

COST-EFFECTIVENESS OF IMMUNIZATION PROGRAMS IN COLOMBIA¹

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INTRODUCTION

At the time of the first PAHO/WHO Expanded Program on Immunization (EPI) evaluation in Colombia in 1980, coverage levels with the EPI vaccines (BCG, DPT, measles, and oral polio vaccines) were found to be very low (1). The routine reporting system indicates that national coverage of infants in 1980 was 16.1% for polio, 15.1% for DPT, and 13.7% for measles. The principal delivery strategy for immunizations in 1980 was an on-demand service provided at all health care levels. Such immunizations were available at any time during normal clinic hours and were administered by an auxiliary nurse specializing largely or totally in immunization work. This pattern remains the standard method of delivery in the cities of Bogotá, Medellín, and Cali, and in the departments of Valle del Cauca, Cundinamarca, and Meta.

Following the first EPI evaluation, a "channeling" strategy was defined and implemented for the first time in March–April 1981. This strategy in-

cluded a systematic program of outreach work. Nursing personnel, vaccinators, and promoters were assigned blocks of houses to visit, in the company of a community representative, in order to gauge the size of the infant population and encourage the use of immunization, prenatal, and family planning services at the local health unit. In addition, outreach immunization clinics were held in the neighborhood being visited, and these were prominently featured in the promotional work of the channeling team. The channeling activities did not include house-to-house immunizations. The strategy was first implemented in several different areas including parts of Huila, Atlántico, and Tolima departments.

The Third EPI Evaluation in 1984 (2) recommended making a systematic assessment of this channeling effort's impact upon the utilization of services. It would be misleading, however, to assume that all post-1981 immunization coverage increases were attributable to channeling (3), as not all regions of the country have been implementing this strategy, and some of these regions (such as Bogotá and Cundinamarca) have also experienced sharp upturns in recorded coverage since 1981–1982.

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The National Vaccination Campaign of 1984 was designed first to increase vaccination coverage of children below four years of age, second to strengthen the channeling strategy where it was operational, and third to implement this strategy in areas where it was not being used. The campaign had several distinct phases, the first being a planning and policy-making phase presided over by the campaign's National Coordinating Committee. This was followed by channeling activities preceding the actual National Vaccination Campaign—activities including intensified channeling work in areas such as Huila that had already implemented the strategy some years earlier, as well as introduction of channeling for the first time in Bogotá, Medellín, Cali, and other areas. Finally, the campaign included the three actual vaccination days of 1984 (23 June, 28 July, and 25 August). On these days, which were preceded and accompanied by intense national publicity, numerous ad hoc vaccinating sites were set up for one vaccination day at a time. Over 10,000 such sites, staffed by health workers and volunteers from various other sectors, were in operation for the first of these days. DPT, oral polio, and measles vaccinations were administered.

The National Coordinating Committee has used the number of third-dose DPT immunizations administered to indicate the number of fully immunized children, and the data collection format has made it possible to routinely identify the number of immunizations (by type and age) given on each national vaccination day separately from those given in the remainder of the year at each health unit. It was thus pos-

sible to determine the number of children beginning and completing courses of immunization during the three national vaccination days, as well as the numbers beginning without completing and completing without beginning. A commendable degree of comparability was maintained between routine immunization histories obtained at health centers and those obtained for the National Vaccination Campaign. This made it possible for health units to identify non-completers and encourage them to complete the course of immunization via routine services after the campaign ended.

It should be noted, however, that some differences exist between the measures used by the national campaign and those used by the Expanded Program on Immunization (EPI) to gauge coverage and performance. That is, the EPI's full immunization schedule includes BCG as well as DPT, oral polio, and measles vaccinations, and the EPI registers the fully immunized infant. In contrast, the national vaccination campaign and routine immunization services record the infants receiving their third dose of DPT as "fully immunized"; and since the number of infants who have received their third dose of DPT is almost always higher than the number who have received measles immunization, a degree of incompatibility exists between national campaign and EPI data relating to program coverage and performance.

It should also be noted that the extent of coverage in Colombia has been hard to measure because of the time elapsed since the last (1973) census, and the (not surprising) differences between the various domestic population projections. Each health unit was given an estimated "susceptible population" for 1984, and these estimates provided a basis for the coverage data shown in Table 4. As of August 1985 it was expected

that forthcoming census data would establish a more accurate set of population denominators, but for the evaluation of the 1984 National Vaccination Campaign the survey by Guerrero and Rodríguez gave the most reliable national picture then available (4). This latter survey indicated coverage increases among infants from 4.4% to 50% with DPT, from 4.2% to 50.6% with oral polio vaccine, and from 1.4% to 51.2% with measles vaccine. It also indicated that by the end of the National Vaccination Campaign (after 25 August), some 29.7% of all infants had not received any polio vaccine and that routine services provided after 25 August raised the total infant three-dose DPT coverage from about 50% to about 66.8% by the end of 1984.

