MEASLES *update*

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Table of Contents

Current News

Progress Towards Measles Elimination in Canada

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The routine one-dose measles vaccination program introduced in Canada in the mid-sixties has had a very positive impact in reducing measles incidence by over 95% from the pre-vaccine era. An estimated 300,000 to 400,000 cases of measles occurred annually in Canada before the routine vaccination.

In recent years, however, the limitations of a one-dose vaccination program have become apparent due to several measles outbreaks in Canada, including one in Quebec in 1989 with 10,184 reported cases and another in Ontario in 1991 with 5,283 reported cases. The actual number of cases in these outbreaks was likely higher as the estimated proportion of cases reported was only 25% to 30%. The outbreaks continued to occur despite stable coverage levels of approximately 97% at 2 years of age. Cases occurred mostly in school-aged children even in populations with virtually 100% documented immunization. Measles transmission was likely caused by the small proportion of children who failed to respond to primary vaccination or, by those who lost protection over time after vaccination. It became increasingly clear with time that, due to the extreme contagiousness of measles, Canada's routine one-dose program would not be sufficient to achieve the elimination of indigenous measles. This was strongly supported by international experience, which showed that the typical pattern of measles in highly vaccinated populations is one of outbreaks at extended intervals involving 1% to 5% of school children, with a spillover into pre-school children. The administration of a second dose of measles-containing vaccine had been shown in other countries to diminish the proportion of susceptible children, decreasing the potential for outbreaks. Conversely, control measures such as exclusion from school and emergency mass revaccination are extremely disruptive, costly and of limited effectiveness.

Despite the fact that participants of a National Conference on Measles Control in 1992 endorsed the goal of elimination of indigenous measles in Canada by the year 2005, little progress was made and competing developments in childhood vaccination programs pre-empted the formal introduction of a two-dose measles vaccination program in Canada. Compared with 1993, when Canada enjoyed its lowest level of measles activity ever recorded with only 204 cases reported, the number of cases had risen steadily to 512 in 1994, and 2,362 in 1995. In 1995, with only 3.6% of the population in the Americas, Canada

accounted for 40% of all reported cases in the region. Other countries in the Americas had recently conducted highly-effective measles mass vaccination campaigns or had implemented routine two-dose programs for many years. It was apparent that the measles control strategy in Canada at that time was the least effective. These developments prompted the endorsement of a true national goal of measles elimination at the political level.

An analysis of the situation in Canada suggested that sufficient numbers of unprotected children existed in each province/territory to fuel outbreaks at any time. It was estimated that without action, an outbreak involving in excess of 20,000 cases, 2,000 complications and several deaths could occur as early as April 1996. Predictions from mathematical modelling and a Delphi study indicated that there were enough susceptibles in the population to produce an average of 12,800 cases of measles a year. Predictions from mathematical modelling also indicated that giving a routine second dose only to young children would not eliminate measles for 10 to 15 years (inconsistent with the elimination targets) and that a national catch-up campaign would be the only way to avoid forecasted outbreaks and to prevent an additional 58,530 cases and several deaths. Cost-benefit analysis indicated that these programs would save in excess of 2.5 dollars per dollar invested.

In August 1995, the National Advisory Committee on Immunization (NACI) reaffirmed its commitment to the goal of measles elimination shared by all the countries of the Americas. NACI confirmed its recommendation for a second dose of measles vaccine to be offered routinely at least one month after the first dose, to raise protection rates as high as possible. It would be most convenient to link this dose with other routinely scheduled vaccinations at 18 months of age or with school-entry vaccinations at 4 to 6 years, or at any intermediate age that is practicable. NACI also recommended that to achieve measles elimination as early as possible, a second dose of measles vaccine should be provided as part of special catch-up programs to all children and adolescents previously immunized under the one-dose schedule. The principal target group for the catch-up campaigns was identified as school children, as they had the highest rates of measles in recent Canadian outbreaks and are most readily identified and served.

Following NACI's recommendation, Health Canada encouraged a mass catch-up vaccination campaign followed by the implementation of a routine two-dose schedule. All provinces/territories with the exception of New Brunswick (97% of the Canadian population) have since introduced a routine second dose measles vaccination at either 18 months or 4 to 6 years depending on the province; Saskatchewan is using measles-rubella (MR) vaccine while all other jurisdictions are using measles-mumps-rubella (MMR) vaccine. Six of the provinces/territories (Ontario, Quebec, British Columbia, Prince Edward Island, the Yukon and the Northwest Territories) representing 80% of the Canadian population have already completed a mass catch-up program for all school-aged children. In Quebec and British Columbia, catch-up was extended to children 18 months of age although this was given a lower priority and catch-up will likely not be completed until these children enter school. A more limited catch-up program has been started in Manitoba to include all primary school students and in Saskatchewan to include all school-aged children > 18 months, but to be completed over a 3 year period in a staggered manner.

