



MEASLES *update*



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MEASLES IN CANADA IN 1993: THE LOWEST EVER REPORTED

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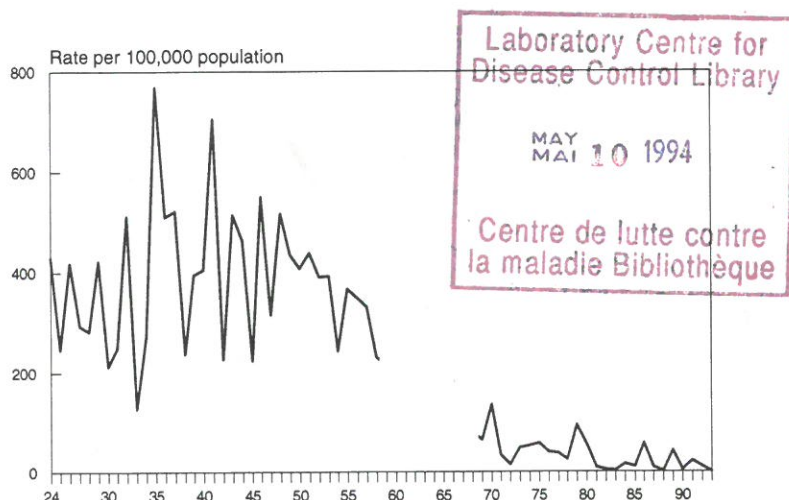
Epidemiologic situation

In 1993, a provisional total of 184 measles cases (0.7/100,000 population) was reported in Canada by the 10 provincial and 2 territorial health departments. This is the lowest total recorded for any year since national notification began in 1924, and reflects a 94% decrease from the 2,904 cases reported in 1992 (Figure 1). The following summarizes the epidemiologic characteristics of cases reported in 1993 as well as recent developments in prevention and control strategies.

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Figure 1
Measles — Reported cases, Canada, 1924-93



Measles live vaccine licensed in 1963
Measles killed vaccine licensed in 1964
Measles was not nationally reportable between 1959-68



*A child with measles generally appears
miserable and ill-looking*

Figure 2 shows the trend in reported cases, by month, during the period January 1992 to December 1993. In 1992 the average number of cases reported per month was 242; the range was 16 (October) to 1,109 (May). In 1993 the average number of cases was 15 with a range of 0 (December) to 29 (May).

In 1993 no cases were reported from 3 provinces (Newfoundland, Prince Edward Island and New Brunswick) and the 2 territories (Yukon and Northwest Territories). Ontario accounted for 99 cases (53.8%) and Quebec 48 (26.1%). Table 1 shows regional distribution and the rates per 100,000 population. Compared to 1992, Ontario has experienced a 97% decline, while Quebec experienced a 23% increase. There has been a remarkable drop in the proportion of cases occurring in school-aged children (5 to 19 years), from 83% in 1992 to 51% in 1993. Figures 3 and 4 show the age distribution and age-specific incidence rates per 100,000 population. The highest rate of infections was among infants, followed by preschoolers; the rate decreased with increasing age.

Table 1
Measles — distribution of cases by province and territory*, Canada, 1993

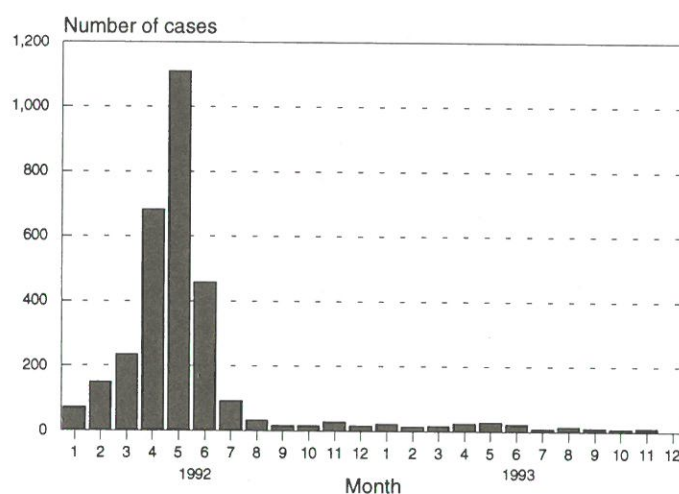
Province	Number of cases	Percentage	Rate per 100,000 population
Nova Scotia	4	2.2	0.4
Quebec	48	26.1	0.7
Ontario	99	53.8	1.0
Manitoba	1	0.5	0.1
Saskatchewan	1	0.5	0.1
Alberta	11	6	0.4
British Columbia	20	10.9	0.6
Total	184	100.0	0.7

