



EPI Newsletter

Expanded Program on Immunization in the Americas

Volume XIII Number 6

IMMUNIZE AND PROTECT YOUR CHILDREN

December 1991

Surveillance of Compatible Polio Cases

Six confirmed and 24 compatible polio cases had been reported by week 47 of 1991. Figure 1 shows that, with the exception of Argentina and Nicaragua, all countries reporting compatible cases (Brazil, Mexico, Guatemala, Colombia, Venezuela, Peru, and Ecuador) have documented wild poliovirus circulation within the past three years.

Of the 24 compatible cases, seven (29%) died, six (24%) were lost to follow-up, and 11 (46%) had residual paralysis. Further analysis of these cases reveals that nine (38%) were under six years of age and had fever at onset of paralysis, which puts them at a higher risk for being true confirmed cases of polio. Figure 2 shows the geographic distribution of these nine compatible cases at higher risk. Note that two of these came from Colombia and Peru, where wild poliovirus transmission was documented during the past year, one came from Ecuador, where transmission was documented two years ago and the remaining six came from Venezuela and Brazil where transmission was last documented three years ago.

**Figure 1. Compatible Polio Cases
Region of the Americas, 1991***



* Up to week 47, 1991
Source: PESS

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The likelihood that the acute flaccid paralysis resulted from wild poliovirus infection increases if it occurs in a child under six years of age who had fever at onset of paralysis and who is from an area where transmission has recently been documented. Because of this, the Eradication Program has directed urgent attention to the improvement of surveillance in Brazil, Mexico, Guatemala, Colombia, Venezuela, Peru, and Ecuador.

The International Certification Commission, established by PAHO in 1990, requires that all cases of acute flaccid paralysis be investigated within 24 hours of their report and that at least two stool samples be collected within 15 days of onset of the paralysis, for a period of at least three years following the last isolation of wild poliovirus in the Region. Because wild poliovirus circulation cannot be ruled out, the occurrence of compatible cases clearly represents a failure of the surveillance system and therefore prevents the Region from being certified as free of polio.

**Figure 2. Compatible Polio Cases Under Six Years of Age who had Fever at Onset of Paralysis
Region of the Americas, 1991***



* Up to week 47, 1991
Source: PESS

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ated with isolation of polioviruses from patients, despite steady improvements in field and laboratory surveillance. Furthermore, only a small proportion of the current poliovirus isolates are determined to be wild. To increase the success of immunization campaigns in high-risk areas, laboratory surveillance is critical. To that end, the information gained by defining the molecular epidemiology of the wild polioviruses isolated has been very useful in identifying the remaining areas of indigenous transmission of wild poliovirus, which are targeted for mop-up operations, ultimately contributing to achieving the goal of eradication.

As a result of this workshop, the program is well on its way to decentralizing these "state-of-the-art" technologies,

which are responsible for improved laboratory surveillance of wild poliovirus, to all the laboratories in the network. Supplies are now being purchased and distributed by PAHO to the network laboratories. Special thanks should be extended to FIOCRUZ (Oswaldo Cruz Foundation, Brazil) and CDC for their roles in catalyzing these efforts to decentralize the technologies.

1. Pan American Health Organization. Surveillance of wild poliovirus in the Americas. EPI Newsletter 1990; 12(5):1-3.

2. Rico-Hesse R, Pallansch MA, Nottay BK, Kew OM. Geographic distribution of wild poliovirus type 1 genotypes. Virology 1987; 160:311-322.

Accelerated Immunization Initiative Launched



A new child health initiative for the Americas, an accelerated immunization program for 1991-1995, was launched by the Pan American Health Organization (PAHO), in partnership with the U.S. Agency for International Development (AID).

In a ceremony held at PAHO Headquarters in Washington, D.C. on July 10, 1991, Dr. Carlyle Guerra de Macedo and the Assistant Administrator of AID, Amb. James Michel, signed a 20 million dollar agreement intended to help save children's lives by accelerating immunization programs and working to control and eliminate vaccine-preventable diseases. Under the new initiative, PAHO, AID, and the other participating agencies will work together to help the countries expand the protection of vaccination to all children through intensified campaigns and special ac-

tivities incorporating government, NGO, and private sector providers, along with additional training and further efforts to maintain and increase vaccination coverage. Surveillance will also be expanded to make certain any possible outbreaks of disease are halted promptly. The introduction of new vaccines to prevent rubella, mumps, and hepatitis B will be considered for those countries where these diseases present problems.

