EPI Newsletter

Expanded Program on Immunization in the Americas

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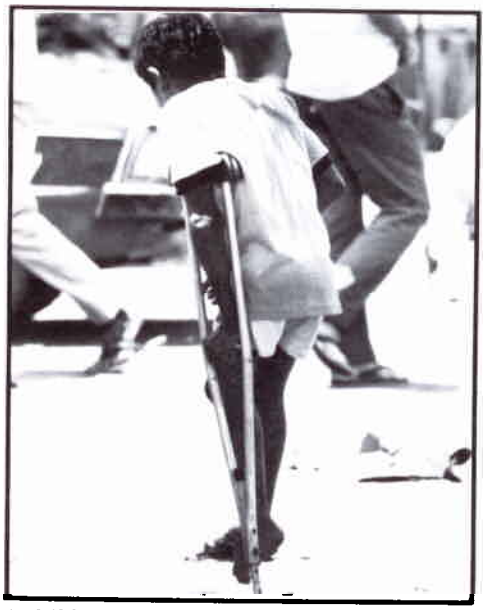
Polio outbreak in Honduras

Clinical efficacy of trivalent oral polio vaccine tested

In December 1984, the Ministry of Health of Honduras, in collaboration with the Pan American Health Organization, (PAHO), carried out a second evaluation of the Expanded Program on Immunization (EPI) in Honduras (the first evaluation had been done in October, 1982). Because of a polio outbreak that had occurred in Honduras earlier in the year, an evaluation of the clinical efficacy of the trivalent oral polio vaccine (TOPV) was added to the EPI evaluation. Since there were only 76 cases clinically compatible with a diagnosis of polio and they had wide geographical distribution, a case-control method was used to calculate the clinical efficacy of TOPV as used in the Honduras EPI program.



*A child crippled by polio is a sight the world would never see again if vaccination programs were properly implemented. (***Photo:*** Julio Vizcarra-Brenner/PAHO)*

Background

The EPI was established in Honduras in 1979 with well defined goals. Since then the estimated vaccine coverage of children under 2 has increased steadily. There also was a considerable impact on the morbidity rates of polio in all age groups through 1983 (Table 1).

In 1984, however, an outbreak of polio occurred, mostly affecting children under 5 years of age. The first cases occurred in Choluteca and other areas along the Pacific coast (Health Region 4) in February and March. Over the next few months, spread occurred to all of the country with a peak in the number of cases in July. Sporadic cases continued to occur until early November. Up to the 26th of November, 49 confirmed cases had been reported to the Ministry of Health. Confirmation occurred in 43 cases by isolation of a polio virus from the stools or by a 4-fold rise in the neutralizing antibody titer to one of the three polio types between acute and convalescent blood specimens, and in six cases by the presence of clinical sequelae consistent with polio two months after initiation of the illness. Of the 43 laboratory confirmed cases, 31 were type 1, four were type 2 and eight were type 3. Three of the polio virus isolates (two type 1 and one type 3) were tested by the Centers for Disease Control (CDC), Atlanta, Georgia using the oligonucleotide method and found to be of wild origin; these were from three different health regions early in the outbreak. There were 17 other cases of acute onset of paralysis compatible with polio in which enteroviruses other than polio were isolated; these have been sent to CDC for identification. Ten other suspected cases with acute onset of paralysis compatible with polio had been reported, but had either negative or pending laboratory results and lacked the two month clinical followup.

Table 2 presents the incidence rate of both confirmed and suspected cases by health regions in children under 5 years of age (13 cases were over 5 years of age). The rates are similar for most regions except for a higher rate in the Metropolitan Health Region (Tegucigalpa). No cases in children under 5 years of age had been reported from Health Region 5.

Contents

TABLE 1. Cases and rates (rate per 100,000) of polio by age, Honduras, 1979-1983

	0-11mo.		1-4yr.		5-14yr.		Total	
Year	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
1979	77	46.2	130	25.1	13	1.3	220	12.9
1980	2	1.2	1	0.2	0	0	3	0.2
1981	7	3.9	11	2.0	0	0	18	1.0
1982	4	2.2	4	0.7	0	0	8	0.4
1983	1	0.5	6	1.0	1	0.1	8	0.4

TABLE 2. Incidence rate (per 100,000) of polio in children under 5 years of age by health regions, Honduras, 1984

