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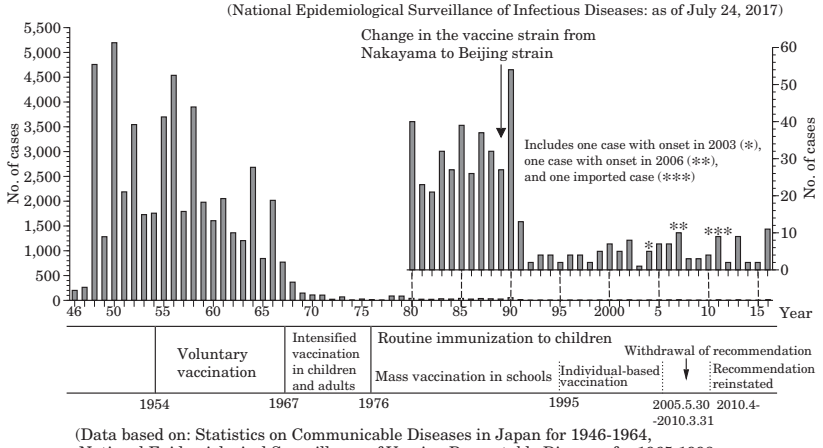
National Institute of Infectious Diseases and Tuberculosis and Infectious Diseases Control Division, Ministry of Health, Labour and Welfare

A case of infant Japanese encephalitis (JE) in Chiba Prefecture in summer 2015 153
Case report of a JE patient in summer 2015 and trends in detection of JEV in farmed pigs and mosquitoes in 1990 & 2008-2016 in Chiba Prefecture 154
Epidemiological investigation of JE in Tsushima City, Nagasaki Prefecture 155
Cluster of JE cases in Tsushima City, Nagasaki Prefecture in 2016 and investigation of mosquitoes and wild boars in the region 157
Trends in laboratory detections of JE and description of diagnostic methods used in Japan, 2007-2016 158
Seroprevalence of JEV neutralizing antibody and JE vaccine coverage in Japan, FY 2007-2016–National Epidemiological Surveillance of Vaccine-Preventable Diseases 159
Prevalence of anti-JEV HI antibody among farmed pigs in Japan, FY 2016–National Epidemiological Surveillance of Vaccine-Preventable Diseases 161
Prevalence of JEV among mosquitoes 162
History of JE vaccine in Japan and switching from mouse brain-derived vaccine to tissue culture-derived vaccine 164
Procurement of JE vaccine in Japan 165
Global situation update on JE and measures necessary for response 166
Assessing risk of infection following exposure to body fluids from a deceased patient with severe fever with thrombocytopenia syndrome (SFTS) 169
Detection of SFTS virus from the eschar of a patient with SFTS 170
Cluster of Japanese spotted fever cases in Yamaguchi Prefecture, September 2016 171
Cautionary points regarding genotyping of rotaviruses 172
Testing for highly pathogenic avian influenza virus among those engaged in culling or disposing of poultry in Hokkaido, December 2016 174
Food poisoning due to *Escherichia albertii*, May 2017–Utsunomiya City 175

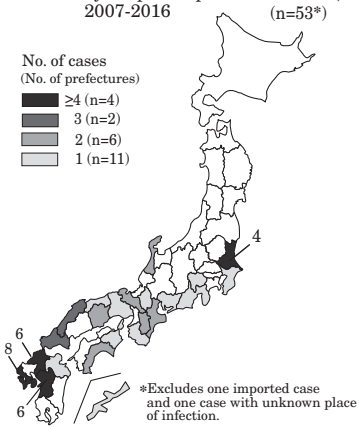
<THE TOPIC OF THIS MONTH>
Japanese encephalitis, Japan, 2007-2016

Figure 1. Reported number of Japanese encephalitis cases in Japan, 1946-2016
(National Epidemiological Surveillance of Infectious Diseases: as of July 24, 2017)



(Data based on: Statistics on Communicable Diseases in Japan for 1946-1964, National Epidemiological Surveillance of Vaccine-Preventable Diseases for 1965-1998, National Epidemiological Surveillance of Infectious Diseases for 1999-2016)

Figure 3. Japanese encephalitis cases by suspected place of infection, 2007-2016 (n=53*)



(National Epidemiological Surveillance of Infectious Diseases: as of July 24, 2017)

Japanese encephalitis (JE) is caused by JE virus (JEV) transmitted by *Culex tritaeniorhynchus*. Most infections are asymptomatic, but when symptomatic, after 1-2 weeks of incubation, case fatality can be 20-40% and half of the survivors will have sequelae. JE is a category IV notifiable infectious disease under the Infectious Diseases Control Law and all diagnosed cases shall be notified immediately (see http://www.nih.go.jp/niid/images/iasr/38/450/de4501.pdf for notification criteria). Prefectural public health institutes (PHIs) measure JEV antibody levels among humans and JEV infection levels among farmed pigs on a periodic basis, annually or once every few years, under the National Epidemiological Surveillance of Vaccine-Preventable Diseases (NESVPD) system. The collected data are collated and summarized at the National Institute of Infectious Diseases. This article describes the trends in JE from 2007-2016 (see IASR 30: 147-148, 2009 for data prior to 2008).