MATERIALS AND METHODS

The specific objectives of this investigation were (1) to estimate the costs per immunization contact for routinely available vaccination services in Colombia, and (2) to compare these with the incremental costs for the additional immunization contacts resulting from the 1984 National Vaccination Campaign. The underlying general purpose was to assess the cost-effectiveness of the immunization strategies applied in Colombia and to derive policy implications for both Colombia and other developing countries.

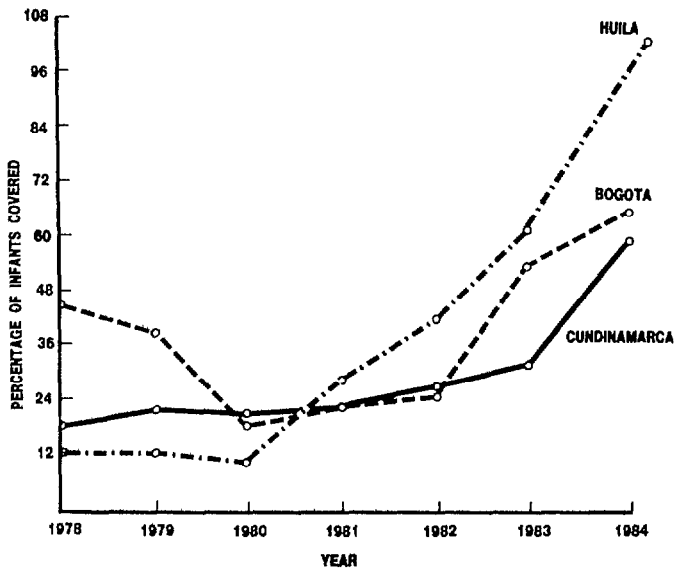
Existing documentation, including routinely available immunization records, permitted rapid appraisal of the structure, evolution, and output of Colombia's Expanded Program on Immunization. In addition, a draft estimate of the aggregate incremental costs of the National Vaccination Campaign

was available (5). No previous analysis of health service costs at the level of individual health facilities had been undertaken, however, and it was necessary to do this to establish an economic reference point for the appraisal of the 1984 campaign. Since the format of existing health sector expenditure records made it impossible to identify component sub-programs at individual health facilities, a small sample of health units was examined to get an initial impression of the different ways immunization resources were utilized. The particular health units studied were chosen to show contrasts between areas using different degrees of channeling in 1984 and also between those parts of the country where channeling strategies had been used before 1984 as compared to those where channeling was only introduced as part of the National Vaccination Campaign. The final selection of health units was also influenced by the time available for making the appraisal. The procedures used to estimate health unit costs were based upon those recommended by the EPI Costing Guidelines (6)—procedures involving a combination of direct observations, discussions with appropriate staff members, and perusal of existing records and returns. Table 1 shows the areas where health units were visited and the type of immunization strategy used in each area before 1984. The approximate percentages of infants provided with their third DPT immunization in each of the departments containing these units from 1978 through 1984 is shown in Figure 1.

TABLE 1. Health units selected for the initial survey and the extent to which channeling strategies were employed by those units before 1984.

Department	Region	Health unit name	Use of channeling
Bogotá	Region 1	Suba Garcés Navas Gaitán Paris	Limited, in immediate preparation for 1984 campaign days only.
	Region 4	Venecia Ismael Perdonó	
Cundinamarca	Facatativa	Facatativa Albán Guayabal	Same as Bogotá.
Huila	Neiva	Campoalegre Rivera	Continuous since 1981.

FIGURE 1. The approximate percentages of infants receiving a third dose of DPT vaccine in Bogotá, Cundinamarca, and Huila departments in 1978-1984, according to vaccination data provided by the National Health Information System and population projections from the National Department of Planning for this period.



RESULTS

Table 2 shows the numbers of immunizations given at each health unit, distinguishing those given on the three campaign days from those administered by the routine services. The numbers of third-dose DPT immunizations given to infants are also broken out and shown separately.

Table 3 shows overall data (routine plus campaign day immunizations) for the three departments in which this study was carried out, and Table 4 indicates the coverages attained.

The total costs of routine immunization services were assessed by identifying the types and quantities of human and physical resources deployed for immunization at each health post, and by apportioning a share of the immunization resources at higher levels (regional, departmental, and national) to each unit. A detailed example of the figures used to estimate total immunization costs at one health center is presented in Annex 1.