The child immunization program, Child Health Phase II, is a five-year \$100 million program to complete the eradication of polio in the Western Hemisphere, to continue the reduction of vaccine-preventable diseases, to eliminate measles from the Caribbean, and to take a great step toward the elimination of both measles and neonatal tetanus throughout the Americas.

Global Advisory Group Addresses Rubella Control

The World Health Organization's (WHO) Expanded Program on Immunization Global Advisory Group (GAG) met from October 14 to 18, 1991 in Antalya, Turkey. Among the major conclusions and recommendations of the meeting were several addressing rubella and congenital rubella syndrome (CRS) control.

Despite the insufficient data available regarding the epidemiology of rubella and CRS in the developing world, WHO is aware of an increase in the interest to introduce rubella-containing vaccines in this area. There are three basic approaches to rubella control: universal vaccination of young children, or the selective vaccination of pre-pubescent school girls and susceptible adult women, or a combination of the two. The first strategy strives for interruption of transmission of the rubella virus, whereas the second seeks to protect women during their childbearing years. While interruption of transmission through high coverage from delivery of vaccine at the same time as measles vaccine may appear attractive, there are some potential risks associated with such a strategy. If coverage is not sufficient to interrupt transmission but merely shifts the age-specific infection rate to older groups, then the potential exists for

more cases of CRS than would have occurred in the absence of vaccination. On the other hand, the combined strategy may be harder to implement due to inherent difficulties in reaching the target populations and the inefficiency of vaccinating those who may already be immune.

The GAG recommended that WHO promote research on the epidemiology of rubella and CRS in developing countries and develop specific guidelines that would assist countries when considering the introduction of rubella control strategies.

Introduction of MMR or rubella vaccines in any immunization program should be within a strategy that aims primarily at the prevention of CRS. Therefore, universal immunization with MMR should be avoided in developing countries unless very high coverage can be assured and vaccination of post-puberal females is simultaneously introduced. The preferred strategy for those countries wishing to embark on a rubella control program is selective vaccination, with an emphasis on high risk groups (postpubescent females).

Eighth Meeting of Caribbean EPI Managers

The Eighth Meeting of Caribbean EPI Managers was held in Montego Bay from 11-15 November, 1991. It was attended by 90 participants from 18 countries of the English-speaking Caribbean, plus Curaçao, St. Marteens, the French Antilles and Suriname, technical and administrative personnel from the Pan American Health Organization (PAHO) and its Caribbean Epidemiology Center (CAREC), and representatives of the major agencies that are supporting the program in this Region, such as the United States Agency for International Development (USAID), the United Nations International Children's Fund (UNICEF), Rotary Foundation, Rotary in Canada, and the Canadian Public Health Association (CPHA). A number of Non-Governmental Organizations (NGO's) were also present, as were, for the first time, representatives of the Commonwealth Secretariat, and the Italian and French Cooperation in Health.

The three main objectives of the meeting were to review the Progress of EPI in the countries of the English-speaking Caribbean, to have them prepare National Work Plans for 1992, to explore all venues for further collaboration between the Ministries of Health and the NGO's to strengthen EPI, and to ensure achievement of the goals of measles elimination and polio eradication.

This was the first time that the various donor agencies and the NGO's were able to discuss with the EPI Managers, the ways in which they can cooperate with the program in their respective countries. This collaboration of public and private sectors is considered essential for the full realization of the goals of the program and resulted from the joint

initiative of the Commonwealth Secretariat, CPHA and PAHO.

Following is a summary of the major conclusions and recommendations which resulted:

Immunization Coverage

Immunization coverage rates for all EPI antigens amongst the 19 countries of the English-speaking Caribbean and Suriname were either maintained or improved in 1990.

For the coming years, countries should be classified according to levels of coverage between 50-79%, between 80-90% and above 90%.

Pockets of unvaccinated children should now be identified for special mop-up operations and activities to prevent the build-up of large numbers of susceptibles.

The countries that still have coverage below 90% should intensify activities to reach that target.