The catch-up campaigns were conducted in schools by public health nurses and followed careful planning and public awareness campaigns. Very high coverage levels (90%) have been reported in targeted age groups by all the provinces/territories that have completed a catch-up campaign. To date, nearly 4 million children have been immunized. Although mass vaccination campaigns had been implemented in the past for invasive meningococcal disease, their extent was more limited, being province-wide in only two jurisdictions, and regional in others. The recent measles campaign was the first mass vaccination campaign of such magnitude in Canada.

These very successful campaigns have had an immediate impact and interrupted three potential outbreaks that were developing earlier this year. As of November 15, only 315 cases of measles have been reported for 1996, most of which occurred prior to the implementation of the catch-up campaigns in the largest provinces. Since June, very few cases have occurred and transmission seems to have been interrupted. A total of 11 importations have been identified to date in 1996. In the provinces which have not yet implemented catch-up programs, there still remain school-aged susceptible populations in sufficient numbers to fuel outbreaks through importations.

Retrospectively, the heavy measles activity occurring in early 1996 (2.5 times the number of cases in the corresponding period in 1995), and the number of outbreaks support the prediction of a large outbreak occurring after April 1996. It also indicates that the implementation of the provincial campaigns was very timely.

Several evaluation and surveillance activities relating to the catch-up campaigns have been implemented, including disease surveillance; surveillance of vaccine-associated adverse events; monitoring of achievements of the targets for coverage; assessment of the process and cost of the campaigns; and evaluation of promotion activities. Health Canada provided technical assistance and facilitated the planning of provincial activities and evaluation of the mass catch-up campaigns. It also produced turnkey material for public awareness campaigns and helped reduce vaccine costs through competitive solicitation and speedy licensure of products needed for the catch-up campaigns.

As we move towards measles elimination in Canada, it is important to ensure that we continue to maintain high levels of measles immunity across the country and, with active measles surveillance, rapidly detect and control any outbreak of the disease. To this end, the Working Group on Measles Elimination in Canada (WGMEC) was recently established. The mission of the working group is as follows:

- to develop the tools to determine where Canada stands with respect to measles elimination;
- to develop a national surveillance protocol; and

- to propose implementation of the surveillance protocol across the country.

The first meeting of the WGMEC was held in Ottawa on October 25, 1996. During the meeting, the scope of the task ahead was outlined and discussion focused on the following issues: documenting measles coverage; enhanced surveillance with particular emphasis on laboratory issues; outbreak control; and research priorities. Detailed information on these issues and the recommendations of the working group will be reported in a future issue of the *Measles Update*.

Measles in Canada, 1996 (as of November 15)

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From January 1 to November 15, 1996, a provisional total of 315 measles cases (1.1 per 100,000 population) has been reported in Canada. This compares with 2,296 cases reported for the same period in 1995, reflecting a decrease of 86%. Figure 1 shows the trend in reported cases by month since January 1991. There has been a noticeable decline in the incidence of reported cases since July 1996; 287 cases (91%) were reported in the first half of the year compared to the 28 cases (9%) reported since July. This reduction is largely due to the low measles transmission in Ontario following the introduction of the mass immunization program.

To date, seven provinces/territories have reported cases: Ontario (176), Quebec (83), British Columbia (38), Alberta (eight), Saskatchewan (five), Nova Scotia (three), and the Yukon Territory (two). No deaths attributed to measles have been reported. Eleven imported cases (3.5% of all cases) have been identified; all were among Canadian residents, most of whom had received one dose of measles vaccine. Countries of exposure include Greece, Belgium, United Kingdom, France, Germany, New Zealand, United States and Japan; however, there has been no evidence of secondary transmission in Canada.

Laboratory Confirmation

The status of all cases is not currently available; however, to date, at least 155 (51%) cases have been laboratory-confirmed.

Age Distribution

The cases ranged from 2 months to 49 years of age (median: 11 years). Figure 2 shows the age distribution of cases at 1-year of age intervals. Infants accounted for 8%, preschoolers (1 to 4 years) 15%, those 5 to 19 years of age 64%, and those ≥ 20 years accounted for 13% of the cases.