* No cases were reported from Newfoundland, Prince Edward Island, New Brunswick, the Yukon and the Northwest Territories.

Information such as vaccination status and confirmation (laboratory vs. clinical) of cases is currently incomplete at the national level. Although some provinces are sending case-by-case data on measles cases (and other selected diseases) to LCDC, it is difficult to determine the true proportion of cases immunized or laboratory-confirmed because of the lack of uniformity in the format and insufficiency in the data collected. The proportion of imported cases from outside Canada is also not identifiable from these records.

National notification began in 1924 and the highest incidence was recorded in 1935 with over 83,000 cases (770/100,000 population). The widespread use of measles vaccine since the mid-1960s has resulted in a dramatic reduction in the overall morbidity and mortality due to the disease across Canada. Immunization programs have been progressively successful in reducing the burden associated with measles, resulting in 90% to 95% reduction in the reported incidence in the last decade.

Figure 2
Measles — Reported cases by month, Canada, 1992-93



Vaccination coverage

A survey conducted in the spring of 1993 indicated that 95% of the 2 to 3-year-olds had received at least one dose of measles vaccine, although only 90.5% had documented evidence of receiving the recommended one dose of vaccine after their first birthday (LCDC - unpublished data).

Recent developments in measles control efforts

Measles prevention and elimination has been a high priority issue in Canada especially since the early 1980s. Despite various attempts, localized outbreaks continued to occur up to 1992. Control measures in such situations have been difficult to implement, expensive and labour intensive.

The Laboratory Centre for Disease Control sponsored a national Consensus Conference on Measles, 1-2 December, 1992⁽¹⁾. The goal set at the conference is to eliminate measles in Canada by the year 2005. To achieve this goal, implementation of a routine 2-dose schedule (the second dose to be given before school entry) was recommended. *However, it was emphasized that the first priority in this schedule still remains the full application of dose one.*

The National Advisory Committee on Immunization (NACI) has recently endorsed the Consensus Conference's recommendations, including the measles elimination goal and the 2-dose routine immunization strategy. However, the final implementation of these recommendations will vary depending on the provincial or territorial government and resources. Some provinces are already taking steps towards implementing the 2-dose strategy.

To achieve total measles elimination, sustained cooperation of physicians, local, provincial, national and international public health agencies is essential.

Comment

Although there has been significant progress in measles surveillance, national data currently available are not adequate to determine all the risk factors.

As the number of cases decreases, we are hoping to expand the surveillance of measles with the assistance and cooperation of the local and provincial public health departments, moving from the current passive system to an active one in the near future.

It was also recommended at the Consensus Conference that mandatory information for measles surveillance should be prioritized and incorporated into all provincial and territorial surveillance systems for inter-provincial comparisons.

Many cases reported in recent years (as observed in 1993), in fact, were reported to have a history of measles vaccination, having received vaccine according to the national recommendation, i.e., after 12 months of age. The proportion of measles cases with a history of vaccination is likely to increase with an increase in vaccine coverage.

The current difficulty in obtaining immunization history of many cases because of the inadequacy in the immunization record-keeping system is very well recognized. A province-wide individual client immunization record system that includes all vaccines, all antigen combinations, and all ages (as recommended at the Consensus Conference), when implemented, will solve this problem.

Having achieved a rate of less than 1 case of measles per 100,000 population in 1993 in all Canadian provincial and territorial jurisdictions is remarkable. If measles activity is kept at this rate or lower, this will fulfil, in part, one of the Consensus Conference's recommended targets even earlier than expected, i.e., achieve and maintain an incidence of less than 1 case per 100,000 by the year 2000 in each province and territory. However, past experience in Canada, as well as in the United States, cautions us that, since a resurgence of measles can happen after a period of low activity, one should not be over optimistic about elimination unless the desired level of immunity is achieved and maintained in all segments of the populations. If low activity, as experienced in 1988 and 1993 is usually preceded by an epidemic, Canadian public health officials are encouraged to be vigilant.