TABLE 3. Immunizations provided during 1984 in the three departments containing health units included in the study.

Department	No. of DPT, OPV, and measles immunizations given (all ages)	No. of third DPT immunizations given to infants
Bogotá	1,213,813	70,846
Cundinamarca	421,009	20,143
Huila	245,274	13,782

The existence of a standard staffing and delivery pattern for routine, on-demand services in both Bogotá and Cundinamarca helps to explain the similarity of the estimated immunization costs at several of the health units shown in Table 5. Clear exceptions to the usual cost levels occurred where large units (Suba and Facatativa) supplemented their vaccination activities by using pro-

TABLE 2. Immunizations provided routinely and during the three campaign days of 1984.

Health unit studied	Immunizations provided by routine services		Immunizations provided during campaign days	
	No. of DPT, OPV, and measles immunizations given (all ages)	No. of third DPT immunizations given to infants	No. of DPT, OPV, and measles immunizations given (all ages)	No. of third DPT immunizations given to infants
Suba	14,486	1,594	18,504	357
Garcés Navas	3,849	459	3,303	66
Gaitán Paris	5,356	506	2,558	38
Venecia	10,918	1,199	5,937	163
Ismael Perdonó	5,500	823	7,277	114
Facatativa	14,121	632	5,007	293
Albán	568	48	636	58
Guayabal	771	101	371	56
Campoalegre	3,226	336 ^a	4,218	224 ^a
Rivera	1,927	169 ^a	1,880	112 ^a

^a Estimated apportionment of third DPT immunizations given to infants based on departmental proportions

TABLE 4. Third DPT immunizations provided to infants in 1984—showing the size of infant populations, percent coverage by routine services, and percent coverage overall.

Country, departments studied, and health units studied	Infant population (< 1 year), 1984	Total coverage (%)	Coverage by routine services only (%)
Colombia	660,000 (approx.)	(66.8) ^a	
Bogotá ^b	103,464	(68.5)	
Cundinamarca ^b	31,622	(63.7)	
Huila ^c	14,808	(93.1)	
Suba	3,377	(57.2)	(47.2)
Garcés Navas	972	(54.0)	(47.2)
Gaitán Paris	993	(54.8)	(51.0)
Venecia	3,228	(42.2)	(37.1)
Ismael Perdonó	791	(118.5)	(104.0)
Facatativa	1,419	(65.2)	(44.5)
Albán	134	(79.1)	(35.8)
Guayabal	121	(129.7)	(83.5)
Campoalegre	571	(98.1)	(58.8)
Rivera	264	(106.4)	(64.0)

^a Guerrero and Rodríguez (4)

^b Population data from 1973-1988 projections by the National Department of Planning, Bogotá. immunization data from Health Information Systems (Sistemas de Información de Salud, SIS) reporting form SIS-151

^c Population data from local population estimates for 1984; immunization data from SIS-151

motors or vaccinators outside the health center for immunization work on either a part-time or full-time basis, and also where, as in Campoalegre and Rivera, the routine services included both a static, on-demand service and channeling activities.

Table 5 also indicates the incremental costs of planning and implementing the three national vaccination days of 1984. At the health unit level this involved three principal activities:

- Formation of a local executive office—typically staffed by a doctor, a chief nurse, a social work director, and a record-keeper, and usually operated with considerable assistance from members of voluntary organizations.

- Initiation or intensification of channeling to identify the at-risk population and encourage clinic attendance. At some units (e.g., Garcés Navas) very little activity of this sort was undertaken, while at others (Albán and Guayabal) these sorts of preparatory efforts for the national campaign were extensive.
- Work performed on the actual national vaccination days, during which large centers such as Suba coordinated as many as 48 vaccinating stations, while smaller health units managed between three and six each.

Table 6 shows the approximate local division of the national campaign's costs into the above components; this division permits the channeling costs to be separated from the costs attributable directly to the three actual vaccination days.

Tables 7 and 8 combine data on the numbers of immunizations (see

TABLE 5. Estimates of total immunization costs and incremental National Vaccination Campaign costs at the health units studied in 1984.

Health unit	Total costs of routine service (in pesos) ^a	Incremental costs of the national campaign (in pesos) ^a
Suba	909,784	1,548,972
Garcés Navas	462,202	309,667
Gaitán Paris	464,481	397,510
Venecia	531,465	332,633
Ismael Perdonó	470,537	427,554
Facatativa	853,461	1,942,175
Albán	541,826	764,221
Guayabal	417,416	408,278
Campoalegre	736,357	825,977
Rivera	740,816	495,284
National estimate		1,075,178,000

^a Average 1984 exchange rate: US\$1 = 101 pesos.

