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POLIOMYELITIS CONTROL

VACCINATION PROGRAM AGAINST POLIOMYELITIS IN THE COUNTRIES OF MIDDLE AMERICA AND SOUTH AMERICA

VACCINATION PROGRAM AGAINST POLIOMYELITIS IN THE COUNTRIES OF MIDDLE AMERICA AND SOUTH AMERICA

1. POLIOMYELITIS IN THE AMERICAS

The use of the oral vaccine containing attenuated live virus has resulted in the complete, or almost complete, disappearance of poliomyelitis in Canada, the United States of America and Cuba. In these countries, besides the intensive programs carried out at the time, the practice of vaccination against poliomyelitis has been kept up in such a way that new generations are immunized at an early age; moreover, epidemiological surveillance services have been organized which operate efficiently and regularly.

Another group of American countries has employed the poliomyelitis vaccine on a large scale, thereby considerably reducing the incidence of the disease. Nevertheless, poliomyelitis is still occurring, in different degrees according to the country, and occasioning the serious sequelae of the disease in those who suffer from it. Poliomyelitis has not been eliminated in these countries due to a number of factors, including insufficient proportions of the susceptible population being immunized, lack of continuity in the program for protecting susceptible persons who join the community and the nonexistence of epidemiological surveillance services to prevent reappearance of the disease.

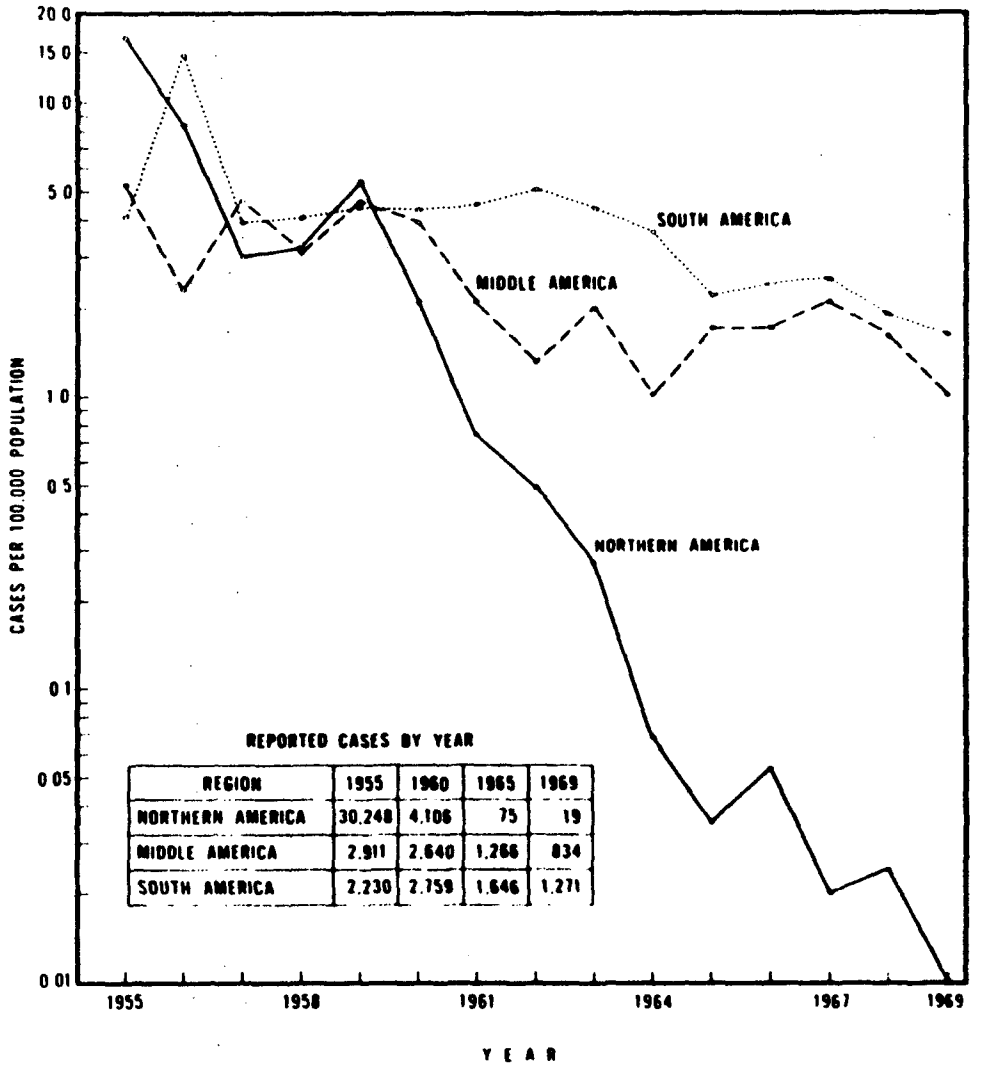
Figure 1 shows the cases of poliomyelitis, per 100,000 inhabitants, reported in the three regions of the Americas between 1955 and 1969. While in Northern America the trend has been continually downward, in Middle America it has been fluctuating and in South America, where the poliomyelitis rates are higher than in Middle America, a slow downward movement became apparent as of 1962.

