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# EPIDEMIOLOGICAL ASPECTS OF IMPORTED CHIKUNGUNYA FEVER AMONG OVERSEAS TRAVELERS IN JAPAN AND KOREA, 2013-2020

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## ABSTRACT

Chikungunya fever is a viral infectious disease. Japan and Korea are not epidemic regions for chikungunya; however, infections among overseas travelers are increasingly being reported. In the present study, we investigated the epidemiological status of imported chikungunya fever cases in Japan and Korea during 2013–2020 and compared their characteristics. Raw data of chikungunya fever cases in Japan were obtained from the National Institute of Infectious Diseases website and those in Korea were obtained from the Korea Center for Disease Control and Prevention website. During the study period, 122 cases of chikungunya fever were reported in Japan, with average annual incidence of 0.94/1,000,000 overseas travelers; 40 cases were reported in Korea, with average annual incidence of 0.23/1,000,000 overseas travelers; Japan had a 4.1-times higher incidence than Korea. Most imported infections in both countries were acquired in Asia, with Myanmar the main source of infection in both countries. Japan had 1.5 times more Myanmar-originated cases than Korea (27.0% and 17.5%, respectively). In 2019, the first epidemic in 9 years occurred in Myanmar, leading to 32 Japanese and 7 Korean chikungunya cases (65.3% and 43.8% of annual cases, respectively). If travelers heading to Myanmar had received appropriate warning, these infections might have been prevented. The seasonal distribution showed a similar pattern in both countries; summer and autumn, especially September, were high-risk seasons. Owing to these situations, systematic improvements are needed in both Japan and Korea to provide timely and appropriate information about the risks and preventive measures against chikungunya fever for individuals who travel to high-risk areas during high-risk seasons.

**KEYWORDS:** Chikungunya fever; Imported infection; Overseas travelers; Japan; Korea.

## INTRODUCTION

Chikungunya fever is a zoonotic disease caused by the chikungunya virus, which is transmitted by infected Aedes species mosquitoes.[1,2] Chikungunya fever was first recognized in 1952 during an outbreak in southern Tanzania. It is an RNA virus that belongs to the Alphavirus genus of the family Togaviridae.[2,3] Chikungunya virus is mainly transmitted to humans through the bite of infected female Aedes mosquitoes; however, maternal–fetal transmission can also occur, which results in high rates of infant morbidity.[2] Most commonly, the species involved are Aedes aegypti and Aedes albopictus. These mosquitoes bite throughout daylight hours, although there may be peaks of activity in the early morning and late afternoon.[3] Chikungunya virus infection causes fever and severe arthralgia. Other symptoms include muscle pain, joint swelling, headache, nausea, fatigue, and rash.[2] Chikungunya fever primarily occurs in Asia and Africa; however, imported cases have been recorded in other regions. Over 2 million cases of chikungunya fever have been reported since 2005.[3] Chikungunya virus has now spread to more than 100 countries and the pathogen is listed among World Health Organization Blueprint priority diseases.[4]

In the case of Japan and Korea, no indigenous chikungunya fever cases have been confirmed; all reported cases have been diagnosed in travelers from endemic or epidemic countries.[5-7] Considering this situation, Japan's Infectious Disease Control Law has classified chikungunya fever as a category IV notifiable infectious disease,[8] aiming for strict control of the disease. In Korea, the Infectious Disease Control and Prevention Act has classified this disease as a group III notifiable infectious disease.[9] However, despite these classifications, the number of imported infections in both countries has increased in recent years, which necessitates a better system to disseminate chikungunya risk information to people planning overseas travel.

Understanding the current status and trends of this disease in these two neighboring countries may provide information to promote improvement in control strategies for both countries. In the present study, we

investigated the epidemiological status of imported chikungunya fever cases among overseas travelers in Japan and Korea during the period 2013–2020 and compared their characteristics.

