

MEASLES *update*



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Measles in Canada, 1997 (as of May 31)

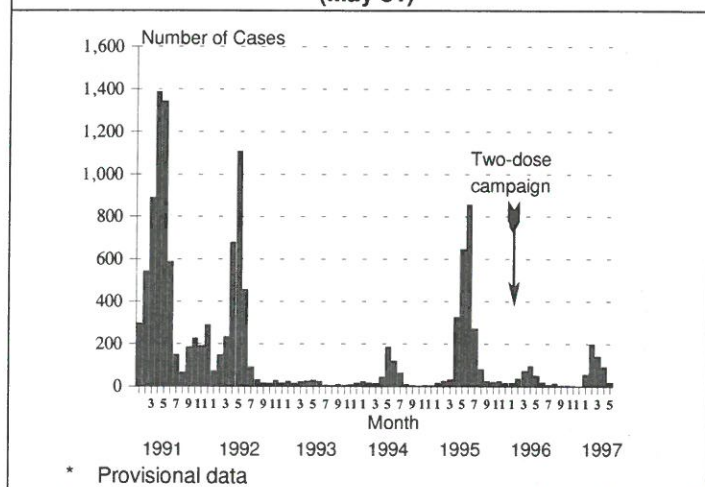
Paul Varughese, Division of Immunization, Bureau of Infectious Diseases, LCDC

From January 1, to May 31 1997, a provisional total of 548 measles cases has been reported in Canada, compared to 278 cases reported for the same period in 1996. Cases were reported from seven provinces: British Columbia (302), Alberta (206), Ontario (16), Saskatchewan (14), Newfoundland (8), Nova Scotia (1) and Quebec (1). Figure 1 shows the distribution of cases by month of onset since 1991.

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Figure 1
Reported cases of measles, by month, Canada, 1991-1997*
(May 31)



Geographic Distribution

British Columbia (BC): A measles outbreak which resulted in over 300 cases from 13 health regions across the province since mid-January appears to have ended. A link to Simon Fraser University was reported for 75 cases while 35 cases were linked to other educational institutions. Onset data suggest the occurrence of four epidemic waves, with peaks on January 24, February 5, 17 and 27. A preliminary report of the initial phase of the outbreak and outbreak control measures was published in an earlier issue of the *Measles Update* (1997;5(1):1-2). The median age of the cases was 21 years. The majority of cases were post-secondary students or young adults who were not targeted for the second dose measles catch-up campaign implemented in 1996 for Grades 1 to 12 students and preschoolers. Most cases had a history of one dose measles vaccination although documentation was not available. No known

Announcement

We wish to thank our many readers who have contributed to the success of the *Measles Update* through their interest in measles-related issues and by providing publication material to keep other readers informed. In future issues, our focus will expand from measles to include other vaccine-preventable diseases (VPDs) and their control through immunization. Consequently, the name of the publication will be changed to *Update: Vaccine-Preventable Diseases*.

The publication will continue to highlight the epidemiologic features, laboratory investigations, vaccine coverage, vaccination schedules, and national and global developments in preventive strategies for VPDs. We would be pleased to receive submissions on any of these issues for publication in the "Update". Photographs of classical or atypical presentations of VPDs are also welcome.

importation of measles has been documented in BC although the case investigation during the outbreak indicated a history of foreign travel for a few cases.

Alberta: The first confirmed case in Alberta was reported in the second week of February and was linked to the BC outbreak. The outbreak in Alberta began in Calgary, following a ringette tournament held in the last week of January, 1997 which was attended by a child from BC in the prodromal phase of measles. A number of participants in varying age groups from other parts of Alberta, BC, Ontario and Saskatchewan were potentially exposed during the tournament. To date, 206 cases involving 12 health regions have been reported in Alberta. Most of the cases are known to have received at least a single dose of measles vaccine. One case was imported, involving a foreign student attending a hockey school in Alberta who had visited Italy and developed measles on his return (April 9) to Canada. Unlike the BC outbreak, cases in Alberta were predominantly in younger children (median: 13 years), most of whom had received only a single dose of measles vaccine. A more detailed report of the outbreak is presented in this issue of the *Measles Update*.