Table 1 shows the number of cases of poliomyelitis reported in the Americas, by country, between 1965 and 1970, and also the deaths caused by the disease. Taking 1970 as reference year, it can be seen that the morbidity rates in Middle and South America are 27 and 19 times higher, respectively, than in Northern America in the same year.

Between 1964 and 1968, 19 countries in Middle and South America reported 10,229 cases of poliomyelitis. Unfortunately, the age groups in the statistics from the different countries are not the same, so that these data cannot be presented in a systematic form. Nevertheless, the following information can be derived from the figures on hand: of the total number of cases, 4,475 (43.74%) occurred in 12 countries reporting children under three, and 4,381 (42.82%) in seven countries reporting children under four. By adding these two groups together, it becomes apparent that of 10,229 persons affected, 8,856 (86.56%) are under four. Table 2 shows the corresponding figures.

FIGURE 1

REPORTED CASES OF POLIOMYELITIS PER 100,000 POPULATION IN THREE REGIONS OF THE AMERICAS, 1955-1969



REPORTED CASES BY YEAR

REGION	1955	1960	1965	1969
NORTHERN AMERICA	30,248	4,106	75	19
MIDDLE AMERICA	2,911	2,640	1,266	834
SOUTH AMERICA	2,230	2,759	1,646	1,271

Table 1

REPORTED CASES OF POLIOMYELITIS IN 26 COUNTRIES OF THE AMERICAS, WITH RATES PER 100,000 POPULATION, 1965–1970.

Country	Cases						Rates					
	1965	1966	1967	1968	1969[a]	1970[a]	1965	1966	1967	1968	1969[a]	1970[a]
Argentina	260	574	80	168	254	242	1.2	2.5	0.3	0.7	1.1	1.0
Barbados	—	—	1	—	—	—	—	—	0.4	—	—	—
Bolivia[b]	41	14	4	6	20	110	0.9	0.8	0.4	0.3	1.0	5.3
Brazil	...	...	...	1,585	1,143	2,263	...	...	...	1.8	1.3	2.4
Canada	3	3	2	—	2	1	0.0	0.0	0.0	—	0.0	0.0
Chile	206	141	79	63	83	190	2.4	1.6	0.9	0.7	0.9	1.9
Colombia	330	489	529	261	244	649	1.8	2.6	2.8	1.3	1.2	3.1
Costa Rica	15	10	7	3	105	22	1.0	0.6	0.4	0.2	6.3	1.3
Cuba	—	—	—	—	—	1	—	—	—	—	—	0.0
Dominican Republic	46	17	51	30	38	9	1.3	0.5	1.3	0.7	0.9	0.2
Ecuador	217	148	796	52	503	164	4.2	2.8	14.5	0.9	8.7	2.7
El Salvador[c]	81	36	74	63	38	68	3.7	1.6	3.0	2.3	1.3	2.3
Guatemala	210	118	240	146	124	108	4.7	2.6	5.1	3.0	2.5	2.1
Guyana	—	—	1	7	—	—	—	—	0.1	1.0	—	—
Haiti	5	5	3	2	3	3	0.1	0.1	0.1	0.0	0.1	0.1
Honduras[c]	265	38	79	62	37	16	23.2	2.8	4.9	3.8	2.3	0.9
Jamaica	53	6	7	—	1	6	3.0	0.3	0.4	—	0.1	0.3
Mexico	477	1,024	636	850	679	2,043	1.1	2.3	1.4	1.8	1.4	4.0
Nicaragua	105	15	461	7	154	9	6.3	0.9	25.9	0.4	8.0	0.5
Panama	9	4	55	6	9	12	0.7	0.3	4.1	0.1	0.6	0.8
Paraguay[c]	18	14	63	70	111	124	1.7	1.3	5.6	6.0	9.2	10.0
Peru[d]	444	138	161	270	103	174	7.5	2.3	2.6	2.1	0.8	1.3
Trinidad and Tobago	—	1	3	1	9	3	—	0.1	0.3	0.1	0.9	0.3
United States of America	72	113	41	53	29	30	0.0	0.1	0.0	0.0	0.0	0.0
Uruguay	12	29	22	6	6	5	0.4	1.1	0.8	0.2	0.2	0.2
Venezuela[c]	118	199	121	568	61	117	2.0	3.2	1.9	8.5	0.9	1.6
Northern America	75	116	43	53	22	31	0.0	0.1	0.0	0.0	0.0	0.0
Middle America	1,266	1,274	1,617	1,170	1,197	2,300	1.7	1.7	2.1	1.6	1.4	2.7
South America[e]	1,646	1,746	1,856	[illegible]	2,52[illegible]	4,038	2.2	2.4	2.5	1.7	1.6	1.9

