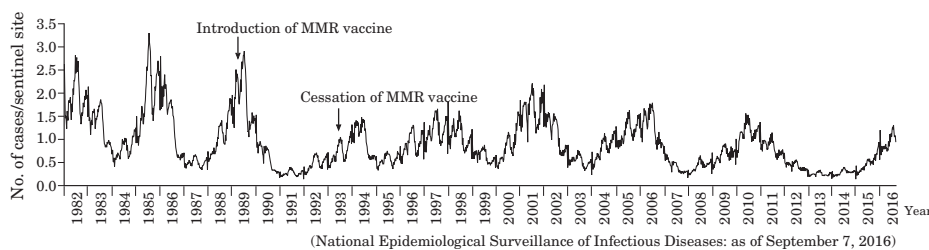


Genotype G mumps virus epidemics in Okinawa Prefecture, 2014-2015	187	Changes in seropositivity before and after the 2010-2011 mumps epidemic.....	199
Mumps epidemic in Ishikawa Prefecture, April 2015-March 2016	188	Summary and update regarding mumps vaccine.....	201
Phylogenetic analysis of the genotype G mumps virus detected in Osaka Prefecture since 2015	189	Notifications of adverse events after mumps vaccination, April 2013-June 2016	203
Epidemiological feature of the mumps epidemic in Tokunoshima, Kagoshima Prefecture, July 2015-June 2016	191	Emergency vaccination campaign in response to the rubella epidemic, Kawasaki City, April 2013-March 2014.....	204
Mumps epidemic and active surveillance for severe cases, Okinawa Prefecture, 2015	192	Confirmation of <i>Taenia asiatica</i> infection in Japan in August 2016 -Chiba Prefecture.....	206
Molecular epidemiological analysis of mumps virus circulating in Japan, 2012-2016	194	Laboratory diagnosis of legionella species at a non-overnight bathing facility repeatedly suspected as the source of legionella infection and hygienic measures taken, Nara Prefecture.....	206
Report of a mumps patient infected in Japan with subsequent symptom development during an American homestay and two Japanese contact cases who also developed symptoms after returning from the United States, July-August, 2016	195	Viruses detected from environmental waters in FY2015 through the environmental poliovirus surveillance program of the National Epidemiological Surveillance of Vaccine-Preventable Diseases	208
Diagnosis of mumps among outpatients.....	197		
Mumps vaccination status by age group in Japan, FY2015-National Epidemiological Surveillance of Vaccine-Preventable Diseases	198		

<THE TOPIC OF THIS MONTH>

Mumps (infectious parotitis) in Japan, as of September 2016

Figure 1. Weekly number of reported mumps cases from week 1 of 1982 to week 35 of 2016, Japan



Mumps is a common viral infection frequent among children. The causative agent is mumps virus (MuV) belonging to the family *Paramyxoviridae*, genus *Rubulavirus*. While there is only one serotype, there are 12 genotypes from A to N (E and M are lacking) based on the variation of the SH gene (IASR 34: 224-225, 2013).

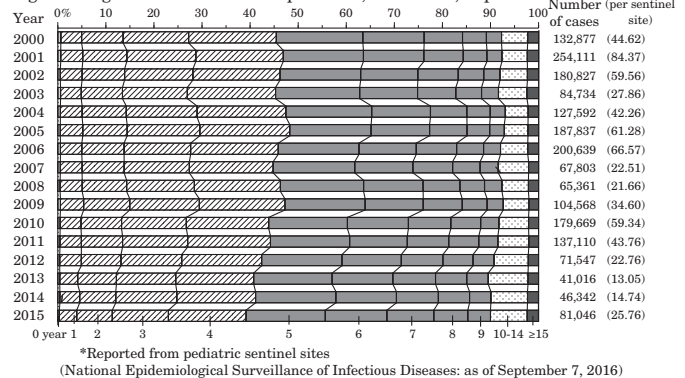
The main symptoms are fever and swelling and tenderness of the parotid gland. The prognosis is generally good. About 30-35% of infections are asymptomatic, but the proportion of symptomatic cases increases with age (20% among 1 year olds and 90% among those ≥ 4 years, according to some reports). Complications among cases include aseptic meningitis (1-10%), encephalitis (0.02-0.3%), pancreatitis and orchitis. The sensorineural hearing loss that occurs in 0.1-0.25% of cases is difficult to cure (see pp. 199 & 201 of this issue).

