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Short Communication

Measles transmission at an international airport — Taiwan, March–April 2018

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ABSTRACT

During March–April 2018, an infectious measles index case traveling from Thailand led to two successive generations of measles transmission in Taiwan, with 21 cases confirmed. The median patient age was 30.5 years (range 22–47 years); six (27%) had documented receipt of one ($n = 3$) or more ($n = 3$) previous measles-containing vaccine doses at age ≥12 months. Epidemiological investigation and sequence analysis found that most ($n = 16$, 76%) measles transmissions had occurred in airport and flight settings; secondary and tertiary cases included cabin crew ($n = 7$), airport staff ($n = 2$), and passengers who had been at the same airport or on the same flight ($n = 7$). This investigation serves as a reminder that an international airport can be a hotspot for measles transmission. International travelers, airline cabin crew, and airport employees are recommended to check their vaccination status and ensure that they are fully vaccinated against measles. Furthermore, it is recommended that airline and airport employers have an occupational health vaccination program in place to ensure appropriate pre-employment assessment of measles immunity and vaccination.

On March 23, 2018, Taiwan Centers for Disease Control (TCDC) was notified by the Japan National Institute of Infectious Diseases of a measles case in a Taiwanese man (32 years old) with an unknown vaccination history. The patient had traveled from Taiwan to Bangkok, Thailand, where measles was widespread, during March 1–4. He had returned to Taiwan on March 4, went to work, and developed fever and cough on March 14. On March 17, he flew from international airport A in Taiwan to Okinawa, Japan, where he developed rash on March 19 and was confirmed to have measles by real-time RT-PCR testing. He remained in Okinawa until March 26, when he returned to Taiwan.

As persons with measles are infectious from 4 days before to 4 days after rash onset (CDC, 2018), TCDC recommended that local health departments begin tracing contacts of the case. These included household contacts, colleagues who shared the work area, cabin crew and passengers seated within two rows of the case during the flight to Okinawa, and persons who had attended the Taiwan clinic at the same time as the case and for 2 h after he had left. The flight involved a single-aisle six-abreast aircraft with seating capacity for 180 passengers, outfitted as a single cabin entirely with economy seats. To aid in identifying contacts, details of his itinerary during the infectious period were released through the Taiwanese media. Persons in Taiwan who might have been exposed were advised to notify their local health department if they developed symptoms of measles.

During March 30–April 5, nine additional measles cases were confirmed: three, including two cabin crew members and one coworker, were identified through contact tracing; six occurred in travelers who had been at Taiwan airport A at the same time as the index case or on the same flight (Figure 1). The travel records, boarding gate information, times of boarding and passing through passport control, and data from local metro cards (passengers pay for their transit by tapping the card over the reader both entering and exiting the stations/buses; the first pass registers the start of the journey and the second registers the end) for these six cases were reviewed; more than 100 photos inside the airport terminal buildings were used as visual aids to help the cases recall their route details. Two cases occurred in passengers who were on the same flight from airport A in Taiwan to Okinawa and seated four and 15 rows away from the index case; three in persons exposed to the index case at passport control; and one exposed in a duty-free shop.