Acknowledgement

Assistance of all provincial and territorial epidemiologists and other public health professionals across Canada, Dr. W. Cuff,

Figure 3
Measles — Age distribution of cases, Canada, 1993*

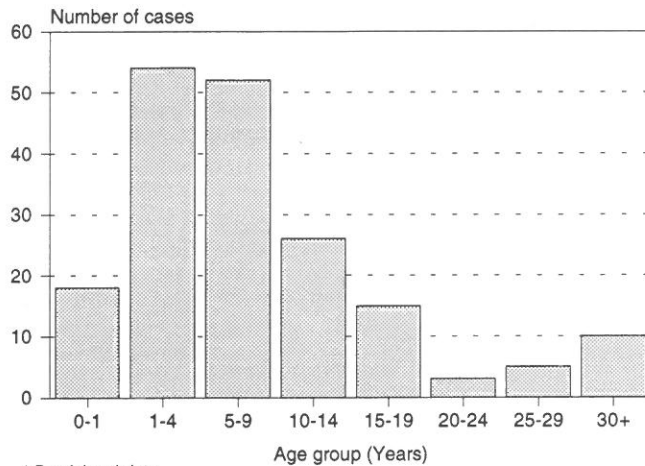
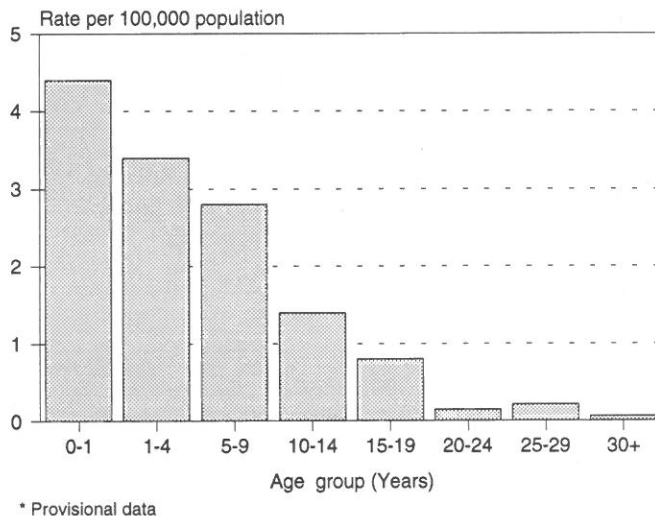


Figure 4
Measles — Age-specific incidence, Canada, 1993*



Ms. Mary-Jane Garnett, and Ms. Carol Scott, Biometrics, LCDC, is appreciated.

Reference

1. *Consensus conference on measles*. Measles Update 1993;1: 2-7.

Measles Antibody Response Following MMR II Immunization of Newfoundland Infants

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A. Objectives

1. To determine pre-immunization maternally-derived measles-specific antibody titre in children at the time of MMR II immunization, i.e., children aged 12 to 13 months, using the highly sensitive plaque reduction neutralization (PRN) test.
2. To determine both the post-immunization measles antibody titre by PRN test 4 to 6 weeks after MMR II immunization and the primary vaccine failure rate.

B. Methods

Five hundred and eighty children, 295 males and 285 females, aged 12 months from various communities representing the different regions of the Province of Newfoundland and Labrador were included in the study.

Pre-immunization blood samples were collected by finger prick from children 12 to 13 months of age immediately prior to immunization with MMR II vaccine. The post-immunization blood samples were collected by finger prick 4 to 6 weeks following MMR II vaccination. Pre-immunization maternally-derived measles-specific antibody levels in children and their post-immunization responses were studied. The association between mothers' ages and pre-immunization measles antibody levels in children was assessed.

Measles antibody titres of the test samples were determined by the PRN test as previously described⁽¹⁾. Both the pre- and post-immunization serum samples from individual study subjects were tested in parallel. The PRN results were expressed quantitatively as PRN units.