Ontario: Of the 16 cases reported, three were imported and one was import-related (median: 20 years). Nine cases were associated with an outbreak at Trent University in Peterborough. The index case in this outbreak was a 21-year-old Canadian resident who had measles exposure during her visit to Austria from February 13 to 19; she developed the rash on March 5. The patient reported a history of vaccination without documentation. The last case in this outbreak had an onset date of April 15. Two other cases have also been classified as imported. The first, an unvaccinated (due to parental refusal) 1-year-old child, is a recent immigrant from the Philippines who had known contact with measles in that country. The other case involved an 18-year-old female Japanese student (vaccination status unknown). The import-related case involved a 17-year-old boy with a history of one dose measles vaccination (second dose missed during the provincial catch-up campaign). This patient contracted measles (onset January 13), from his 18-month-old unvaccinated sibling who developed measles in late December 1996 following a trip to Switzerland and had known contact with measles in that country. More than 2,500 persons, associated with the University-based outbreak, have been vaccinated.

Saskatchewan: Between March 9 and May 5, a total of 14 cases of measles was reported from four Public Health Regions in the northwestern part of the province. Two cases reported measles exposure outside the province (Alberta and BC). Follow-up and immunization of contacts with measles-rubella (MR) vaccine was conducted. As an immediate control measure, Saskatchewan has implemented a catch-up program with MR vaccine targeting students in Grades 9 to 12 with emphasis on those in Grade 12. This is in addition to the modified catch-up program introduced in the fall of 1996, with a second dose of MR vaccine for preschoolers and students in Grades 6 and 8. A second dose of MR vaccine is also routinely administered to children at 18 months of age.

Newfoundland: All the eight cases reported in this province occurred in March in the Eastern Public Health Unit (population 18,000), and all were laboratory confirmed. The index case, a 9-year-old unvaccinated (due to medical reasons) child, developed measles on March 2, following her return from Florida, USA. The remaining cases were epidemiologically linked to the index case and occurred between March 12 and 25. The cases ranged in age from 11 months to 23 years with a median of 11 years. Five cases were school-aged children while two were 21 and 23 years old. Six cases had a history of one-dose measles vaccination, although only four of them could document the date of vaccination. Single dose vaccination coverage for school-aged children in the area is approximately 97%. In response to the outbreak, an immunization program was initiated on March 2, to provide a second dose of measles vaccine to all children between the ages of 6 months to 19 years in the area as well as susceptible school teachers, staff and students in post-secondary settings. Approximately 6,000 persons were vaccinated. To date no further cases have been reported.

Nova Scotia and Quebec: One case each was reported in Nova Scotia (in a 12-year-old unvaccinated visitor from Switzerland) and in Quebec (clinical case in a 14-month-old vaccinated child).

Importation

In 1997, at least eight cases were identified as international importations; countries/continents of exposure or travel prior to the disease are Austria, Italy, Switzerland, Europe (country unspecified), Philippines, Japan and the USA. At least two cases were foreign students studying in Canada; one was a visitor; and a fourth was a recent immigrant child who was eligible for vaccination but was unvaccinated. Other cases were mostly Canadian residents who had received one dose of measles vaccine. Except for the outbreaks at the Trent University (Ontario) and Newfoundland, secondary transmission linked to importation was very limited.

Confirmation of Diagnosis

The diagnostic status of all cases is not currently available; however, at least 95% of the cases reported to date are laboratory confirmed, epidemiologically linked or clinically compatible.

