Focus on Vaccine Preventable Diseases

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PLUS

Public Health Response to Monkeypox in Singapore
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Our ENB Quarterly this month focuses on vaccine-preventable diseases and for this purpose, we bring together four major articles describing different aspects of prevention and control.

First, we learn of findings from Singapore’s enhanced surveillance programme for measles and rubella in 2017. Last year, the World Health Organization verified that Singapore had interrupted endemic measles virus transmission for at least 36 months. This article provides timely caution on maintaining vigilance and vaccination coverage of the community to prevent outbreaks.

Next, authors analysed respiratory outbreaks in long-term care facilities and their characteristics, and reported influenza vaccination being effective as a protective factor. MOH recommends at least once a year vaccination in the young, old and immunocompromised who are at risk of disease complications. In the following article, we draw attention to an adult vaccinations schedule which, compared to childhood immunization, is a recent phenomenon. Our National Adult Immunisation Schedule was established in 2017 and the authors share relevant information on its history, recommendations and rationale.

Last, but not least, comes an article on travel medicine. This discipline encompasses pre-travel consultation, risk assessment, antimicrobial prophylaxis, vaccinations and post-travel consultation. With increasing international travel, travellers need to ensure that they are protected from exotic diseases while visiting these spots.

In Notes from the Field, we feature our first imported case of monkeypox in Singapore. This was a wake-up call to our readiness capabilities in managing emerging infectious disease and how effective response is made possible only through cooperation by the many affected stakeholders.

Enjoy!
Epidemiology and Control of Measles and Rubella Cases in Singapore, 2017

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INTRODUCTION

In Singapore, both measles and rubella are legally notifiable diseases under the Infectious Disease Act (IDA). Medical practitioners are required to report clinical cases of measles and rubella to the Communicable Disease Division (CDD) of the Ministry of Health (MOH) within 24 hours from the time of clinical suspicion, and the laboratories are required to report cases of measles and rubella within 24 hours upon laboratory confirmation.

Both diseases are highly transmissible with basic reproduction number ($R_0$) greater than one, and measles is known to be more transmissible than rubella.1 There are no specific antivirals to treat measles and rubella infection, and management of patients is mainly providing symptomatic treatment and to prevent secondary spread of the diseases. Nevertheless, effective vaccines to prevent measles and rubella infections are available and have been in use worldwide as early as 1960s. In Singapore, measles and rubella vaccines are offered in the form of a trivalent vaccine, together with mumps vaccine (MMR). Under the MOH’s National Childhood Immunization Programme (NCIP), the first dose of MMR is scheduled at 12 months of age, and the second dose is at 15 to 18 months of age. Vaccination against measles is compulsory by law.

The MOH had enhanced the surveillance of measles and rubella in 2012.2 This allows a more holistic management of all measles and rubella notifications, and prompt implementation of control measures to prevent further spread of the diseases in the community. In view of Singapore’s continuous efforts to keep measles transmission low, with the support from the National Verification Committee of measles elimination, Singapore was verified by the WHO to have eliminated of endemic transmission of measles in October 2018. We herein report on the measles and rubella situation in Singapore for 2017, covering on the epidemiology of measles and rubella cases notified to MOH.

DISEASE BACKGROUND

Measles is a ribonucleic acid (RNA) virus of the genus Morbillivirus. The virus is spread through inhalation of contaminated respiratory droplets and direct contact with nasal and throat secretion.3

Infected individual may develop symptoms between eight and 14 days after exposure. Generally, patient recovers from the infection after a week without interventions. Severe infection is more likely to occur in young children who are less than five years of age and are malnourished. Complications of measles include otitis media, laryngotracheobronchitis, diarrhoea and pneumonia.4 In developing countries, the case-fatality rate (CFR) is approximately 3% to 6%, and death is reported to be rare in developed countries.4

Rubella, also known as ‘German measles’, belongs to a different genus from measles virus. Also a RNA virus, rubella belongs to the genus Rubivirus, and shares the same transmission mode as measles.

Symptoms of rubella infection usually occur between two and three weeks following exposure. Similar to measles, most patients recover after a week without treatment, although rare complications including brain infection and bleeding problem have been reported.5,6 Infant with Congenital rubella syndrome (CRS) may develop hearing impairment, eye and heart problems, liver and spleen damage and other disabilities.7
EPIDEMIOLOGY OF MEASLES AND RUBELLA

Prior to the introduction of vaccines, the globally annual number of measles and its associated deaths were estimated to be 30 million and 2 million, respectively.\(^4\) Around 95% of the people had been infected with the virus by the age of 15 years. In 2017, the WHO reported 173,330 cases of measles and the associated deaths were estimated to be 110,000.

While rubella infection is generally mild in children and adults, infection during pregnancy especially in the first trimester can cause miscarriage, foetal death, stillbirth or CRS in newborn.\(^7\) In 1996, the WHO estimated the number of babies born with CRS in Africa, Southeast Asia and Western Pacific, where majority of the population were not vaccinated, to be 22,000 cases, 46,000 cases and 13,000 cases, respectively.\(^8\)

The World Health Assembly (WHA) endorsed the Global Vaccine Action Plan (GVAP) in 2012 and targeted to eliminate measles in five WHO regions by 2020.\(^4\) As of 2017, 37 countries in the European Region (EUR) had eliminated measles. In the South-East Asia Region (SEAR), only Bhutan and Maldives had achieved measles elimination. The Americas Region (AMR) was declared measles eliminated in September 2016. Lastly, nine countries and areas in Western Pacific Region (WPR) were verified to be measles eliminated. Under WHO’s guidance on elimination of measles and rubella, maintaining high immunization coverage is one of the strategies to halt endemic transmission of the diseases.\(^6\)

SURVEILLANCE OF MEASLES AND RUBELLA

Under the enhanced surveillance for measles and rubella, all notifications (laboratory confirmed and clinically diagnosed cases) of these two diseases will be reviewed and investigated by the MOH. MOH will offer laboratory testing to patients who are notified as clinical cases if the reported symptoms fit the clinical case definition.

The case definitions of measles and rubella are as follow:

Clinical measles case - An individual with clinical symptoms of fever and rash, and either cough, or coryza (runny nose), or conjunctivitis.

Confirmed measles case - An individual with clinical symptoms of measles (as above), and laboratory confirmed by polymerase chain reaction (PCR) or virus isolation or serology.

Clinical rubella case - An individual with clinical symptoms of fever and rash.

Confirmed rubella case - An individual with clinical symptoms of rubella (as above), and laboratory confirmed by PCR or serology.