C. Observations

- a) 9% of children had maternally-acquired measles antibody at the time of MMR II immunization. Persistence of maternally-acquired measles antibody was more common among children of women born before 1966.
- b) Children having maternally-acquired measles antibody at the time of MMR II immunization did not respond to the measles component of the vaccine as well as those children who did not have it.

- c) Children receiving MMR II vaccine at 12 months of age responded to the measles component of the vaccine as well as those receiving it at 13 months of age.
- d) 2.6% of children receiving MMR II vaccine at 12 to 13 months of age completely failed to respond to the measles component of the vaccine.
- e) A further 13.8% had a poor measles antibody response below the protective level.

D. Conclusions

- a) Pre-existing measles antibody at a level that may not be detectable by tests other than PRN assay interferes with the measles antibody response following MMR II immunization.
- b) The currently used MMR II vaccine is not sufficiently immunogenic in inducing adequate measles antibody response after a single dose given at 12 to 13 months of age.
- c) There is a need to consider a 2-dose measles immunization strategy in Canada.

E. Reference

1. Chen RT, Markowitz LE, Albrecht P et al. *Measles antibody: reevaluation of protective titers*. J Infect Dis 1990;162: 1036-42.



Red watery eyes in a child with measles

The detailed report of this study is about to be submitted for peer review. The authors intend this to be a preliminary report to disseminate the principal findings of the study to the Public Health community as rapidly as possible.

MEASLES CONTROL/ELIMINATION INITIATIVES IN THE AMERICAS

C. de Quadros, J.-M. Olivé, P. Carrasco, EPI/PAHO, Washington, D.C.

In 1988, the Health Ministers of the English-speaking countries of the Caribbean declared their commitment to the goal of eliminating the indigenous transmission of measles by 1995. Their belief that this was possible was based on the successful effort launched by Cuba in 1986. In May 1991, these countries conducted mass immunization campaigns that vaccinated well over 90% of all the children between 9 months and 14 years of age. Subsequently, surveillance for fever and rash illnesses was initiated and all the countries in that area now report on a weekly basis to the Caribbean Epidemiological Center (CAREC) on the occurrence or not (negative reporting) of fever and rash illnesses (suspected measles cases). No laboratory-confirmed measles cases have been detected in nearly 2 years in the English-speaking Caribbean (Figure 1).

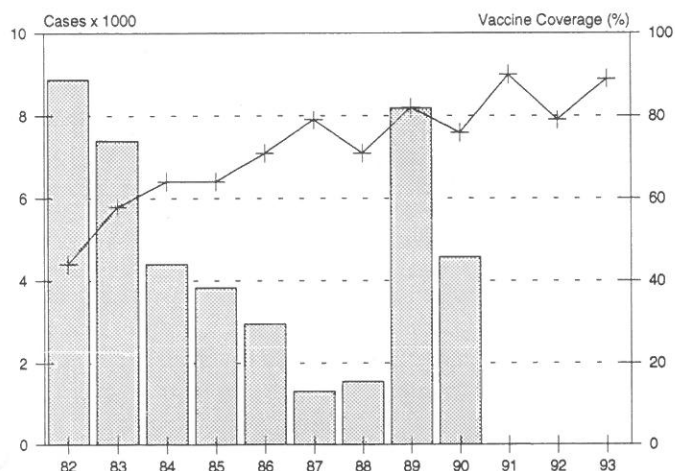
Chile and Brazil followed in April-May 1992 by holding mass campaigns to immunize all the children between 9 months and 14 years of age. In Chile only two cases of measles were confirmed since the campaign, both imported from Peru and Venezuela, respectively, and in Brazil less than 100 cases were laboratory-confirmed since then. In Peru, where there had been a measles epidemic in 1991, the government vaccinated almost

70% of the children 9 months to 15 years of age between September and November 1992 to stop the epidemic.