Health regions	Population under 5	Confirmed cases		Suspected cases		Confirmed and suspected cases	
		No.	Rate	No.	Rate	No.	Rate
Metrop.	80,712	8	9.9	6	7.4	14	17.4
No. 1	84,881	6	7.1	2	2.4	8	9.4
No. 2	82,611	5	6.1	-	-	5	6.1
No. 3	218,901	11*	5.0	6+	2.7	17	7.8
No. 4	99,451	5*	5.0	-	-	5	5.0
No. 5	97,449	-	-	-+	-	-	-
No. 6	96,952	6*	6.2	4	4.1	10	10.3
No. 7	48,275	3	6.2	1+	2.4	4	8.3
Total	809,232	44	5.4	19	2.4	63	7.8

*Confirmed cases in children over 5
2 HR No. 3
2 HR No. 4
1 HR No. 6

+Suspected cases in children over 5
5 HR No. 3
2 HR No. 5
1 HR No. 7

TABLE 3. Distribution by age of confirmed polio cases, Honduras, 1984

Age group	Number of children (percent)
0-11 months	12 (24.5)
12-23 months	15 (30.6)
24-59 months	17 (34.7)
5 years or more	5 (10.2)
Total	49 (100.0)

TABLE 4. Previous vaccination status of confirmed polio cases, Honduras, 1984

Previous vaccination status	Number of children (percent)
0 dose	14 (28.6)
One dose	9 (18.4)
Two doses	5 (10.2)
Three doses	15 (30.6)
Four or more doses	5 (10.2)
Not known	1 (2.0)
Total	49 (100.0)

Table 3 presents in more detail the age distribution of the 49 confirmed cases. Ninety percent of the confirmed cases were in children less than 5 years of age and one quarter in those less than 1 year of age. Twenty-two (44.9%) of the confirmed cases occurred in males.

Table 4 presents the distribution of the confirmed cases by immunization history. Of the 48 confirmed cases occurring in children with known vaccine history, 20 (41.7%) had received three or more doses of trivalent oral polio vaccine. This high proportion of cases in fully vaccinated children in the face of vaccine coverage of less than 50%, raised the suspicion that the clinical vaccine efficacy of TOPV used in Honduras over the past five years was lower than the hoped for level of over 90%.

Methodology

Because of the small number of cases and their wide geographical distribution, the only feasible means to estimate vaccine efficacy was to use a case-control method. In this method, as many cases as possible are selected (not all need to be included) and one or more controls are matched to each case by age and residence. Vaccine histories are rigorously determined for both cases and controls, preferably by written records. This allows calculation of the odds ratio (ratio of the odds a case is vaccinated divided by the odds a control is vaccinated). The odds ratio can be substituted for the relative risk in the vaccine efficacy equation and vaccine efficacy calculated.

In the present study, the following case definition of polio was used: *any child with acute flaccid paralysis compatible with polio who was reported to the Ministry of Health from January 1 to November 26, 1984.* A total of 65 of the 76 such reported cases were chosen for inclusion in the case-control study, 11 were excluded because of difficult access to their village (most in Health Regions 6 and 7). In order to have enough controls with no or ≥ 3 doses of TOPV, five controls were chosen for each case. The controls were matched within two months of age of the case if the case child was under 2 years of age at the time of onset of disease; the controls were matched within six months of age if the case child was from 2 to 5 years of age at the time of onset of the disease; if the case occurred in a child more than 5 years of age, the matching on age of cases and controls was within 1 year of age. Controls were randomly selected from families living in close proximity to the house where the patient lived when he became ill.

In addition to identifying information, age data, and detailed information on the previous history of TOPV vaccination, the data collection form included a number of possible risk factor questions. Clinical information was collected only on the cases and included a simplified physical exam and laboratory data.

Results

Fifty-nine cases with five or more controls for each case were completed for a completion rate of 91%. Since the laboratory data are incomplete, there may be changes in the number of confirmed cases in the final analyses. Table 5 presents the preliminary results of the calculations of the polio vaccine efficacy. Two methods were employed to calculate the odds ratio and then the vaccine efficacy. In the first method a case-control matched analysis with variable matching ratio was employed using the computer program developed by Rothman and Boice.(1) Only the first four controls were used since the matching ratio in this program cannot exceed four. In the second method only the first two controls with no or ≥ 3 doses were used. A 2 by 2 table was constructed, the cases and controls were analyzed separately, and the odds ratio calculated.