Vaccination status

Vaccination information is incomplete because information was unavailable for many cases, especially adults. At least 64% of the cases had a history of one dose measles vaccination and 8% were not eligible for vaccination (< 12 months old).

Comments

Weekly surveillance data suggest that measles transmission has been interrupted in Canada, and the very few cases reported in recent months are sporadic cases. Most of these cases were laboratory-confirmed as IgM positive, but despite investigation by local public health officials, lacked a history of exposure to another case or travel in an endemic area. The declining incidence of measles is undoubtedly due to the recent implementation of two-dose catch-up campaigns, particularly in

Figure 1
Reported cases of measles, by month, Canada, 1991-1996* (November 15)

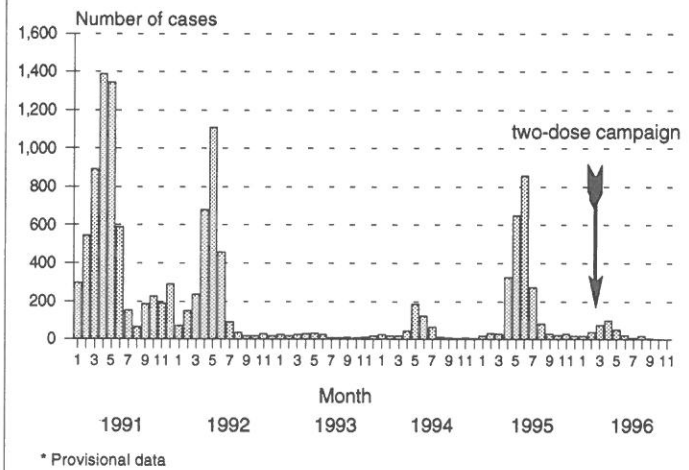
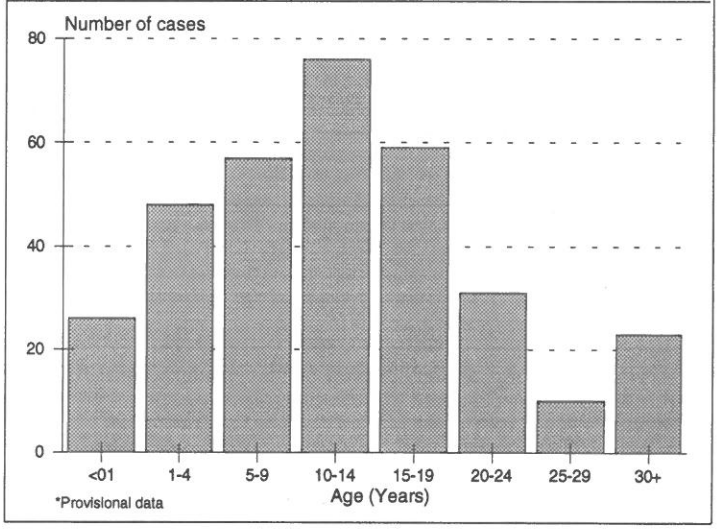


Figure 2
Age distribution of measles cases in Canada, 1996* (November 15)



Ontario where measles transmission was still ongoing during the first part of this year.

Measles activity in Quebec in 1996, although limited, has been unique in that half of the 83 cases reported were in older children and young adults (17 to 20 years) attending high school or college. Of the 83 cases, 58 (70%) had a history of a single dose measles vaccination. The majority of cases reported from Quebec were not in the age group that was targeted for the recent two-dose catch-up campaign.

There have been no reports of vaccine failures among those who have received the second dose sufficiently early to produce protective levels of immunity. Reported reaction rates to the second dose of measles vaccine are well within the expected range, and the vaccine has been well tolerated with no serious outcomes. However, anxiety reactions have been common, particularly among older school-aged students.

Acknowledgment

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

Update on Implementation of Routine Two-dose Measles Vaccination Schedule and Supplementary Catch-up Programs

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To date, all provinces/territories with the exception of New Brunswick have implemented routine two-dose measles vaccination using either measles-mumps-rubella (MMR) vaccine or measles-rubella (MR) vaccine (Saskatchewan only) for the second dose. In Newfoundland, Quebec, British Columbia, the Northwest Territories and the Yukon Territory, the second dose is recommended at 18 months of age while in the remaining six provinces it is recommended at 4 to 6 years of age, prior to school entry (in Manitoba, the second dose will be used at 5 years of age). Manitoba and Saskatchewan initiated the routine two-dose program this fall although they announced their commitment to the program along with the other jurisdictions by the spring of 1996.