The Presidents of Central America, in December 1991, declared the goal of eliminating measles from Central America by 1997 and mass campaigns were begun in late 1992 to vaccinate all the children between 9 months and 14 years of age. These campaigns were completed in March-April 1993 with over 80% coverage. Similar campaigns were completed in the Dominican Republic in March 1993, in Argentina and Columbia in May 1993, and in Mexico in November 1993, all achieving very high levels of coverage (Figure 2). In November 1993, the Ministers of Health of the Andean countries passed a resolution to eliminate measles by 1997.

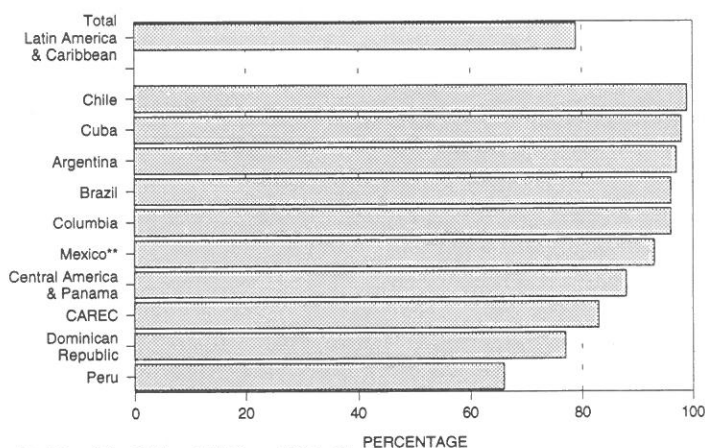
Experience gained thus far indicates that the strategy recommended by PAHO may give very positive results in the fight against measles. It consists in undertaking a one-time effort to vaccinate all the children between 9 months and 14 years of age, regardless of their previous immunization or disease history, and subsequently ensuring that high measles vaccination coverage rates are maintained in each new cohort of infants. Subsequent vaccination campaigns may be needed to catch up with children that do not get vaccinated at the proper recommended age during routine vaccination activities. The

Figure 1
Measles cases and vaccine coverage in the English-speaking Caribbean and Suriname, 1982-93*



* For 1993 information up to November 1993
Source: PAHO/CAREC

Figure 2
Percentage of children 1 to 14 years of age vaccinated against measles, Latin America and the Caribbean, and specific countries, 1987-93*



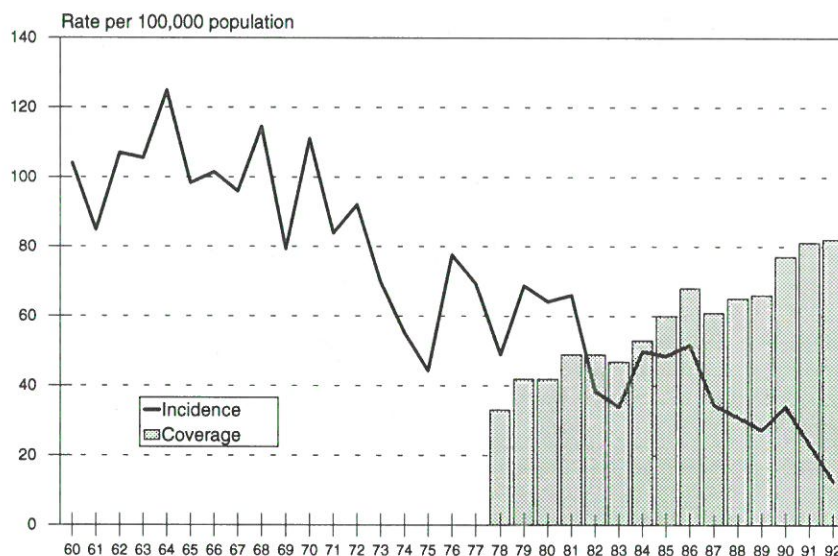
Total Population Children 1-14 Years: 162.7 million
Total Vaccinated Children 1-14 Years: 121.5 million
* Data as of 2 December
** Estimated data
Source: EPI/PAHO

