



The role of travel in measles outbreaks in Australia – An enhanced surveillance study



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ABSTRACT

Many developed countries, like Australia, maintain a high population level immunity against measles, however, there remains a risk of acquisition of measles in non-immune travellers and subsequent importation into Australia leading to localised outbreaks. In this study, we estimate the incidence of measles and describe characteristics including immunisation and pre-travel health seeking behaviour of notified cases of measles in New South Wales and Victoria, Australia between February 2013 and January 2014. Cases were followed up by telephone interview using a questionnaire to collect information of demographic and travel characteristics. In NSW, the incidence was highest in age group 0–9 years (20/million population) whereas in Victoria the highest incidence was observed in 10–19 (23/million population) years group. Out of 44 cases interviewed, 25 (56.8%) had history of travel outside of Australia during or immediately prior to the onset of measles. Holiday (60%) was the main reason for travel with 44% (11/25) reporting visiting friends and relatives (VFR) during the trip. The major reason described for not seeking prior medical advice before travel were “no perceived risk of diseases” (41%) and “previous overseas travel without any problem” (41%). Of the 25 measles cases with recent overseas travel during the incubation period, one reported a measles vaccine prior to their recent trip. Four cases were children of parents who refused vaccination. Twenty out of 25 (80.0%) had attended mass gathering events. Young adults and VFR travellers should be a high priority for preventive strategies in order to maintain measles elimination status.

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1. Background

Measles is a highly infectious viral infection which can result in severe complications such as pneumonia, encephalitis and death [1]. The World Health Organization (WHO) considers measles a global challenge and has set a goal for measles elimination in five WHO regions by 2020 [2]. Many developed countries, like Australia, maintain a high population level immunity against measles (>90% in all age groups) which is required to interrupt endemic transmission [3,4], however, there remains a risk of acquisition of measles in non-immune travellers and subsequent importation into Australia.

In March 2014, WHO declared that measles elimination has been achieved in Australia [5]. Although endemic transmission of measles has been eliminated from Australia, considerable numbers of cases are imported each year via international travel. The transmission by imported cases can lead to localised outbreaks with ongoing transmission particularly in communities and geographi-

cal regions where the population-level immunity is low [6]. Measles outbreaks occur regularly in Australia as a result of importation. In 2012, the largest outbreak of measles in Australia since 1997 occurred primarily in Southwest Sydney resulting in 167 cases which were linked to an imported case from Thailand [7]. Under-vaccinated groups including migrants were identified as key risk groups driving the ongoing transmission. Approximately 20% of cases were in people of Pacific Islander descent and many cases were in Australian residents who had not travelled, particularly those who were too young to be vaccinated [7].

Measles is endemic in many countries of South and Southeast Asia which are popular travel destinations for Australian residents. For example, the Philippines had almost 60,000 cases of measles during 2011–2014, with a surge in cases following Typhoon Haiyan [8]. In 2014, a total of 53,803, 7928, 7580, and 834 confirmed cases of measles were reported to the WHO by the Philippines, Indonesia, Vietnam, and Thailand respectively [9]. Importation of cases and recurrent outbreaks continue to test the status of measles elimination in Australia and other developed countries. For example in 2015, a large epidemic of 147 cases occurred in visitors to Disneyland, California, USA and their contacts resulting in

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imported cases across multiple States as well as other countries [10]. Measles control is challenging because it has a very high reproductive number, estimated to be between 11 and 18, and requires high vaccination coverage (in excess of 93%) to achieve herd immunity and maintain elimination [11]. Currently two doses of measles-containing vaccine are recommended for all children in Australia with the first dose recommended at 12 months and second at 18 months [12]. Measles is a nationally notifiable disease in Australia.

The number of Australian residents departing for short term trips abroad in 2014–2015 was 9.2 million, almost double compared to 2004–2005 [13]. The highest volume destination countries in 2015 included Indonesia (Bali), Thailand, India, and China, which have substantial measles circulation [13,14]. A significant proportion (27%) of departing residents report visiting friends and relatives (VFRs) as their purpose of travel [13]. Travellers from developed countries travelling to their country of origin or their parent's country of origin in a less developed country are at disproportionate risk of acquiring infectious diseases compared to other travellers, due to increased exposure and lower rates of pre-travel health seeking behaviours, including vaccination [15,16]. The control of measles in the elimination phase in Australia necessarily must focus on the populations at risk of under-vaccination, particularly geographical areas with low population immunity, with targeted strategies for achieving higher vaccination rates in these groups. Understanding the epidemiology of measles cases in Australia will assist in targeting strategies for measles control. In this report, we describe characteristics including immunisation and pre-travel health seeking behaviour of notified cases of measles in New South Wales and Victoria between February 2013 and January 2014.