TABLE 5. Preliminary analysis of polio vaccine efficacy, Honduras, 1984

Method of calculating vaccine efficacy	Polio vaccine efficacy by case category*	
	All cases (N = 49)	Laboratory confirmed cases (N = 27)
Case-controls paired, (using the first 4 controls)	50% (0-79)**	51% (0-82)
Cases and controls separated, (using the first controls with 0 or ≥ 3 doses)	35% (0-68)	43% (0-78)

* Only cases with 0 or ≥ 3 dosis

** The maximum and minimum limits appear within parentheses (using a confidence interval of 95%).

Proper vaccine storage and cold room management at the central level are absolutely essential to insure that potent vaccines reach the clinics where they will be used in immunization programs. (**Photo:** Fernando Laender/PAHO)

Vaccine efficacy was then calculated by each method for all cases investigated (49 of 59 received either no or ≥ 3 doses of TOPV) and then for the cases with laboratory confirmation (27 of 32 had received either no or ≥ 3 doses of TOPV). Vaccine efficacy varied from 35% to 51%. Because of the small number of cases in the study, the 95% confidence limits were wide.

Of the 59 cases investigated, it was confirmed that 31 (52.5%) had received three or more doses of TOPV one month or more before onset of their disease. Also, 51 (86.4%) of these 59 cases had residual findings compatible with polio two months or more after onset of symptoms. Eight (13.6%) of the 59 cases died. The data on risk factors are presently being analyzed.

Editorial note: This is the first application of the case-control method to calculate clinical efficacy of polio vaccine. There has only been limited application of this technique to the calculation of vaccine efficacy in measles and rubella outbreaks (2, 3).

The major bias in this type of study is whether vaccinated cases would more likely be reported to public health authorities than unvaccinated cases. In Honduras, the Ministry of Health epidemiologists did not feel this was a problem. They felt that, during the 1984 outbreak, all cases of acute paralysis had been reported to them.

A theoretical problem is the effect of subclinical disease on vaccine efficacy. This is especially important in polio where only about one in 1,000 infections result in paralytic disease. However, there is no reason to expect that the attack rate of subclinical polio infection would be any different in those children who are susceptible because they had not been vaccinated versus those who are susceptible because they were vaccine failures.

In this study, the clinical vaccine efficacy estimates ranged from 35% to 51% depending on the case group examined and the method used to determine the odds ratio. Because of the small number of cases available for study, the 95% confidence limits were wide and the results should be interpreted with caution. However, the highest upper 95% confidence limit was only 82% which indicates that in Honduras the receipt of 3 doses of TOPV has not provided the expected clinical efficacy of over 90%.

The evaluation of the EPI program that took place in parallel with the case-control study revealed the following problems in the cold chain:

1. The freezer room at the central level has had a number

of known failures. For example, from March 30 to April 5, 1984, there was a failure in its control system and during this period the polio and measles vaccines were not kept frozen. Also at the end of August 1984 the compressor for the freezer room ceased to function; the temperature of the freezer room at the time of the EPI evaluation in December was 7.5°C.

2. Another major factor at the central level was that, whenever it was necessary to enter the freezer room, the room was allowed to warm up by disconnecting the electricity to the compressor or by leaving the door open. Also, the door to the freezer room does not close hermetically.

3. Other problems at the peripheral levels of the cold chain were also noted; these related to the maintenance of refrigerators.

The major problems of vaccine management at the central level may be the explanation for the low clinical vaccine efficacy seen in this polio outbreak, and would explain the uniform geographical distribution of fully vaccinated cases. Plans are in progress to correct the problems in the cold chain, especially at the central level. In addition, routine monitoring of the potency of the TOPV used in Honduras will be done at all levels of the cold chain.

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2. Greaves WL, Orenstein WA, Hinman AR, et al. *Clinical efficacy of rubella vaccine.* Pediatr Infections Diseases 1983; 2:284-286.
3. Orenstein WA, Marks JS, Hogue CR, et al. "Vaccine efficacy: A new application of case-control and case exposure methodology." Presented at the Society for Epidemiologic Research, Cincinnati, Ohio. June 16-18, 1982.

Source: Ministry of Public Health, Honduras. A full report on this study will be published as soon as final analysis is complete.

New publication

Vaccination certificate requirements for international travel and health advice to travelers.