frequency and target group for these subsequent campaigns will have to be determined by the accumulated surveillance data. Countries that have implemented these measles immunization catch-up campaigns have moved into an elimination mode and will have to adjust their strategies accordingly. Once the mass campaigns have been carried out, existing surveillance systems will have to be fine-tuned to enable the national immunization programs to make quick adjustments and focus control activities on eliminating pockets of transmission. It is therefore recommended that in addition to the immunization campaigns, a sensitive and aggressive surveillance system be established to detect any remaining chains of transmission and to deal with imported cases. This surveillance system will have to be based on routine reporting, and follow-up of fever and rash illnesses will serve as surrogate for the suspect cases of measles. In those countries that have implemented this strategy, transmission was considerably curtailed or was temporarily interrupted; therefore, the children < 1 year of age are now at a considerably lower risk of infection. Consequently, it is advisable that national immunization schedules be adjusted to this new phase of the program, with the increase in the age for vaccination from 9 months to 1 year of age, bringing the added benefit of increased vaccine efficacy.

For 1992 the Region of the Americas reported the lowest number of measles cases ever reported in its history and achieved the highest levels of coverage ever, with nearly 80% of the districts reporting coverage of 70% + for the children by 1 year of age (Figures 3 and 4). Should these efforts succeed, the Americas could lead the way for a global effort to the eventual global elimination of this major killer in children. These national and subregional initiatives to control and/or eliminate measles attest to the governments' confidence in the sustainability of their immunization programs, and to their unswerving commitment to the goals of the World Summit for Children.

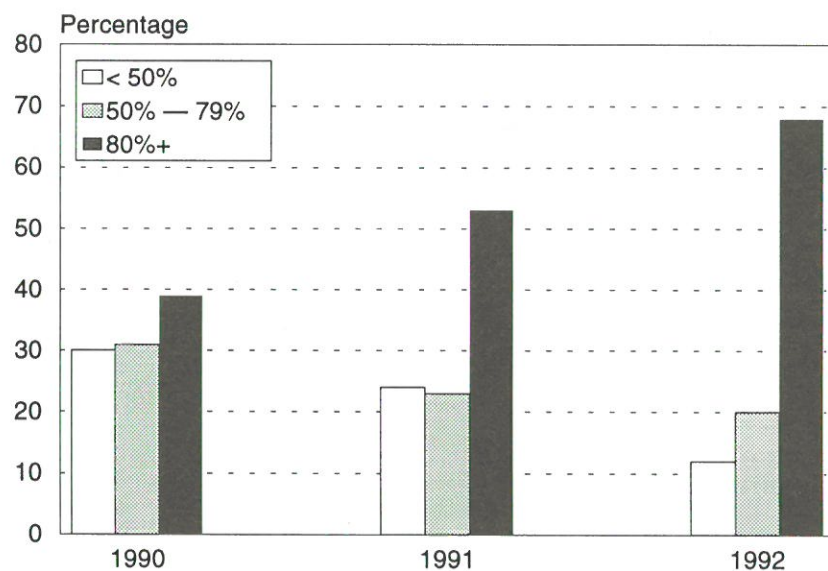
Despite this marked progress, problems still remain. There are a number of countries that have not reached 80% vaccination coverage rates in the children by 1 year of age. Furthermore, many reported cases are not yet properly investigated. Crucial epidemiologic information and blood samples necessary to classify the cases accurately are not being

Figure 3
Reported measles cases and vaccine coverage, Latin America, 1960-92



Coverage for children < 1 year of age
Source: PAHO/WHO

Figure 4
Distribution of districts by range of measles vaccine coverage in children less than 1 year of age, Region of the Americas, 1990-92



No. of districts: 1990: 7,864; 1991: 10,178; 1992: 12,963
Source: EPI/PAHO

routinely collected, the laboratory network is not yet prepared to respond to the new program needs and the present diagnostic technology is not simple enough for field utilization. These barriers will have to be removed to enable these initiatives to succeed.

MEASLES — UNITED STATES, FIRST 26 WEEKS, 1993

Morbidity and Mortality Weekly Report, Vol 42, No 42, 1993

As of 3 July, 1993 (week 26), local and state health departments had reported a provisional total of 167 measles cases for 1993 - the lowest total reported for the first 26 weeks of any year since surveillance began in 1943 and a 99% decrease from the 13,787 cases reported during the first 26 weeks of 1990, the peak of the recent resurgence. Cases were reported from 18 states. This report summarizes the epidemiologic characteristics of measles cases reported for the first 26 weeks of 1993 and compares them with cases reported during 1989-1991.