Measles notifications

In 2017, the MOH received a total of 168 measles notifications from General Practitioners, polyclinics, hospitals and laboratories. Of the 168 notifications, 70 (42.7%) were laboratory-tested by the notifying institutions while the remaining 98 (58.3%) were clinically diagnosed cases.

Among the 70 notified cases with laboratory results, eight (11.5%) did not meet MOH’s case definition for confirmed cases, four (5.7%) tested positive for measles type A (vaccine strain), and the remaining 58 (82.8%) were classified as confirmed cases.

Of the 98 clinically diagnosed cases, 21 (21.4%) did not fit MOH’s clinical case definition and no further laboratory testing was performed. Of the 77 cases that fit the clinical case definition, 51 (66.2%) were tested negative, 13 (16.9%) were not tested and remained as clinical cases (cases refused testing or were uncontactable), 12 (15.6%) were tested positive, and one (1.3%) was tested positive for measles type A. (Table 1) Majority of the clinical cases were from the four years and below age group, and were found to be unlinked based on available information.

Confirmed cases

After reviewing all notified cases reported between January and December 2017, there were a total of 70 laboratory confirmed cases that fit the case definition of measles. This is a 48.5% decrease compared to 136 cases reported in 2016 (Figure 1).\(^9\) Figure 2 shows the age distribution of cases by gender. The highest proportion of cases were observed in the 25 to 44 years age group (41.4%), followed by the four years and below age group (32.9%).

Details of the vaccination history of the four years and below age group are summarised in Table 2.

Clusters

Investigation of the 70 confirmed cases revealed that 57 (81.0%) were unlinked and the remaining 13 involved five family clusters; four clusters had two cases each and one cluster had five cases.

The cluster of five cases involved a French family (one adult and four children aged between one
and seven years) who were in Singapore for the purpose of social visit. All five cases reported having symptoms prior to their arrival in Singapore, and all had an exposure to a known measles case in France. The four children had not received MMR vaccination, and the adult case was unsure of her vaccination history. Separately, it was noted that France had experienced measles outbreaks in 2017.10

Source of infection
In terms of source or country of infection, 50 (71.5%) of the 70 confirmed cases were classified as unknown, 19 (27.0%) were imported and one (1.5%)
was import-related (i.e. epidemiologically linked to an imported case). Among the 50 cases whose source of infection were unknown, there were nine with short travel history. These nine cases were not classified as imported because the number of days spent overseas was less than half of the incubation period for measles, and they did not report of any exposure to known measles overseas. The remaining 41 cases were sporadic and reported no contact with other measles cases nor had recent travel history. Figure 3 shows the countries where the 19 imported cases were likely to have been infected. Lastly, the import-related case was a household contact of an imported case.

Genotyping
Of the 70 laboratory confirmed cases, genotyping was performed on 42 biological samples. Genotyping was not performed on the remaining 28 cases as they were either tested positive by serology and/or had insufficient residual samples for/after PCR testing. The circulating measles genotypes detected in 2017 were similar to that of the previous years; and D8 and D9 were the predominant strains, which were also the common genotypes detected in the Southeast Asia region. It was noteworthy that there was no sample of B3 genotype detected in 2017, although the number of B3 in 2016 had increased compared to 2015.

Rubella notifications
In 2017, MOH received a total of 52 rubella notifications. Of the 52 notifications, 25 (48.1%) were laboratory tested by the notifying institutions, while the remaining 27 (51.9%) were notified as clinically diagnosed cases. Among the 25 cases with laboratory results, 13 met MOH’s case definition for confirmed cases. Further testing was not performed on eight (29.6%) of the 27 clinical cases, as these cases did not fit the clinical case definition of rubella. Of the remaining 19 cases that fit the clinical case definition, 13 (68.4%) were tested negative, four (21.1%) were not tested and remained as clinical cases (cases refused testing or were uncontactable), and two (10.5%) were tested positive (Table 3). Three of the four clinical cases were from the four years and below age group, and all cases found to be unlinked based on available information.
years age group, followed by the 45 to 54 years age group.

Unlike measles where more cases were males, the case ratio of male to female for rubella was approximately 1:3. Of the 11 female cases, nine (82%) were from the child bearing age group of 20 to 45 years.

Of the 15 confirmed cases, only one had received two doses of MMR vaccination, while the others had unknown vaccination records. No cluster was detected among the cases.

Source of infection
The source or country of infection was unknown for eight cases (53.3%), while the remaining seven cases (46.7%) were classified as imported. All seven imported cases had travel history to or had arrived from Indonesia.

Genotyping
Of the 15 laboratory confirmed rubella cases, genotyping was performed on three PCR positive samples. These three samples were from cases whose source of infection was unknown; two were

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Table 3. Classification of all notified rubella cases after investigations

| Total number of unique notifications (lab. confirmed + clinically diagnosed-only) | 52 |
| Notified with laboratory results* | 25 |
| Positive for rubella | confirmed case | 13 |
| Positive for rubella but does not have compatible symptoms | not a case | 12 |
| Notified as clinically diagnosed - only | 27 |
| Does not fit MOH's clinical case definition | not a case | 8 |
| Fit MOH's clinical case definition | 19 |
| Tested negative | not a case | 13 |
| Not tested | clinical case | 4 |
| Tested positive | confirmed case | 2 |

* Does not require MOH to offer laboratory testing. Cases may be notified as clinical cases first and subsequently followed up with laboratory results.
of the 1E genotype and one of 2B genotype (Table 4). The rubella genotypes detected locally in 2017 were also the circulatory strains reported in the Southeast Asia region.\(^{11}\)

**DISCUSSION**

Although Singapore has been verified to have achieved elimination of endemic transmission of measles, this does not imply that there will be no measles cases or clusters reported. Given that measles has a high \(R_0\) value, the virus can spread among susceptible close contacts and household members of an infected individual within a short exposure period. Similarly, reports of sporadic cases of rubella and small clusters are not unexpected, even though rubella is less transmissible than measles. Furthermore, there are groups of individuals in our population who are susceptible to measles and rubella. These include children who are too young to receive MMR vaccination or had missed vaccination, and adults who have never been vaccinated or have waning immunity or are immunocompromised.

The number of measles cases reported in 2017 were nearly half of that reported in 2016. Similar to previous year, a higher proportion of cases were observed in the younger age group of below four years, and in the adult age group of between 20s and 40s. Majority of the cases were found to be unlinked, suggesting that there were no protracted or ongoing transmission in the community. Nevertheless, it is not uncommon to observe occasional spikes in cases every two to three years, as noted in 2016, 2014 and 2011.