Scientific publication of the World Health Organization No. 463. 1984. 68 pages. ISBN 92 75 31463 2. US$6.00

This book, published each year in English by the World Health Organization, is now offered in a Spanish translation. It provides updated information regarding preventive measures that travelers should take against many contagious diseases not included in the International Health Regulations. Among them are malaria, certain infections transmitted by insects, numerous forms of diarrheal diseases, and a series of illnesses associated with food and water consumption.

The book is divided into five chapters that deal with the following topics: requirements regarding international vaccination certificates and information about malaria; countries which require vaccination certificates and information about the malaria situation locally; possible health risks to which travelers are exposed; geographic distribution of possible health dangers for travelers, and precautions against certain illnesses. It has one annex with a sample international vaccination or revaccination certificate against yellow fever, and maps of the zones in which malaria and yellow fever are transmitted. The book is indexed by country and by subject matter, and is cross referenced. It is a very useful book for national and local public health authorities, professionals, travel agencies, and for travelers themselves.

National Vaccination Days in Bolivia

Higher coverage attained through public participation

Since the inception of the Expanded Program on Immunization (EPI) in 1979, a better understanding of the vaccine-preventable diseases in Bolivian children has been achieved by provision of useful epidemiological data on the target EPI diseases. A strength of the EPI lies in that it is not confined to the use of a single delivery tactic or to a repetitive description of coverage gains, but focuses attention on sociocultural, economic and political conditions, with a view to the application of new and more realistic tactics for the benefit of vulnerable and neglected population groups.

In 1980 and 1981, the coverages achieved by purely fixed health facility delivery tactics did not exceed 25% to 30% with the third dose of DPT and polio vaccines, or 28% with the single-dose vaccines (BCG and measles) among children under three years of age.

In 1982 a technical and administrative EPI evaluation was performed and impediments limiting the attainment of epidemiologically significant vaccination coverages were identified. The leading causes were found to be a lack of political commitment, a lack of participation by the public, poor coordination of the program with the general health services, rigid and uniform administrative standards for the whole country, the abstractness of the technical standards, and poor public information.

From this analysis emerged the strategy of mobilization of the population through the local health committees in order to help improve vaccination coverages. These local

committees have been able to substantially improve the coverage of polio vaccination by aiding health staff in the application of that vaccine during the operations carried out on National Vaccination Days, organized three times a year.

The implementation of this strategy in Bolivia since 1983 allows each user of health services to be an active agent for his/her own health rather than a passive recipient of services. By participating in programs he/she exercises the right to health acccorded him/her in the country's Constitution. An increasing number of Bolivians are becoming parties to health decisions that affect them as a result of the government's request and encouragement for popular participation. The achievements of mass mobilization for vaccination may be classified as follows:

Overall achievements

- It has made the country's health condition an object of thought and discussion and helped the country to achieve the highest vaccination coverage in the last few years.
- It has prompted a revision of vaccination standards for the public.
- It has prompted responses to requests for health services from the public.
- It has given the health services a new image through the activities they have promoted.
- It has induced a joint effort to identify the organizations, movements and individuals that respond to interests of the public and genuinely seek to serve them.
- It has helped consolidate grass-roots organizations.

Specific achievements

- It has provided the people with needed health information so that they may become their own agents for health improvement.
- It has raised the level of institutional participation through analysis and self-criticism.
- It has effectively protected the infant population against polio and measles.

Some preliminary results

a) Poliomyelitis

The occurrence of poliomyelitis is seen to follow a pattern of seasonal variation with a distinct rise in the first months of the year followed by a gradual decline beginning in May which continues until November, when the epidemiological curve ascends again. Incidence is highest in children from one to three years of age.

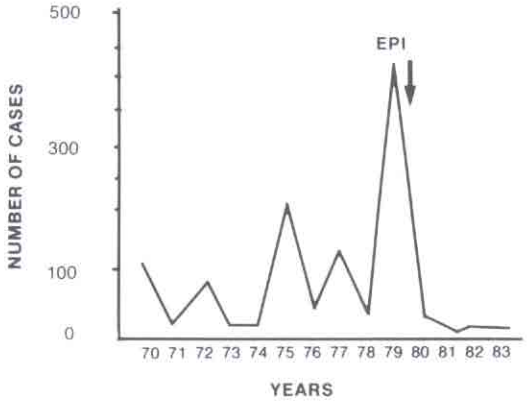
During the seventies reported polio cases held steady at an average of about 60 cases a year until 1979, when the prevalence of this disease peaked in the country with 433 paralytic cases. Factors contributing to this situation were a lack of routine vaccination activities and of an adequate cold chain (it had just been installed that year). This prevented the attainment of good vaccination coverages among the susceptible population.