2. Methods

Measles is a notifiable disease in Australia. Confirmed cases of measles notified to Departments of Health in New South Wales and Victoria from February 2013 to January 2014 were identified. During routine follow-up of notified cases, public health officers obtained permission from the case, or case's parent/guardian, to be contacted by the research team by telephone to administer an enhanced surveillance questionnaire. Among a total of 106 notified cases of measles, 79 (74.5%) agreed to be contacted by the researchers. Verbal informed consent was obtained from participants by researchers prior to administering the telephone questionnaire. The study included the participants only if they had either acquired measles in Australia or from travel departing from Australia (overseas visitors and arriving migrants were excluded from the survey).

The questionnaire collected demographic details including migrant status; travel history including international travel within the incubation period, itinerary, reason for travel and length of stay, accommodation; whether travel-associated cases had sought pre-travel health advice from a healthcare provider or non-medical sources, had received a MMR vaccine prior to travel and undertaken disease-specific at-risk behaviours during travel such as attending mass gatherings during travel. Mass gatherings were defined as organised group events, with examples given (such as concerts, religious pilgrimages, and sporting events).

Distributions of variables are presented as percentages. Age-specific incidence rates of measles in NSW and Victoria are calculated using the age-wise populations projected for 2013 for NSW and Victoria obtained from the Australian Bureau of Statistics [17]. Patients/carers perspectives on possible transmission source, reasons for not vaccinating, reasons for not seeking medical advice prior to travel are presented for those who acquired measles

during travel. This study was approved by the NSW Population & Health Services Research Ethics Committee (2012/04/382).

A systematic review of literature was also conducted to identify studies reporting the outbreaks of measles in Australia from 2000 to 2012 using "PubMed", "Google scholar" and online websites of medical journals published from Australia using the terms "outbreak" and "measles". Studies and reports that reported the number of cases, place and date of outbreak were included to create a timeline of measles outbreaks in Australia.

3. Results

Fig. 1 shows the chronology of reported outbreaks of measles from 2000 to 2012. A total of 106 measles cases were notified in NSW ($N = 43$) and Victoria ($N = 63$) during the study period. Age-specific incidence rates of measles in NSW and Victoria are presented in Fig. 2. In NSW, the incidence was highest in age group 0–9 years (20/million population) whereas in Victoria the highest incidence was observed in 10–19 (23/million population) years group. There were three cases which were <12 months of age when they departed for travel, but only 1 was >9 months for whom pre-travel measles vaccine could have been recommended. Fig. 3 shows the timeline of notification of measles in each state per month, with 71% of notifications occurring between August 2013 and January 2014. Of those 106 cases, contact details were available for 79 cases. Among those 79, 11 were unable to be contacted for interview, 13 did not consent to be contacted, 3 were overseas visitors (since departed overseas) and 1 was an arriving migrant. Overall, 44 out of 106 (41.5%) completed the interview. Demographic details of included measles cases are presented in Table 1 including information on age, sex, Australian citizenship/residence status, region of birth, immigration history, language other than English spoken at home, and education.

Out of 44 cases, 25 (56.8%) had history of travel outside of Australia during or immediately prior to the onset of measles and were part of enhanced surveillance. Holiday (60%) was the main reason for travel with 44% (11/25) reporting visiting friends and relatives (VFR) during the trip. Of those participating in the enhanced surveillance, 52% had a trip length of 2 weeks to 1 month. Of the VFR travellers, 6 had travelled to the Philippines. In terms of past travel, 17/25 (78%) had travelled overseas from Australia 1–5 times, and 25% travelled >5 times in last 5 years. Twenty out of 25 (80%) participants were either migrants or had migrant parents. Most travel bookings were made directly on the Internet by the

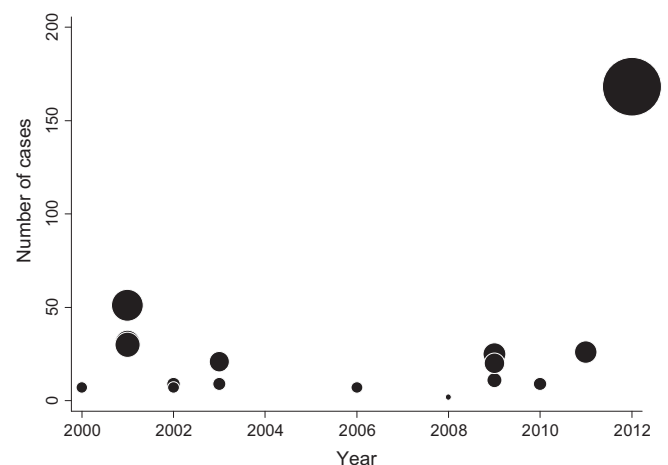


Fig. 1. Reported studies of measles outbreak in Australia. Note: Each circle represents an outbreak of Measles in Australia. The size of the circle is proportional to the size of the outbreak but not exactly to scale.

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