TABLE 6. National vaccination campaign costs in pesos, showing the channeling and implementation components.

Health unit	Precampaign channeling cost (in pesos) ^a	Organizing committee time cost (in pesos) ^a	Campaign day cost in pesos ^a (including a share of the national level costs)	Total incremental campaign cost (in pesos) ^a
Suba	245,632	—	1,303,340	1,548,972
Garcés Navas	—	—	309,667	309,667
Gaitán Paris	235,136	—	162,374	397,510
Venecia	100,728	—	231,905	332,633
Ismael Perdonó	212,539	—	215,015	427,554
Facatativa	319,780	917,460	704,935	1,942,175
Campoalegre	52,083	458,730	315,164	825,977

^a Average 1984 exchange rate: US\$1 = 101 pesos.

Table 2) with data on costs (Table 5) to give the average cost per immunization and average cost per fully immunized infant—both for the routine service and for the national vaccination days.

A previous estimate (5) of the aggregate program costs was compared with the average cost range in the sample of health posts visited. This estimate was

found to be within the ranges, but below the means, of both the incremental cost per immunization and the incremental cost per fully immunized infant.

TABLE 7. The average costs to the routine services per immunization contact and per fully immunized infant in 1984.

Health unit	Average cost per immunization (in pesos) ^a	Average cost per infant receiving a third dose of DPT (in pesos) ^a
Suba	62.8	570.8
Garcés Navas	120.1	1,007.0
Gaitán Paris	86.7	917.9
Venecia	48.7	443.3
Ismael Perdonó	85.6	571.7
Facatativa	60.4	1,350.4
Albán	953.9	11,288.0
Guayabal	541.4	4,132.8
Campoalegre	228.3	2,191.5
Rivera	384.4	4,383.5
Sample mean	257.2	2,685.7
Range	60-954	443-11,288

^a Average 1984 exchange rate: US\$1 = 101 pesos.

CONCLUSIONS

The general impact of the 1984 National Vaccination Campaign upon the number of immunizations administered appears to have been substantial. The records of the Health Ministry's National Health Information System indicate that some 636,000 doses of DPT were given to infants during the campaign's three vaccination days, and that nearly 190,000 infants received a third dose of DPT on those days. The total number of infants that both began and completed their DPT immunization schedules on the vaccination days was approximately 98,000.

TABLE 8. The incremental costs ascribed to the national vaccination campaign per immunization and per fully immunized infant—national campaign days, 1984.

Health unit	The national campaign's incremental cost per immunization (in pesos) ^a	The national campaign's incremental cost per infant receiving a third dose of DPT (in pesos) ^a
Suba	83.7	4,338.9
Garcés Navas	93.7	4,691.9
Gaitán Paris	155.4	10,460.8
Venecia	56.0	2,041.0
Ismael Perdonó	58.7	3,750.5
Facatativa	387.9	6,628.6
Albán	1,201.6	13,176.2
Guayabal	1,100.5	7,291.0
Campoalegre	195.8	3,687.4
Rivera	263.4	4,422.2
Previous national estimate	215.0 ^b	5,685.7 ^c
Sample mean	359.7	6,050.0
Range	56-1,202	2,041-13,176

^a Average 1984 exchange rate. US\$1 = 101 pesos.

^b Based on an approximate figure of five million doses given.

^c Data provided by the Ministry of Health of Colombia's National Health Information System (sis)

The percentage of all infants covered, however, remains uncertain. The effect of the campaign days alone, as determined by the national coverage survey, was to push coverage to approximately 50% among infants. However, the data in Table 9 suggest that infant coverage in 1983 was around 42-44%. On this basis, the increase in national coverage achieved by the routine services in 1984 appears to have exceeded that directly attributable to the campaign. The coverage survey showed 66.7% of the infant population covered with DPT by the time of the survey (November/December 1984), but only 50% covered on the

TABLE 9. Percentage coverage of infants with the indicated vaccines in 1978-1983.

Vaccine	% coverage in:					
	1978	1979	1980	1981	1982	1983
Polio	16.6	18.7	16.1	25.4	27.2	43.7
DPT	18.0	18.2	15.1	21.6	26.3	42.3
Measles	8.1	13.1	13.7	27.5	27.8	43.4

Source: Ministry of Health (3).

actual national vaccination days.⁴ Moreover, of the total national increase in 1984, more than half may have been achieved outside of the three vaccination days. The very low infant coverage levels documented in early 1984 by the national survey,⁵ which might appear to indicate a major impact made by the national campaign, do not in fact constitute an adequate base from which to measure the campaign's achievement. Routine services, as the coverage survey shows, continued to raise coverage throughout the year—which means that the index of national campaign performance should be annual or cohort differences in coverage levels. Since differences between areas with and without national campaign activities were not observable for 1984, the use of 1983 data provides the best available measure of the consequence of introduction of the national campaign in 1984.