## MATERIALS AND METHODS

We analyzed the data of reported chikungunya fever cases in Japan and Korea from 2013 to 2020. During this period, accurate information of chikungunya fever infections was available in both countries. The data of 122 chikungunya fever cases in Japan were obtained from the website of the National Institute of Infectious Diseases, Infectious Disease Surveillance Center.[8] The data of 40 chikungunya fever cases in Korea were obtained from the Korea Center for Disease Control and Prevention (KCDC) website.[9] Information for overseas travelers in Japan and Korea was obtained from the JTB Tourism Research & Consulting Co. website[10] and e-Narajipyo website,[11] respectively. Information on the length of travel and nationality of patients was unavailable. We analyzed and compared the annual status of chikungunya fever outbreaks, geographic origin of chikungunya fever infections, and seasonal distribution of chikungunya occurrence in both countries.

## RESULTS AND DISCUSSION

Figure 1 shows the annual status of chikungunya fever cases in Japan and Korea. Japan had more cases than Korea over the entire study period. The highest number of cases was reported in 2019, with 49 in Japan and 16 in Korea. The number of chikungunya infections is thought to be related to the number of overseas travelers; however, as shown in Fig. 2, overseas travelers in Korea exceeded those in Japan from 2015. Chikungunya fever infections are expected to be consistent with the preferred travel destination. An obvious decrease in cases can be observed in 2020, owing to the pandemic of coronavirus disease 2019 (COVID-19), which led to a drastic decline in the number of overseas travelers.