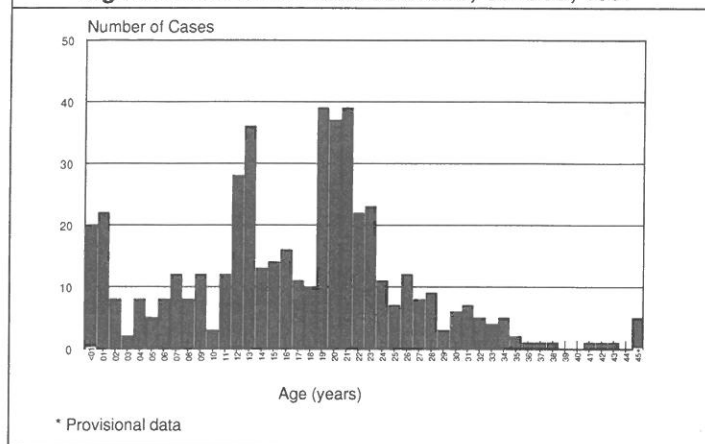
Age Distribution

Among the 498 cases with information available, their ages ranged from 2 months to 63 years (median: 19 years) (Figure 2). Infants accounted for 4%, preschoolers (1 to 4 years) 8%, those 5 to 19 years of age 46%, and those 20 years accounted for 42% of the cases. Only five cases were over 40 years of age (born before 1957), the vaccine-eligible group. Age-specific measles activity varied by geographic region, reflecting population susceptibility and exposure to the measles virus.

Comments

During the first 5 months of 1997, measles transmission occurred in several regions in Canada, following the introduction of measles virus from other parts of the country, or international importation. Outbreaks have been of varying magnitude,

Figure 2
Age distribution of measles cases, Canada, 1997*



depending on the population susceptibility, the nature of exposure to the virus and the control strategies implemented. Prolonged transmission extending over three incubation periods was reported in BC and Alberta, while transmission was limited in Newfoundland and Ontario. It is too early to predict the extent of transmission in Saskatchewan.

- Measles outbreaks in BC and Ontario, where school-based catch-up programs were implemented in 1996, suggest the

vulnerability of post-secondary students/young adults to measles, while outbreaks in Alberta, Saskatchewan and Newfoundland emphasize the need for two-dose measles vaccination for all school-aged children.

- From the current outbreaks, measles is not eliminated from Canada, although the susceptible population is undoubtedly diminishing due to the recently introduced catch-up campaigns (in some provinces/territories) and routine two-dose programs aimed at preschoolers across Canada. However, it is apparent that a more systematic and immediate action is needed to protect post-secondary students and others who have received single dose vaccination only.
- Until global eradication is achieved, international importations into Canada will continue; protection of all individuals by appropriate vaccination strategies is the only choice.

Acknowledgement

The assistance and cooperation of all provincial and territorial epidemiologists, and laboratory staff, medical officers of health and other health care personnel, and staff from LCDC is greatly appreciated.