Six provinces/territories have completed supplementary school-based mass catch-up campaigns targeted at all school-aged children; in Quebec and British Columbia, catch-up was extended to children 18 months of age although this was given a lower priority. Preliminary estimates of coverage indicate highly successful immunization uptake: in Ontario, 89% coverage among children in kindergarten through Grade 13 (approximately 2.1 million children); in British Columbia, 89% among Grades 1 to 12 students (679,600) and 71% among pre-schoolers (173,700); in Prince Edward Island, 92% among Grades 1 to 12 students (24,600) and 73% among pre-schoolers (2,600); and in the Northwest Territories, 85% among all school children (21,000). Coverage among Grades 1 to 12 students was 87% in Quebec (approximately 1.1 million) and 81% in the Yukon Territory (5,500); both Quebec and the Yukon Territory are yet to evaluate coverage among their pre-school populations. In addition, when children who had previously received two doses of vaccine and those who had acquired natural measles are included, about 94% of all school children in Ontario and 89% of Grades 1 to 12 students in Quebec are estimated to be protected against measles.

These estimates are based on coverage achieved during the mass campaigns, however, overall catch-up coverage is expected to be higher in some jurisdictions as children, particularly preschoolers, continue to be immunized. In some cases, children who may have been absent on school vaccination days have since obtained their vaccination from health units. Although the full impact of the measles catch-up campaign was not expected to be immediate, there has been considerable evidence of benefits accruing already. The change in the measles control strategy has successfully led to an interruption of transmission this year, and control of at least three potential outbreaks identified early in 1996.

Saskatchewan and Manitoba have recently initiated more limited mass catch-up programs using MR vaccine. In Saskatchewan, a province-wide catch-up program for 18-month old children and 4 to 6 year olds was initiated on September 1, 1996. Similar programs targeted at students in grades 6 and 8 will be linked to existing immunization programs for tetanus and diphtheria toxoids (Td) and hepatitis B and will be completed over a 3 year period in a staggered manner. A number of districts have already initiated catch-up for these older students while other districts will be implementing the program in the spring of 1997. Manitoba's catch-up program, formally announced by the Health Minister on October 8, 1996, is targeted at all school-aged children in kindergarten through grade 6 and is expected to run from October 21 through December 20, 1996. To date, more than 50% of approximately 100,000 children targeted in Manitoba have received the second dose of measles vaccine.

Adverse Vaccine Events Reported During the Ontario Measles Immunization Campaign

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(Adapted from Public Health and Epidemiology Report Ontario, Vol 7, No 9, 1996)

The measles elimination immunization campaign, perhaps the largest immunization campaign in Ontario history, was conducted between February and June of 1996. The campaign was targeted at 2.1 million students aged 4 to 19 years, using live monovalent vaccine. Live monovalent measles vaccine has been used for over 25 years. Local reactions, and fever with or without a rash are the most common adverse events reported following receipt of this vaccine[1,2]. A report from the Institute of Medicine in the United States has documented a causal relationship between measles vaccine and anaphylaxis[3]. Possible associations between measles vaccine and meningitis/encephalitis, encephalopathy, thrombocytopenia, and demyelinating disorders, have been investigated but to date the evidence is inadequate to accept or reject a causal relationship[3]. The measles campaign provided a unique opportunity to study adverse events temporally associated with receipt of monovalent measles vaccine in this school-aged population. Due to the large size of the target population, the potential existed for detecting extremely rare adverse events.

Methods

Adverse events temporally associated with the receipt of monovalent measles vaccine were reported by Ontario's 42 public health departments to the Ministry of Health electronically through the Reportable Diseases Information System (RDIS), and/or by telephone. For surveillance purposes, a reportable adverse vaccine event (AVE) is defined as any event that meets the criteria outlined on the current provincial adverse vaccine event reporting form[4], and which is temporally associated with the receipt of a vaccine. A "case" is considered to be any person who experiences one or more AVEs. Health department staff were asked to review the AVE criteria and to include only those reports that met the definition of a "case" in their transmissions to the Ministry. Correct application of this definition was verified by a Ministry consultant for serious events. Reports transmitted to the Ministry through RDIS in which the adverse event(s) did not meet the criteria for an AVE, were removed from the analysis.

