

Infectious disease activity during the COVID-19 epidemic in Japan: Lessons learned from prevention and control measures

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SUMMARY In Japan, the Law Concerning the Prevention of Infectious Diseases and Medical Care for Patients with Infectious Diseases (the "Infectious Diseases Control Law") classifies infectious diseases as category I-V infectious diseases, pandemic influenza, and designated infectious diseases based on their infectivity, severity, and impact on public health. COVID-19 was designated as a designated infectious disease as of February 1, 2020 and then classified under pandemic influenza as of February 13, 2021. According to national reports from sentinel surveillance, some infectious diseases transmitted by droplets, contact, or orally declined during the COVID-19 epidemic in Japan. As of week 22 (June 6, 2021), there were 704 cumulative cases of seasonal influenza, 8,144 cumulative cases of chickenpox, 356 cumulative cases of mycoplasma pneumonia, and 45 cumulative cases of rotavirus gastroenteritis; these numbers were significantly lower than those last year, with 563,487 cumulative cases of seasonal influenza, 31,785 cumulative cases of chickenpox, 3,518 cumulative cases of mycoplasma pneumonia, and 250 cumulative cases of rotavirus gastroenteritis. Similarly, many infectious diseases transmitted by droplets or contact declined in other countries and areas during the COVID-19 pandemic. One can reasonably assume that various measures adopted to control the transmission of COVID-19 have played a role in reducing the spread of other infectious diseases, and especially those transmitted by droplets or contact. Extensive and thorough implementation of personal protective measures and behavioral changes may serve as a valuable reference when identifying ways to reduce the spread of infectious diseases transmitted by droplets or contact in the future.

Keywords COVID-19, infectious diseases, influenza, chickenpox, mycoplasma pneumonia, rotavirus gastroenteritis

1. Introduction

As of June 30, 2021, the pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has resulted in 181,521,067 confirmed cases of coronavirus disease COVID-19 (COVID-19), including 3,937,437 deaths, worldwide according to a report from the World Health Organization (WHO) (1). Transmission of SARS-CoV-2 is mainly through direct, indirect, or close contact with an infected person by infectious secretions such as saliva, respiratory secretions, or droplets from an infected person, and the global population has generally been susceptible to COVID-19 (2-4).

Various prevention and control measures are being implemented globally to control the spread of SARS-CoV-2 (5-7). Studies indicated that COVID-19 prevention and control measures, including extensive

and thorough implementation of personal protective measures, limiting of public gatherings, and social distancing, can play a role in reducing the spread of other infectious diseases, such as influenza (8-10). The current work has reviewed infectious disease activity during the COVID-19 epidemic in Japan and discussed the lessons learned from COVID-19 prevention and control measures as a way to reduce the spread of other infectious diseases, and especially those transmitted by droplets or contact.

2. Current status of infectious diseases in Japan during the COVID-19 epidemic

The first case of COVID-19 was reported on January 16, 2020 in Japan (11). COVID-19 was designated as a designated infectious disease as of February 1, 2020 (12) and then classified under pandemic influenza as of

February 13, 2021 (13).

In Japan, the Law Concerning the Prevention of Infectious Diseases and Medical Care for Patients with Infectious Diseases (the "Infectious Diseases Control Law") classifies infectious diseases into the following categories: *i*) Category I Infectious Diseases (includes 7 diseases), *ii*) Category II Infectious Diseases (includes 7 diseases), *iii*) Category III Infectious Diseases (includes 5 diseases), *iv*) Category IV Infectious Diseases (includes

44 diseases), *v*) Category V Infectious Diseases (includes 24 diseases), *vi*) Pandemic Influenza (includes 4 diseases), and *vii*) Designated Infectious Diseases. The specific infectious diseases in each category are listed in Table 1.