Epidemiology of a Measles Outbreak in Alberta, 1997

Ruth Richardson and Karen Grimsrud, Alberta Health Communicable Disease Control

Overview

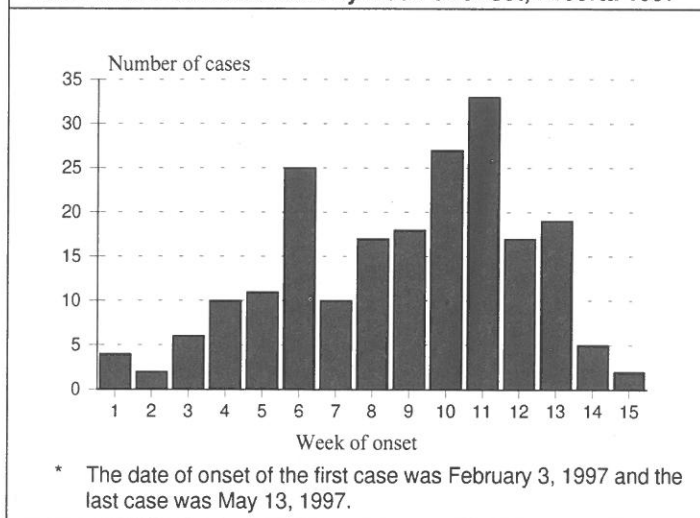
From January 24 to 26, 1997, Calgary hosted a ringette tournament with 164 teams attending from four provinces (Alberta, British Columbia, Ontario and Saskatchewan). On February 6, Alberta Health was notified by the BC Centre for Disease Control that one player had been diagnosed as a case of measles and had been in the prodromal phase while in Calgary. Subsequently, all of the teams who had attended the tournament were notified. The first confirmed case of measles in Alberta was reported February 11 in Calgary and had a definite link with the BC case. That same week, Edmonton reported their first case in a woman who had been a referee at the tournament. By March 7, there were a total of 24 confirmed cases in Calgary, Edmonton and Peace River. A mass catch-up program was announced on March 17 to provide a second dose measles vaccine (using monovalent measles vaccine) to students in Grades 1 to 9. The catch-up program was initiated on April 1, 1997 and targeted for completion by March 1998.

As of May 15, 1997, 206 confirmed cases have been reported from 12 of the 17 health regions in Alberta. All cases were laboratory confirmed or epidemiologically linked to a confirmed case. Only one case was reported to have been exposed outside of Alberta; exposure occurred in Italy.

Date of Onset

Figure 1 shows the number of cases by week of onset. The number of new cases is decreasing, and this trend should continue as protection from the catch-up measles immunization program comes into effect and the school year ends.

Figure 1
Number of measles cases by week of onset, Alberta 1997*



Age Distribution

Of the 206 cases occurring from February 11 to May 16, the majority (67%) were aged 6 to 15 years, the age group targeted for the second-dose catch-up campaign. Approximately 11% of cases were aged ≤ 5 years, 9% were aged 16 to 18 years, and 14% were > 18 years.

Geographical Distribution

One hundred and fifteen (56%) of the cases occurred in the Capital Health Authority (which accounts for approximately 30% of Alberta's population) while the remaining cases were spread through 11 other health regions.

Immunization Information

Of the 206 cases, immunization information is known on 168 (82%) cases. Of these 168 cases, 25 (15%) had never received any measles vaccine; 18 (11%) were reported as having received measles immunization but the date was unknown; and eight (5%) had received two doses prior to the onset of the outbreak. Of five cases occurring in children < 2 years of age, two had received their first measles-mumps-rubella (MMR) vaccine dose in February 1997 while the other three were too young to be immunized. There have been only 20 cases in children between the ages of 2 and 6 years; of these, eight had never been immunized, two had an unknown history, nine had received one dose (with two of these being administered in January/February 1997) while only one child had received a second dose.

Control Measures

Following identification of the initial case, immunization was provided for the school population at the school attended by that

student: this was found to be an ineffective control measure. As the number of cases grew, the practice of excluding unprotected students and provision of immune globulin to pregnant women with unknown/unprotected status and to those high-risk individuals (infants and immunosuppressed) was aggressively followed. The second dose measles catch-up program was implemented in response to this outbreak for long-term control of measles. Many regions have made the decision to complete a major portion of their catch-up campaign by the end of June 1997. A second dose of MMR to be administered with the preschool booster was previously introduced on July 1, 1996.

Conclusions

As shown, measles is a highly infectious disease that can begin innocently and spread rapidly throughout a community. Initial contact with a BC case led to over 200 cases in Alberta, as well as some cases in Saskatchewan. The fact that cases occurred in immunized individuals reinforces the fact that one dose of a measles-containing vaccine does not provide 100% protection.

The minimal number of cases in the 4 to 6-year-old age group (16) might reflect the protection provided through the second dose MMR vaccination instituted in spring 1996. The fact that the majority of cases in this outbreak occurred in the 6 to 15-year-old age group substantiates the decision to provide second dose measles immunization to the Grade 1 to 9 population.