Measles Elimination

With the exception of Bermuda, all countries of the English-speaking Caribbean and Suriname mobilized their manpower and material resources with the assistance of donor agencies such as CPHA, UNICEF, Rotary International, USAID and PAHO to carry out a Measles Elimination Month in May, during which they simultaneously achieved the highest immunization coverage against measles ever recorded in the history of the entire area: a regional average of 91.4% among the large cohort of children 9 months to 15 years of age. Over 1.5 million children were

immunized during this campaign, and the elimination of indigenous measles by the end of 1995 appears to be an achievable objective. The mass campaign was also intended to boost measles coverage and interrupt transmission of the virus. It is clear that the social mobilization activities carried out helped to educate and win the participation of the people of the Caribbean. "Mop-up" vaccinations are taking place in hard-to-reach areas in many countries, and overall measles coverage levels are now well above the 91.4% figure. It is very likely that measles transmission may have been interrupted in a number of countries, although only improved surveillance will allow for verification.

Fever with rash occurring 5-15 days after measles vaccination should be regarded as an adverse event and should not be counted as a measles case or be considered for collection of blood specimens for diagnosis. These cases should be recorded in a register for adverse events following vaccinations, whenever such registries exist.

The standardized case definition should be understood and used by all health workers and institutions. It was stressed that countries may wish to monitor rash and fever illnesses by a simple tally or a brief line-listing, but efforts should be focused only on those cases which actually meet the case definition for a suspect measles case: rash and fever illness with at least one of the following symptoms - coryza, cough or conjunctivitis. These cases should then be entered into the system, given an identification number and have an investigation form completed.

It will be necessary to increase the number of reporting sites throughout the subregion, with the inclusion of private practitioners and pediatricians who are the most likely health care providers to see imported cases.

The timeliness of weekly reporting needs to be improved.

Aggressive mop-up vaccination should be initiated as soon as a suspected measles case is detected. For the present it is expected that the suspected cases most likely to be confirmed are those in unvaccinated children under 15 years of age or those in young adults. It is therefore critical that aggressive outbreak control be undertaken particularly when such cases are detected.

There is a need to strongly encourage the complete collection of information on case investigation forms and laboratory report forms. The availability of detailed information on each case will allow a better understanding of the disease and direct the adequate measures, both to adjust the surveillance system and to implement control measures.

Social mobilization needs to continue to maintain public interest and vigilance.

The goal for measles vaccination should be 100% of the children under two years of age. Given the new epidemiological situation, consideration could be given to start vaccination at 12 months of age, in order to increase vaccine efficacy.

Poliomyelitis Eradication

The last poliomyelitis cases detected in the sub-region were in Jamaica, in 1982. Since that time, no cases have

been confirmed. However, only recently, surveillance for acute flaccid paralysis has been initiated in most countries. Fourteen probable cases were reported during 1991, most of them had a complete vaccination history and so far none have been confirmed as poliomyelitis.

However, some of the indicators needed for certification are still unsatisfactory:

The rate of AFP in children under 15 years of age is still below the expected of at least one per 100,000. For 1991, the projected rate is around 0.5/100,000, but it is apparent that some countries are not reporting promptly all cases of AFP.

Only a few of the reported cases of AFP have had two stools specimens collected within 15 days of onset and it is rare that contacts of such cases have stool specimens collected.

It is of paramount importance that all cases of AFP detected in any country be immediately reported to CAREC so that the real incidence can be determined, and that two stool specimens be collected promptly and sent to CAREC for examination, so that the countries of this region may be certified as free of polio. There is a need to focus on hospitals and pediatricians to strengthen the reporting of AFP, and hospital infection control nurses should be incorporated into the national surveillance system.

Rubella and Congenital Rubella Syndrome

The primary reason for rubella immunization is the prevention of congenital rubella syndrome (CRS). Cost-benefit analysis shows that the benefits gained from prevention of CRS far outweigh costs of immunization.

If rubella circulation is reduced by vaccination of young children, rather than interrupted, then the age distribution of cases is shifted to older persons, some of whom will be pregnant women.

Studies throughout the world have revealed different levels of susceptibility of pregnant women, who are the highest risk group. In island communities, levels of susceptibility are often higher and epidemics of rubella less frequent. Every study reveals some level of susceptibility, and even when susceptibility is extremely low, e.g. 1 - 2% in England, cases of CRS occur. CRS is preventable through immunization and there are three different approaches that can be used, namely :

Universal immunization of young children, often at the same time as measles immunization, in order to interrupt transmission of rubella. Any susceptible pregnant women are therefore protected through prevention of exposure.