Characteristics

In addition to the 167 measles cases reported through CDC's National Notifiable Diseases Surveillance System (NNDSS), 8 additional cases not reported through NNDSS as of week 26 were identified by CDC's National Immunization Program. Of these 175 reported measles cases, 102 (58%) were acquired indigenously; 1 case was acquired in Puerto Rico. Of 14 (8%) imported cases, the country of acquisition was known for 12: 5 were acquired in Germany, 2 in Japan, and 1 each in Haiti, Liberia, the Philippines, Sierra Leone, and El Salvador. A total of 58 (33%) cases were epidemiologically linked to imported cases.

Of the 98 (56%) cases for which serologic testing for measles was reported, 93 were serologically confirmed. Although the other 5 cases were seronegative, all met the standard CDC case definition for measles⁽¹⁾.

Of the 175 case-patients, 54 (31%) were aged < 5 years, including 17 (10%) aged < 12 months. In addition, 77 (44%) case-patients were aged 5 to 19 years, and 44 (25%) were aged ≥ 20 years (Table 1).

Vaccination Status

Overall, 39 (22%) reported case-patients had received one dose of measles-containing vaccine on or after the first birthday; no cases were reported among persons who had received 2 doses of vaccine. A total of 47 (27%) reported case-patients were unvaccinated but vaccine-eligible (i.e., U.S. citizens aged ≥ 16 months without medical, religious, or philosophic exemption to vaccination) (Table 1). Other unvaccinated groups included 35 (20%) persons with philosophic exemption to vaccination, 30 (17%) who were aged < 16 months, 10 (6%) who were born before 1957, and 10 (6%) who were non-U.S. citizens. Vaccination status varied by age group: 36% of persons aged 5 to 19 years were adequately vaccinated, compared with 14% of children aged 1 to 4 years (Table 1).

Outbreaks

The largest measles outbreaks were reported from California (Los Angeles County [29 cases] and Sonoma County [40 cases]) and Vermont (Chittenden County [20 cases]). In all three counties, 60% to 78% of cases occurred among school-aged persons (i.e., aged 5 to 19 years). In the Los Angeles County and Chittenden County outbreaks, previous receipt of one dose of measles-containing vaccine was documented for 40% and 82%

Table 1
Age and vaccination status of 175 reported measles case-patients — United States, first 26 weeks, 1993

Age group (yrs)	Vaccinated*				Unvaccinated							
	2 doses		1 dose		Vaccine-eligible**		Not routinely eligible for vaccination***		Other****		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
< 12 mos	NE†	—	NE	—	NE	—	17	(100)	NE	—	17	(10)
1 - 4 yrs	0	—	5	(14)	8	(22)	14‡	(38)	10§	(27)	37	(21)
5 - 19 yrs	0	—	28	(36)	18	(23)	0	—	31§	(40)	77	(44)
≥ 20 yrs	0	—	6	(14)	21	(48)	11	(25)	6	(14)	44	(25)
Total	0	—	39	(22)	47	(27)	42	(24)	47	(27)	175	(100)

* At least one dose of measles-containing vaccine on or after the first birthday.

** U.S. citizens aged ≥ 16 months without medical, religious, or philosophic exemption to vaccination.

*** Persons aged > 16 months, born before 1957, with medical contraindication, or with documented physician or serologic evidence of measles immunity.

**** Non-U.S. citizens and persons with religious or philosophic exemption to vaccination.

† Not eligible.

‡ Thirteen (93%) case-patients were aged < 16 months (i.e., less than the routine age of vaccination).

§ Seven (70%) 1-4-year-olds and 28 (90%) 5-19-year-olds in this category had philosophic exemption to vaccination.

of school-aged persons, respectively. In Sonoma County, the outbreak involved an alternative-lifestyle community; because most persons claimed philosophic exemption to vaccination, 95% were unvaccinated. The index patient of this outbreak had acquired measles in Germany.

