
e-mail: cmromano@usp.br
Received 10 August 2016
Accepted 5 April 2017

including the low persistence of protective antibodies, the emergence of new strains capable of evading the vaccine, the difficulties in accessing hard-to-reach populations, the non-vaccination of children or adults motivated by ideological or religious reasons, as well as demographic and economic reasons. In particular, the lack of a booster dose during childhood, the astonishing misinformation about its benefits, and the fear of adverse effects from being vaccinated are among the main reasons that compromise the vaccine coverage for mumps[11]. As an example, the vaccination denial for children across Europe resulted in 26,000 cases of measles only in 2011[5].

Additionally, the combination of low or insufficient immunity and the continuous virus importation by travelers may contribute to the reintroduction of viruses in partially susceptible populations.

Brazil's immunization program is one of the most impressive in the world. The country makes most of its own vaccines, which are widely distributed. Since the 1970s, when the national vaccination program started, Brazil has experienced a sharp decline in infant mortality and deaths from infectious diseases[12]. Until 2013, the Brazilian vaccination schedule recommended the MMR vaccination of children at 12 months and the second dose in children from 4 to 6 years. A booster was recommended in adolescents 11-19 years of age, and a second booster after 20 years[13]. The 2016 updated schedule, however, recommends the MMR vaccine be applied at 12 months of age and a second dose at 15 months of age. Two additional boosters shots are indicated before 20 years of age, or a single dose in individuals over 20 years of age[14].

From 2014 to 2015, there was an 82% increase in the number of reported mumps cases in São Paulo State (**Figure 1**), with the highest incidence in young adults between 15-29 years of age (n=49 for 2014, and n=297 for 2015). This number is also higher than recorded in the 2003 and 2007/2008 outbreaks, considered as important outbreaks in the country. Although the previous vaccination program was reasonable, the campaigns for vaccination boosters are very ineffective, and only the first dose is usually applied.

The 2016 mumps outbreak appears to be the largest ever recorded in São Paulo in the last 10 years. São Paulo is the most populous state in Brazil and is the most important site of population movement to and from the state. As a consequence, nine Brazilian states recorded mumps outbreaks in 2016. The most affected regions were the South and Southwest regions (**Table 1**); only Espírito Santo and Rio de Janeiro (RJ) recorded no confirmed case. Probably the outbreak which occurred in 2015 in RJ, together with the implementation of the mass vaccination program in 2015 (that reached ~150,000 individuals), had some impact on the incidence of mumps in the state in 2016. In São Paulo, most cases were reported in people between 20-49 years of age [660 (38.7%) cases] followed by young people aged