With the launching of the EPI in 1979 the trend showed a steady decrease in the reported cases (see Graph 1).

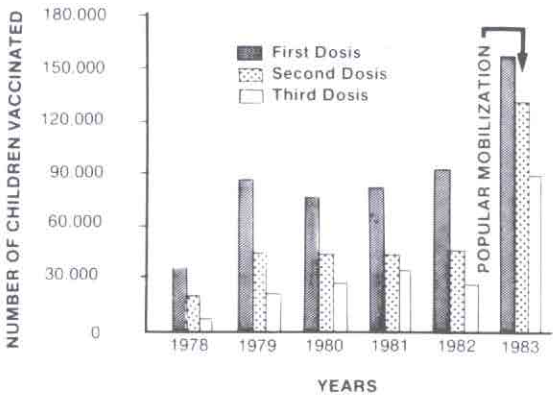
The coverage of polio vaccination has been steadily rising since 1979, but the coverage with the third dose has proved disappointing, as shown by the coverages achieved for the third dose in infants under one year (see Graph 2).

It is important that parents participate actively in immunization activities and make sure their children complete the recommended series of vaccinations before they reach their first birthday. (**Photo:** Julio-Vizcarra Brenner/PAHO)

GRAPH 1. Polio trend in Bolivia, 1970-1983



GRAPH 2. Polio vaccination
Annual coverage by dose in children under 1
Bolivia, 1978-1983



More than 60% more children have been vaccinated since 1979 when compared to previous years, and this increase represents 42.9% of the targeted population under one year of age. With implementation of the National Vaccination Days and public participation, polio vaccine coverage reached 90.1% for children three years and older.

b) Measles

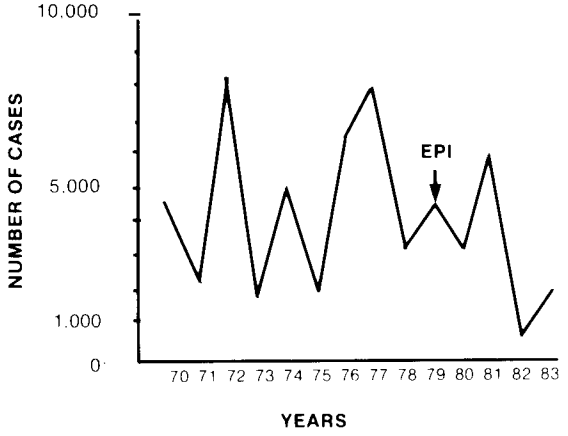
On the basis of reported cases, measles ranks sixth among the communicable diseases in Bolivia. This disease maintains its presence during July and its prevalence peaks in September, after which it begins declining in November. The age group most severely affected is that of children between two and four years of age. It ranks third among the causes of general morbidity in children under 5 years of age.

The years of highest incidence were 1972 and 1977, with 8,315 and 8,194 cases, respectively. Graph 3 demonstrates that the number of cases dropped significantly in 1981.

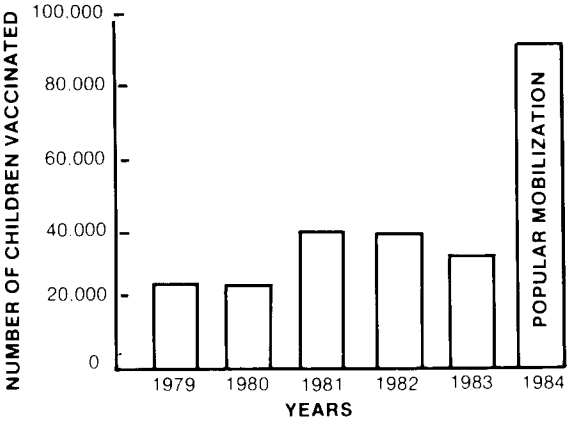
Vaccination against measles has been administered in Bolivia since 1965; however, the low coverages obtained were due to the program's limited coverage. In 1979 measles vaccination activities were made routine, but even so, coverages proved inadequate until 1984 when this vaccine was also included in National Vaccination Days.