MuV is excreted into the saliva. Transmission is by droplet or contact from symptomatic or asymptomatic patients. The incubation period is 2-3 weeks. Cases are infectious from 6 days before the swelling of the parotid gland. The School Health and Safety Act designates mumps infection as a Class 2 school infectious disease; after the appearance of the swelling of the parotid, submandibular or sublingual gland, school attendance is prohibited for at least 5 days and till recovery of general health. The basic reproduction number (R_0) of mumps (the average number of persons infected by one patient in a 100% susceptible population) has been estimated to be 4-7 or 11-14, comparable to that of rubella or varicella (7-9 and 8-10, respectively) (see p. 199 of this issue) (R_0 for measles is estimated to be 16-21, <http://idsc.nih.go.jp/training/20kanri/003.html>). Based on this R_0 , the level of immunity necessary in the population for preventing a mumps epidemic is estimated to be 75-93% (see p. 199 of this issue).

Cases notified under the National Epidemiological Surveillance of Infectious Diseases: Mumps (infectious parotitis) is a category V infectious disease under the Infectious Diseases Control Law. It is monitored by approximately 3,000 pediatric sentinel sites, which report cases on a weekly basis (see <http://www.nih.go.jp/niid/images/iasr/34/402/de4021.pdf> for the notification criteria) (Fig. 1).

Though immunization with the mumps vaccine started in 1981 on a voluntary basis, the coverage remained low and large scale epidemics recurred at 3-5 year intervals. In April 1989, a measles-mumps-rubella (MMR) vaccine became possible to select as a routine immunization, which increased the mumps vaccine coverage and mumps notifications decreased. However, MMR vaccine was discontinued in April 1993 on account of the occurrence of aseptic meningitis following vaccination, which was attributed to the mumps

Figure 2. Age distribution of mumps cases*, 2000-2015, Japan



(THE TOPIC OF THIS MONTH-Continued)

vaccine component in the MMR vaccine (<http://www.mhlw.go.jp/stf2/shingi2/2r9852000000bx23-att/2r9852000000bybc.pdf>). Though monovalent mumps vaccine was used thereafter on a voluntary basis, vaccination coverage declined and large mumps epidemics recurred at 4-5 year intervals (Fig. 1). According to the National Epidemiological Surveillance of Vaccine-Preventable Diseases, the mumps vaccine coverage has been 30-40% in recent years (see p. 198 of this issue), and the proportion of antibody positive was approximately 70% (see p. 199 of this issue), which is an insufficient level of herd immunity to prevent an outbreak.

As mumps patients are reported from pediatric sentinel sites, the trend in mumps among adults is not precisely known. Among the patients notified, however, the proportion of patients aged <6 years has been declining (63.9% in 2009 and 55.6% in 2015) while that of patients older than ≥10 years has been increasing (~7% in 2004-2005 and 9.9-10.5% in 2013-2015) (Fig. 2).

There are, in addition, mumps patients reported as "aseptic meningitis" (see <http://www.nih.go.jp/niid/images/iasr/37/440/de4401.pdf> for the notification criteria) that were reported from the 500 designated sentinel hospitals with ≥300 beds. In 2006-2016, pathogens were detected from 10-20% of the patients notified as "aseptic meningitis" and among them, MuV occupied 42% of the detections and its detection rate increased during mumps epidemics (Fig. 3).

Mumps virus isolation/detection: Prefectural and municipal public health institutes (PHIs) conduct laboratory tests of specimens obtained from designated pathogen sentinel sites (~10% of the pediatric sentinel sites) and from all sentinel hospitals. From January 2006 to August 2016, PHIs isolated/detected MuV in 2,012 cases, among which 1,366 cases (68%) were diagnosed as mumps and 444 (22%) as aseptic meningitis (as of 14 September 2016) (Fig. 4).

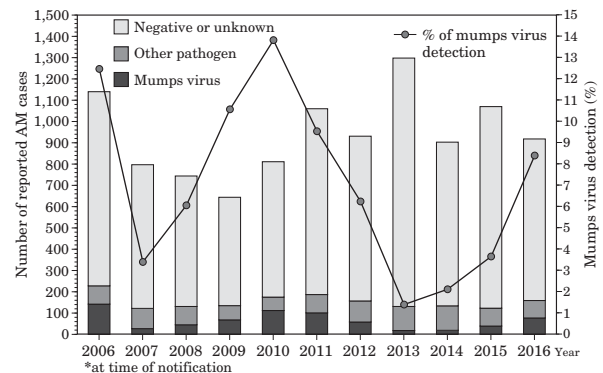
The epidemic MuV strain in Japan was genotype B in the 1980's, a mixture of B and J during 1993-1998, a mixture of G and L in 1999, and genotype G since 2000 (IASR 34: 224-225, 2013). Till 2016, the genotype G isolates were either Ge or Gw. However, Ghk genotype, which was phylogenetically related to the 2014 Hong Kong strain, was isolated in Okinawa Prefecture and Kitakyushu City in 2015-2016, and genotype F, which is endemic in mainland China, was isolated in Aichi Prefecture (see p. 194 of this issue).