On the other hand, the number of rubella cases in 2017 remained relatively low and stable compared to 2016. As the number of cases were small, there was no obvious trend observed. Not all age groups had presentation of cases, and the number of cases in some age bands ranged from one to five. In 2016, the below four years age group reported the most number of cases. However, no case was notified from this age group in 2017.

Similar to measles, there was no ongoing
transmission of rubella in the community in 2017. All rubella cases were found to be unlinked. Although Singapore has yet to apply to WHO for verification of rubella elimination, the low figures suggested that there was no endemic transmission of rubella.

Prior to 2016, laboratory confirmation of rubella cases was performed mainly through serological methods. PCR testing and genotyping using rubella clinical samples were gradually introduced and adopted by the National Public Health Laboratory (NPHL) from 2016. This is in line with WHO's requirements for NPHL to perform the role as MMR reference laboratory in Singapore. Overall, the rubella and measles genotypes detected in 2017 were similar to the circulating strains reported in this region.

Our laboratory capacity and laboratory network at the hospitals have allowed prompt testing of suspected cases of measles and rubella, and the short turnaround time of the test results enables MOH to confirm cases and detect vaccine associated cases early. This enables MOH to implement public health control measures timely. Furthermore, phylogenetic analysis capabilities provided supportive molecular evidence, on top of the epidemiological findings, to determine if cases are linked and if there is endemic transmission of measles.

**CONCLUSION**

Moving forward, maintaining high MMR vaccination coverage is one of the key strategies to ensure that Singapore remains free from endemic transmission of measles and rubella. From the lessons learnt in other countries, surge in measles cases/outbreaks can occur rapidly with the decline in MMR vaccination and increase in anti-vaccine movements. Maintaining surveillance efforts as well as providing confirmatory laboratory tests and genotyping of the viruses are important for the prompt implementation of public health measures to prevent further spread of the diseases in the community and to protect the vulnerable groups, and as well as to monitor viral circulation and importation patterns.

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### Table 4. Distribution of rubella cases by genotype and source of infection, 2017

<table>
<thead>
<tr>
<th>Genotypes</th>
<th>Unknown</th>
<th>Imported</th>
<th>Import-Related</th>
<th>Total (No. of cases)</th>
<th>Country of origin</th>
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<tbody>
<tr>
<td>1E</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>2B</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-</td>
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<tr>
<td>Genotyping not performed</td>
<td>5</td>
<td>7</td>
<td>0</td>
<td>12</td>
<td>Indonesia (7)</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>7</td>
<td>0</td>
<td>15</td>
<td>-</td>
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REFERENCES


Influenza Infection and its Associated Factors Among Adults in Long Term Care Facilities, 2017

Yixiang Ng, Khine Nandar, Lily Ai Vee Chua
Public Health Group, Ministry of Health

INTRODUCTION

Influenza outbreaks occur periodically in long term care facilities (LTCFs) and vaccination is an important tool in preventing influenza infections. The Ministry of Health (MOH), Singapore recommends annual influenza vaccination for those who are at increased risk of influenza-related complications, including persons aged 65 years and above and residents of these facilities. LTCFs in Singapore report outbreaks of infectious diseases among their residents and/or staff to MOH. The MOH offers assistance to affected LTCFs to investigate the outbreaks. This includes providing advice on additional infection prevention and control measures and monitoring the situation. Outbreak investigations involve the collection and analysis of epidemiological information and the identification of causative pathogen(s) such as influenza through laboratory testing.

In this study, we described the epidemiological characteristics of LTCF residents or staff who were involved in respiratory outbreaks and were tested for influenza in Singapore, and also identified factors associated with influenza infection.

MATERIALS AND METHODS

This study retrospectively examined the outbreaks in LTCFs that occurred between 1 January and 31 December 2017 and were reported to MOH. As part of MOH’s outbreak investigations under the Infectious Diseases Act (IDA), random specimens of nasopharyngeal or throat swabs were collected from individuals who developed influenza-like illness (ILI) symptoms recently or were symptomatic at the time of the investigations. The samples were then sent to the National Public Health Laboratory (NPHL) for testing of influenza and other respiratory pathogens using FilmArray Respiratory Panel. Individuals were considered vaccinated if they were administered with any influenza vaccine 15 – 365 days prior to illness onset.

Proportions of selected characteristics (such as age group, gender, ethnic group and vaccination status) of those who tested positive and negative for influenza were compared using Chi-square test, or Fisher’s Exact Test where appropriate.

RESULTS

Based on the MOH’s outbreak investigations, 1006 LTCF’s residents and staff were involved in 26 respiratory outbreaks in 2017 that occurred in 20 different sites, with 4 sites reporting multiple outbreaks over the year. A total of 264 individuals who were tested for respiratory pathogens were included in the final analysis. They were aged between 18 to 104 years and had dates of onset ranging from 11 January 2017 to 30 November 2017. The majority of the individuals were in the age group 50-64 years old (38.3%) and were male (54.9%). Only 7.6% of the studied subjects were LTCF’s staff. 52.6% were classified as having been vaccinated according to the definition previously described. 146 individuals (55.3%) were tested negative for...
influenza while the remaining 118 (44.7%) were tested positive.

The influenza-negative group had a higher proportion of vaccinated individuals (56.9%), as compared to 47.5% in individuals who tested positive for influenza (p-value=0.01). Individuals who were more recently vaccinated, i.e. within 15-180 days prior to illness onset, were more likely to be tested negative for influenza. Subjects who tested positive for influenza had higher proportions of 65-79 year olds (29.6% vs 16.5%; p-value=0.01) and males (61.9% vs 49.3%; p-value=0.04) as compared to those who tested negative for influenza. Subjects who tested positive for influenza were also more likely to have their swab specimen collected closer to the

Table 1. Characteristics of flu-negative and flu-positive individuals

<table>
<thead>
<tr>
<th></th>
<th>All (n=264)</th>
<th>Flu-negative (n=146)</th>
<th>Flu-positive (n=118)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group (years)</td>
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<td>&lt;50</td>
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<td>50-64</td>
<td>101</td>
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<td>Gender</td>
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<tr>
<td>Female</td>
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<tr>
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<td>Ethnic group</td>
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<td>10</td>
<td></td>
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<tr>
<td>Malay</td>
<td>25</td>
<td>15</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>16</td>
<td>6</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Resident/Staff</td>
<td></td>
<td></td>
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<tr>
<td>Resident</td>
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<td>133</td>
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<tr>
<td>Staff</td>
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<tr>
<td>Vaccination status</td>
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<td>15 – 180 days</td>
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Table 1 (continued). Characteristics of flu-negative and flu-positive individuals