Data were analysed using EpiInfo version 6.02[5]. Although the majority of students were immunized between February and June, clinics started as early as January 8, 1996 and continued throughout the summer in some areas. All results are based on cases reported between January 8 and September 30, 1996.

Results

A total of 751 cases of AVEs were reported following receipt of live monovalent measles vaccine. Nine students received another vaccine on the same day as the measles vaccine; four received hepatitis B vaccine, three received Td-polio, and two received DPT-polio vaccine. These nine students are included in the analyses presented in this report.

The overall rate for cases experiencing one or more AVEs following receipt of measles vaccine was 40 per 100,000 students immunized. The average number of cases reported per health unit was 18 (range 0 to 126). Health unit specific AVE rates ranged from 0 to 203 cases per 100,000 immunized (mean: 40.7/ 100,000).

Over 60% of the cases were female, with a sex ratio of 1 male: 1.7 females. The mean age of cases was 11 years (range 3 to 21 years). The mean age of female cases (11.6 years) was significantly higher than that of male cases (9.9 years); $p < 0.01$.

Each case reported an average of 1.3 adverse events. The most common event reported was a rash with a rate of 13.9 reports per 100,000 students immunized, followed by fever of 39° C or higher (7.9/100,000) and allergic-type reactions excluding anaphylaxis (7.6/100,000). The total number of reports by event is shown in Figure 1. Twenty-six cases, including those with neurologic events and those brought to the attention of a Ministry consultant (due to the severity or unusual nature of the event), were reviewed in detail. Three of the 26 cases were considered by the primary physician to be unrelated to receipt of measles vaccine and were excluded from the analysis presented in this paper. The other 23 cases are currently considered to be temporally associated with the receipt of measles vaccine and will be submitted for review by the Advisory Committee on Causality Assessment (ACCA)[6]. A summary of these cases is presented in Table 1.

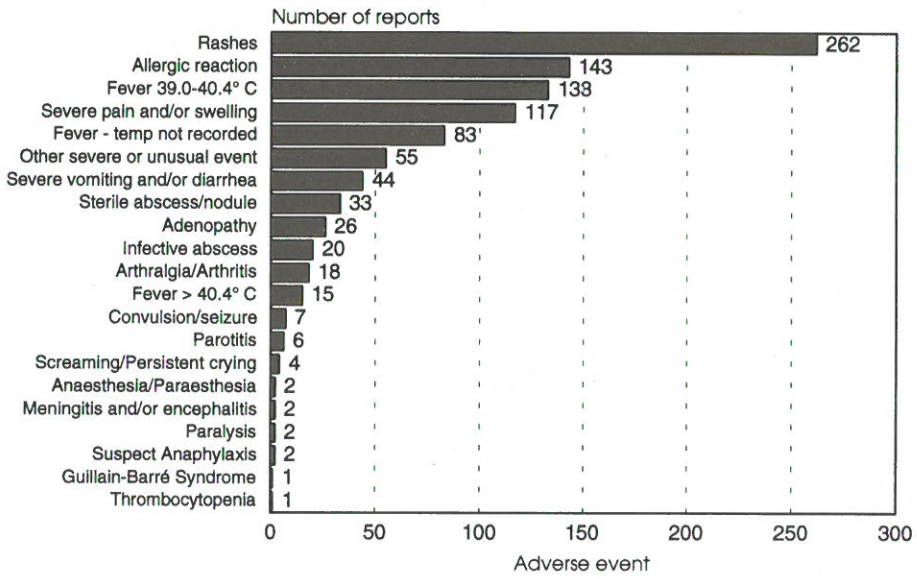
Discussion

As expected, the majority of reported events (53.9%) were in one of three categories: rash, fever > 39° C and severe pain or swelling at injection site. One unexpected finding was the number of allergic-type reactions reported (n=143). Very few allergic-type reactions were expected because of prior screening and exclusion of students with allergies to the components of the vaccine. Anxiety related reactions, manifested as shortness of breath or "blotchy skin", that met the case definition for an "other allergic" event may have been included in the 143 cases. Since extensive information on symptoms was not collected, it was not possible to exclude these cases from the analysis. Since vaccines were administered at school-based clinics, where students were observed for longer periods of time following vaccination than is common in medical settings, it is also possible that reporting of these reactions may have been more complete than usual.