Selective immunization of high risk groups. Here girls are immunized around the age of puberty, and vaccine is offered to any susceptible adult women, or given post-partum to those found to be susceptible on screening in pregnancy. This strategy depends on providing individual protection. It may waste vaccine as many of those immunized are already immune, but less costly as only half the annual birth cohort are immunized.

Combination of the above two strategies. Although the most expensive, this approach provides the most rapid and effective control of rubella and prevention of CRS, through interruption of transmission and protection of high risk groups.

Many Caribbean countries are using MMR or MR vaccine for the last few years, not necessarily with a long term defined strategy for rubella and CRS control. Concern was expressed that at present, outbreaks of the disease are being experienced by several Caribbean Countries, all confirmed by lab tests. An MMR seroconversion study was conducted in St. Lucia in 1991. The study was a collaboration the St. Lucia Ministry of Health, CAREC and the Centers for Disease Control of the USA, with support from PAHO/EPI. The study evaluated maternal antibody levels in infants aged six to 15 months and seroconversion among infants vaccinated at nine to 15 months. Preliminary seroconversion results for 140 children indicated an overall seroconversion of 91%, 87% and 94% for measles, mumps, and rubella respectively. Seroconversion from nine to 12 months of age ranged from 89% to 100% for measles, 85% to 95% for mumps, and 93% to 100% for rubella. This study replicates findings from other parts of the world and suggests that an additional 10% seroconversion may be accomplished by shifting immunization from nine to 12 months.

Countries considering introducing rubella vaccines, should ensure that the risks outlined above are recognized and avoided.

It is therefore of priority to assess the likelihood of achieving and maintaining high immunization coverage and to identify the prospects for CRS surveillance, before embarking in a national rubella vaccination program.

Furthermore, it is essential to select the appropriate strategy and identify the financial implications of such a long term control program.

PAHO and CAREC should coordinate and support an in-depth review of the rubella vaccine utilization in the Caribbean countries over the last few years and the present epidemiological situation of rubella and CRS, in order that strategies for their control can be properly made by every country.

Information and Surveillance Systems

The second phase of measles elimination, intensive epidemiologic surveillance, was initiated by several countries from September, 1991 on. To date, all 19 countries are involved in weekly reporting. There are currently 350 reporting sites across the subregion and over 90% of these are reporting weekly to CAREC. As of the week ending 2 November 1991, CAREC had received reports of 385 suspected cases, of which 282 have been confirmed, 51 discarded, and 52 are pending. Of the 282 confirmed cases (nearly all from Jamaica where measles cases peaked in May, 1991), 280 were confirmed on the basis of loss to follow-up. It is possible that many of these were post-vaccination, and some, rubella as only two of the 280 were confirmed serologically. Ten countries have reported no suspected or confirmed cases for the last two months. The last confirmed case in the subregion was a suspected case

in a traveller to Trinidad who was subsequently lost to follow-up.

Weekly reporting of suspected cases is now well underway throughout the subregion with over 90% of sites reporting on a weekly basis. However, more detailed information (vaccination history, clinical history, and date of onset of rash and of fever) on lab and case investigation forms is necessary for improved functioning of the system.

A new computer program developed by PAHO was installed in CAREC. This program is principally aimed at tracking all suspected measles cases and providing related analysis of critical data from the case investigation form. Initial data analysis of reported cases has indicated that not all critical data are reaching CAREC. The need for standardized data, from all member countries was stressed and therefore, changes that eventually could be made in the investigation form should comply with the minimum data necessary for comparison among the countries.

CAREC will be increasing epidemiology training in the 1992/93 period, including the use of computers in disease surveillance and control. For the Eastern Caribbean, training will be done jointly with the PAHO/CPC office in Barbados.

The Measles Elimination Field Guide was reviewed by the participants and, in general, it was considered a useful reference document that needs to be adapted to each country and field situation.

It was noted that a Weekly Surveillance Measles Bulletin is now published by CAREC, reporting dynamically the situation in each country. This feed back is critical to maintain the awareness of everyone involved with the program.

The goals regarding computerization and Measles Surveillance Software were presented. The long-term goal is to ensure that each country has computer capability, both for epidemiological analysis and for EPI management purposes. However, manual recording and analysis should not be hampered if a computer is not available or becomes inoperable. Computerization is not an overnight occurrence and even with the procurement of equipment and software, there is a necessity to maintain a back-up system by hand. Both proper training and technical support were considered to be key elements required before widespread use.