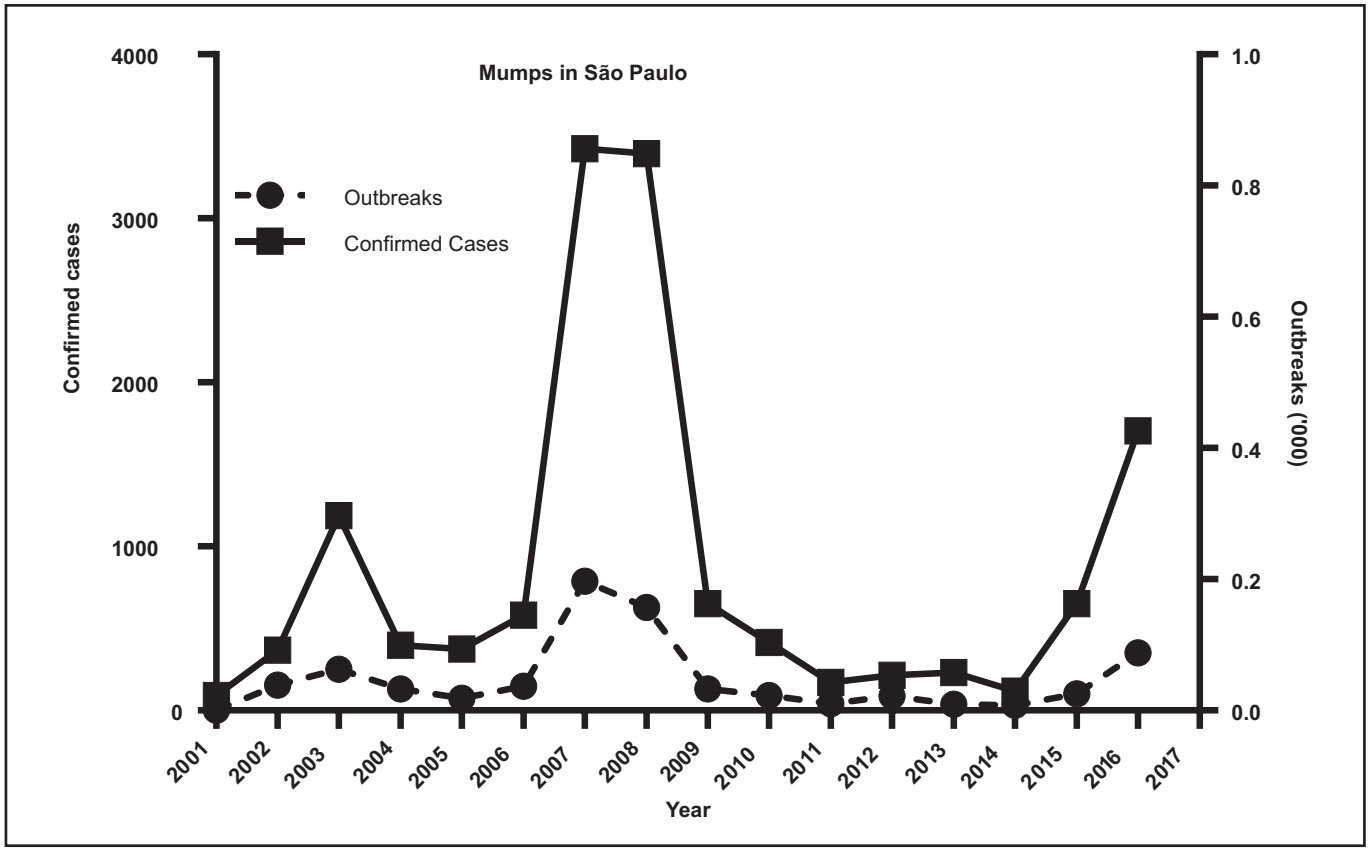

FIGURE 1 – The incidence of mumps in São Paulo, Brazil, 2001-2016. **Source:** SINANW/SINANNET/DDTR/CVE/CCD/SES-SP. *SINANNET: preliminary data: 25/07/2016.

TABLE 1

Brazilian states and their respective capitals with confirmed cases of mumps, divided by regions.

Mumps: confirmed cases/State – Brazil, 2016				
State	**Capital**	**Region**	**Confirmed cases***	**Cases between 20-29 years of age (%)**
Federal District	Brasília	Midwest	1,158	46.1
Goiás	Goiânia	Midwest	71	77.5
Mato Grosso	Cuiabá	Midwest	0	-
Mato Grosso do Sul	Campo Grande	Midwest	0	-
Alagoas	Maceió	Northeast	0	-
Bahia	Salvador	Northeast	73	74
Ceará	Fortaleza	Northeast	0	-
Maranhão	São Luis	Northeast	0	-
Paraíba	João Pessoa	Northeast	0	-
Pernambuco	Recife	Northeast	38	68.4
Piauí	Teresina	Northeast	**	-
Rio Grande do Norte	Natal	Northeast	0	-
Sergipe	Aracaju	Northeast	0	-
Acre	Rio Branco	North	0	-
Amapá	Macapá	North	0	-
Amazonas	Manaus	North	0	-
Pará	Belém	North	0	-
Rondônia	Porto Velho	North	0	-
Roraima	Boa Vista	North	0	-
Tocantins	Palmas	North	0	-
Espírito Santo	Vitória	Southeast	0	-
Minas Gerais	Belo Horizonte	Southeast	400	NA
Rio de Janeiro	Rio de Janeiro	Southeast	0	-
São Paulo	São Paulo	Southeast	1,704	38.7%
Paraná	Curitiba	South	613	NA
Rio Grande do Sul	Porto Alegre	South	113	NA
Santa Catarina	Florianópolis	South	43	NA

NA: data not available *Source: SINANNET - preliminary data - 25/07/2016. **The data available for Teresina is only related to the number of outbreaks (n=40) cities with the larger number of reported cases are in bold font.

15 to 19 years of age [507 (29.7%) cases], thus corroborating the need for a booster dose after childhood as well as the decline in vaccine coverage in the younger population (**Table 1**).