— None.
... Data not available.
[a] Provisional data; incomplete data for Colombia and Panama in 1969, and for Bolivia, Colombia, Honduras, Mexico, Peru, Uruguay, and Venezuela in 1970.
[b] Reporting area from 1966.
[c] Reporting area.
[d] Reporting area up to 1967.
[e] Excluding Brazil up to 1968.

Table 2

POLIOMYELITIS CASES REPORTED BY
19 SOUTH AND MIDDLE AMERICAN COUNTRIES, BY AGE, 1964-1968

Under 3 years of age	4,475	43.74%
Under 4 years of age	4,381	42.82%
5-9 years of age	579	5.66%
5-14 years of age	238	2.32%
10 years of age and older	256	2.51%
Under 14 years of age	32	0.32%
15 years of age and older	104	1.01%
Not stated	164	1.60%
TOTAL	10,229	100%

The data available do not provide a breakdown of the cases between urban and rural areas, but observation indicates that the greater proportion has occurred in the urban areas, mainly the large conurbations. In the same way it may be stated that poliovirus Type I has been most prevalent in the region.

Table 3 gives figures for the number of persons vaccinated with attenuated live oral poliovirus vaccine, by country in the Americas, between 1965 and 1969.

2. THE CONTROL OF POLIOMYELITIS

In most countries, oral live virus vaccine is preferred because of greater ease of administration resulting in lower costs. Other advantages of the oral live virus vaccine include reduction of other enteric viruses and the initiation of a natural chain of vaccine virus transmission, thus greatly extending its immunity-producing effect.

2.1 With regard to schedules for administration of live virus vaccine, Dr. Albert B. Sabin's recommendations are as follows:

> Vaccination of the maximum possible number (at least 80%) of the children in urban areas between two months and three years of age, inclusive (i.e. the cut off is with children who are 4 years of age or over), in a specially organized mass campaign on two separate Sundays of the year, with an interval of not less than two months between them. On the first Sunday the children should be given a dose of Type I oral vaccine, and on the second Sunday a dose of oral trivalent vaccine. This schedule should be repeated in successive years for all children in the age group indicated above.
>
> Under this scheme, children starting their initial vaccination at two months of age will have received before their fourth birthday a total of four doses of Type I vaccine, and four doses of trivalent vaccine. This type of program would be an annual activity. This vaccination schedule has many advantages, especially in areas with a high prevalence of other enteric viruses during all seasons of the year, and where naturally occurring polioviruses are also still being extensively disseminated.
>
> The simultaneous administration of the vaccine strains on a single day results in a great reduction in the prevalence of other enteric viruses, as well as of the natural polioviruses, and also sets up a natural chain of transmission of the vaccine strains. This has been found to result in a much higher level of immunity than from programs in which the vaccine is administered at random throughout the course of the year.

Table 3

PERSONS IMMUNIZED WITH ATTENUATED LIVE POLIOVIRUS VACCINE BY COUNTRY, 1965–1969.