Laboratory diagnosis: For the definitive diagnosis of mumps, laboratory diagnosis is indispensable (see p. 197 of this issue). The IgM test is useful if the patient has not been vaccinated. The methods detecting mumps genome include the RT-PCR method (MuV detection manual: <http://www.niid.go.jp/niid/images/lab-manual/Mumps2015.pdf>) and the simple and rapid RT-LAMP method. The RT-PCR method is particularly useful in identifying the genotype of the isolates, which is necessary for the definitive diagnosis of vaccine-related aseptic meningitis, phylogenetic analysis of the field isolates and tracing of infection routes (see pp.187-195 & 203 of this issue).

Mumps vaccine and its future perspective: Mumps is a vaccine-preventable disease. Currently 121 countries in the world implement the two-dose schedule as a routine vaccination (see p. 201 of this issue). Among the developed countries, only Japan has not yet included the mumps vaccine in the routine vaccination schedule. In a document that reviews vaccination systems, the Health Science Council of the Ministry of Health, Labour and Welfare, Division of Infectious Diseases, Vaccination Branch, stated that, mumps vaccine is one of the vaccines that should ideally be promoted widely.

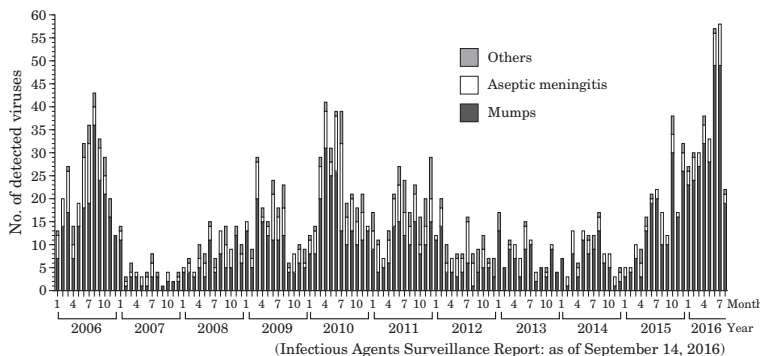
Currently, Hoshino and Torii strains are used for mumps vaccination in Japan, which is provided on a voluntary basis. Based on the number of vaccines delivered, across all age groups, the estimated rate of the post-vaccination aseptic meningitis of these vaccines was 1.62/100,000 (Ihara, *et al.*, Rinsho to uirusu 42: 174-182, 2014). According to Ihara *et al.*'s investigation, among those aged 1-3 years, post-vaccination aseptic meningitis occurred in 0.185/100,000 vaccinees, which was similar to the Jeryl-Lynn strain

Figure 3. Number of reported aseptic meningitis (AM) cases and proportion of cases positive for mumps virus*, 2006 to week 35 of 2016, Japan



*at time of notification
(National Epidemiological Surveillance of Infectious Diseases: as of September 7, 2016)

Figure 4. Monthly detection of mumps virus by syndrome, January 2006-August 2016, Japan



(Infectious Agents Surveillance Report: as of September 14, 2016)

The statistics in this report are based on 1) the data concerning patients and laboratory findings obtained by the National Epidemiological Surveillance of Infectious Diseases undertaken in compliance with the Law Concerning the Prevention of Infectious Diseases and Medical Care for Patients of Infections, and 2) other data covering various aspects of infectious diseases. The prefectural and municipal health centers and public health institutes (PHIs), the Department of Food Safety, the Ministry of Health, Labour and Welfare, and quarantine stations, have provided the above data.

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that has been used safely worldwide. It was also found that the frequency of aseptic meningitis declined with a decrease in the vaccinee's age. These figures were considerably lower than the frequencies of adverse events described in the document attached to the currently used vaccines, i.e. 1/2,300 for the Hoshino strain and 1/1,600 for the Torii strain.

From past experience, the development of a safe MMR vaccine is necessary. So as to prevent mumps epidemics and prevent mumps infection associated complications such as hearing loss, inclusion of the mumps vaccine into the routine vaccination schedule should be considered.