Two small outbreaks were reported from Connecticut (Hartford County [7 cases]) and Honolulu (9 cases). In Hartford County, 4 of the 7 cases occurred among adults aged ≥ 25 years; although the specific source of the outbreak was unidentified, it probably was related to ongoing measles transmission in Puerto Rico. In Honolulu, 7 of the 9 cases occurred among preschool-aged children; the index patient of this outbreak had acquired measles in the Philippines.

MMWR Editorial Note: During 1989-1991, widespread measles activity occurred in the United States; however, in 1992, reported measles cases decreased sharply⁽²⁾. The sustained decline during the first 26 weeks of 1993 represents the lowest total of reported measles cases in the history of measles surveillance in the United States. From 1985 through 1992, an average of 54% of the annual total of measles cases had been reported by week 26 (range: 47% to 67%) (CDC unpublished data, 1993). Based on current reporting trends - and if no large outbreaks occur - fewer than 500 measles cases may be reported in 1993.

During 1993, measles cases have involved predominantly school-aged persons, and the largest outbreaks have occurred among school-aged persons who had received one dose of measles vaccine (i.e., vaccine failures). In contrast, during 1989-1991, cases involved predominantly preschool-aged children, and the largest outbreaks occurred among unvaccinated preschool-aged children living in large urban areas⁽³⁻⁵⁾. In addition, during 1993, the largest measles outbreak among predominantly preschool-aged children has involved 9 cases in Hawaii; during 1989-1991, several outbreaks among such children involved more than 1,000 cases.

The decline in measles incidence during 1992 and 1993 most likely reflects increased measles vaccination coverage levels among preschool-aged children. The estimated level of measles vaccination coverage for children aged 2 years was substantially higher in 1991 (83%) than in 1985 (61%)⁽⁶⁾ (CDC, unpublished data, 1993). In addition, this decline may reflect a decrease in measles importation from other countries in the Western Hemisphere associated with aggressive measles-control programs.

The risk for measles outbreaks among school-aged persons and college entrants can be reduced through systematic efforts to

introduce and enforce vaccination with a second dose of measles vaccine among members of these age groups⁽⁷⁾. In addition, efforts must be continued to further increase measles vaccination levels among preschool-aged children to ensure against the recurrence of measles outbreaks among young children in urban settings.

Although the low reported incidence of measles during the first 26 weeks of 1993 suggests that transmission has been interrupted in many parts of the United States, the report of 102 indigenous cases without a known source indicates that undetected transmission is occurring in some areas. Reports of individual cases of measles should be immediately and thoroughly investigated and, when possible, serologically confirmed; rapid implementation of appropriate vaccination strategies can prevent small clusters of cases from becoming large outbreaks.

References

1. CDC. *Case definitions for public health surveillance*. MMWR 1990;39(no. RR-13):23.
2. CDC. *Measles - United States, 1992*. MMWR 1993;42:378-81.
3. Atkinson WL, Orenstein WA, Krugman S. *The resurgence of measles in the United States, 1989-1990*. Annu Rev Med 1992;43:451-63.
4. Gindler JS, Atkinson WL, Markowitz LE et al. *Epidemiology of measles in the United States in 1989 and 1990*. Pediatr Infect Dis J 1992;11:841-6.
5. Atkinson WL, Hadler SC, Redd SB et al. *Measles surveillance - United States, 1991*. In: *CDC surveillance summaries (November)*. MMWR 1992;41(no. SS-6):1-12.
6. Bureau of the Census. *Statistical abstract of the United States, 1993*. 113th ed. Washington, DC: US Department of Commerce, Bureau of the Census, 1993.
7. ACIP. *Measles prevention: recommendations of the Immunization Practices Advisory Committee (ACIP)*. MMWR 1989;38(no. SS-9).

Submissions of pertinent reports/epi notes are welcome and success of this endeavour depends upon the readers' interest and cooperation. Priority for inclusion in the newsletter is determined by the article's relevancy. This is not a formal publication, and the views and interpretation may not necessarily reflect Health Canada's position. Distribution is free of charge. Anyone wishing to receive a copy on a regular basis should contact the Childhood Immunization Division, Bureau of Communicable Disease Epidemiology, LCDC, Ottawa, Ontario, K1A 0L2; telephone (613) 957-1340; Fax (613) 998-6413.

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