Country	Number of doses[a]	1965	1966	1967	1968	1969
Argentina[b]	3	6,774,571	10,186,196	3,005,529	2,244,742	2,600,342[b]
Barbados	3	2,118	1,521	2,484	18,068	2,103
Bolivia	2	10,505	71,797	...	608	...
Brazil	2	...	...	7,708,056	...	...
Canada	3	2,155,706[b]	1,521,747[b]	1,394,779	1,547,394[b]	1,118,983[b]
Chile	2	190,935	228,271	268,227	239,590	829,555
Colombia	2	29,364	92,421	228,878[b]	...	242,691[b]
Costa Rica	3	...	94,967[b]	302,378[b]	87,861[b]	1,156,119[b]
Cuba	2	230,716	234,985	222,872	204,936	926,278[b]
Dominican Republic	2	72,101	28,659	24,436	2,328,349[b]	...
Ecuador	3	...	15,484	620,091[c]	493,634	...
El Salvador	2	174	186,238	82,853	69,241	221,860[b]
Guatemala	2	175,384	67,163	65,359	28,879	...
Guyana	...	...	20,604	...	7,044[c]	...
Honduras	2	106,540	50,213	79,832	64,505	222,979[b]
Jamaica	3	13,135	21,347	7,351	...	...
Mexico	3	3,635,686	1,140,510	1,701,127	2,293,027	2,748,371[b]
Nicaragua	3	19,680	...	...	65,283	...
Panama	2	5,761	8,958	60,970	14,010	4,283
Paraguay	2	266,789	16,931	11,976	763	26,924
Peru	3	17,981	1,969,500[c]	2,930,026[b]	2,344,162[b]	1,235,940[b]
United States of America[d]	3	...	...	...	8,066,000	...
Uruguay[b]	2	34,043	81,915	335,854	188,417	...
Venezuela	3	476,311[c]	486,801	137,914	190,730	437,918

... Data not available.

[a] From country reports on the number of doses usually given in the primary course.

[b] Number of doses administered.

[c] Based on second doses only.

[d] Based on the percentage of the population 1–4 years of age found to have had 3 or more doses of live or inactivated poliovirus vaccine in a sample survey in 1969.

2.2 Another possible scheme which the countries may wish to consider for the vaccination of the children between two months and three years of age in the urban areas is the following:

2.2.1 Three doses of oral trivalent vaccine given to 80% of the children under one year, with two months between the first two doses and the third dose being given six to eight months after the second. A booster dose would be given in the following year.

2.2.2 Three doses of oral trivalent vaccine given to 80% of the children from one to three years old (excepting those children having received three doses in their first year of life). The first two doses would be separated by an interval of two months and the third would be given six to eight months after the second.

With regard to vaccination schemes different from 2.1, Dr. Sabin believes that where programs of the type described in paragraph 2.1 cannot be properly organized or carried out, that random administration of the vaccine is at best only a poor substitute. It may be well in such circumstances to consider having a special epidemic preparedness program, in which vaccination would occur as early as possible after a potential epidemic may be suspected.

2.3 During poliomyelitis epidemics:

All affected are groups given an oral vaccine containing the type of virus prevalent in the epidemic, after which one of the two schemes indicated under 2.1 or 2.2.1 and 2.2.2 would be followed.

3. PLANS OF OPERATION

Whatever the vaccination scheme selected, the preparation of a plan of operation is imperative in a poliomyelitis control program. The plan must cover the aspects relating to planning, programming, organization, evaluation, and epidemiological surveillance.

Planning includes the organizing of a data registration system (reporting, registration, tabulation, analysis, interpretation, and publication of the data); the analysis of the resources available, both human and material, and their actual and potential utilization; analysis of the techniques to be employed in terms of effectiveness, yield, cost, secondary effects and community acceptance; and determination of quantitative objetives in terms of time.

Programming comprises the projection in time of the actions to be carried out in order to fulfill the objectives in the time interval set. Timetables have to be prepared for this purpose.

The organizational work has to be directed toward determining the most suitable structure for the normal implementation of the actions planned in the program. Where there are integrated health services, these should be the normal vehicles for a poliomyelitis vaccination program. Where such services are not available, coordination of the poliomyelitis vaccination program with control programs for other infectious diseases and community development programs are mechanisms to be considered.

Where none of the foregoing are in existence, categorical vaccination programs may be carried out, every effort being made to have such programs serve as starting points for the organization of permanent health services. The cooperation of the community has to be obtained whatever the degree of development of the health services.

Evaluation includes the quantitative and the qualitative aspects, and also the permanent determining of the yield of the personnel and equipment and the cost of the units deployed.

Epidemiological surveillance includes the following aspects:

(a) Clinical diagnosis: Other diseases of the nervous system may have clinical characteristics similar to those of poliomyelitis, hence the necessity of an early and accurate diagnosis for correct treatment of the disease and the adoption of the proper measures to control it. It is accordingly recommended that a group of distinguished clinical doctors from the continent, with a wide experience of poliomyelitis, be selected, whose assistance would be sought by the Organization, at the request of the countries, whenever it was necessary and whose function would be to cooperate in the diagnosis of poliomyelitis and train the local doctors in the differential clinical diagnosis of the disease.