It may be argued that many of the immunizations given late in 1984 resulted as spillovers from the national campaign; but in comparing apparent coverage levels at different points in time allowance should also be made for the influence of secular trends (such as those in evidence during 1982 and 1983 in regions not implementing channeling). Awareness of the importance and avail-

ability of immunization services in Colombia is clearly growing fast at a time when health authorities are raising the priority accorded to these services and improving the quality of their routine programming. Disentangling the precise impact upon coverage of a single policy change, even so large a one as initiation of the national vaccination days, remains fraught with problems—especially when the population denominator remains so uncertain.

Nevertheless, some comparisons of the relationship between costs and the numbers of immunizations achieved seem possible on the basis of this preliminary study. These are summarized in the remainder of this article, which also presents some tentative general comments on the fiscal feasibility and replicability of alternative types of intensified national immunization strategies.

Costs of Immunization Activities

Routine immunization services. In both Bogotá and Cundinamarca departments, with the exception of the two larger units at Suba and Facatativa, these services were found to involve similar total costs. The allocation of one full-time auxiliary nurse to immunization work

⁴ See Table 3 in R. Guerrero and R. Rodríguez (4).

⁵ See p. 6 in R. Guerrero and R. Rodríguez (4).

created a substantial fixed cost in the service, and this explains why the health units with the smallest populations (Albán and Guayabal) showed the highest average costs of routine immunization activity. It would make economic sense in such cases to redeploy underemployed immunization personnel or to assign them additional responsibilities such as promotional outreach work.

It should also be noted, however, that there were essentially two different types of routine immunization service in Colombia—because some areas performed routine channeling activities and some did not. In the Huila units (Campoalegre and Rivera), where channeling activity was routine, the cost per immunization was nearly 50% higher than at Ismael Perdonó and Albán (which served the most closely comparable populations in parts of the country where routine channeling was not yet practiced). In 1984 the average cost per immunization (total costs/total number of polio, DPT, and measles vaccinations) in the nonoutreach routine services was 80.8 pesos (US\$0.80) at the health units in Bogotá; 518.6 (US\$5.13) in Cundinamarca; and 306.4 (US\$3.03) in Huila. The average cost per fully immunized infant (total costs/total number of third DPT doses given to children under one year old) in Huila was also between those of Bogotá and Cundinamarca. In general, this analysis suggests that the size of the population served, rather than the mode of organizing routine services, was the major determinant of the average cost per unit output for both types of routine services.

Regarding coverage, it is not clear from the data collected (see Table 4) whether there was any real difference in

the coverage achieved by units that employed channeling and those that did not. The departmental data in Table 4 suggest that the long-term channeling in Huila since 1981 combined with the National Vaccination Campaign achieved almost 100% coverage in 1984. Also, a small coverage survey reported in the second EPI evaluation (7), using the same methods that were subsequently employed in the national coverage survey of 1984, showed that areas with channeling achieved 48% coverage of infants in 1982, while in other areas with partial channeling or none, infant coverage was only 29% (the average coverage indicated by this survey was 35%, slightly less than that shown for this year by the data in Figure 1). Hence, it may be that in terms of cost relative to coverage the channeling strategy offers an economically attractive alternative to static, on-demand services. However, as of mid-1985, without the channeling evaluation recommended by the third EPI evaluation, this could not be determined.

National Vaccination Campaign costs. The impact of the national vaccination days on routine immunization program costs in all parts of the country was substantial. In the sample of units visited, the national campaign costs increased the routine cost totals by 120%. This cost increment appears to have been larger at the bigger health units (local hospitals and the larger health centers), probably because of the greater burden of administrative responsibility at these levels.

One way of estimating the national costs of the campaign would be to assume similar increases at all hospitals and health centers in the country, these being the major organizational elements in the campaign. This would lead to the following calculations:

600 local hospitals with a 150% increase in routine immunization costs of approximately 850,000 pesos per year: 765 million pesos

600 health centers (and their dependent health posts) with a 100% increase in routine immunization costs of approximately 450,000 pesos per year: 270 million pesos

Total cost increase attributed to the National Vaccination Campaign: 1,035 million pesos (US\$10.2 million)

An alternative method, described on the pages that follow and based on the estimated cost per fully immunized infant, yields a similar total figure. Moreover, the figures derived by both methods are very similar to the previously cited figure of 1,075 million pesos (US\$10.6 million) (5).