Laboratory Support

Between January and October 1991, CAREC received 188 serum specimens from 11 member countries which included Anguilla, Bahamas, Barbados, British Virgin Islands, Grenada, Guyana, Montserrat, St Kitts and Nevis, St Vincent, Suriname and Trinidad. During September through October 1991, soon after the initiation of weekly reporting of suspected measles cases from week 36 of 1991, 63 specimens were received, this was 33% of total samples received during the year. All specimens were tested for measles, for rubella using ELISA Test, and for dengue using HAI. Only 43 specimens could have confirmatory laboratory diagnosis; there were 40 confirmed cases of rubella, three of dengue and zero of measles. Only 62 samples were received paired, while the remaining 126 were single sam-

Reported Cases of EPI Diseases

Number of reported cases of measles, poliomyelitis, tetanus, diphtheria, and whooping cough, from 1 January 1991 to date of last report, and for same epidemiological period in 1990, by country.

Subregion and country	Date of last Report	Measles		Poliomyelitis #		Tetanus				Diphtheria		Whooping Cough	
						Non Neonatal		Neonatal					
		1991	1990	1991	1990	1991	1990	1991	1990	1991	1990	1991	1990
LATIN AMERICA													
Andean Region													
Bolivia	28 Dec.	1 913	751	0	0	...	38	34	42	4	4	56	155
Colombia	5 Oct.	7 401	10 603	6	4	62	129	42	104	6	22	685	1 630
Ecuador	5 Oct.	1 069	1 272	0	1	50	45	48	49	3	2	401	401
Peru	12 Oct.	322	172	1	3	87	136	63	96	2	2	17	14
Venezuela	28 Dec.	13 845	9 981	0	0	49	99	35	28	0	0	777	1 389
Southern Cone													
Argentina	28 Sept.	17 806	1 084	0	0	25	46	12	4	2	7	1 132	1 391
Chile	7 Dec.	1 828	1 578	0	0	12	20	1	0	21	32	54	58
Paraguay	5 Oct.	315	168	0	0	27	42	29	33	1	3	75	83
Uruguay	5 Oct.	1 055	13	0	0	3	3	0	0	0	0	41	79
Brazil	7 Dec.	32 335	38 757	0	0	1 141	1 248	215	196	558	695	5 858	12 734
Central America													
Belize	20 Jul.	7	58	0	0	0	0	1	0	0	0	2	2
Costa Rica	5 Oct.	3 110	21	0	0	1	3	0	0	0	0	17	58
El Salvador	3 Aug.	539	721	0	0	32	31	9	12	0	0	62	135
Guatemala	14 Sept.	138	8 632	0	3	15	35	3	4	1	2	32	41
Honduras	12 Oct.	90	8 130	0	0	10	20	9	21	0	0	29	93
Nicaragua	29 Jun.	2 365	17 529	0	0	36	22	5	15	0	0	19	220
Panama	30 Nov.	2 425	1 701	0	0	1	2	3	4	0	0	102	20
Mexico	7 Dec.	2 930	68 357	0	7	180	219	42	78	1	0	123	1 052
Latin Caribbean													
Cuba	28 Sept.	11	41	0	0	1	4	0	0	0	0	0	22
Haiti	*	...	...	0	0	...	...	...	...	...	...	...	...
Dominican Republic	28 Sept.	1 299	3 477	0	0	35	56	4	12	22	27	10	227
CARIBBEAN													
Antigua & Barbuda	8 Jun.	0	0	0	0	0	0	0	0	0	0	0	0
Bahamas	6 Jul.	0	52	0	0	1	0	0	0	0	0	0	0
Barbados	29 Jun.	0	21	0	0	4	0	0	0	0	0	1	0
Dominica	29 Jun.	2	8	0	0	1	0	0	0	0	0	0	1
Grenada	29 Jun.	2	1	0	0	1	0	0	0	0	0	0	0
Guyana	29 Jun.	2	1	0	0	0	0	0	0	0	0	0	0
Jamaica	29 Jun.	280	3 577	0	0	5	4	0	0	1	0	14	1
St. Kitts/Nevis	29 Jun.	5	61	0	0	0	0	0	0	0	0	0	0
St. Vincent	29 Jun.	2	1	0	0	1	0	0	0	0	0	0	0
Saint Lucia	29 Jun.	6	23	0	0	0	0	0	0	0	0	0	0
Suriname	13 Jul.	10	14	0	0	0	0	0	0	0	0	0	0
Trinidad & Tobago	29 Jun.	83	453	0	0	7	6	0	0	1	0	4	1
NORTH AMERICA													
Canada	28 Dec.	5 817	726	0	0	1	2	0	0	2	8	1 124	6 266
United States	28 Dec.	9 461	26 520	0	0	48	60	0	0	2	4	2 522	4 188

Data for polio includes only confirmed cases through week 52 (ending 28 December, 1991).