A comparison of coverages among one-year-olds vaccinated against measles from 1979 to 1983 reveals a considerably irregular pattern, and even a significant drop in 1983. Due to the mass mobilization in 1984, the coverage of measles vaccination among one-year-olds was 80% greater than it had been in 1983 being the highest ever achieved in the country for this vaccine (see Graph 4).

GRAPH 3. Measles trend in Bolivia, 1970-1983



GRAPH 4. Measles vaccination
Annual coverage in children 1 year old
Bolivia, 1979-1984



Editorial note: This activity in Bolivia is an excellent example of the utilization of intensified strategies as mentioned in the Global Advisory Group report of 1984 which states the following:

"Intensified strategies have been developed in several countries in an effort to raise immunization levels more rapidly than would routine program implementation. These strategies include:

1. Accelerated implementation of existing plans;
2. Use of periodic rounds of intensified activity ("pulses" or "rounds");
3. Designation of 1 or more days each year as national immunization days; on these days, all children in the target age group are immunized without regard to their previous immunization status; frequently only 1 vaccine is used (usually oral polio vaccine) and no attempt is made to complete the child's record;
4. Designation of 1 or more days each year as national immunization days; all vaccines are available and used according to the child's needs; each dose given is entered on the child's record."

Bolivia's activities also represent a practical example of program acceleration and implementation called for in the first part of the five-point action program (Resolution WHA 35.31) of the Thirty-fifth World Health Assembly in May, 1982:

"Promote EPI within the context of primary health care:

- Develop mechanisms to enable the community to participate as an active partner in program planning, implementation and evaluation, providing the technical and logistical resources to support these functions; and
- Deliver immunization services with other health services, particularly those directed towards mothers and children, so that they are mutually supportive."

Panama increases measles surveillance

Measles in the Republic of Panama occurs in a pattern that makes it possible to predict epidemics every two or three years, especially between November and March.

Because the epidemic in Panama from December 1981 to March 1982 was monitored, the last trimester of 1984 was determined to be a high risk period for measles.

Based on this finding, vaccination and surveillance activities were intensified at local and regional levels,

Reported Cases of EPI Diseases

Number of reported cases of measles, poliomyelitis, tetanus, diphtheria and whooping cough, from 1 January 1984 to date of last report, and for same epidemiological period in 1983, by country

Subregion and Country	Date of last report	Measles		Poliomyelitis		Tetanus				Diphtheria		Whooping Cough	
						Non-neonatorum		Neonatorum					
		1984	1983	1984	1983	1984	1983	1984	1983	1984	1983	1984	1983
NORTHERN AMERICA													
Canada	29 Dec.	4,125	934	1	—	2	6	...	...	4	12	1,311	2,231
United States	29 Dec.	2,534	1,497	4	8	64	74	...	...	21	5	2,450	2,460
CARIBBEAN													
Antigua and Barbuda	29 Dec.	1	10	...	—	—	1	—	—	—	—	—	—
Bahamas	29 Dec.	36	2,868	—	—	1	—	—	—	—	—	1	8
Barbados	01 Dec.	4	5	—	—	4	6	—	—	—	—	—	—
Cuba	03 Nov.	3,113	2,822	—	—	11	20	—	—	—	—	76	263
Dominica	29 Dec.	188	1	—	—	—	1	—	1	—	2	1	11
Dominican Republic	16 Jun.	2,115	1,440	—	7	42	49	1	11	51	41	88	151
Grenada	29 Dec.	11	268	—	—	—	—	—	—	—	—	—	—
Haiti	16 Jun.	1,225	...	13	...	145	...	44	12	18	...	427	...
Jamaica	29 Dec.	237	...	—	...	4	...	2	...	7	...	27	...
Saint Lucia	08 Sep.	12	59	—	—	1	1	...	...	—	—	—	—
St. Christopher-Nevis	01 Dec.	2	556	—	—	1	—	—	—	—	—	—	—
St. Vincent and the Grenadines	22 Dec.	15	63	...	...	...	...	...	...	—	...	...	...
Trinidad and Tobago	01 Dec.	3,500	2,152	—	—	15	15	—	—	—	—	21	—
CONTINENTAL MIDDLE AMERICA													
Belize	29 Dec.	4	11	...	—	—	1	...	...	...	...	3	1
Costa Rica	01 Dec.	8	32	—	—	5	4	—	2	—	—	154	46
El Salvador	08 Sep.	3,248	1,665	15	58	48	33	33	28	12	11	325	344
Guatemala	31 Mar.	868	867	5	31	28	30	...	...	2	6	450	297
Honduras	01 Dec.	3,797	1,116	49	3	17	22	14	—	—	—	546	516
Mexico	*	...	...	...	...	...	...	...	...	...	...	...	...
Nicaragua	06 Oct.	121	...	—	...	...	...	...	...	—	...	54	...
Panama	03 Nov.	338	3,747	—	...	5	5	5	15	—	—	144	66
TROPICAL SOUTH AMERICA													
Bolivia	21 Apr.	805	...	1	...	13	...	...	...	19[a]	46	438	...
Brazil	10 Oct.	56,256	44,984	55	37	1,777	1,656	352	554	2,663	2,861	13,952	21,054
Colombia	*	...	...	...	...	...	...	...	...	...	...	...	...
Ecuador	16 Jun.	4,188	546	—	5	43	32	21	35	62	8	195	502
Guyana	08 Sep.	187	—	—	—	7	—	...	...	—	—	—	—
Paraguay	01 Dec.	804	1,054	1	11	86	68	82	123	10	3	656	244
Peru	22 Sep.	2,406	...	63	...	189	...	4	...	42	...	2,236	...
Suriname	08 Sep.	25	13	—	—	2	...	—	...	—	1	—	—
Venezuela	03 Nov.	8,078	...	—	...	...	...	...	...	2	...	1,306	...
TEMPERATE SOUTH AMERICA													
Argentina	06 Oct.	17,246	2,374	2[b]	...	105[b]	...	...	...	10	35	10,708	1,963
Chile	29 Dec.	4,781	6,750	—	—	21	32	...	...	153	78	1,984	149
Uruguay	28 Aug.	28	6	—	—	7	1	—	...	—	...	63	182