Notifications of JE: Until the 1960s, more than 1,000 JE cases were reported every year. With introduction of JEV vaccine in 1954 and reduction of mosquitoes due to environmental management, the number of reported cases decreased. The annual number of reported JE cases was reduced to under 50 (range 21-40) during the 1980s and to ~10 since 1992 (Fig. 1). During 2007-2016, a total of 55 JE cases (including one case that had developed symptoms in 2006) were reported. As of July 2017, no JE case has been reported so far in 2017.

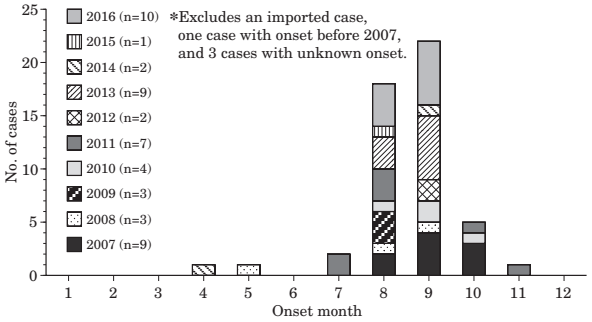
During 2007-2016, among the 55 reported cases, all but one case from India were infected in Japan. Among these 54 cases infected domestically, the month of onset for the majority of cases was August-September (Fig. 2); the earliest onset was April 14 (case infected in Hyogo Prefecture, 2014) and the latest November 18 (case infected in Nagasaki Prefecture, 2011). The suspected place of infection was from 23 prefectures, all located in the western half of the country (i.e. none east of the Kanto region), with many being in Kyushu region and Okinawa Prefecture (22 among 54 cases) (Fig. 3 in p. 152 of this issue). Among the total of 55 cases reported, 33 were males and 22 were females; 39 were aged ≥60 years and 7 were aged ≤10 years (Fig. 4 in p. 152 of this issue). Six of the cases (2 male cases and 4 female cases) were fatal at the time of notification.

JE vaccine (see pp. 164 & 165 of this issue): The vaccination schedule consists of two rounds. Under the routine vaccination scheme, vaccination in the first round consists of 2 shots in those at least 6 months but under 90 months of age and a third shot 1 year after the second dose; for the second round, one shot is administered in those at least 9 years but under 13 years of age. Under the standard vaccination scheme, the first round consists of 2 shots at 3 years of age and 1 shot at 4 years of age; for the second round, one shot is administered at 9 years of age. However, after the occurrence of a 10-month-old infant JE case in 2015 (see p. 153 of this issue), some local governments have implemented administration of vaccination at 6 months of age.

(Continued on page 152′)

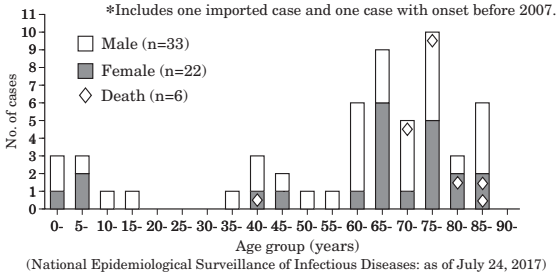
(THE TOPIC OF THIS MONTH-Continued)

Figure 2. Reported number of Japanese encephalitis cases by month of onset, 2007-2016 (n=50*)



(National Epidemiological Surveillance of Infectious Diseases: as of July 24, 2017)

Figure 4. Age distribution of Japanese encephalitis cases by gender, 2007-2016 (n=55*)



(National Epidemiological Surveillance of Infectious Diseases: as of July 24, 2017)

Prevalence of neutralizing antibody to JEV among humans (see p. 159 of this issue): Based on the national serosurvey in 2016 (Fig. 5), prevalence of the neutralizing antibody to JEV (measured as antibody titer ≥10) was <20% among children aged younger than 3 years, approximately 70% among those aged 3 years, and 80-90% among those aged 4 to 34 years. Based on serosurveys conducted from 1988 to 2016, among those older than 35 years, the prevalence of antibody was found to depend on birth cohort, based on 5 year age groups. For example, prevalence in those aged 65-69 years was approximately 90% in 1988 (1919-1923 birth cohort), 55% in 2008 (1939-1943 birth cohort), and 30% in 2016 (1947-1951 birth cohort), and the prevalence against JEV has been declining over time.

