A measles outbreak among young adults in Victoria, February 2001

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On behalf of the outbreak investigation team.

Abstract

In January 2001 a 19-year-old Sydney resident, who had recently returned from India, visited Melbourne for 4 days while infectious with measles. A further 50 measles cases were subsequently identified, mainly among young adults. Thirty-eight cases (75%) were in the same birth cohort (born between 1968 and 1981). This cohort was identified as being at high risk of measles infection after a previous outbreak in Victoria involving 75 cases. These individuals are now aged between 20 and 33 years. A high proportion of cases, 22 (43%) were hospitalised after multiple visits to various healthcare providers. None of the cases had documentation of receiving the recommended number of doses of measles-containing vaccine for their age. Repeated outbreaks clearly demonstrate that young adults remain the group at highest risk of measles infection in Victoria. More targeted strategies for young adults and healthcare workers are required to better protect these groups against measles. *Commun Dis Intell* 2002;26:273–278.

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Introduction

In 1999, Victoria experienced a large outbreak of measles when a returned traveller was identified as the primary case with further transmission to 74 mainly young adult cases.[1] Together with serologic evidence which indicated a relatively low level of immunity among this cohort,[2,3] this outbreak as well as outbreaks in other States[4,5] were the impetus for a national campaign recommending measles immunisation for 18–30 year olds. The results of an investigation of another measles outbreak in Victoria that occurred less than 2 years later[6] are reported. Once again the measles virus was introduced by a returned traveller and the majority of cases occurred among young adults. The epidemiological characteristics of this outbreak which highlight the risks associated with multiple presentations to healthcare providers prior to diagnosis and the continued failure to vaccinate young adults, are described.

In Victoria, medical practitioners and diagnostic laboratories who suspect that a person may have measles are required to notify the Department of Human Services. In collaboration with the Victorian Infectious Diseases Reference Laboratory (VIDRL), the Victorian Department of Human Services has been conducting enhanced surveillance for measles since 1997 which includes home visits to collect specimens for laboratory confirmation of the diagnosis and, where possible, identification of the virus genotype.[7,8] The specimen collection service is offered for all notified cases not just those that meet the definition of 'suspected infection' (see below). Specimens are forwarded to VIDRL and tested for IgM and IgG antibodies to measles, rubella and parvovirus B19. Testing for viruses commonly causing rash illnesses improves the turn-around time of an alternative diagnosis to measles and adds a specificity check for a positive IgM result. All notifications are followed-up with the medical practitioner, patient (or the parent/guardian if the patient is a child) and, if applicable, the primary diagnostic laboratory. Demographic data, clinical details, vaccination history, exposures during the incubation period and contacts during the infectious period are recorded using structured telephone interviews.

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Methods

Measles cases were defined in accordance with the national guidelines:[9]

Confirmed infection

- A laboratory-confirmed case defined as the presence of measles specific IgM antibody in an appropriate specimen[9] (excluding those serologically diagnosed cases who received a measles-containing vaccine 8 days to 8 weeks before testing who were not linked to another laboratory-confirmed case).
- A person with signs and symptoms consistent with measles (see 'suspected infection') epidemiologically linked to a laboratory-confirmed case.

Suspected infection

- A person with an illness including all of the following features: morbilliform rash, cough and fever present at the time of rash onset.

On identification of this outbreak, active surveillance was instituted to identify additional cases and protect susceptible contacts. Health alerts were distributed to medical practitioners, hospitals, local councils and child-care centers. Regular press releases were issued.

Where appropriate, advice was given about the need for personal isolation during the infectious period, such as exclusion from school and child-care centres. Measles-mumps-rubella vaccination or immunoglobulin was offered to contacts in accordance with the guidelines.[9]

If initial serology was performed elsewhere the original sample was requested to be forwarded to VIDRL for confirmatory testing. During the outbreak the turnaround time for measles IgM and IgG results was approximately 4 hours from receipt of specimen. Polymerase chain reaction (PCR) for the detection of measles virus RNA was performed for virus genotyping at VIDRL.[10]

Results

The primary case

On 29 January 2001 the New South Wales Health Department reported that a 19-year-old Sydney resident with no documented history of previous measles vaccination had been serologically confirmed with measles after returning from India on 4 January 2001. Rash onset for this patient was 20 January 2001. During the infectious period the patient visited Melbourne for 4 days (from 17 to 20 January 2001) and attended numerous locations including restaurants, a nightclub and shopping centres, and had travelled on public transport.