A retrospective study of college students in the United States who received measles vaccine during a revaccination campaign did not report a significant number of allergic-type events[7], however, the sample size was relatively small and the case

definition may have been different. Preliminary data from the recent immunization campaign in British Columbia, in which measles-rubella vaccine was used for the pre-school and school age cohorts, indicate an allergic-type reaction rate of 10.5 cases per 100,000 children immunized (Dr. Patricia Daly, B.C. Centre for Communicable Disease Control, British Columbia: personal communication, 1996). This rate is slightly higher than the 7.6 cases per 100,000 immunized reported in Ontario. A direct comparison between the British Columbia and Ontario campaigns is not possible due to the use of different vaccines, however, both campaigns targeted similar populations and used the same case definition for an allergic event. The higher rates of allergic-type reactions observed during these campaigns may be related to variables unique to school-based campaigns. A controlled study, however, would be required to confirm this suspicion.

Figure 1
Reported adverse vaccine events
Ontario measles immunization campaign, 1996



Note: One or more events may have been reported for each case, however, "allergic reaction" and "suspect anaphylaxis" are mutually exclusive. Denominator is approximately 1.9 million doses administered.

Table 1. Serious or unusual events following measles vaccine

Event	Number of cases	Details	Outcome
Anaesthesia/Paraesthesia	2	• "tingling" in left hand and fingers (no medical exam) • diagnosed with brachial neuritis	• both recovered
Meningitis and/or encephalitis	2	• clinically diagnosed by MD • hospitalized for 2 days, no causal organism identified	• both recovered
Paralysis	2	• lateral cervical myelitis with quadriplegia, no causal organism identified • paralysis of left arm	• with slight improvement but unresolved • recovered
Guillain-Barré Syndrome	1	• profound leg weakness	• recovering
Thrombocytopenia	1	• petechial rash, arthralgia	• recovered
Suspect anaphylaxis	2	• no documented BP but evidence of hypotension in both cases	• both resolved with adrenalin
Prolonged fatigue and arthralgia	1	• symptoms lasting over 1 month	• unknown
Changes in vision	2	• blurred vision and prolonged "dizziness" • changes in colour perception	• recovered • ongoing
Pneumonia	1	• hospitalized for 1 month, no causal organism identified	• recovered
Sickle cell crisis	1	• onset 2 hours post-immunization	• recovered
Transverse myelitis	1	• profound weakness from waist down	• recovered
Convulsion/seizure	7	• 3 febrile (2 with prior history) • 3 afebrile (1 with prior history) • 1 with no temperature recorded	• all recovered

Considerable information was collected on the serious events listed in Table 1. Although a causal relationship has not been established for any of these events, the possibility that these are extremely rare vaccine-associated events cannot be ignored. The ACCA will review these cases and assess the likelihood that they are causally related to the receipt of the measles vaccine.

The observed rate of meningitis/encephalitis following measles vaccine of approximately 1 case per million immunized, is consistent with previously reported rates[2]. Similarly, cases of demyelinating disorders, thrombocytopenia and Guillain-Barré Syndrome temporally associated with the administration of measles vaccine have been described in the literature. To date the evidence has not been sufficient to confirm or rule out a causal relationship for these rare events[3].

The finding that significantly more adverse reactions were reported for female versus male students and that the female cases were on average older than the male cases, may reflect a reporting bias. Older males may be less likely to report symptoms to a nurse or to their parents, and cases in this cohort may therefore be missed. Unlike rubella vaccine, which is known to cause joint pain more often in females than males[1], monovalent measles vaccine is not known to adversely affect one sex differently from the other.

The increased public awareness surrounding the campaign may have positively affected the reporting of events to health unit staff. Variations between health units in the application of the AVE definition may have affected the number of reports transmitted to the Ministry. Consequently, an analysis of adverse events by lot number was not valid since vaccines from different lots were not randomly distributed to the health units.

The definition used for an AVE includes only the most severe manifestations of each type of adverse event. Fever with or without a rash is expected to occur in approximately 5% to 10% of vaccine recipients following the first dose of vaccine and should be less common following a second dose[1]. According to the reporting criteria for AVEs, only those reports in which a fever of 39° C or higher was recorded (or suspected) and in which the rash lasted 4 days or more and/or required hospitalization are reportable. This report is therefore not an all-inclusive review of all adverse events that occurred during the campaign, but reflects the reported incidence which are serious enough to be nationally reportable.

Conclusions

Overall, the adverse events reported following the administration of measles vaccine in this campaign were consistent with events and rates previously described in the literature. The observed higher incidence of allergic-type events may be unique to a school-based campaign setting, where anxiety reactions are prevalent and reporting is high. The serious and unusual events temporally associated with the vaccine must be reviewed in detail and compared to the background rates for these events in this population before they can be attributed to the receipt of vaccine.