The total number of vaccinations administered increased sharply as a result of the national campaign, however, and the average cost ranges per immunization provided by the routine services and by the national campaign (see Tables 7 and 8) were very similar. By either strategy it appears to have cost between 60 pesos (US\$0.59) and 1,200 pesos (US\$11.90) to provide an immunization, the average cost at routine services in the study unit being US\$2.50 and the average national campaign costs being US\$3.60. Although marginal costs might be expected to rise as coverage increases, the similarity of these average costs indicates that no dramatic economies of scale were achieved by the national campaign strategy.

There was a more striking difference in the average cost per infant fully immunized with DPT, however, the averages in the units studied being 2,686 pesos (US\$26.60) via the routine services and 6,050 pesos (US\$59.90) via the national campaign. The difference between the costs per immunization and the costs per infant fully immunized with DPT may be taken as an index of the specific-

ity with which the immunization program was targeted. (It is clear that in recent years the routine services have been more specifically targeted toward infants than were the 1984 vaccination days. A greater emphasis in the 1985 national vaccination days on children under two should raise the ratio of costs per immunization to costs per infant fully immunized with DPT.)

However, in view of the epidemiologic importance of measles in Colombia and the need for consistency with the EPI definition of full immunization, it would seem more appropriate to use the number of measles immunizations provided to infants as an indicator of "full immunization." Although a single shot immunization, measles should be scheduled with or after the third doses of DPT and oral polio vaccine. At some of the health units visited, the number of measles immunizations given to infants was 40% below the number of third doses of DPT recorded for the same age group. In this same vein, recorded wastage rates for measles vaccine were unusually high—averaging 80% in the sample and exceeding 100% at some units.

If the mean cost per infant fully immunized with DPT of 6,050 pesos is representative of the National Vaccination Campaign as a whole, then the total national costs of the program will be in the area of $190,000 \times 6,050 = 1,149.5$ million pesos (US\$11.4 million). It would thus seem realistic to estimate the national campaign costs for 1984 at between 1 and 1.2 billion pesos (US\$9.9–11.9 million). Considering that the costs per fully immunized infant are likely to rise as coverage is extended, it appears that possible modifications in

the campaign strategy should be considered. Two potential ways of reducing costs that might be further explored are as follows:

- Limited duration channeling, as practiced in Bogotá and Cundinamarca, appears to have had little identifiable effect on the additional numbers of children being vaccinated on national vaccination days. Units with little or no preparatory channeling (e.g., Garcés Navas) appear to have had as large an increase in their workload on vaccination days as units that engaged in a full three months of preparatory channeling (e.g., Venecia). Since the costs of such work are often a substantial part—over half at one health center (see Table 6)—of the total national campaign costs, the effectiveness of deploying health workers for preliminary channeling work should be monitored. This could be done by comparing national vaccination day attendances with routine attendances at a small sample of health centers where channeling is not practiced, and comparing these data with similar data from other centers engaging in channeling activities.
- In some cases the appropriate number of posts to establish for national vaccination days was greatly overestimated. This resulted in very small numbers of immunizations being given at some posts, and reduction of the number of posts on subsequent vaccination days. At Ismael Perdonó, for instance, the number of posts operating during the June, July, and August vaccination days was 15, nine, and six, respectively. To the extent that it can be done without reducing accessibility, such rationalization of vaccination-day posts should be encouraged at the health center level in the interests of containing future vaccination-day costs.

Fiscal Implications of the National Vaccination Campaign

In general, the foregoing analysis of Colombia's 1984 experience shows that national mobilization for immunization was achieved at total costs broadly comparable to those of routine immunization services. However, the unit cost per infant provided with a third dose of DPT vaccine was about twice as high when the third dose was provided via the campaign as when it was provided by the routine services. This indicates a need for attention to the national campaign's organization and targeting, and for review of possible variations in the general strategy for intensifying immunization coverage.

Among other things, those evaluating the program should assess the cost and success of long-term channeling activities in certain parts of the country, and should consider using national publicity to encourage attendance at routine immunization services, without calling for the mass mobilization of the national campaign.

Also, a continuous monitoring effort, in which the epidemiologic and economic implications of alternative styles of programs are considered, should be built into the National Vaccination Campaign. In a country as diverse as Colombia, the most cost-effective immunization strategy for the nation may well involve a mix of different strategies rather than a single strategy.

The increased expenditure associated with the 1984 National Vaccination Campaign (estimated at 1.2 billion pesos) represents a per capita expense of just over 40 pesos (US\$0.40). Colombia's per capita income in 1983 was estimated at US\$806 (8), which at 1983 exchange rates was approximately 64,000 pesos. The legislated minimum wage in 1984 was just over 150,000 pesos per year.