Acknowledgements

We would like to thank the staff of the health units and laboratories throughout Alberta's Health Regions for their timely and complete reporting.

The 1996 Measles Elimination Campaign in British Columbia

Karen Pielak and Patricia Daly, Communicable Disease Epidemiology, British Columbia Centre for Disease Control (Adapted from BC Health and Disease Surveillance, Vol 6, No 4, 1997)

In the spring of 1996, British Columbia (BC) implemented a mass immunization program as part of a Measles Elimination Campaign. This was a huge undertaking for public health staff. Such a province-wide mass immunization campaign last occurred in BC in 1964, with the oral polio vaccination program. This report summarizes the background of the campaign, program planning and implementation, evaluation results, and recommendations for future mass immunization campaigns.

Campaign Background

Experience and research over the last 25 years had demonstrated that measles elimination in Canada was not possible with a single-dose measles immunization program. Outbreaks were still occurring at periodic intervals despite high coverage with one dose of measles vaccine⁽¹⁾. BC experienced an

outbreak of more than 7,000 cases in 1986 with at least one death. An outbreak of more than 10,000 cases occurred in Quebec in 1989, with five deaths and five people left with permanent brain damage. These outbreaks resulted largely from the pool of susceptibles in the population due to the lack of immunization or primary vaccine failure. Between 5% and 10% of those immunized with a single dose fail to develop protective immunity. A second dose of measles vaccine has been shown to result in seroconversion of most of those who experience primary vaccine failure after a single dose⁽²⁾.

The impetus for the campaign followed recommendations from the Laboratory Centre for Disease Control, Health Canada, and the National Advisory Committee on Immunization and the prediction of a national outbreak of measles in 1996. As most cases of measles in BC from 1990 to 1994 occurred in those < 4 years of age, it was decided that a routine second dose of measles-mumps-rubella (MMR) vaccine would be given at 18 months of age. The other component was a catch-up immunization campaign planned for the age group of 19 months

to 18 years of age. It was decided that measles-rubella (MR) vaccine would be used in the catch-up campaign as approximately 10% of women screened prenatally for rubella in BC are not immune. The goal of the campaign was to immunize 95% of the target population and to stop indigenous transmission of the measles virus, thereby eliminating indigenously acquired measles cases in the province.

Planning

An Implementation Group was formed, comprised of field level public health nurses, Medical Health Officers, and provincial consultants from Communicable Disease Epidemiology Services, the BC Centre for Disease Control, and Public Health Nursing, Central Office. This group planned the logistics of the campaign, and developed the following materials: staff training package, teaching package for members of the community, sample letters to physicians and school boards, consent form, and promotional materials (which incorporated materials developed by Health Canada).

Implementation

The program was launched on April 1, 1996 with the introduction of a routine second dose of MMR at 18 months of age, and a catch-up immunization campaign with MR vaccine. The catch-up campaign was administered by public health nurses in schools and community facilities; MR vaccine was not made available to private physicians. It was thought that the administration of the campaign through public health would be the most efficient way of reaching the targeted population of approximately 800,000 children in the 3-month time period scheduled for the campaign.

To quickly respond to field staff concerns and questions, six question and answer documents were prepared during the course of the campaign. Also, a newsletter, the Marvin Report, advised staff of the progress of the campaign and provided a vehicle for sharing ideas, tips, and humorous anecdotal accounts of campaign experiences.

Evaluation methods

Immunization coverage was reported bi-weekly by health units. This consisted of the number of children targeted for immunization in the 2-week period and the number of children immunized.

Vaccine administration time per injection was recorded. This included all aspects of the nursing services required for vaccine administration (i.e., local promotion and publicity, staff training, coordination of school clinics, ensuring consent was obtained, travel, clinic set-up and clean-up, vaccination, recording of information, management and reporting of adverse events following immunization, and answering of telephone enquiries).