Acknowledgement

The author would like to acknowledge the diligence and dedication of all the measles campaign coordinators, immunizing staff and other health unit staff involved in management and reporting of adverse vaccine events during the campaign. The financial assistance of Connaught Laboratories Limited in this project is gratefully acknowledged.

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Expanded Programme On Immunization (EPI) Meeting On Advances In Measles Elimination: Conclusions And Recommendations

Adapted from Weekly Epidemiological Record, Vol 71, No 41, 1996

On 9-10 July 1996, a two-day meeting was hosted by the Centers for Disease Control and Prevention, the Pan American Health Organization and the World Health Organization (WHO) to discuss the feasibility of global measles eradication. Recent international experience with measles elimination activities in both developing and industrialized countries was reviewed, focusing on specific immunization strategies for interrupting measles transmission, surveillance for clinical disease and laboratory methods for virus identification and antibody detection. Factors which determine the eradicability of the disease were also discussed, including non-human reservoirs for the virus, asymptomatic transmission and waning of measles immunity. This report summarizes the conclusions and recommendations of that meeting.

Global eradication of measles basically represents the sum of successful elimination efforts in all countries. Elimination has been achieved already in some areas for limited periods of time. Factors that favour global eradication within the next 10 to 15 years include the expected success of poliomyelitis eradication by the year 2000, the success to date of measles elimination in the Americas and in the United Kingdom, the urgency of measles eradication because of expected epidemiological changes resulting from routine measles vaccination programmes (i.e. the accumulation of a growing population of susceptible adults), the predictable cost/benefit ratio to developed countries, and the recognition of measles as a major public health problem in many developing countries.

Feasibility of measles eradication

Based on the success in controlling measles in the Americas and in the United Kingdom, global measles eradication is technically feasible with currently available vaccines. National, subregional, and regional elimination of measles can and should be accomplished. Although non-human primates can be infected with measles virus, it is very unlikely that non-human reservoirs could sustain measles transmission. Asymptomatic and non-classical cases of measles may occur in vaccinated persons but would not impede elimination or eradication of the virus. Waning immunity does not appear to play a major role in vaccine failure.

Recommendations: A goal of global measles eradication should be established, with a target date within the next 10 to 15 years (i.e. between 2005 and 2010). Measles eradication is a logical follow-on to the current poliomyelitis eradication initiative but needs to build on the success of poliomyelitis eradication. Consequently, it should not be rushed into immediately in all parts of the world, but await maturation of the poliomyelitis eradication programme and be carried out as countries and Regions become polio-free. Because of the rapid accumulation of susceptibles to measles, the implementation phase of an eradication effort should be compressed into as brief a time as possible. Further research to understand molecular pathogenesis and the immune response to measles virus infection should be continued.

Immunization strategies for measles eradication

Existing vaccines and strategies are sufficient to eradicate measles but eradication requires more than a routine one-dose vaccination strategy. However, no single two-dose approach is optimal for all countries. Great success has been attained in many countries, particularly in the Americas, with mass catch-up campaigns vaccinating all persons 1 to 14 years old regardless of prior vaccination status, followed by high routine vaccination coverage and supplementary follow-up campaigns periodically to vaccinate all children 1 to 4 years old. In some countries with highly developed immunization programmes capable of reaching extremely high coverage on a routine basis, it appears that an ongoing two-dose "plus" strategy can eventually achieve elimination of measles. Routine strategies must be supplemented with special efforts to reach populations at high risk. Regardless of the strategy selected, it is essential to monitor the accumulation of susceptible individuals due to vaccine failure after a single dose, or lack of vaccination. This will permit appropriate action, either in the form of follow-up campaigns or special vaccination activities in those areas at highest risk.

Recommendations: Countries switching to an elimination strategy will need to implement some form of catch-up immunization rather than just adding a second dose to the routine immunization schedule. It is essential to reach all children with measles vaccine; those who missed the first dose should be vaccinated and subsequently receive a second dose. Alternative methods of vaccine delivery, particularly jet injectors, and alternative preparations of the vaccine should continue to be explored.