The categories of infectious diseases according to the Infectious Diseases Control Law are determined based on their infectivity, severity, and impact on public health. These aspects are the basis for preventing and controlling

Table 1. Current categories of infectious diseases in Japan

Category	Disease
Category I Infectious Diseases (Surveillance of nationally notifiable diseases)	(1) Ebola hemorrhagic fever, (2) Crimean-Congo hemorrhagic fever, (3) Smallpox, (4) South American hemorrhagic fever, (5) Plague, (6) Marburg disease, (7) Lassa fever.
Category II Infectious Diseases (Surveillance of nationally notifiable diseases)	(8) Poliomyelitis, (9) Tuberculosis, (10) Diphtheria, (11) Severe acute respiratory syndrome (SARS), (12) Middle East respiratory syndrome (MERS), (13) Avian influenza (H5N1), (14) Avian influenza (H7N9).
Category III Infectious Diseases (Surveillance of nationally notifiable diseases)	(15) Cholera, (16) Shigellosis, (17) Enterohemorrhagic E. coli infection, (18) Typhoid fever, (19) Salmonella serovar paratyphi A.
Category IV Infectious Diseases (Surveillance of nationally notifiable diseases)	(20) Hepatitis E, (21) West Nile fever (including West Nile encephalitis), (22) Hepatitis A, (23) Echinococcosis, (24) Yellow fever, (25) Psittacosis, (26) Omsk hemorrhagic fever, (27) Relapsing fever, (28) Kyasanur Forest disease, (29) Q fever (Coxiella burnetii), (30) Rabies, (31) Coccidioidomycosis, (32) Monkeypox, (33) Zika virus infection, (34) Severe fever with thrombocytopenia syndrome (Phlebovirus), (35) Hemorrhagic fever with renal syndrome, (36) Western equine encephalitis, (37) Tick-borne encephalitis, (38) Anthrax, (39) Chikungunya fever, (40) Scrub typhus, (41) Dengue fever, (42) Eastern equine encephalitis, (43) Avian influenza (excluding H5N1 and H7N9), (44) Nipah virus infection, (45) Japanese spotted fever, (46) Japanese encephalitis, (47) Hantavirus pulmonary syndrome, (48) B virus disease, (49) Glanders, (50) Brucellosis, (51) Venezuelan equine encephalitis, (52) Hendra virus infection, (53) Typhoid fever, (54) Botulism, (55) Malaria, (56) Tularemia, (57) Lyme disease, (58) Lyssavirus infection, (59) Rift Valley fever, (60) Melioidosis, (61) Legionnaires' disease, (62) Leptospirosis, (63) Rocky Mountain spotted fever.
Category V Infectious Diseases (Surveillance of nationally notifiable diseases)	(64) Amoebiasis, (65) Viral hepatitis (excluding hepatitis E and A), (66) Carbapenem-resistant enterobacteriaceae infections, (67) Acute flaccid paralysis (excluding acute poliomyelitis), (68) Acute encephalitis (excluding West Nile encephalitis, Western equine encephalitis, tick-borne encephalitis, Eastern equine encephalitis, Japanese encephalitis, Venezuelan equine encephalitis, and Rift Valley fever), (69) Cryptosporidiosis, (70) Creutzfeldt-Jakob disease, (71) Invasive group A streptococcal infection, (72) Acquired immune deficiency syndrome (AIDS), (73) Giardiasis, (74) Invasive Haemophilus influenzae disease, (75) Invasive meningococcal disease, (76) Invasive pneumococcal disease, (77) Varicella (the patient requires hospitalization), (78) Congenital rubella syndrome, (79) Syphilis, (80) Disseminated cryptococcosis, (81) Tetanus, (82) Vancomycin-resistant Staphylococcus aureus infection, (83) Vancomycin-resistant Enterococcus infection, (84) Pertussis, (85) Rubella, (86) Measles, (87) Multi-drug-resistant Acinetobacter infection.
Category V Infectious Diseases (Sentinel surveillance)	<i>Weekly Report:</i> (88) Respiratory syncytial virus infection, (89) Pharyngoconjunctival fever, (90) Group A streptococcus pharyngitis, (91) Infectious gastroenteritis, (92) Varicella, (93) Hand, foot, and mouth disease, (94) Erythema infectiosum, (95) Exanthema subitum, (96) Herpangina, (97) Mumps, (98) Influenza (excluding avian influenza, novel influenza, etc.), (99) Acute hemorrhagic conjunctivitis, (100) Epidemic keratoconjunctivitis, (105) Chlamydia pneumonia (excluding psittacosis), (106) Bacterial pneumonia (excluding pathogens causing Haemophilus influenzae, Meningococcus meningitidis, or Streptococcus pneumoniae), (107) Mycobacterial meningitis, (108) Mycoplasma pneumoniae, (109) Aseptic meningitis. <i>Monthly Report:</i> (101) Genital chlamydia infection, (102) Genital herpes virus infection, (103) Condyloma acuminatum, (104) Gonococcal infection, (107) Penicillin-resistant streptococcus pneumoniae infection, (110) Methicillin-resistant staphylococcus aureus infection, (111) Drug-resistant pseudomonas aeruginosa infection.
Pandemic Influenza (Novel Influenza or Re-emerging Influenza) (Surveillance of nationally notifiable diseases)	(112) Novel influenza, (113) Re-emerging influenza, (114) Novel coronavirus infection (COVID-19)*, (115) Re-emerging coronavirus infection*.
Designated infectious diseases (Surveillance of nationally notifiable diseases)	--