The outbreak

The first Victorian case was notified on 1 February 2001 and the following day 2 more cases were reported. All three were young adults who had been admitted to hospital. By 31 March 2001, 151 notified cases of measles had been investigated. The diagnosis of measles was confirmed in 52 patients, although one case was not considered part of the outbreak as the person had been overseas for the entire incubation period (United States of America) and the virus identified was a distinctly different genotype (see below). Of the 51 confirmed cases considered part of the Victorian outbreak, 50 were laboratory-confirmed (including the primary case) and one was epidemiologically linked (a housemate of a laboratory-confirmed case). The median age of these cases was 25 years (range 10 months – 34 years) with most (75%) aged 20–34 years (Figure 1). Twenty-seven were males.

Figure 1. Confirmed cases of measles, Victoria, February to March 2001 (n=51), by age group

Of the 151 notifications, 70 cases were rejected on the basis of serological evidence.[7,9] Two of these cases were confirmed as parvovirus B19, one was confirmed as rubella virus, and two were vaccine reactions (a 14-month-old child vaccinated 7 days prior to rash onset and confirmed by PCR to be shedding vaccine strain measles virus, and a 20-year-old person with no epidemiological link to a laboratory-confirmed case who was vaccinated 14 days prior to rash onset). There was no alternative diagnosis for the remaining 65 cases.

A further 29 cases did not have an epidemiological link to a laboratory-confirmed case and could not be confirmed or rejected on laboratory evidence. Only four of these cases met the clinical definition of 'suspected infection': three were unvaccinated infants who were measles IgM and IgG negative but the specimen was collected less than 4 days after rash onset and the offer to collect a convalescent specimen was declined; the parent of the fourth case (an unvaccinated child aged 9 years) did not consent to specimens being collected for laboratory confirmation of the diagnosis. Twenty-five cases did not meet the clinical definition of 'suspected infection', 20 of these were measles IgM and IgG negative but the specimen was collected less than 4 days after rash onset so they and were excluded on clinical grounds.[9]

Utility of clinical definition for suspected measles

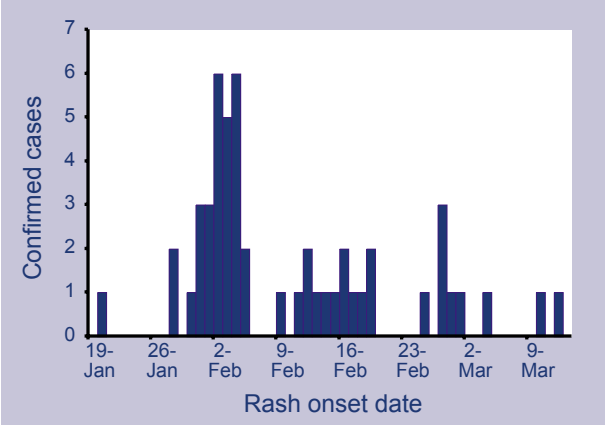
In order to assess the utility of the clinical definition of suspected measles infection,[9] the clinical symptoms for the 50 laboratory-confirmed cases were compared to the clinical symptoms of the 70 cases that were serologically-confirmed as not being measles. Of those cases who met the suspected case definition, 71 per cent (47/66) were confirmed as measles whereas 94 per cent of cases who did not meet the clinical criteria (51/54) were serologically-confirmed as not being measles (sensitivity 94%, specificity 73%).

Transmission

The first Victorian case developed a rash on 28 January 2001, 8 days after rash onset in the primary case. The last case developed a rash on 13 March 2001 (Figure 2). Direct links between the primary case and a further 8 cases were identified in the first wave of transmission. These secondary cases were known to have attended the same restaurant, nightclub or airport terminal at the same time as the primary case during his infectious period. Probable links with another 9 patients were established. These patients had either been in the same area, visited a common shopping centre or travelled on the same train line as the primary case. Further chains of transmission were established for 24 additional cases. Two of the identified chains of transmission included:

- An unvaccinated 21-year-old female who may have traveled on the same train line as the primary case, visited a nightclub during her infectious period (prior to rash onset). A singer at the nightclub subsequently developed measles with symptoms of rash and fever. He attended a hospital emergency department during his infectious period at the same time as an unvaccinated 11-year-old who was presenting with a broken arm. The 11-year-old subsequently developed measles and infected his unvaccinated 9-year-old sibling. Every case in this chain of transmission was laboratory-confirmed and none had been vaccinated against measles.
- A 29-year-old woman, in whom measles had not been suspected, had 2 visits to a hospital emergency department and was subsequently admitted to a ward but was not isolated. A healthcare worker at the hospital, who had remained unvaccinated despite being identified as susceptible in the previous outbreak, subsequently became infected and was also hospitalised.[11]

Figure 2. Epidemic curve for measles outbreak, Victoria, February to March 2001 (n=51)



All but two of the 51 confirmed cases lived in the metropolitan area of Melbourne. One of the non-metropolitan cases was at the same Melbourne Airport terminal as the primary case when the latter was infectious. No direct epidemiological link was identified for the other non-metropolitan case (aged 13 months), however, the infant had been at a wedding at which a number of guests were young adults from metropolitan Melbourne.