Health sector expenditures for 1981 totaled 121.4 billion pesos (8). As of mid-1985, projection of this figure to 1984 on the basis of monetary growth in health spending from the previous year (43.4%) would give a 1984 sector total of approximately 350 billion pesos. The additional costs of the National Vaccination Campaign represent one-third of one percent (0.34%) of this sum, and under 1% of the actual 1981 health sector budget. Furthermore, the estimated increased costs of the national campaign include the costed time of large numbers of volunteer workers—a cost that is part of the social opportunity cost of the campaign but not a financial cost to the Ministry of Health. (Financial costs assigned to the Ministry of Health comprise about 75% of the total costs of the campaign.) In general, the financial and economic costs of the campaign (and of routine immunization work) appear small in comparison to total health sector resources and average personal income levels.

Foreign donor contributions (from the United Nations Development Program, UNICEF, and PAHO/WHO) accounted for a relatively small part of the total 1984 national campaign cost (about 43 million pesos or 3% of the total).

All of this indicates that the short-run affordability of the national campaign does not appear to be a major constraint. Provision for more substantial economic and epidemiologic evaluation should be built into the program, however, and it would appear advantageous to extend the planning horizon for intensified immunization from an annual period to a three-year rolling period, as outlined below.

The Role of the National Campaign

The National Vaccination Campaign produced increased immunization activity and gave the government's health sector a higher public profile in a manner that was broadly supported and largely noncontroversial. At the same time, it caused large numbers of volunteers and personnel in other government agencies to work together with the country's health professionals.

Record-keeping for the campaign was designed to complement the information system of the routine immunization service, thus avoiding some of the incompatibilities that were manifest in Brazil's early national campaign experience. Clearly, this record-keeping pattern should be maintained in the future.

It is also important that the on-demand or routine channeling services be maintained at health units, because these services played a major part in the overall increase of coverage levels in 1984.

A potential problem is that the national campaign could conceivably eclipse the continuous multipurpose routine services—detracting not only from their immunization efforts but from other preventive and promotional activities as well.

A major disadvantage of campaign-type, periodic, and discrete actions is their very specificity. Brazil's early immunization campaigns (since broadened in scope) were initially restricted to administering only poliomyelitis vaccine. In contrast, intensification of routine services by channeling allows multiple activities—including immunization—to be implemented.

Also, in evaluating the cost and effectiveness of future national campaigns, it will be important to monitor both short-term (monthly) and longer-

term patterns of immunization at Colombian health centers, so as to detect various trends and to ascertain whether the campaign produces an obvious increase in the "clumping" of immunizations at certain times.

Repeating the National Vaccination Campaign Strategy

As of mid-1985, it appeared that continuity of administrative effort would be as important as adequate financial resources for effective repetition of the 1984 campaign. The first of the 1985 vaccination days was already at least 13 months after the last 1984 vaccination day. In order to improve administrative continuity, it has been suggested that these national campaigns involving intensification of immunization efforts should be planned not on an annual but on a triennial basis, with national and departmental committees chosen for and working on a rolling three-year plan. In this same vein, increased and continuous attention should be given to comparative monitoring and to evaluation of national options for immunization strategies.

There is now an accumulation of international expertise in immunization campaign management and evaluation in Central and South America that includes a noteworthy exchange of personnel between countries implementing, planning, and evaluating such programs.

The national prerequisites for success, in terms of program cost and im-

pact, are probably more related to general development of the necessary communication than to the health sector's physical infrastructure. Communication vertically within the health sector requires some physical elements of infrastructure (radio-telephone, telephones, and a functioning transportation system) and will prove beneficial to the extent that national radio stations and newspapers are developed. But a line management system within the immunization program—a system better-developed in the areas of Colombia with long-established channeling—is an essential component. Better development of such a system in the rest of Colombia remains an important priority for the EPI, and should be part of the groundwork in countries considering the initiation of campaign activity.

Horizontal communication at each tier of the health sector is of equal importance. This permits national engagement of broadcasting networks and other media to support the program, and also helps to ensure that the additional human resources, vehicles, furniture, food, etc. that are needed in each local area to sustain a large, temporary network of health stations will be forthcoming to supplement the skills of the regular health workers.

For countries considering a campaign strategy, appraisal of the quality of communications (which depends on both communication equipment and associated managerial skills) together with the degree of planning continuity should help to indicate the prospects for successful adoption of the strategy for extending immunization coverage to the most vulnerable groups. Preparatory work should also document the cost and effectiveness of the existing program, so that national policy changes may be appraised in a consistent fashion.