*Novel coronavirus infection (COVID-19) and re-emerging coronavirus infection have been changed from a designated infection to pandemic influenza since February 13, 2021. Data source: <http://idsc.tokyo-eiken.go.jp/survey/sikkan>

Table 2. Main measures based on the Infectious Diseases Control Law

Items	Hospitalization advised	Self-quarantine required	Building access and traffic restrictions	Asymptomatic patients	Work restrictions
Category I Infectious Diseases	Possible	Not possible	Possible	Possible	Possible
Category II Infectious Diseases	Possible	Not possible	Not possible	Not possible	Possible
Category III Infectious Diseases	Not possible	Not possible	Not possible	Not possible	Possible
Category IV Infectious Diseases	Not possible	Not possible	Not possible	Not possible	Not possible
Category V Infectious Diseases	Not possible	Not possible	Not possible	Not possible	Not possible
Pandemic Influenza (Novel Influenza or Re-emerging Influenza)	Possible	Possible	*Possible under certain conditions	Possible	Not possible
Designated infectious diseases	Possible	Possible	Possible	Possible	Possible

*Only the provisions of Article 44-4 of the Infectious Diseases Control Law apply. Data Source: https://corona.go.jp/news/pdf/shiteikansensho_20200831.pdf

the transmission and spread of infectious diseases. Restrictions differ for each category of infectious disease (Table 2).

Sentinel surveillance and surveillance of nationally notifiable diseases are used collect information on infectious diseases pursuant to the Infectious Diseases Control Law. To ascertain the epidemiology of an infectious disease, sentinel surveillance is performed for specific Category V infectious diseases, and designated hospitals or clinics are required to report the number of cases and clinical data to a public health center on a weekly or monthly basis (Table 1). Public health centers report to the prefectural government and the Ministry of Health, Labor, and Welfare *via* an online reporting platform. Since 1999, the National Institute of Infectious Diseases has collected and analyzed clinical data from the platform and published the Infectious Disease Weekly Report (IDWR) (14,15).

According to the IDWR (16), some infectious diseases transmitted by droplets, contact, or orally declined during the COVID-19 epidemic. An example is the following 4 Category V Infectious Diseases:

i) The incidence of seasonal influenza is based on 5,000 sentinel surveillance sites (3,000 sites in pediatrics and 2,000 sites in internal or general medicine at hospitals and clinics). As of week 22 (June 6, 2021), there were 704 cumulative cases, compared to a total of 563,487 cases last year.

ii) The incidence of chickenpox is based on 3,000 sentinel sites in pediatrics. As of week 22 (June 6, 2021), there were 8,144 cumulative cases, compared to a total of 31,785 cases last year.

iii) The incidence of mycoplasma pneumonia is based on 500 sentinel sites in general medicine at hospital and clinics (with more than 300 beds). As of week 22 (June 6, 2021), there were 356 cumulative cases, compared to a total of 3,518 cases last year.

iv) The incidence of rotavirus gastroenteritis is based on 500 sentinel sites in general medicine at hospitals and clinics (with more than 300 beds). As of week 22 (June 6, 2021), there were 45 cumulative cases, compared to a total of 250 cases last year.