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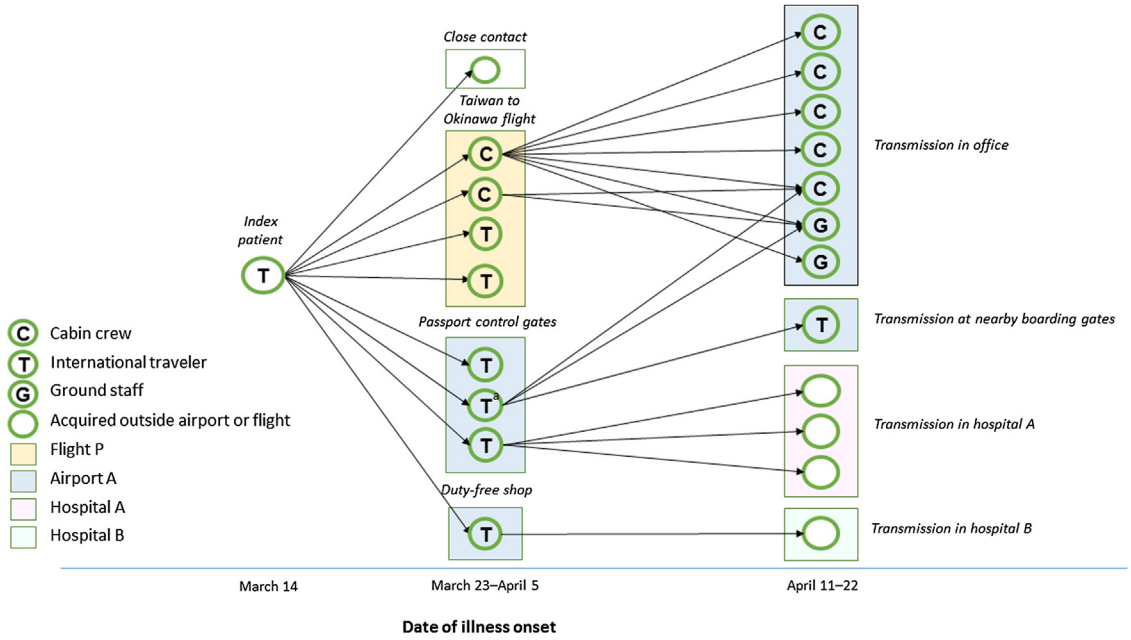

Figure 1. Transmission of measles from an international traveler — Taiwan, March–April 2018.
[a]The case was an airline cabin crew member who was traveling off duty at the time.

During April 13–22, 12 tertiary cases were confirmed, including five cabin crew members, two ground staff, one international traveler, and four (three patients/visitors and one health care worker) acquired through contact with secondary cases in hospitals (Figure 1). All of the cabin crew members worked for the same airline; they were required to report for duty at an office located in the airport terminal before scheduled departure of the flight. A review of their work shifts indicated that the five tertiary cases had stayed in that office at the same time or within 2 h after the three secondary cases. The two ground staff worked for other airlines in the area of offices, sharing the same aisle and bathroom.

The median patient age was 30.5 years (range 22–47 years). Among all 22 cases, six (27%) had documented receipt of one ($n = 3$) or more ($n = 3$) previous measles-containing vaccine (MCV) doses at age $\geq$12 months. Acute specimens collected for measles serological testing within 0–5 days of rash onset showed positive immunoglobulin (Ig) G and negative IgM antibodies in 15 (68%) cases. All cases were infected by measles genotype D8; the sequences of measles virus from the 21 available isolates in Taiwan were identical. No additional cases linked to this outbreak were identified in Taiwan after April. There were chains of measles transmission in Japan arising from the same index case, primarily in Okinawa (Mizumoto et al., 2018).

Measles virus is highly contagious and can remain infectious in the air for up to 2 h (CDC, 2018). This investigation identified multiple locations at the airport and the entire aircraft as exposure settings (Banerjee et al., 2015; Nic Lochlainn et al., 2016; Vega et al., 2014; Watanabe et al., 2017; Zhao, 2019). Routine measles contact tracing of aircraft passengers based on seating proximity is not recommended in the European and Australian guidelines (ECDC, 2009; CDNA, 2019); if initiated, however, eight rows from the case is the minimum distance that should be considered for contact tracing (ECDC, 2009). When investigating measles cases in travelers, expanded strategies, including routinely releasing the itinerary of the index case during their infectious period to identify unknown contacts (Beard et al., 2011; Nelson et al., 2013), are recommended by TCDC to facilitate the identification of exposures and additional cases.

MCV was introduced into the national immunization program in Taiwan in 1978, with the first dose administered at age 9 months and the second dose administered at age 15 months. Routine two-dose MCV administration at age 12–15 months and 6 years began in 2001, and >95% two-dose coverage among children aged 6 years has been documented (Liu et al., 2014). Catch-up vaccination of children born between 1976 and 1994 was offered during 1992–1994 and 2001–2004. A 2007 serosurvey of 3552 Taiwanese volunteers found a measles IgG seroprevalence of 75%, with lower rates (50%–60%) in adolescents and young adults (Chen et al., 2012). TCDC recommends that all adults who do not have documented receipt of two doses of MCV or serological evidence of measles immunity receive two doses of MCV, especially health care workers, women of childbearing age, international travelers, airline cabin crew, and airport employees. It is recommended that airline, airport, and hospital employers have an occupational health vaccination program in place to ensure appropriate pre-employment assessment of measles immunity and vaccination.