[a] 21 Aug.

[b] 14 Jul.

* No 1984 reports received, therefore 1983 data not shown.

— No cases

... Data not available

including individual case investigation to determine previous vaccination status and guarantee the vaccination of all susceptible children.

During the course of these investigations, a case of measles was defined using the clinical criteria proposed by the Centers for Disease Control in Atlanta (*see EPI Newsletter* VI-5):

- *Fever 38.3°C or higher*
- *Generalized rash of 3 days or longer*
- *At least one of the following: coryza, conjunctivitis or cough.*

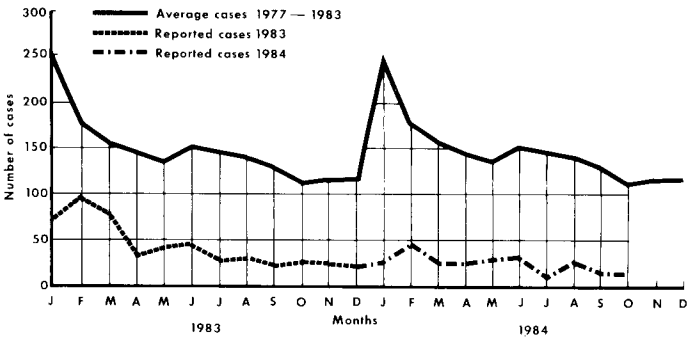
Many suspected cases were rejected as non-measles cases by applying these criteria, especially in infants under six months of age and in persons over six years of age.

As of October 1984, a total of 338 measles cases had been reported in the Republic of Panama. This represents a reduction of 36% when compared with the same period in 1983.

During the last two years, the monthly number of reported cases in the country has remained below the median of reported cases from 1977 to 1983, (see Graph 1). A reduction of approximately 80% of reported measles cases was observed during October 1984, for example. This pattern can be partly attributed to the increase of vaccination coverage, which reached 71.6% in children under one year of age during the first trimester of 1984. To avoid a probable measles epidemic, it will be necessary to increase vaccination activities, especially in those under one year of age and in preschoolers, until a coverage of over 90% is reached.

Health regions, such as Panama and San Blas in 1982 and Bocas del Toro in 1983, managed to avoid epidemics by means of exhaustive vaccination efforts by regional and local teams. Their experience shows that measles can be controlled in Panama.

GRAPH 1. Measles cases by year and month 1983-1984, Panama



Source: adapted from the *Boletín epidemiológico*, CSS Panama, 8(10):1, 1984.

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