Moreover, the incidence of the above four infectious

diseases is significantly lower during the COVID-19 epidemic in Japan (2020-2021) compared with data from the past decade (2011-2020) (Figure 1).

3. Current status of infectious diseases around the world during the COVID-19 pandemic

Many infectious diseases transmitted by droplets or contact have declined in other countries and areas during the COVID-19 pandemic. The WHO reported significant declines in influenza virus infection in many countries such as the United States, Australia, and South Korea in 2020-2021. According to reports of visits for influenza-like illness (ILI) from the US Outpatient Influenza-like Illness Surveillance Network (ILINet), during week 22 (June 6, 2021), 1.2% of patient visits was due to ILI, which is below the national baseline of 2.6% (17). In Australia prior to week 22 (June 6, 2021), the National Notifiable Disease Surveillance System (NNDSS) reported 326 notifications of laboratory-confirmed influenza, which is significantly lower than the 5-year average for influenza. South Korea reported an overall weekly ILI rate of 1.9 ILI cases per 1,000 outpatient visits in week 23 (June 23) of 2021, and the ILI rate has been below the national epidemic threshold (5.8 ILI cases per 1,000 outpatient visits) since week 10 (March 8) of 2020 (18).

Moreover, the number of chickenpox cases has decreased in some areas of the United States during the COVID-19 pandemic. From January-April 2021, a total of 93 cases of chickenpox were reported in Florida, and 30 cases were reported in April 2021; this number is lower than the 5-year average (19). Minnesota reported 122 cases of chickenpox in 2020, which is the lowest incidence in 8 years compared to statistics from 2013 (20).

In China, a study noted a decrease in mycoplasma pneumonia among children after the outbreak of COVID-19 (21). Based on clinical data from 2017 to 2020, 34,977 patients with mycoplasma pneumonia were analyzed by year, season, sex, and age. The data revealed two outbreaks of mycoplasma pneumonia, the first occurring between October and December 2017 and the