Surveillance strategies

Measles surveillance is a critical component of an elimination/eradication strategy. The most important functions of surveillance are to assess the adequacy, implementation and effectiveness of elimination strategies and to detect circulation of measles virus in a population, rather than to find every case of

measles infection (except in the end stages of elimination). Although a passive system of surveillance for measles may be adequate among health care providers who are appropriately sensitized, there are settings where active surveillance will be important (i.e. in areas with a dense population of unvaccinated children, a low rate of notification, identification of a confirmed case, or clusters of suspected cases). As more countries interrupt measles transmission, importations of measles virus will become more prominent. It may be useful to consider the following classification scheme for confirmed measles cases: indigenous; source unknown; imported (source known); and imported (source unknown). Surveillance indicators are a useful means of evaluating the performance of surveillance systems but must be limited in number to be optimally effective. No external standard for determining the completeness of measles surveillance exists which is comparable to using the rate of acute flaccid paralysis for poliomyelitis.

Recommendations: Collecting surveillance data on a case-by-case basis needs to be implemented at an early stage of the elimination programme. Measles notification should be based on clinical suspicion rather than rigid case definitions (such case definitions are important, however, during investigation and classification of suspected cases). To establish the source of imported measles cases, collaboration between countries can be facilitated by WHO offices. Experience in using measles surveillance indicators is limited and the indicators proposed may need to be modified based on accumulating experience.

Laboratory strategies

Laboratory confirmation will play an increasingly important role as measles incidence declines and countries progress towards elimination. Establishment of a functioning global network of laboratories will be a critical element in achieving global eradication and the availability of a rapid field diagnostic test will be of great help. In addition to confirmation of cases, the laboratory plays a vital role in characterizing measles virus isolates to determine whether cases represent sustained indigenous transmission or importations. For example, all measles viruses isolated in the United States in the past 2 years share characteristics with virus strains from other countries, and not with the strains that were circulating in the United States in 1989-1992. Specimens that can be cultured for virus isolation include urine as well as nasopharyngeal swabs or blood. The laboratory will also play a key role in surveillance of immunity as serological measures may be useful in confirming the level of protection suggested by immunization coverage in an area.

Recommendations: In countries with elimination goals, all single cases of measles and at least one case from each chain of transmission should be laboratory confirmed. In addition to serum or saliva specimens for laboratory confirmation, specimens for virus isolation should be collected within 7 days of rash onset, in conjunction with case investigation. The most pressing research need is a rapid field diagnostic test.

Response to measles outbreaks

Prevention of measles outbreaks is much more effective than trying to contain them. Attempting to terminate measles transmission in response to outbreaks has a limited role in most countries because such efforts are costly, disruptive, and often ineffective by the time they are instituted. Careful investigation of all outbreaks, however, can generate data needed to obtain the political will for elimination. In addition, outbreak investigations can help determine why transmission of measles occurred; such investigations will be critical in refining measles elimination strategies.

Recommendations: Measles outbreaks may be used as opportunities to reinforce surveillance, assess the health burden of continuing measles transmission, and determine the cause so that appropriate preventive measures can be taken in the future.

Obstacles to measles eradication

The major obstacles to measles eradication are perceptual, political, and financial. The full significance of measles is often not understood and it is frequently perceived as a minor illness of little consequence, particularly in industrialized countries. This perception may make it difficult to develop the political will necessary to carry out a successful global eradication effort. In many developing countries, however, measles is widely recognized as a major killer and support for its eradication can be expected to be very strong. Measles eradication will quickly pay for itself due to savings in vaccinations, hospitalizations and deaths prevented.

Recommendations: There is a need to educate parents, medical practitioners, and public health professionals about the global burden of disease due to measles, particularly in industrialized countries. The health burden of measles should be better documented in more countries, especially in the developed world, to gain support for global eradication.

Announcement

LCDC LAUNCHES NEW WEBSITE: http://www.hwc.ca/hpb/lcdc

The LCDC Website, launched on October 24, 1996, is a key Canadian public health site. It contains disease surveillance and control information, disease prevention guidelines, health hazard advisories and travel health information, LCDC publications from 1995 onward, including Chronic Diseases in Canada, AIDs in Canada, the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) News, Canada Communicable Disease Report, Measles Update, Farm Family Health, and descriptions of LCDC's epidemiology and laboratory programs.

The site also provides links to other public health sites in Canada and to international public health bulletins. It can be thought of as a digital library - a collection of documents available to anyone with Internet access. Visit our site for a variety of public health information.

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 Division of Immunization, Bureau of Infectious Diseases, LCDC, Ottawa, Ontario, K1A 0L2; telephone (613) 957-1340; Fax (613) 998-6413.

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