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<tr>
<th></th>
<th>All (n=264)</th>
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<th>Flu-positive (n=118)</th>
<th>P-value</th>
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<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
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<td><strong>Influenza subtyping</strong></td>
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<td>Negative</td>
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<td>Other respiratory viruses</td>
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<td>75</td>
<td>28.4</td>
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<td>-</td>
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<td>A not subtyped</td>
<td>11</td>
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<td>-</td>
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<td></td>
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<td>72</td>
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<td>25</td>
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<td>85</td>
<td>32.2</td>
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<td>July</td>
<td>16</td>
<td>6.1</td>
<td>8</td>
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<td>September</td>
<td>22</td>
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<tr>
<td>October</td>
<td>2</td>
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<tr>
<td>November</td>
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<td>4.2</td>
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<tr>
<td>December</td>
<td>0</td>
<td>0</td>
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<td>0</td>
</tr>
<tr>
<td><strong>Days from illness onset till swab collection</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>138</td>
<td>52.3</td>
<td>68</td>
<td>46.6</td>
</tr>
<tr>
<td>3-4</td>
<td>62</td>
<td>23.5</td>
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<td>&gt;7</td>
<td>21</td>
<td>8</td>
<td>16</td>
<td>11</td>
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date of onset, as 59.3% of them had their specimen collected within 2 days compared to 46.6% in influenza-negative subjects (p-value=0.01). (Table 1)

Out of the 118 subjects who tested positive, 32 (27.1%) tested positive for influenza A(H1N1) pdm09 and 75 (63.6%) were infected with A(H3N2), while the remaining 11 (9.3%) tested positive for influenza A but were not subtyped due to low viral titre. No one tested positive for influenza B.
The majority (83.1%) of the cases had influenza infections between April and July which coincided with the southern hemisphere influenza season (Table 1 & Figure 1).

**CONCLUSION**

The findings suggested that influenza vaccination was effective in preventing influenza infections. Further analysis should be conducted to quantify and estimate the effectiveness of the influenza vaccine during the LTCF’s respiratory outbreaks that occurred in 2017.

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1. World Health Organization. Influenza (seasonal): fact sheet. 31 Jan 2018


Establishment of National Adult Immunisation Schedule in Singapore

Yuske Kita¹, Wei Wei Tiong², Ee Hui Goh¹, Ethan Goh¹, Vernon Lee¹

¹Communicable Diseases Division, Ministry of Health, ²Regulatory Policy and Legislation Division, Ministry of Health

INTRODUCTION

Vaccination is one of the great public health achievements, and has contributed to the reduction in mortality and increase in life expectancy among children.¹ Diphtheria, tetanus, pertussis (DTP), polio and measles vaccines have been introduced in the national schedules in all countries around the world and more than 80% of children received vaccines for protection against tuberculosis (TB), hepatitis B, DTP, polio and measles in 2017 globally.²

Vaccination for adults is also recognised as a public health priority, especially in countries with increasing ageing population.³ In Singapore, recommendations were issued for individual adult vaccinations as standalone guidelines. Over time, the collection of recommendations were not easily referenced. Separately, MediSave use was also not uniformly extended to all recommended adult vaccinations. A comprehensive national schedule for adult vaccinations, with a uniform approach towards lowering financing barrier was necessary to increase awareness among the public and encourage take-up. This paper describes the establishment of a National Adult Immunisation Schedule (NAIS) in Singapore.

NATIONAL ADULT IMMUNISATION SCHEDULE

In November 2017, the Ministry of Health (MOH) established the NAIS to increase the awareness and facilitate the take-up of important vaccinations for adults (i.e persons aged 18 years and older) for personal protection and prevention against vaccine-preventable diseases.⁴ The NAIS was formulated in consultation with MOH’s Expert Committee on Immunisation (ECI). Main considerations for the recommendations in the NAIS included specific adult groups' vulnerability to vaccine-preventable diseases e.g. age, occupation, pre-existing medical conditions, vaccination history as well as clinical- and cost-effectiveness of the vaccines.

The NAIS provides guidance to the public and healthcare professionals on: 1) the recommended adult vaccines; 2) the target population groups; and 3) the schedule and frequency of vaccinations. Currently, the NAIS comprises recommendations for vaccinations against 11 diseases (Table 1). Many of these vaccinations are also recommended for healthcare workers.⁵

Influenza

Influenza vaccination is recommended for the prevention of influenza-associated complications for persons in high-risk groups, such as adults aged 65 years or older, as well as those below 65 years of age with chronic diseases, including cardiovascular, pulmonary, metabolic, renal, neurologic, hepatic or haematologic disorders, or those who are immunosuppressed; women at all stages of pregnancy and persons receiving intermediate and long term care (ILTC) services. Influenza-associated complications include secondary bacterial pneumonia, primary influenza viral pneumonia, Reye syndrome, myocarditis and worsening of chronic pulmonary diseases.⁶ Vaccination of persons staying in ILTC facilities can reduce the risk of influenza outbreak in such facilities.⁷

Vaccination is recommended once or twice a year depending on vaccine composition. Recommendations for influenza vaccination, including the frequency of vaccination (yearly or six-monthly) are published in the bi-annual MOH Circular on the seasonal influenza vaccination at the beginning of northern and southern hemisphere influenza seasons.
## Table 1. Summary of National Adult Immunisation Schedule (NAIS) (For persons aged 18 years and older)*

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>18-26 years</th>
<th>27-64 years</th>
<th>≥ 65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Influenza† ‡</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 dose annually</td>
<td></td>
<td></td>
<td>1 dose annually</td>
</tr>
<tr>
<td><strong>Pneumococcal (PCV13/PPSV23)§ ‡</strong></td>
<td></td>
<td>1 or 2 doses</td>
<td></td>
</tr>
<tr>
<td>(dose and type depends on indication)</td>
<td></td>
<td>1 dose each</td>
<td></td>
</tr>
<tr>
<td><strong>Human papillomavirus (HPV)¶ ‡</strong></td>
<td></td>
<td>3 doses</td>
<td></td>
</tr>
<tr>
<td><strong>Hepatitis B ‡</strong></td>
<td></td>
<td></td>
<td>3 doses</td>
</tr>
<tr>
<td><strong>Tetanus, diphtheria and pertussis (Tdap) ‡</strong></td>
<td></td>
<td></td>
<td>1 dose per pregnancy</td>
</tr>
<tr>
<td><strong>Measles, mumps and rubella (MMR) ‡</strong></td>
<td></td>
<td></td>
<td>2 doses</td>
</tr>
<tr>
<td><strong>Varicella ‡</strong></td>
<td></td>
<td></td>
<td>2 doses</td>
</tr>
</tbody>
</table>

Recommended for adults who have not been previously vaccinated or lack evidence of past infection/immunity

Recommended for adults with specific medical conditions or indications

### Footnotes:

* Please refer to MOH Circular 23/2017 dated 19 Sep 2017 and MOH Circular 23A/2017 dated 3 Nov 2017 for further details on vaccination schedule and specific vaccine recommendations in the NAIS.¹²,¹³

† Please refer to the semi-annual seasonal influenza vaccine circulars for the latest recommendations.