Genotyping

Serum from the primary case was negative for measles virus RNA by PCR. However, measles virus RNA was detected by PCR from clinical specimens from 24 patients all of whom were infected with the same novel genotype, proposed as new genotype 'D8'.[12] During the course of the outbreak, we identified one laboratory-confirmed case that was a different genotype (D3). This case, a 23-year-old female, developed a rash and fever while flying back from the United States of America and was admitted directly to hospital.

Hospitalisations

Of the 51 confirmed cases, 22 (43%) were hospitalised for a total of 91 in-patient days (range one to 10 days). All but two of the hospitalised cases were in the 17–34 year age range. Clinical presentations requiring admission included a combination of dehydration, lethargy, diarrhoea, nausea, vomiting, headache, rash and fever of unknown origin. One case also presented with suspected appendicitis and had an appendectomy the day prior to rash onset. Two cases developed pneumonia. There were no deaths.

The 22 hospitalised cases accessed health services (either hospitals, GPs or health centres) a total of 62 times. All 22 had sought treatment at GP clinics before being admitted to hospital. Three of the cases had been admitted and discharged without diagnoses before being readmitted and subsequently diagnosed. Only 4 of the 22 hospitalised cases (13%) were suspected as having measles on the initial presentation to a healthcare provider. An early case sought treatment at four different GPs before being admitted to hospital 11 days after the initial presentation. Another case visited 3 hospitals with no clear diagnoses before being admitted 4 days after rash onset. Information regarding access to healthcare from non-hospitalised patients was not collected.

During the 1999 measles outbreak 6 healthcare workers were infected,[1] however, despite the large number of cases hospitalised during this outbreak only one healthcare worker was infected. Of concern is the fact that this healthcare worker was identified during the 1999 outbreak as being susceptible to measles infection but did not receive any measles containing vaccine. During infection control investigations following possible exposure of staff relating to a hospital admission of a confirmed case, exposure and infection of this healthcare worker were confirmed. This case highlights the need for continued vigilance on the part of healthcare workers and healthcare employers to ensure staff protection from vaccine preventable diseases.

Vaccination status

One case was too young to have received a first dose of measles vaccination (10 months of age). Four cases (age range 17–29 years) had received one documented dose of a measles-containing vaccine when they were aged between 13–24 months but none of these cases had received a second dose as currently recommended.[13] None of the other cases had a documented history of prior measles vaccination, 2 cases were siblings whose parents were conscientious objectors to vaccination.

Discussion

In 1999, a 21-year-old unvaccinated person who returned from holidays in Bali was the index case in an outbreak in which 75 cases of measles were identified.[1] In January 2001, another returned traveller, this time a 19-year-old who had returned from India, triggered an outbreak of 51 cases among a similar age group. The primary case in this outbreak developed a rash 16 days after returning from India and was only in Melbourne for 4 days during the infectious period. We were able to identify exposure to the primary case for eight of the cases in the first wave of transmission and probable exposure for another 9 cases. Genotyping established that 24 cases had the same novel genotype virus recently described as an endemic strain in Nepal.[12] This continues the pattern of rapidly changing measles virus genotypes in Victoria over the last 15 years without evidence of sustained transmission,[10] which is highly suggestive of the interruption of indigenous measles transmission.

Lambert, et al highlighted the changing epidemiology of measles in Victoria and suggested that young adults[1] born between 1968 and 1981, were the group most at risk of measles in Victoria. Of the 51 cases identified in the 2001 outbreak, 38 (75%) were in this birth cohort and none of these cases had documentation of receiving 2 doses of a measles-containing vaccine. Persons born prior to 1970 are generally presumed to be immune to measles,[13] however in this outbreak 6 confirmed cases (12%) were born between 1966 and 1970.

In both the 1999 and 2001 outbreaks, a large proportion of the young adults with measles were hospitalised. The increased severity of the disease in adults has been documented elsewhere.[14,15] A third outbreak has now been identified among a similar age group in Victoria and was being investigated at the time this manuscript was prepared. Repeated outbreaks clearly demonstrate that young adults remain the group at highest risk of measles infection in Victoria.

Highly sociable, mobile living patterns within this group together with the fact that they were born during a period of introduction of vaccination into routine use makes them more susceptible to infection. This age group were either not vaccinated or because of the introduction of vaccines reducing the circulation of the virus, they were less likely to have come into contact with the virus and therefore not vaccinated or infected. The variety of settings and passing of incidental contact of most cases highlights the infectiousness of this disease and the need for prompt implementation of public health measures.

In this age of relatively inexpensive and rapid travel between countries and within regions, importation of measles, particularly in young adults, will continue to be a public health problem. Vaccination of international travellers to endemic areas should be emphasised until global elimination of measles has been achieved.