Data not available.

ples. 65% of rubella and all dengue cases were confirmed through testing both acute and convalescent sera.

There are logistical problems in the collection of convalescent specimens following the two to three week interval after the case first comes in contact with a health worker. Some countries have collected the second sample by home visiting. In many instances mothers have been very reluctant to allow blood withdrawal when the child has recovered from the illness.

The quality of shipments received so far was quite satisfactory. However some countries do not have formal means for shipping their specimens on a regular basis to CAREC.

Those countries which are on the route of BWIA and LIAT should have a facility to avail courtesy shipments through these airlines. Those countries which are not on BWIA's route will have to ship their specimens through Miami's port health authorities. Member countries participating in the surveillance system will need explicit guidelines on this matter.

Countries should also consider training the health workers in the techniques of venous blood collection and ensure availability of specimen collection kit for shipment to the laboratory.

Systems for improved shipment of specimens to CAREC need to be developed and further refined.

Social Mobilization and Communication

The Caribbean already has a reputation for innovation in EPI. At this meeting, for the first time, the program managers were joined by representatives of leading NGOs from Belize, Guyana, Jamaica and Trinidad. The participation of NGOs was made possible through collaboration of the Commonwealth Secretariat, the Canadian Public Health Association, and PAHO.

As noted in the final report of the Seventh Caribbean Meeting of EPI Managers held in November 1990, it was imperative that Measles Elimination Month, May 1991, count on well organized social mobilization and communication plans. To address this issue every country produced local materials ranging from TV/radio spots to call in programs to inform and educate their public on measles. PAHO's regional efforts, with support from AID and CPHA also complemented country efforts to raise the

awareness of the need for measles immunization. An evaluation of the promotional component of the English-speaking Caribbean Measles Elimination Campaign was conducted in five selected countries - Barbados, Belize, Jamaica, St. Lucia and Trinidad.

It was agreed by the NGOs and the managers that there should be a continuous dialogue between Governments and NGOs. This could be best facilitated by setting up Interagency Coordinating Committees (ICCs) or other co-ordinating mechanisms appropriate to any given country. The NGOs recommended that there should be agreed Plans of Action that identified the tasks and targets for NGOs and Governments, including the NGO responsibilities. Whenever possible, the basis for collaboration between NGOs and Governments should be the national plans.

The sustainability of the achievements of EPI will depend in part on the involvement of NGOs as lobbyists for EPI at the highest political levels. Equally, NGO involvement in community mobilization may be crucial in providing extra resources, both human and financial, to ensure EPI's success.

All countries must continue to prepare and produce health education materials in order to maintain the awareness of the danger of measles and the goal of elimination.

PAHO should also from time to time produce regional materials TV/Radio spots for Caribbean in order to maintain the momentum and mobilize the political will.

National Work Plans

All countries have produced a National Work Plan for 1992. These Plans were discussed during the Working Group Sessions, in which there was the participation from all the collaborating agencies and NGOs. The Plans cover several program components such as: biologicals and logistics, cold chain, training, supervision, surveillance, research, social communication, evaluation and operational costs. These Plans outline all the major activities that need to be implemented to address the issues identified in each component and the responsible MOH officer to carry them out. It also identifies the cost of each activity and the source of funding, both national or external, that eventually should be negotiated with the collaborating agencies.

The *EPI Newsletter* is published every two months, in Spanish and English by the Expanded Program on Immunization (EPI) of the Pan American Health Organization (PAHO), Regional Office for the Americas of the World Health Organization (WHO). Its purpose is to facilitate the exchange of ideas and information concerning immunization programs in the Region, in order to promote greater knowledge of the problems faced and their possible solutions.

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Editor: Ciro de Quadros
Associate Editor: Roxane Moncayo Eikhof

ISSN 0251-4729



Expanded Program on Immunization
Maternal and Child Health Program
Pan American Health Organization
525 Twenty-third Street, N.W.
Washington, D.C. 20037
U.S.A.