‡ Pneumococcal vaccines in the NAIS include 13-valent pneumococcal conjugate vaccine (PCV13) and 23-valent pneumococcal polysaccharide vaccine (PPSV23).

¶ Two types of HPV vaccines are currently in the NAIS – bivalent HPV vaccine (HPV2) and quadrivalent HPV (HPV4) vaccine.

### Explanatory notes:

¹ Existing recommendations, no change in target groups, schedule or MediSave use.

‡ New recommendation for pregnant women; MediSave use now allowed.

§ New recommendations for adults who have not been previously vaccinated or lack evidence of past infection/immunity; MediSave use now allowed.
Pneumococcus
Pneumococcal vaccination is recommended for the prevention of severe pneumococcal disease and associated complications for persons in high-risk groups, such as adults aged 65 years or older, and persons below 65 years of age who have chronic diseases, including pulmonary, cardiovascular, renal, or hepatic disease, or diabetes mellitus. Other recommended groups include persons with cochlear implants, cerebrospinal fluid leaks, anatomic or functional asplenia, or those who are immunosuppressed. Pneumococcal pneumonia, bacteraemia and meningitis are the three major clinical presentations of pneumococcal disease. Pneumococcal vaccines in the NAIS include 13-valent pneumococcal conjugate vaccine (PCV13) and 23-valent pneumococcal polysaccharide vaccine (PPSV23). One dose of PCV13 and one or more doses of PPSV23 are recommended, depending on age and medical condition.

Human papillomavirus (HPV)
Under the NAIS, the HPV vaccination is recommended in all females aged 18 to 26 years for the prevention of HPV infection (due to types 16 and 18) which, if untreated, may lead to precancerous lesions and cervical cancer. Three doses are recommended over a period of six months. Two types of vaccines are currently recommended in the NAIS: bivalent (HPV2) and quadrivalent (HPV4) vaccines. The recommendations for HPV vaccination under the NAIS complement those made under the National Childhood Immunisation Schedule (NCIS).

Hepatitis B
Hepatitis B vaccination is recommended for the prevention of acute and chronic hepatitis B infection in adults who have not had the vaccination or the disease before, and are not immune. While acute hepatitis B infection can cause fulminant hepatitis, chronic infection can lead to cirrhosis and hepatocellular carcinoma (liver cancer). Three doses are recommended over six months.

Tetanus, diphtheria and pertussis (Tdap)
Tdap vaccination is recommended in all pregnant women for the protection of infants against pertussis through passive antibody transfer from mother to infant, who are at highest risk of pertussis-related complications, including secondary bacterial pneumonia and neurologic complications. Pregnant women are recommended to receive Tdap between the 16th to 32nd weeks of each pregnancy for maximal protection to every infant. Tdap is recommended for each pregnancy, regardless of the interval since the previous dose of Tdap orTd (tetanus toxoid and reduce diphtheria toxoid vaccine), including pregnancies which are closely spaced (e.g. <2 years).

Measles, mumps and rubella (MMR)
MMR vaccination is recommended for protection against measles, mumps and rubella in adults who have not had the vaccination or the disease before, and are not immune against all three diseases. Complications from measles, such as pneumonia and acute encephalitis, are most common in adults and young children and can lead to death. For rubella, the primary objective of vaccination is the prevention of congenital rubella infection, including congenital rubella syndrome (CRS). In addition to maintaining high coverage in children, vaccination of adults can further reduce or interrupt the rubella transmission and reduce the risk of rubella exposure to pregnant women. Two doses are recommended at an interval of at least four weeks. Adults who were vaccinated with only one dose of measles-containing vaccine during childhood are recommended to receive a second dose of MMR vaccine.

Varicella
Varicella vaccination is recommended for protection against varicella in adults who have not had the vaccination or the disease before, and are not immune. Varicella in adults is more severe in adults than in children, with higher risk of complications, such as pneumonia. Two doses are recommended at an interval of at least four to eight weeks.

USE OF MEDISAVE
To encourage take-up and to help pay for recommended vaccines, MediSave use has been extended to all recommended vaccinations for relevant target population groups under the NAIS since November 2017. Under the MediSave500 scheme, Singaporeans are able to use up to $500 from their MediSave account (or their family members) per year to pay for these vaccinations.

NOTIFICATION OF VACCINATION
Medical practitioners are required to notify adult vaccination to the National Immunisation Registry (NIR) Doctors’ Portal of the Health Promotion Board (HPB) (https://www.nir.hpb.gov.sg/nird/ens/enslogin). Notification of vaccination serves two important purposes: i) as a contribution to the patients’ vaccination record; and ii) to allow other medical
professionals to verify their patients' vaccination history and determine their vaccination needs.

COMMENTS

Singapore has a well-established childhood immunisation schedule, starting with smallpox in 1862, followed by diphtheria (1938), TB (1957), polio (1958), pertussis and tetanus (1959), measles and rubella (1976) and hepatitis B (1987). Recent additions to the NCIS include pneumococcal (2009), HPV (2010), *Haemophilus influenzae* type *b* (Hib) and switch from oral to inactivated polio vaccine (2013). In comparison, the recommendations for adult vaccinations were established relatively recently and evolved over time from disease-specific guidelines to a consolidated schedule encompassing all vaccinations recommended for adults.

The ECI first recommended influenza vaccination in persons at high risk of influenza-related complications in 1999. The initial recommended groups included i) persons aged 65 years or older, and ii) adults and children with chronic medical conditions (e.g. respiratory and heart disease). Other vulnerable groups at increased risk of developing influenza-related complications (e.g. children aged 6 months to under 5 years) were added into the recommended groups over the years. In 2009, the ECI recommended pneumococcal vaccination for persons at high-risk of developing severe pneumococcal disease, including all persons aged 65 years or older, and adults and children aged 2 to 64 years with chronic or rare medical conditions, with PPSV23. The PPSV23 recommendations were made in addition to the 2009-introduction of pneumococcal conjugate vaccine (PCV) for children in the NCIS (at 3, 5 and 12 months of age). MediSave use was extended for pneumococcal vaccination in children under 5 years of age. However, the recommendations on influenza and pneumococcal (PPSV23) vaccinations for high-risk groups remained as professional recommendations without MediSave use. In order to lower financial barrier and further encourage vaccine take-up, MediSave use was subsequently extended to the recommended groups for influenza and PPSV23 vaccinations in 2014.