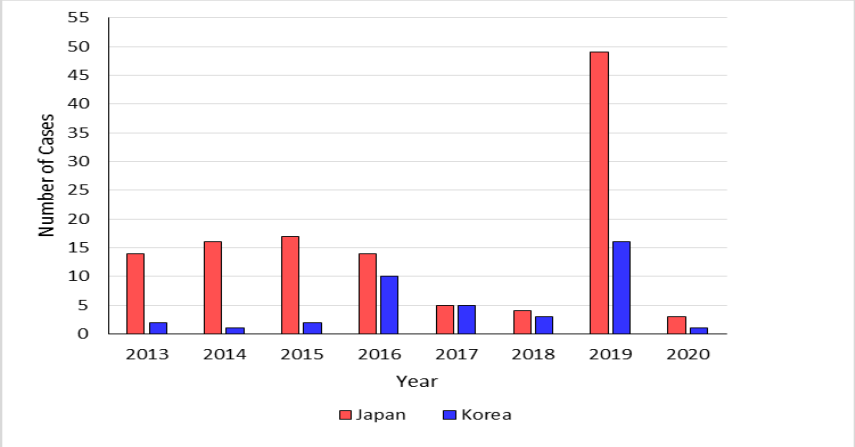


**Fig. 1: Annual status of chikungunya fever cases imported into Japan and Korea, 2013–2020.**

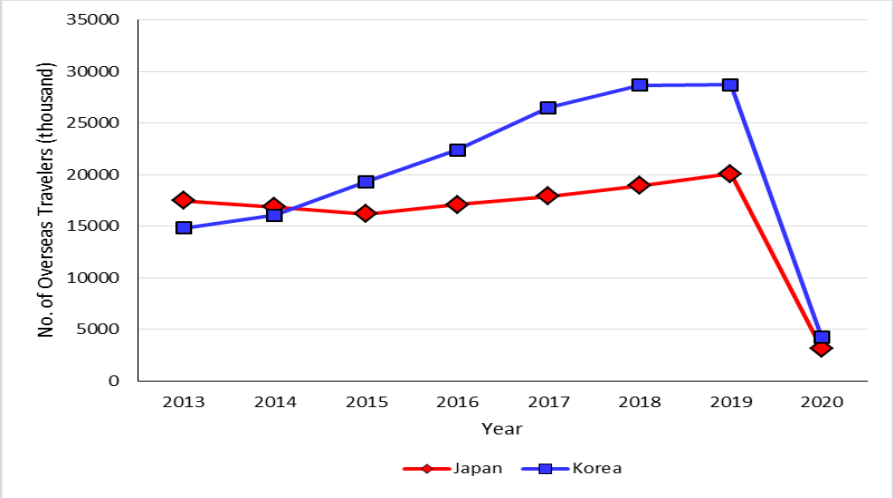


**Fig. 2: Annual trends in the number of overseas travelers in Japan and Korea, 2013–2020.**

Table 1 shows the status of chikungunya fever incidence in Japan and Korea between 2013 and 2020. In Japan, 122 cases of chikungunya fever were reported, with an average annual incidence of 0.94 (range 0.21–2.44) per 1,000,000 overseas travelers during the study period. During the same period in Korea, 40 cases were reported, with an average annual incidence of 0.23 (range 0.10–0.56) per 1,000,000 overseas travelers. By comparison,

the average annual incidence of the disease was approximately 4.1 times higher in Japan than in Korea. The population of Japan is approximately 2.4 times greater than that of Korea (126.2 million vs. 51.8 million in 2019, respectively).[12,13] However, during the study period, the total number of overseas travelers in Japan was 1.26 times lower than that in Korea (127.8 million vs. 160.8 million, respectively).[10,11] Given these facts, chikungunya fever infections were more frequent among Japanese people, even though Korean people were more engaged in overseas travel.

**Table 1: Characteristics of chikungunya fever cases in Japan and Korea, 2013–2020.**

| | No. of Cases (%) | |
|---|---|---|
| | **Japan** | **Korea** |
| No. of total cases | 122 | 40 |
| Average annual incidence per 1,000,000 overseas travelers | 0.94 | 0.23 |
| Suspected source country/areas | | |
| Asia | 95 (77.9) | 37 (92.5) |
| Myanmar | 33 (27.0) | 7 (17.5) |
| India | 18 (14.8) | 8 (20.0) |
| Philippines | 13 (10.7) | 4 (10.0) |
| Thailand | 6 (4.9) | 7 (17.5) |
| Indonesia | 17 (13.9) | 3 (7.5) |
| Malaysia | - | 2 (5.0) |
| Maldives | 3 (2.5) | - |
| Nepal | 1 (0.8) | - |
| Bangladesh | 1 (0.8) | 1 (2.5) |
| Laos | 1 (0.8) | 2 (5.0) |
| Vietnam | - | 2 (5.0) |
| Pakistan | - | 1 (2.5) |
| Cambodia | 1 (0.8) | - |
| Singapore | 1 (0.8) | - |
| Oceania | 8 (6.6) | - |
| Cook Islands | 2 (1.6) | - |
| Solomon Island | 1 (0.8) | - |
| Micronesia | 1 (0.8) | - |
| French Polynesia | 1 (0.8) | - |
| Tahiti | 2 (1.6) | - |
| Tonga | 1 (0.8) | - |
| Central and South America | 14 (11.5) | 2 (5.0) |
| Nicaragua | 2 (1.6) | - |
| Cuba | 1 (0.8) | - |
| Guatemala | 1 (0.8) | - |
| Colombia | 2 (1.6) | - |
| Bolivia | 1 (0.8) | - |
| Honduras | 1 (0.8) | - |
| Mexico | 1 (0.8) | - |
| Suriname | - | 1 (2.5) |
| Ecuador | - | 1 (2.5) |
| Jamaica | 2 (1.6) | - |
| Guyana | 1 (0.8) | - |
| St. Martin | 1 (0.8) | - |
| Dominican Republic | 1 (0.8) | - |
| Africa | 1 (0.8) | - |
| Angola | 1 (0.8) | - |
| Others or Unknown | 4 (3.3) | 1 (2.5) |

As shown in Table 1, the presumptive origin of imported chikungunya fever cases in Japan was as follows: Asia (77.9% of total cases), Oceania (6.6%), Central and South America (11.5%), Africa (0.8%), and Others or Unknown (3.3%); in Korea, these were Asia (92.5%), Central and South America (5.0%), and Others or Unknown (2.5%). In both countries, Asia was the region from which the most cases originated, and the case percentage in Korea was higher than that in Japan (92.5% vs 77.9%). Myanmar was the primary source of imported infections in both countries, with a 1.5-times higher proportion of Myanmar-originated cases in Japan than in Korea (27.0% and 17.5%, respectively). India was the main source of imported Korean cases (20.0%), with more cases originating in that country than among Japanese cases (14.8%). These differences are probably owing to differences between Japanese and Koreans in their preference of travel destination and the situation of chikungunya fever transmission in those travel destinations.