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Ethics approval

This investigation was conducted in accordance with the Communicable Disease Control Act of Taiwan as a public health response and therefore did not require Institutional Review Board approval.

Conflict of interest

All authors have completed and submitted the ICMJE form for disclosure of potential conflicts of interest. No disclosures were reported.

Author contributions

HIH, MCT, KBW, WYC, MTL, and WTH designed the study and collected data. HIH, MCT, KBW, WCC, ASH, WYC, and WTH established the analytic framework and contributed to the analyses. HIH was the primary analyst and wrote the first draft. WCC, ASH, and WTH critically appraised and revised the manuscript. All authors agreed the content to be submitted.

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References

Banerjee E, Hickman C, Engels K, Kenyon C, Centers for Disease Control and Prevention. Notes from the field: measles transmission in an international airport at a domestic terminal gate — April–May 2014. MMWR Morb Mortal Wkly Rep 2015;64:679.

Beard FH, Franklin L, Donohue SD, Moran RJ, Lambert SB, Maloney ME, et al. Contact tracing of in-flight measles exposures: lessons from an outbreak investigation and case series, Australia, 2010. Western Pac Surveill Response J 2011;2:25–33.

CDC. Measles (rubeola): for healthcare professionals. Atlanta, GA: US Department of Health and Human Services, CDC; 2018. . [Accessed 15 April 2019] https://www.cdc.gov/measles/hcp/index.html.

Chen CJ, Lee PI, Hsieh YC, Chen PY, Ho YH, Chang CJ, et al. Waning population immunity to measles in Taiwan. Vaccine 2012;30:6721–7.

CDNA. Measles: national guidelines for public health units. Canberra, Australia: Communicable Diseases Network Australia (CDNA); 2019. . [Accessed 24 July 2019] https://www1.health.gov.au/internet/main/publishing.nsf/Content/cdna-song-measles.htm.

ECDC. Risk assessment guidelines for infectious diseases transmitted on aircraft. Stockholm, Sweden: European Centre for Disease Prevention and Control (ECDC); 2009. . [Accessed 24 July 2019] https://ecdc.europa.eu/en/publications-data/risk-assessment-guidelines-infectious-diseases-transmitted-aircraft.

Liu DP, Wang ET, Pan YH, Cheng SH. Innovative applications of immunization registration information systems: example of improved measles control in Taiwan. Euro Surveill 2014;19:20994.

Mizumoto K, Kobayashi T, Chowell G. Transmission potential of modified measles during an outbreak, Japan, March–May 2018. Euro Surveill 2018;23:1800239.

Nelson K, Marienau K, Schembri C, Redd S. Measles transmission during air travel, United States, December 1, 2008 – December 31, 2011. Travel Med Infect Dis 2013;11:81–9.

Nic Lochlainn L, Mandal S, de Sousa R, Paranthaman K, van Binnendijk R, Ramsay M, et al. A unique measles B3 cluster in the United Kingdom and the Netherlands linked to air travel and transit at a large international airport, February to April 2014. Euro Surveill 2016;21:30177.

Vega JS, Escobedo M, Schulte CR, Rosen JB, Schauer S, Wiseman R, et al. Notes from the field: measles transmission at a domestic terminal gate in an international airport United States, January 2014. MMWR Morb Mortal Wkly Rep 2014;63:1211.

Watanabe A, Kobayashi Y, Shimada T, Yahata Y, Kobayashi A, Kanai M, et al. Exposure to H1 genotype measles virus at an international airport in Japan on 31 July 2016 results in a measles outbreak. Western Pac Surveill Response J 2017;8:37–9.

Zhao S. Epidemiology of an unexpected measles outbreak in Hong Kong, from March to April, 2019. Travel Med Infect Dis 2019;30:133–6, doi:http://dx.doi.org/10.1016/j.tmaid.2019.06.002.