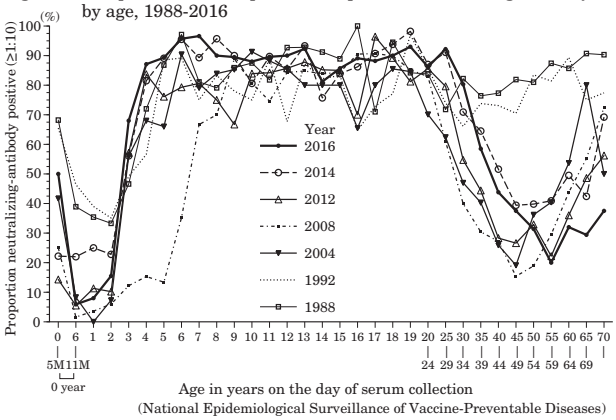
JEV infection in farmed pigs (see p. 161 of this issue): As JEV viremia remains high for a rather long period of 4-5 days in farmed pigs, and the mosquitoes that feed on infected pigs can transmit JEV to humans, farmed pigs are considered to be an important amplifier of JEV. As farmed pigs are generally shipped out of farms for human consumption at 6-10 months of age, there is a continuous presence of young pigs susceptible to JEV. Therefore, prevalence of anti-JEV HI antibody is measured in pigs 5-8 months after birth when they are brought into the slaughter houses in the summer, and this information is used for assessing the risk of JEV infection (Fig. 6). Human JE cases tended to be reported from locations reporting a high prevalence of anti-JEV HI antibody in farmed pigs (Fig. 3 and Fig. 6). In 2016, among the 33 prefectures investigated as of October, anti-JEV HI antibody was detected in 26 prefectures, with 17 prefectures having prevalence of anti-JEV HI antibody at levels of 50% or above. In 2016, Tsushima-City in Nagasaki Prefecture reported 4 JE cases. As there are no pig farms in Tsushima Island, animals other than farmed pigs, such as wild boars, were considered to be possible amplifiers of JEV (see pp. 155 & 157 of this issue).

Virus isolation/detection: Five JEV genotypes, I to V, have been described, and until 1980, only type III JEV had been isolated in Japan. However, since the latter half of the 1980s, type I JEV began to be detected, and became the dominant type detected since 1990 (see pp. 154 & 162 of this issue). Given the short viremic period in humans, detection of viral genome from JE patients is difficult (see p. 158 of this issue). Thus, further research into improving viral genome detection among humans should be pursued. At the same time, isolation and genome detection from mosquitoes and farmed pigs continue to be important for the monitoring of JEV transmission.

Conclusion: Since the 1990s, the annual number of reported JE cases has been at around 10 and remains low. In recent years, most cases were among the elderly ≥60 years of age with low immunity against JEV (Fig. 4). In countries that lack a JE vaccination policy, children ≤5 years of age constitute the largest number of JE cases, and 75% of all JE patients are aged ≤14 years (see pp. 166 & 168 of this issue). In Japan, JE patients ≤10 years of age have also been reported, and vaccination is an important measure against prevention of infection and disease.

The clinical diagnosis of JE is generally difficult as its clinical signs and symptoms are non-specific and the occurrence of the disease is rare. Thus, during the summer months, JE should be included in the differential diagnosis of encephalitis or encephalopathy of unknown cause and be proactively tested; doing so would also help in obtaining a more accurate picture of JE epidemiology.

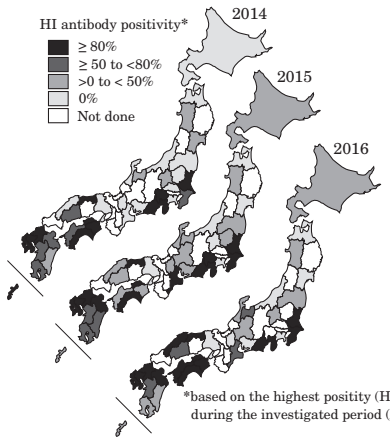
Figure 5. Seroprevalence of Japanese encephalitis neutralizing antibody by age, 1988-2016



(National Epidemiological Surveillance of Vaccine-Preventable Diseases)

Figure 6. Prevalence of HI antibody to Japanese encephalitis virus among pigs in Japan, 2014-2016

(National Epidemiological Surveillance of Vaccine-Preventable Diseases)



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.

Infectious Disease Surveillance Center, National Institute of Infectious Diseases
Toyama 1-23-1, Shinjuku-ku, Tokyo 162-8640, JAPAN Tel (+81-3)5285-1111