Several reasons can contribute to the continuous reemergence of mumps, but a definite solution to actually reducing the incidence of this disease is to increase the measures of prevention and vaccination campaigns in young adults. The 2016 Brazilian vaccination schedule seems to be very effective in the long term, but campaigns dedicated to encouraging adolescents and adults to receive the vaccine boosters are particularly important to prevent contagion among young adults since this age group is currently suffering from the weak immunity induced by a single

dose in the past[15]. A mass second dose vaccination campaign is challenging but is the only way to prevent the spread of the virus in unvaccinated children or those who received only the first dose. However, more studies are needed to determine the real reasons for the emergence of outbreaks.

Acknowledgments

The authors wish to acknowledge the assistance from *Instituto de Medicina Tropical de São Paulo, Universidade de São Paulo* (USP), Laboratórios de Investigação Médica LIM - 49/LIM – 52 do Hospital das Clínicas da Faculdade de Medicina/Universidade de São Paulo and Coordenadoria de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) agency.

Conflict of interest

The authors declare that have no conflicts of interest.

REFERENCES

1. Sabbe M, Vandermeulen C. The resurgence of mumps and pertussis. Hum Vaccin Immunother. 2016;12(4):955-9.
2. Elango N, Varsanyi TM, Kövamees J, Norrby E. Molecular cloning and characterization of six genes, determination of gene order and intergenic sequences and leader sequence of mumps virus. J Gen Virol. 1988;69(11):2893-900.
3. Rubin S, Eckhaus M, Rennick LJ, Bamford CGG, Duprex WP. Molecular biology, pathogenesis and pathology of mumps virus. J Pathol. 2015;235(2):242-52.
4. Watson JC, Hadler SC, Dykewicz CA, Reef S, Phillips L. Measles, mumps, and rubella--vaccine use and strategies for elimination of measles, rubella, and congenital rubella syndrome and control of mumps: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep. 1998;47(RR-8):1-57.
5. Centers for Disease Control and Prevention (CDC). Increased Transmission and Outbreaks of Measles−European Region, 2011. [Internet]. Weekly. 2011; 60(47)1605-10. Available from: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6047a1.htm
6. Yung CF, Andrews N, Bukasa A, Brown KE, Ramsay M. Mumps complications and effects of mumps vaccination, England and Wales, 2002-2006. Emerg Infect Dis. 2011;17(4):661-7.
7. Davis NF, McGuire BB, Mahon JA, Smyth AE, O'Malley KJ, Fitzpatrick JM. The increasing incidence of mumps orchitis: A comprehensive review. Vol. 105, BJU Int. 2010;105(8):1060-5.
8. Centers for Disease Control and Prevention (CDC). Epidemiology and Prevention of Vaccine-Preventable Diseases. In: Hamborsky J, Kroger A, Wolfe S, editors. 13th edition. Supplement. Washington, D.C.: Public Health Foundation; 2015. 12p.. Available from: http://www.cdc.gov/vaccines/pubs/pinkbook/mumps.html
9. Centers for Disease Control and Prevention (CDC). Mumps Vaccination [Internet]. 2016 [cited 2016 Jun 29]. Available from: http://www.cdc.gov/mumps/vaccination.html
10. Galazka AM, Robertson SE, Kraigher A. Mumps and mumps vaccine: a global review. Bull World Health Organ. 1999;77(1):3-14.
11. Tabacchi G, Costantino C, Napoli G, Marchese V, Cracchiolo M, Casuccio A, et al. Determinants of European parents' decision on the vaccination of their children against measles, mumps and rubella: a systematic review and meta-analysis. Hum Vaccin Immunother. 2016;12(7):1909-23.
12. Instituto Brasileiro de Geogerafia e Estatística. Observações sobre a evolução da mortalidade no Brasil: o passado, o presente e perspectivas. Rio de Janeiro: 2010. 56p.
13. de Martino Mota A, Carvalho-Costa FA. Varicella zoster virus related deaths and hospitalizations in Brazil before the introduction of universal vaccination with the tetraviral vaccine. J Pediatr. 2016;92(4):361-6.
14. Ministério da Saúde. Immunization Schedules - Brazil [Internet]. 2016 [cited 2016 Jul 2]. Available from: http://portalsaude.saude.gov.br/index.php/o-ministerio/principal/leia-mais-o-ministerio/197-secretaria-svs/13600-calendario-nacional-de-vacinacao
15. Poscia A, La Milia DI, Lohmeyer F, Teleman AA, de Waure C, Ricciardi W. Sexual behaviours and preconception health in Italian university students. Ann dell'Istituto Super di Sanità. 2015;51(2):116-20. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26156190.