Data on adverse events were collected by public health nurses using the standard provincial reporting form.

A survey of Public Health Nurses, Public Health Nursing Administrators, Assistant Administrators, and Medical Health Officers was done in November 1996, 3 months after the

completion of the catch-up campaign. The objectives were to evaluate both logistic and subjective aspects of the program. Logistic aspects evaluated included ministry support services, promotional materials, and ministry resource materials such as the regularly issued question and answer documents. Subjective aspects of the campaign were evaluated to ascertain the effects of the campaign on health unit staff. The results of this survey have been reported separately.

Results

Immunization coverage levels: As indicated in Table 1, the immunization coverage for school-aged children exceeded the coverage for preschool children. The lower coverage in preschoolers reflects the fact that this age group is not as easily accessed as the school-age population.

Table 1. Immunization Coverage			
Age Group	Number Targeted	Number Immunized	Percent Coverage
Preschool	173,687	130,093	74.9
School age (Grades K to 12)	639,335	573,757	89.7
Provincial Total	813,022	703,850	86.6

Administration time per dose: The mean nursing time/dose was assessed as 13.5 minutes and the mean clerical time/dose as 0.8 minutes. The mean nursing time per dose reported by health units ranged from 6.3 minutes to 25.2 minutes. This variance between health units was primarily due to the lack of standardization in data collection; there was insufficient time to develop a data collection tool as part of the planning process. Some of the other factors which may have accounted for the difference between health units include: incomplete recording of nursing time spent in the various activities, travel time, informed consent procedure (i.e., use or non-use of the Infant's Act), inconsistent inclusion of time spent by Public Health Nursing Administrators.

Reported adverse events: The pattern of reported adverse events is not unlike the pattern of events reported for MMR vaccine administered in the regular immunization program in the province. The results are shown in Table 2.

Table 2. Adverse event reports		
Event	Frequency	Rate (per 100,000 vaccinees)
Measles-like illness	177	25.5
Local reaction	73	10.5
Allergic reaction*	81	11.7
Joint pain or swelling	9	1.3
Thrombocytopenia	1	0.1
Other, non-specific	121	17.4
Total	462	66.6

* Including one suspected anaphylactic reaction.

Discussion and recommendations

The Implementation Group held a meeting in September 1996 to evaluate the campaign. The issues discussed and recommendations made at that meeting are summarized in Table 3.

Table 3. Evaluation issues and recommendations	
Issue	Recommendation
Preschool coverage was found to be very low at the mid-point of the campaign. A special promotional campaign was required late in May 1996 to improve coverage in this group.	Coverage should be monitored on an ongoing basis while a mass campaign is in progress in order to take action sooner for groups with lower coverage.
The BC Infants Act (legislation permitting mature minors to give their own consent) was inconsistently used across the province. This may have influenced coverage and nursing time per dose.	Wherever possible, informed consent should be obtained from the "mature minor" student.
Insufficient resources were allocated for public education, advertising, and promotion of the campaign.	Resources for public education and advertising must be sufficient to promote a mass campaign to the target population and to multi-cultural groups.
Staff felt overwhelmed with the demands of the campaign, which were in addition to their regular workload.	Staff must be given direction from supervisors in prioritizing existing workload in order to implement such a mass campaign.
Staff had difficulty adapting their standard of practice from routine immunization programs to a mass immunization campaign.	There is a need to educate staff regarding the objectives and goals of a mass immunization campaign as opposed to those of routine immunization programs. For example, this may include not keeping client records, and not pursuing children who missed scheduled clinics.
Questioning of the Implementation Group's decisions by management staff took up valuable time at the beginning of the campaign.	The Provincial Implementation Group must be given complete authority for decision-making in planning such a campaign. Once decisions are made, management should endorse them, and staff adhere to them.