The recommended groups for influenza and pneumococcal vaccinations among adults, were subsequently subsumed into the NAIS in 2017, including the 2016 addition of PCV13 for persons aged 65 years or older and persons with cochlear implants, cerebrospinal fluid leaks or other rare medical conditions. Similarly, the recommendations for hepatitis B and HPV vaccinations among adults, which were made at the time of implementation in children under the NCIS, were also incorporated into the NAIS. MOH issued a press release in October 2017 to announce the establishment of the NAIS; the new recommendations were disseminated to medical practitioners and healthcare institutions. The information on NAIS has also been made available on HPB's HealthHub as a reference for public.

The NAIS is meant to serve as a useful reference for the public to be aware of important vaccination for adults, and for healthcare professionals in recommending these vaccinations to their patients. Healthcare professionals are encouraged to routinely review their patients’ vaccination status and offer the recommended vaccinations for both adults and children under the NAIS and NCIS, respectively.

REFERENCES


Vaccinations and Travel Medicine

Poh Lian Lim1,2

1Travellers’ Health & Vaccination Clinic, Tan Tock Seng Hospital, 2National Centre for Infectious Diseases

INTRODUCTION

Travellers’ health is an important aspect of public health because of the threat of infectious diseases world-wide through the movement of people and products. At the clinician level, it is focused on keeping the individual traveller safe and healthy, and providing diagnosis and treatment for returning travellers who are ill or concerned about specific exposures. At the public health level, it is concerned with preventing imported infections, particularly from pathogens which can cause outbreaks. The medical specialty that focuses on multi-disciplinary preventive care for travellers is known as travel medicine.

IMPORTANCE OF TRAVEL MEDICINE

The severe acute respiratory syndrome (SARS) outbreak in 2003 started in Singapore with one index patient who acquired the respiratory infection in Hong Kong. The Middle East respiratory syndrome (MERS) outbreak in South Korea in 2015, which caused 186 cases and 36 deaths, started with one ill returning traveller. Along with the 2009 H1N1 pandemic and the 2014 Ebola outbreak in West Africa, these are sobering reminders that we are only a short plane-ride away from an outbreak, and infections occurring even in faraway places may be relevant to us. With increasing globalization and urbanization, the risk of outbreaks spreading through travel will continue to rise over the next few decades.

Singapore remains vulnerable to infections brought in through imported food and inbound travellers, whether returning Singaporeans or tourists from abroad. The total population of Singapore in 2018 is 5.6 million, comprising 3.4 million citizens, 500,000 permanent residents, and 1.7 million non-residents. Singaporeans and non-residents travel outbound for work, education, family visits, leisure as well as volunteer activities. In addition, 62 million passengers passed through Changi Airport, and Singapore saw 17 million tourist arrivals in 2017.

At an individual level, patients have acquired life-threatening infections such as malaria and typhoid even from short trips to locales nearby (E.g: Indonesia, Cambodia) and faraway (E.g: Nigeria, Nepal). Singaporeans have died abroad from non-infectious hazards such as altitude illness and motor vehicle accidents. What you don’t know can hurt you, but with internet access, it is easy to book flights at short notice, and travel without appropriate precautions.

SCOPE OF TRAVEL MEDICINE

Travel medicine covers pre-travel consultation and post-travel management. For pre-travel visits, after making an assessment of the traveller’s risks and the hazards of the destination, vaccine recommendations and prescriptions for malaria and altitude illness, if appropriate, will be provided. Travel health visits may be conducted by a well-trained nurse or pharmacist, which is common in many developed countries. Doctor visits are often reserved for those with more complex medical issues, higher risk travel itineraries, and those who require prescriptions by a physician.

TRAVELLER RISKS

The risk for a traveller depends on several factors, including age, gender, pregnancy and breast-feeding status, degree of immunosuppression (whether due to malignancy, chemotherapy, medications or medical conditions such as HIV), and active medical conditions such as dialysis, anti-coagulation, asplenia, recent surgery or blood clots. Traveller risk also depends on what vaccines and prior immunity the traveller already has. If the individual is travelling to an area with ongoing measles or chickenpox transmission, the risk is obviously greater for an unvaccinated individual.
Another type of risk pertains to the category of travel engaged in. Travellers who visit friends and relatives, also known as VFR travellers, and expatriates are well-documented categories at higher risk for certain travel-acquired diseases such as vector-borne infections.10,11 Duration of travel also introduces another dimension of risk, with long-term travel (over 6 months) putting individuals at higher risk due to more prolonged exposure and inability to maintain precautions for extended periods.12

DESTINATION HAZARDS

Travel health risk is directly related to the destination, and what activities the traveller engages in at the destination. Rural destinations generally pose a greater risk for malaria, and Japanese encephalitis. Some infections are present only on certain continents: yellow fever in Africa and South America, Japanese encephalitis in Asia. Geography can result in specific health hazards risks such as high altitude cerebral and pulmonary oedema which can occur above 3000 metres, and hypothermia with extreme weather events like blizzards, or high latitude locations such as the Arctic and Antarctic. Vector-borne infections will vary by location, with falciparum malaria more common in Africa compared to vivax malaria in India, Lyme disease and babesia in North America, Chagas disease and yellow fever in South America, and so on.

The activities a traveller engages in at the destination will also affect travel health risks. Someone volunteering in an orphanage in a developing country may be exposed to vaccine-preventable infections of childhood, such as pertussis. Sex tourists may be exposed to resistant human immunodeficiency virusus (HIV) or gonorrhea. Active individuals on treks or safaris may be at risk for abrasions (tetanus) or tick-borne rickettsial infections. Travellers with freshwater exposures (lakes, waterfalls) may be exposed to leptospirosis or schistosomiasis. Medical tourists getting organ transplants or joint replacements abroad may acquire infections that reflect the antibiotic resistance of their overseas hospital.

PRE-TRAVEL CONSULTATION

A competent pre-travel consultation will review the destination, timeframe for travel and activities planned, as well as the traveller’s medical history, medications (including any immunosuppression within the previous 6 months), and vaccine records. The patient should be up-to-date for routine vaccinations. Vaccines for travel, and prescriptions for malaria or altitude illness prophylaxis should be given, if appropriate. Advice about food and water precautions, travellers’ diarrhoea prevention and treatment, non-infectious risks such as traffic safety, and management of animal bites should be discussed, if relevant.