Young adults are a particularly difficult group to target effectively for widespread immunisation programs because of their mobility and diversity of employment. GPs, travel clinics and university and defence forces health services should be advised to take every opportunity to vaccinate this age group. Because of the continued threat of reintroduction of the virus, vaccination of travellers in this age group should be a high priority. Strategies should also target young adults who travel to measles endemic countries, as they are at increased risk of being exposed to measles.

Difficulties in clinical diagnosis of measles are well recognised now that measles has become a much rarer disease.[16,17] Even though 71 per cent of confirmed cases in this outbreak could have been diagnosed as suspected measles on the clinical grounds of rash, cough and fever at rash onset, many cases experienced delay in diagnoses. All but one of the 22 hospitalised cases experienced delayed diagnoses and there were multiple presentations among this group, presenting opportunities for further transmission within the healthcare setting. Laboratory confirmation is an integral component of enhanced surveillance for measles in Victoria,[7] but the disease must first be suspected before it can be reported.

Outbreaks will continue to occur in Victoria as imported cases introduce the virus into a high-risk young adult population. Not only are young adults a susceptible population, they are also a group which is highly mobile and may travel to areas where they are at higher risk of acquiring measles. Awareness amongst practitioners and the community that measles is now a disease of young adults as opposed to children, needs to be reinforced. The high number of hospitalisations also suggests that young adults are more likely to have severe disease. The single most effective strategy is to ensure that all young adults, healthcare workers included, have at least 2 documented doses of a measles-containing vaccine. It is not enough to rely on self-reported history of previous vaccination or exposure to wild virus.[18]

Outbreak investigation team

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References

1. Lambert SB, Morgan ML, Riddell MA, Andrews MA, Kelly HA et al. Measles outbreak in young adults in Victoria, 1999. *Med J Aust* 2000;173:467–471.
2. Gidding H, Gilbert G. Measles immunity in young Australian adults, *Commun Dis Intell* 2001;25: 133–136
3. Kelly HA, Riddell MA, Lambert S, Leydon JA, Catton MG. Measles immunity among young adults in Victoria, *Commun Dis Intell* 2001;25:129–132.
4. McDonnell LF, Jorm LR, Patel MS. Measles outbreak in western Sydney. *Med J Aust* 1995;162:471–475.
5. Gidding HF, Hills S, Selvey L, Roberts LA, Johnston S. An outbreak of measles in a rural Queensland town in 1997; an opportunity to assess vaccine effectiveness. *Commun Dis Intell* 1999;23:240–245.
6. Andrews R. Measles outbreak among young adults in Victoria. *Commun Dis Intell* 2001;25:12.
7. The Enhanced Measles Surveillance Working Party. Implementing a system of enhanced measles surveillance during an interepidemic period in Victoria. *Commun Dis Intell* 1999;23:51–54.
8. Lambert SB, Kelly HA, Andrews RM, Catton MC, Lynch PA et al. Enhanced measles surveillance during an interepidemic period in Victoria. *Med J Aust* 2000;172:114–118.
9. Communicable Diseases Network Australia New Zealand. Guidelines for the control of measles outbreaks in Australia. Communicable Diseases Intelligence Technical Report Series No. 5. Canberra: Commonwealth Department of Health and Aged Care, 2000.
10. Chibo D, Birch CJ, Rota PA, Catton MG. Molecular characterization of measles viruses isolated in Victoria, Australia, between 1973 and 1998. *J Gen Virol* 2000;81:2511–2518.
11. Skull SA, Andrews RM, Gorrie GJ, Riddell MA and Street AC. Healthcare workers continue to be at risk of measles: a case for better vaccination coverage. *Med J Aust* 2001;174:662–663.
12. Truong AT, Mulders MN, Gautam DC, Ammerlaan W, de Swart RL et al. Genetic analysis of Asian measles virus strains — new endemic genotype in Nepal. *Virus Res* 2001;76:71–78.
13. National Health and Medical Research Council. The Australian Immunisation Handbook. 7th Ed. Canberra, AGPS, 2000.
14. J eremijenko AM, Kelly H, Patel M. The high morbidity associated with a measles outbreak in a west Australian town. *J Paediat Child Health* 1996;32:382–385.
15. Gremillion DH, Crawford GE. Measles pneumonia in young adults, An analysis of 106 cases. *Am J Med* 1981;71:539–542.
16. Durrheim DN, Speares R. Measles elimination — a case definition to enhance surveillance. *Commun Dis Intell* 2000;24:329–30.
17. Ferson MJ, Young LC, Robertson PW, Whybin LR. Difficulties in the clinical diagnoses of measles: proposal for modified clinical case definition. *Med J Aust* 1995;163:364–366.
18. Houck P, Scott-Johnson G, Krebs L. Measles immunity among community hospital employees. *Infect Control Hosp Epidemiol* 1991;12:663–668.