Conclusion

As a result of this campaign, it is anticipated that the risk of indigenous measles transmission within BC has been reduced to an absolute minimum within the targeted population. Another benefit from the campaign is the experience gained by public health staff, which should help facilitate any future mass immunization campaigns should the need arise.

Acknowledgements

The Communicable Disease Epidemiology Services would like to thank all health unit/department staff for the very hard work which enabled the successful implementation of this mass immunization campaign. Special thanks are given to the Measles Elimination Campaign Working Group: Alison Bell (Director, Communicable Disease Epidemiology, BCCDC); Shelagh Weatherill (Communicable Disease Nurse, VHB); Micheline Nimmock (Nursing Supervisor, BHD); Cathy Shether (PHN, SCHU); Rob Parker (Deputy Medical Health Officer, SFHU); Jim Lugsdin (Medical Health Officer, EKHU); Christine Pfeiffer (PHN, UFVHU); Margaret Wilson and Vicki Anderson (Public Health Nursing, CO); Bev Barnby (PHN Assistant Administrator, UFVHU); Elaine Eastman (PHN, CRD).

References

1. National Advisory Committee on Immunization. *Supplementary statement on measles elimination in Canada*. CCDC 1996;22:9-15.
2. Whittler R, Veit BC, McIntyre S et al. *Measles revaccination response in a school-age population*. Pediatrics 1991;88:1024-30.

Editorial Comment

Following preparation of this article for publication, an outbreak of measles was reported in BC with cases mostly occurring among persons aged between 19 and 29 years (see *Measles Update* 1997;5(1):1-2). This age group was not targeted for immunization during the 1996 measles elimination campaign; of those with known immunization histories, the majority were reported to have received one dose of a measles-containing vaccine, or no vaccine. The number of cases reported among children and adolescents < 18 years old has been substantially lower than could have been expected without the mass immunization campaign, based on the recent epidemiology of measles outbreaks in Canada with 5 to 6 times as many cases occurring in persons < 18 years of age compared to those 19 years or older. The decreased incidence of cases < 18 years in the recent BC outbreak has been attributed to the high uptake (86.6%) of a second dose of measles-rubella vaccine during the catch-up campaign. The current epidemiology of measles in BC is further described in the first article of this issue of *Measles Update*.

Measles – United States, 1996, and the Interruption of Indigenous Transmission

Adapted from MMWR Vol 46, No. 11, 1997

As of December 30, 1996 (week 52), local and state health departments had reported a provisional total of 488 confirmed cases of measles to CDC for 1996, and the Commonwealth of Puerto Rico had reported eight cases. In addition, indigenous transmission of measles in the United States was interrupted for a prolonged period beginning in late 1996. This report summarizes measles surveillance data for 1996, which indicate a substantial proportion of cases were associated with continued international importations of measles and outbreaks among school-aged children who were not required to receive a second dose of measles-containing vaccine (MCV) to attend school.

Case Classification

Of the 488 provisional cases, 355 (73%) were indigenous to the United States, including 332 (68%) cases acquired in the state reporting the case and 23 (5%) cases resulting from spread from another state. International importations accounted for 47 (10%) cases, and an additional 86 (18%) cases were epidemiologically linked to imported cases. Importations originated from or occurred among persons who had traveled in Germany (seven cases); Greece and Japan (five each); Austria, India, and Philippines (three each); China, Italy, and Russia (two each); and England, Kenya, Liberia, Nepal, Somalia, Tahiti, and Turkey (one each). For eight of the imported cases, the exact source was unknown because the patient had traveled in more than one country outside the United States during the exposure period. None of the imported cases were acquired in countries in the Americas.

Age and Vaccination Status

Of the 465 measles patients for whom age was known, 117 (25%) were aged < 5 years, including 37 (8%) aged < 12 months and 25 (5%) aged 12 to 15 months. A total of 195 (42%) measles patients were aged 5 to 19 years, and 153 (33%) were aged ≥ 20 years.