(b) Laboratory diagnosis: isolation of the virus, diagnosis and serotyping of the same to complement the clinical diagnosis. Seven South American and three Middle American countries have reported that they have laboratory facilities and trained personnel for carrying out these tests. In this way a chain of laboratories can be organized which could handle the isolating of the virus, diagnosis and typing of the virus in the countries where the laboratories are located and for those countries which do not have such facilities, in accordance with the rules to be set for this purpose.

(c) Recording of morbidity

(d) Recording of mortality

(e) Interview surveys

(f) Serological and virological surveys.

4. DETERMINATION OF THE QUANTITY OF VACCINE TO BE EMPLOYED AND THE ESTIMATED COST OF THE VACCINE, ACCORDING TO THE SCHEDULE ADOPTED

4.1 Schedule as in 2.1

Population under four years of age, urban areas, 1972:

Table 4

POPULATION UNDER FOUR YEARS OF AGE, URBAN AREAS, 1972

	Under 1 Year	1 Year	2 Years	3 Years	Total
South America	3,826,200	3,429,800	3,337,100	3,220,600	13,813,700
Central America	1,584,710	1,514,080	1,437,820	1,406,350	5,942,960
Caribbean Area*	315,530	300,830	291,870	299,350	1,207,580
TOTAL	5,726,440	5,244,710	5,066,790	4,926,300	20,964,240

*Excluding USA territories

Calculation of the number of doses of oral vaccine containing Type I virus and oral trivalent vaccine:

Table 5

ESTIMATED NUMBER OF DOSES OF VACCINE USING SCHEME 2.1
(80% of population under four years of age)

	Type I Attenuated Oral Vaccine	Attenuated Oral Trivalent Vaccine
First year	16,771,392	16,771,392
Second year	17,411,504	17,411,504
Third year	17,939,224	17,939,224
Fourth year	18,324,608	18,324,608
Fifth year	18,324,608	18,324,608
TOTAL	88,771,336	88,771,336

Estimated cost of the vaccine, per year and for a five-year period:

Table 6

ESTIMATED COST* OF ATTENUATED ORAL VACCINE, USING 2.1 SCHEME
(80% of population under four years of age)
(In US dollars)

	Type I Attenuated Oral Vaccine	Attenuated Oral Trivalent Vaccine	Total
	$	$	$
First year	503,143	503,143	1,006,286
Second year	522,345	522,345	1,044,690
Third year	538,177	538,177	1,076,354
Fourth year	549,738	549,738	1,099,476
Fifth year	549,738	549,738	1,099,476
TOTAL	2,663,141	2,663,141	5,326,282

*The amounts shown are based upon known costs of vaccine currently available. If vaccine can be purchased in lots of several million doses it is expected that some economies would be affected below the figures shown.

4.2 Schedule as in 2.2

Population under four, urban areas, 1972:

Table 7

POPULATION UNDER FOUR YEARS OF AGE, URBAN AREAS, 1972

	Under 1 Year	1-3 Years	Total
South America	3,826,200	9,987,500	13,813,700
Central America	1,584,710	4,358,250	5,942,600
Caribbean Area*	315,530	892,050	1,207,800
TOTAL	5,726,440	15,237,800	20,964,240

*Excluding USA territories

Calculation of the number of doses of oral trivalent vaccine, per year and for a five-year period:

Table 8

ESTIMATED DOSES OF ATTENUATED ORAL TRIVALENT VACCINE, USING 2.2 SCHEME

A. Attack Phase			
First year			
	80% under 4 years	16,771,392	
	3 doses each attenuated oral trivalent vaccine		50,314,176
B. Maintenance Phase			
Second to fifth year			
	80% under one year	4,581,152	
	3 doses attenuated oral trivalent vaccine per year	13,743,456	
	80% under one year	4,581,152	
	One booster dose	4,581,152	
	Total vaccine doses per year	18,324,608	
	Total vaccine doses for 4 years		73,298,432
	Total for five-year program		123,612,608

Estimated cost of the oral trivalent vaccine, per year and for a five-year period:

Table 9

ESTIMATED COST OF ATTENUATED TRIVALENT ORAL VACCINE, USING 2.2 SCHEME
(In US dollars)

A. Attack Phase				
First year				
	50,314,176 doses at 0.03 per dose			$1,509,426
B. Maintenance Phase				
Second to fifth year				
	Total vaccine doses first year	18,324,608	= $549,739	
	Total vaccine doses for 4 years	73,298,432		2,198,953
	Total for five-year program			$3,708,379

5. PAHO/WHO COOPERATION

5.1 Technical personnel.

5.1.1 Medical personnel of the Central Office unit responsible for the program.

5.1.2 Medical and paramedical personnel from the other Central Office departments involved in the program: statistics, nursing, health education, planning, laboratory, health administration, etc.