VACCINATIONS

Routine vaccines are defined as vaccines a patient should have received, based on their age and medical conditions, even if they were not travelling. Individuals who are behind on their routine vaccinations should be advised to get them done prior to travel. Common examples of routine vaccinations include:

- Influenza & pneumococcal vaccines: for adults > 65 years old, diabetics, chronic heart, lung, liver, and kidney disease, asplenics, immunocompromised patients
- Measles, mumps & rubella vaccine (MMR): 2 doses 4 weeks apart, for anyone > 12 months old, who is non-immune, unless pregnant or severely immunocompromised
- Chickenpox vaccine: 2 doses 6 weeks apart, for anyone > 12 months old, who is non-immune, unless pregnant or severely immunocompromised
- Hepatitis B vaccine: 3 doses at 0, 1, 6 months, for anyone who is unvaccinated and non-immune

Travel vaccines are recommended based on destination or potential exposures, to persons who either have no vaccine records, or are uncertain of their vaccination history. Common examples of travel vaccinations include:

- Hepatitis A: 2 doses 6 months apart, to protect against this food & water-borne virus
- Typhoid: 1 dose injected, valid for 2-3 years, to protect against this food & water-borne salmonella
- Yellow fever: 1 dose, valid lifelong, to protect against this Aedes-transmitted virus
- Japanese encephalitis: Imojev or Ixiaro, to protect against this Culex-transmitted virus
- Rabies: 2 – 3 doses, to protect against this fatal viral infection from mammal bites
- Meningococcus ACWY-135: 1 dose, to protect against this droplet-spread bacteria

If departure dates do not allow enough time for serology results, or the patient declines testing due to cost or discomfort, vaccination can be given
if the patient understands the issues and agrees. If the patient is actually immune but gets vaccinated, the vaccination is unnecessary but should not be harmful to the patient, assuming due diligence has been taken to check for relevant vaccine precautions and contraindications.

POST-TRAVEL CONSULTATIONS

Post-travel consultations are focused on the patient’s clinical presentation. Common problems seen post-travel include travellers’ diarrhea, respiratory infections and animal bites for which rabies post-exposure prophylaxis may be required. However, based on public health advisories, the patient may require admission, isolation and diagnostic investigations for infections such as MERS or avian influenza (H7N9).

The most important infection that should not be missed in a returning traveller with fever is malaria. Falciparum malaria typically has an incubation period (duration from exposure to first symptoms) of 1-4 weeks, whereas vivax malaria may be somewhat longer. However, there is a long tail with malaria incubation periods, extending up to 6-12 months. Questions about travel exposure will therefore need to take into account the infection being considered, and its incubation period.

CONCLUSION

Travel medicine is an important aspect of medicine that is relevant to most doctors practicing in Singapore because of its impact on patients as well as public health. Pre-travel consultation requires attention to traveller factors and destination hazards, assessment for vaccinations and preventive advice. Post-travel management requires a detailed travel history, careful consideration of the clinical presentation and an index of suspicion for potential infections with serious clinical or public health impact. Travel-related imported infections such as Zika or yellow fever have the potential to cause outbreak in Singapore because of the presence of Aedes vectors locally. Referral to a travel health clinic for preventive vaccines or to infectious disease specialists for diagnosis and treatment may be needed.

REFERENCES


NOTES FROM THE FIELD

Public Health Response to Monkeypox in Singapore

Reported by Kelly Foo, with the Public Health Interventions Team

Communicable Diseases Division, Ministry of Health
On the night of 7 May 2019, MOH was notified of a suspect case of monkeypox involving a 38-year-old Nigerian male who had arrived in Singapore on 28 April to attend a business workshop. He developed fever, muscle ache, chills and multiple pustular and nodular skin lesions over hands, arms torso and face on 30 April and was admitted to the National Centre for Infectious Diseases (NCID) on 7 May. We describe herein Singapore's public health response to our first imported case of this emerging infectious disease.

What is monkeypox?

Monkeypox, a member of the Orthopoxvirus genus in the Poxviridae family, is a rare virus transmitted to humans from animals (typically rodents) through the hunting and consumption of bush meat that occurs sporadically in central and western parts of Africa's tropical rainforest. Infected persons would typically experience fever, headache, muscle ache, backache, swollen lymph nodes and skin rash. The disease is usually self-limiting, with most patients recovering within two to three weeks. In some cases, however, the virus can cause serious complications such as pneumonia, sepsis, encephalitis (brain inflammation) and eye infection with ensuing loss of vision. There have been reported mortality rates of 1% to 10% during outbreaks.

Human-to-human transmission, while possible, is limited. A person is infectious only during the period when he has symptoms, particularly skin rash. Transmission typically occurs from close contact with the respiratory tract secretions or skin lesions of an infected person, or objects recently contaminated by an infected person's fluids or lesion materials. The incubation period (interval between infection to onset of symptoms) of monkeypox is usually from 6 to 16 days but can range from 5 to 21 days.

There are no specific treatments or vaccines available for monkeypox infection, but outbreaks can be controlled. Post-Exposure-Prophylaxis (PEP) vaccination (using smallpox vaccine) has been proven to be 85% effective in preventing monkeypox if given within 4 days after the exposure, and reduce symptoms of disease if given within 4-14 days after exposure.

Is this the first reported case of monkeypox in Asia?

No, if we consider Israel and the Middle East as part of the Asian continent. Most of the patients then were reported to have had close contact with pet prairie dogs that were infected by African rodents that had been imported into the country. In 2018, three human cases of monkeypox were reported in the United Kingdom followed by one imported case reported in Israel.

What were the immediate public health actions?

Our Integrated Operations Management Group convened on 8 May to study the timeline of events, determine the case's infectious period, and define the risk categories for management. Activity mapping identified the following groups of contacts of the case: (i) workshop participants and staff; and (ii) hotel staff. MOH conducted contact tracing.

A total of 18 workshop participants and staff/trainers, and four hotel staff were identified as close contacts to be quarantined. On the morning of 9 May, our team was at the workshop venue to brief the participants. The workshop participants and hotel staff were transported to NCID for medical assessment and PEP before quarantine.

Eight other contacts who were assessed to have a low risk of being infected had been put on active surveillance, where they were called twice daily to monitor their health progress.
How are quarantine and post-exposure prophylaxis instituted for close contacts of the case?