Vaccination status was reported for 354 patients. Of the 226 (64%) who were not vaccinated, 170 (75%) were eligible to be vaccinated (i.e., aged > 12 months and born after 1956). Vaccination status varied by age group: all 32 patients aged < 1 year were unvaccinated, compared with 44 (71%) of 62 patients aged 1 to 4 years, 65 (48%) of 136 patients aged 5 to 19 years, and 85 (69%) of 124 patients aged ≥ 20 years. Of the 77 patients for whom dates of vaccination were available, 51 (66%) had received at least one dose of MCV after their first birthday and ≥ 14 days before rash onset. Five cases of measles were reported among persons who had received two doses of MCV after their first birthday, and one case was reported in a person who had received three doses of MCV.

Outbreaks

Twenty-three outbreaks (i.e., clusters of three or more epidemiologically linked cases) were reported by 15 states, accounting for 76% of all cases. The number of cases associated with outbreaks ranged from three to 121 (median: five cases). Transmission of measles occurred in school settings in seven outbreaks, and these outbreaks accounted for 55% of all cases reported in 1996. In four outbreaks (Alaska, Texas, Utah, and Washington), cases among school-aged children occurred primarily in those who had received only one dose of MCV; in two other outbreaks (Massachusetts and Minnesota), cases occurred among school-aged children who had religious or philosophic exemptions to vaccination. In Hawaii, an outbreak occurred in a college without a prematriculation vaccination requirement.

In outbreaks related to vaccine failure among school-aged children, the age distribution of cases reflected the type of second-dose policy implemented in the state. In Utah, which had the largest outbreak in the country in 1996 (121 cases, including cases resulting from spread to other states), a requirement for a second dose of measles-mumps-rubella (MMR) vaccine at kindergarten entrance has existed since 1992; at the time of the outbreak, children aged 5 to 9 years should have received a second dose of MMR. In this outbreak, 75 cases occurred among persons aged 10 to 19 years, and two cases occurred among children aged 5 to 9 years. Similarly, in Texas and Washington, which both require a second dose of MMR at middle school entry, outbreak-associated cases occurred among either primary school students, or among high school juniors and seniors who entered secondary school before the policy was implemented. In Alaska, which had not implemented a requirement for a second dose of MMR at the time of the outbreak*, the 63 total cases occurred among elementary school students (17 cases), middle school students (17), and high school students (six)⁽¹⁾.

The source case for six outbreaks (California, Hawaii, Massachusetts, New York, Pennsylvania, and Washington) was traced to an international importation. Genomic sequences from measles virus isolates from four outbreaks without an identified source case (Alaska, Massachusetts [a different outbreak from the outbreak in Massachusetts listed above], Minnesota, and Utah) were similar to sequences from viruses that were identified as importations from Europe and Southeast Asia, suggesting that an additional 205 (42%) of the 488 provisional cases reported for 1996 were related to international importations.

With the exception of an outbreak of measles in Hawaii (which was linked both by case investigation and molecular epidemiology to international importations of measles virus), indigenous transmission of measles in the United States appears to have been interrupted in late 1996. From October 18, 1996, to

February 10, 1997 (16 weeks), only one case of measles (with rash onset on December 16) not linked to an international importation was reported in the United States. An indigenous case with rash onset in February is still under investigation.

Reference

1. CDC. *Measles outbreak among school-aged children — Juneau, Alaska, 1996*. MMWR 1996;45:777-80.

* Alaska's requirement for a second dose of MMR at kindergarten and first-grade entry became effective beginning with the 1996-97 school year.

Erratum

We wish to bring to our readers' attention that the last issue of the *Measles Update* was erroneously labeled as Volume 1, No. 1, April 1997. The issue should have been numbered **Volume 5**, No. 1, April 1997.

We regret any inconvenience caused by this error.

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Health Canada

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