The seasonal patterns of chikungunya fever cases are shown in Fig. 3. In Japan, 12.3% of cases occurred in spring (March to May), 29.5% in summer (June to August), 41.8 % in autumn (September to November), and 16.4% in winter (December to February). In Korea, the proportions during these seasons were 10.0%, 32.5%, 42.5 % and 15.0%, respectively. These data showed that similar seasonal fluctuations existed in both countries, with summer and autumn being the seasons during which extra precautions against chikungunya fever infection are required. During the study period, the number of cases reported in Japan increased from June, peaked in September, and then decreased. Cases also peaked in September in Korea. These particular patterns of infection are expected to be related to periods when people in both countries are undertaking holiday travel and when chikungunya fever infections are most active in travel destination countries. It is reported that most patients who acquired chikungunya in Myanmar had been infected from August to October. A chikungunya epidemic occurred in Myanmar during 2019, the first in 9 years.[14] Owing to this epidemic, the number of infections increased sharply in 2019, with 32 Japanese and 7 Korean cases, accounting for 65.3% and 43.8% of annual cases, respectively. It is assumed that if travelers heading to Myanmar had been adequately warned in advance, these infections might have been prevented.

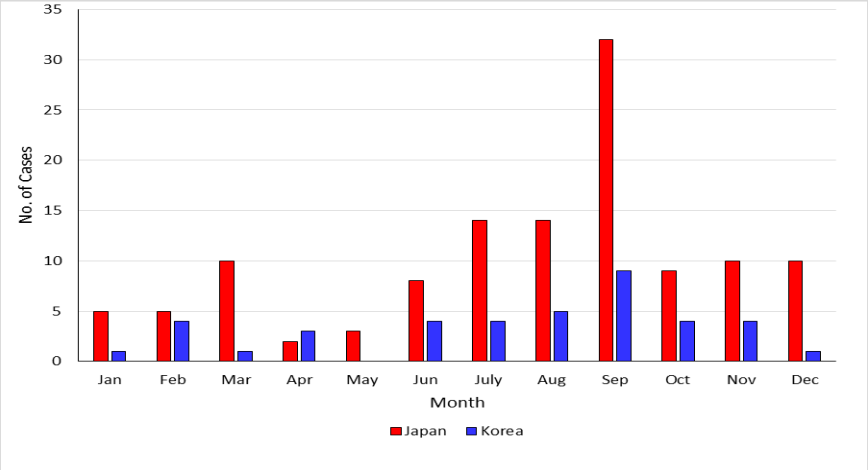


**Fig. 3: Distribution of chikungunya fever cases by month in Japan and Korea, 2013–2020.**

In Japan and Korea, legal systems are in place to prevent the harm caused by chikungunya fever. However, because the number of patients with chikungunya fever is small compared with other diseases, individuals traveling to epidemic areas may not be fully informed about the risks of this disease and how to avoid infection. Systematic efforts are needed to provide timely information that will improve knowledge regarding this potentially life-threatening disease that can lead to a variety of detrimental conditions.

In conclusion, the incidence of imported chikungunya fever infection was more frequent in Japan than in Korea. This is not necessarily owing to the total number of overseas travelers but it may be related to the frequency of travel to high-risk regions during high-risk seasons. In this regard, systematic improvements must be made in both Japan and Korea to provide overseas travelers with appropriate and easily available information on risks and preventive measures against this disease.

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