With lessons learned from the SARS and H1N1 influenza pandemics, Singapore was well prepared to quarantine the close contacts after they were medically assessed within 24 hours of case notification on 9 May. 18 close contacts were quarantined at the Government Quarantine Facility which has single rooms with attached bathroom. The remaining four close contacts were home quarantined at their respective homes. Post-exposure prophylaxis was offered to all high-risk close contacts on 9 May at NCID, and they were closely monitored for side effects arising from the vaccination or potential infection. 14 close contacts took the vaccines. The vaccinees were given information sheet of the vaccine and instructions on how to care for their injection sites. All vaccinees had a ‘vaccine take’ on 7 days' post vaccination verified by NCID, and no severe adverse vaccine reactions were noted.
What were challenges in managing this incident?

One challenge was the difficulty of the affected individual and contacts recalling their movement history accurately. We worked with the hotel to review CCTV footage to establish all contacts with varying levels of exposure for risk assessment. A detailed mapping is important in the identification of contacts, and information from multiple sources help triangulate the persons at risk.

What are key lessons learned from this incident?

This incident tested many of our capabilities for epidemic response and decontamination. The case was deemed non-infectious after 17 days and discharged well, and the incident closed on 18 June (after two incubation periods from case's isolation date, i.e. 7 May). Terminal cleaning was conducted for the hospital isolation room. At the hotel, the entire floor and the case's room were left unoccupied until the room and corridor were cleaned and disinfected on 13 May.

It is crucial to have a coordinated public health response and this was made possible through trust and rapport between stakeholders (including the case and the workshop organiser) and the public health authority. Timely communication platforms were set up with both the case and the workshop organiser who is the liaison with the workshop participants (close contacts) to obtain information and vice versa.

Below: Contact tracing and public health interventions involved multiple locations.
Indications for Vaccination

A Jab to Protect You

Here’s what you need to know about vaccinations under the National Adult Immunisation Schedule

Influenza Vaccine

Protects you from the seasonal flu, as well as potentially serious complications e.g. pneumonia

Recommended for*

- People aged 65 years or older
- People up to 18 years old receiving long-term aspirin therapy
- People with chronic medical conditions, e.g. diabetes mellitus, asthma, and heart disease
- People with weakened immunity systems
- People receiving intermediate and long-term care services
- Women at all stages of pregnancy

When to get it

Annually

* Also recommended for specific groups of children, including those who are immunocompromised, have medical conditions, or have other rare conditions
FAST FACTS

Pneumococcal Vaccine
Protects against pneumococcal disease, which can cause pneumonia, blood poisoning and meningitis

Who should get it*
- People aged 65 years or older
- People with chronic illnesses, e.g. chronic lung, heart, kidney or liver diseases, and diabetes mellitus
- People with weakened immunity systems or other medical conditions

When to get it
Two vaccines help prevent pneumococcal disease (PCV13/PPSV23). Talk to your doctor to find out when and which vaccine(s) you need

* Also recommended for children below five, and children who are immunocompromised, have medical conditions, or have other rare conditions under the National Childhood Immunisation Schedule

Human Papillomavirus (HPV) Vaccine
Prevents cervical cancer caused by HPV infection from types 16 and 18

Who should get it
Females aged 18 to 26 years old*

Schedule
Three doses over six months

* Also recommended for females aged 9 to 17 years under the National Childhood Immunisation Schedule
Tetanus, Diphtheria and Pertussis (Tdap) Vaccine
Protects newborns from pertussis (whooping cough), which can be serious and fatal in young infants

Who should get it
Pregnant women

When to get it
One dose between 16 and 32 weeks of gestation for each pregnancy

Measles, Mumps and Rubella (MMR) Vaccine
Protects against measles, mumps and rubella, which can be serious and cause complications

Who should get it
Adults who have not had the vaccination or the diseases before, and are not immune

Schedule
Two doses at least four weeks apart
Hepatitis B Vaccine
Protects against hepatitis B, which can cause cirrhosis (scarring), liver failure and liver cancer

Who should get it
Adults who have not had the vaccination or the disease before, and are not immune

Schedule
Three doses over six months

Varicella (Chickenpox) Vaccine
Protects against varicella (chickenpox). Risk of complications is higher in adults

Who should get it
Adults who have not had the vaccination or the disease before

Schedule
Two doses at least four to eight weeks apart

Source: Health Promotion Board, Singapore
## Infectious Diseases Update
### As of E Week 26 (23-29 Jun 2019)

### SURVEILLANCE SUMMARY

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### POLYCLINIC ATTENDANCES - AVERAGE DAILY NUMBER

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<td>Acute conjunctivitis</td>
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<td>Acute Diarrhoea</td>
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<td>Chickenpox</td>
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<td>Hand, Foot And Mouth Disease</td>
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### HIV/STI/TS NOTIFICATIONS

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<td>Tuberculosis</td>
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<td>540</td>
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*Preliminary figures, subject to revision when more information is available.*
The average daily number of patients seeking treatment in the polyclinics for Acute Respiratory Infection (ARI) remained below 70th percentile in April 2019. It increased above 70th percentile in May and June 2019. The proportion of patients with influenza-like illness (ILI) among the polyclinic attendances for ARI is 2.3%. The overall positivity rate for influenza among ILI samples (n=358) in the community was 35.2% in the past 4 weeks. Of the specimens typed for influenza in May 2019, these were positive for influenza A (H3N2) (12.5%), influenza A (H1N1) pdm09 (11.1%), and influenza B (75%). 1.4% of the influenza A specimens were untypable due to low titre.
SURVEILLANCE SUMMARY

SURVEILLANCE OF OTHER SELECTED DISEASES

Dengue Fever/Dengue Haemorrhagic Fever

Chikungunya

Salmonellosis
SURVEILLANCE SUMMARY

Measles

Mumps

Pertussis
ENB Quarterly is published in Jan, Apr, Jul and Oct every year by the Ministry of Health, Singapore. Readership includes physicians, epidemiologists, microbiologists, laboratorians, researchers, scientists, and public health practitioners. Correspondence address: The Editor (ENB Quarterly), Public Health Group, Ministry of Health, 16 College Road, College of Medicine Building, Singapore 169854. A downloadable electronic format is provided free of charge at our website: https://www.moh.gov.sg/content/moh_web/home/Publications/epidemiological_news_bulletin.html

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Summary statistical data provided in ENB Quarterly are provisional, based on reports to the Ministry of Health. For more current updates, please refer to our MOH Weekly Infectious Diseases Bulletin: https://www.moh.gov.sg/content/moh_web/home/statistics/infectiousDiseasesStatistics/weekly_infectiousdiseasesbulletin.html

Do you have any ideas or suggestions? Your views are important to us.

Please contact us at ENB_Quarterly@moh.gov.sg