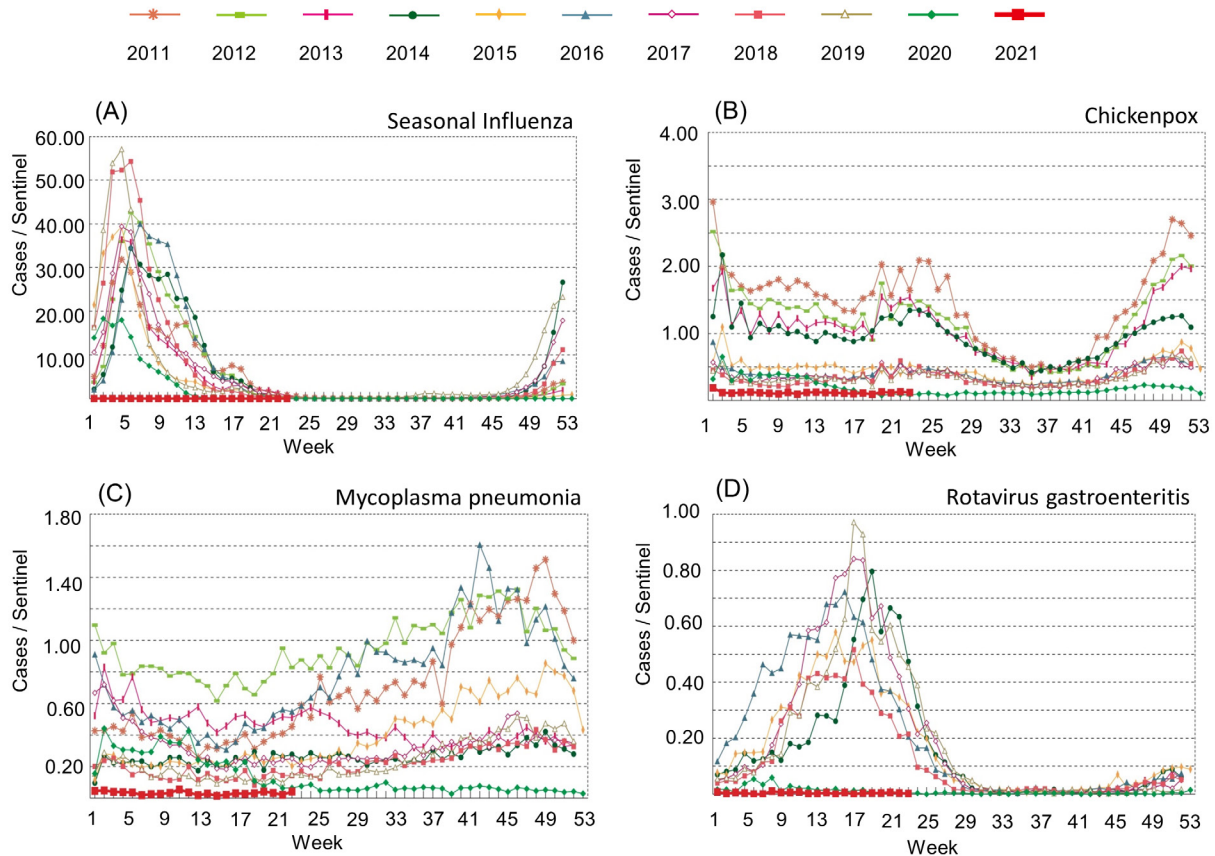


Figure 1. The number of cases reported from sentinel sites during 2011-2021 in Japan. (A) Seasonal influenza, (B) Chickenpox, (C) Mycoplasma pneumonia, and (D) Rotavirus gastroenteritis. Data source: <https://www.niid.go.jp/niid/images/idsc/idwr/IDWR2021/idwr2021-22.pdf>

second occurring between April 2019 and January 2020. However, mycoplasma pneumonia decreased due to restrictive measures and strict self-isolation implemented after the outbreak of COVID-19.

4. Have COVID-19 prevention and control measures reduced the incidence of infectious diseases transmitted by droplets or contact?

Infectious diseases are transmitted through multiple channels, such as droplets, contact, and orally. Seasonal influenza, chickenpox, and mycoplasma pneumonia are transmitted mainly through droplets and contact (22-24). Rotavirus gastroenteritis is mainly transmitted orally and by contact (25).

Various prevention and control measures have been and are being implemented during the COVID-19 epidemic in Japan, and especially during the three declared states of emergency (the first state of emergency was declared from April 7 to May 25, 2020, the second was declared from January 8 to March 21, 2021, and the third was declared from April 25 to June 20, 2021). Personal protective measures were thoroughly implemented, including wearing masks, handwashing, and avoiding confined spaces, crowded places, and close-contact settings. More importantly, behavioral changes adopted to constrain COVID-19 during the three declared

states of emergency reduced population density and contact with people, including closing schools, asking restaurants to reduce their business hours, teleworking, curbing the flow of people during vacation week (26).

During the COVID-19 epidemic, other infectious diseases transmitted by droplets, contact, or orally, such as seasonal influenza, chickenpox, mycoplasma pneumonia, and rotavirus gastroenteritis, have declined in Japan. One can reasonably assume that various measures adopted to control the transmission of COVID-19 have played a role in reducing the spread of other infectious diseases, and especially those transmitted by droplets or contact. Extensive and thorough implementation of personal protective measures and behavioral changes may serve as a valuable reference when identifying ways to reduce the spread of infectious diseases transmitted by droplets or contact in the future.

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