5.1.3 Epidemiologists, statisticians, planners and administrators for zones and countries.

5.1.4 PAHO/WHO Zone and Country personnel.

5.2 Assistance by PAHO/WHO technical personnel. PAHO/WHO technical staff will assist the technical personnel of the countries in the following fields:

5.2.1 Study of the problem of poliomyelitis in the countries.

5.2.2 Assistance with the preparation of plans of operation for control and epidemiological surveillance programs for poliomyelitis.

5.2.3 Evaluation of the programs.

5.2.4 Training of staff by means of local courses, visits by specialized consultants, fellowships abroad, etc.

5.2.5 Organization and running of laboratories for the isolation, diagnosis and typification of the poliomyelitis virus.

5.2.6 Provision of specialist medical personnel, in the case of epidemics or threatened epidemics of poliomyelitis, for study of the problem, clinical diagnosis of the disease, suggesting plans of action, evaluation and epidemiological watch duties.

5.3 In addition, PAHO/WHO would assist the countries by making its administrative services available for vaccine purchasing.

5.4 In the same way, in emergency cases the Organization would supply vaccine, of the type of virus prevalent, for control of the outbreak. For this purpose PAHO/WHO would keep a stock of two million doses of oral vaccine of the attenuated Type I poliovirus, since "wild" poliovirus Type I predominates in the Continent, and consider maintaining a small reserve of Types II and III.

Table 10

5.5 Extraordinary costs and number of consultants in the PAHO/WHO estimate

	1st year	2nd year	3rd year	4th year	5th year	6th year	Total
5.5.1 Short-term consultants:							
(a) Laboratory	12 months	8 months	8 months	6 months	6 months	6 months	
(b) Refrigeration	12 "	8 "	6 "	4 "	4 "	4 "	
(c) Planning	3 "	3 "	3 "	2 "	2 "	2 "	
(d) Statistics	3 "	3 "	3 "	3 "	3 "	3 "	
(e) Others (clinics, health educn.)	6 "	3 "	4 "	4 "	4 "	4 "	
Total	36 months	26 months	24 months	19 months	19 months	19 months	
Cost	US$ 64,800	46,800	43,200	34,200	34,200	34,200	257,400
5.5.2 Refrigeration equipment							
(a) Freezers (140)	35,000 (70)	35,000 (70)	--	--	--	--	70,000
(b) Refrigerated flasks (1000)	25,000 (500)	25,000 (500)	--	--	--	--	50,000
(c) Stocks of spare parts for refrigeration equipment	5,000	5,000	2,000	2,000	2,000	2,000	18,000
5.5.3 Transport vehicles (50)	100,000	100,000	--	--	--	--	200,000
(a) Stores	10,00	10,000	8,000	8,000	12,000	12,000	60,000
5.5.4 Statistical material (stationery, cards, ink, etc.)	20,000	20,000	20,000	20,000	20,000	10,000	110,000
5.5.5 Laboratory material							
(a) For dispatch of samples	5,000	5,000	--	--	--	--	10,000
(b) International transport of samples	2,000	2,000	2,000	2,000	2,000	2,000	12,000
(c) Laboratory and specialized equipment	20,000	20,000	5,000	2,000	2,000	2,000	51,000
5.5.6 Training of personnel							
(a) Assistance with courses	15,000	10,000	5,000	--	--	--	30,000
(b) Short-term fellowships abroad	14,000 (10)	14,000 (10)	7,000 (5)	7,000 (5)	--	--	42,000
5.5.7 Oral vaccine for 5 year program	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	--	5,500,000
5.5.8 Permanent reserve of 2 million doses of Type I attenuated oral vaccine	60,000	--	60,000	--	60,000	--	180,000
5.5.9 Contingencies	10,000	10,000	5,000	5,000	5,000	5,000	40,000
Total	1,485,800	1,402,800	1,257,200	1,180,200	1,237,200	67,200	6,630,400