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SUMMARY

In 1984 Colombia conducted a National Vaccination Campaign designed to improve coverage of the population with DPT, oral polio, and measles vaccines. The study reported here was designed to estimate the cost of administering vaccinations through the routine vaccination services and through the national campaign, assess the cost-effectiveness of the vaccination strategies employed, and make appropriate recommendations applicable inside and outside Colombia.

This study showed the costs per immunization via the routine services and via the national campaign to be roughly comparable (US\$2.60 versus US\$3.60). However, the cost per infant receiving a third dose of DPT was found to be over twice as high for the campaign as for the routine services (US\$59.90 versus US\$26.60).

The study also found that national immunization coverage (as measured by the proportion of infants receiving a third dose of DPT) improved

substantially in 1984, with both the national campaign and the routine services contributing.

The added cost of the national campaign in 1984 was in the range of US\$9.9–11.9 million. It appears that this cost could be lowered by improved targeting of the age group most at risk and by reduction of the number of temporary vaccination sites. In addition, it would appear desirable to develop an ongoing evaluation capacity, so that both existing variations and innovations in the strategies for delivering immunizations can be assessed.

The authors suggest that Colombia's national campaign should be planned on a rolling three-year basis rather than annually, so as to provide better continuity from one year to the next. They also recommend that countries trying to identify the most appropriate vaccination strategy for themselves should evaluate how good their intersectoral and intrasectoral communications are and should estimate the cost and effectiveness of the existing immunization strategies employed.

REFERENCES

- 1 OPS/OMS/Ministerio de Salud (Colombia). 1a Evaluación del Programa Ampliado de Inmunizaciones—PAI. Mimeographed document. Bogotá, Colombia, 1980.
- 2 OPS/OMS/UNICEF/Ministerio de Salud (Colombia). 3a Evaluación PAI. Mimeographed document. Bogotá, Colombia, 1984.
- 3 Ministry of Health (Colombia). *National Vaccination Crusade: Summary of the Experience, Achievements, and Perspectives*. Bogotá, 1984, p. 4.

- 4 Guerrero, R., and R. Rodríguez. Epidemiological Evaluation of National Immunization Days Experience in Colombia. Document PAHO/ACHR/25/6.3. Pan American Health Organization, Washington, D.C., 1985.
- 5 Buendía, H. G. El costo de las jornadas. Mimeographed document. 1984.
- 6 World Health Organization. EPI Costing Guidelines. WHO document EPI/GEN/79/5. Geneva, 1979.
- 7 OPS/OMS/Ministerio de Salud (Colombia). 2a Evaluación PAI. Mimeographed document. Bogotá, Colombia, 1982.
- 8 Ministerio de Salud (Colombia)/OPS. Colombia: Diagnóstico de salud—políticas y estrategias. Mimeographed document. Bogotá, 1984.

ANNEX 1. Data used to estimate immunization costs at one of the health centers studied (Suba) in 1984.

A Routine Services

1 Personnel

Type	Gross monthly salary and allowances	Months employed per year (%)	% of time devoted to immunization	EPI cost
Medical director	50,970 pesos	10.5	6	32,111 pesos ^a
Head nurse	50,970 "	10.5	6	32,111 "
Promoters (7)	21,485 "	10.5	17	268,455 "
Promoter (1)	21,485 "	12	17	43,829 "
Auxiliary nurse	30,518 "	12	72	263,675 "
Subtotal				640,181 "

2 Equipment

Refrigerator
Thermometer
Sterilizer
Cold box
Cupboard
Table

Total replacement cost: 45,428 pesos
Annual equivalent at 10 years life at 10% = 11,983 pesos

3 Vaccines

OPV: 6,208 doses given + 20% wastage^b × 2.3 pesos per dose = 17,134 pesos
 DPT: 6,208 doses given + 20% wastage^b × 3.4 pesos per dose = 26,384 "
 Measles: 2,070 doses given + 80% wastage^b × 7.7 pesos per dose = 28,690 "
 Subtotal 72,208 "

4 Nonreusable items

Syringes, cotton, alcohol, etc.
 Unit cost per vaccination needle: 15.15 pesos × 8,278
 (data supplied by Bogota City Health Service) 125,412 pesos

^a Average 1984 exchange rate US\$1 = 101 pesos.

^b Wastage rates determined from total vaccine usage at units visited

5 Share of administrative/supervisory costs

Cost from regional center 60,000 pesos
 (6% of total recurrent costs, estimated at 25 million pesos,
 allocated equally to 25 health units)
 Total routine costs: 909,784 "

B National Campaign Services

1 Channeling personnel

Type	No.	Gross monthly salary and allowances	Months employed per year	% of time devoted to immunization	EPI cost
Doctor	1	50,970 pesos	1.5	6	4,587 pesos
Head nurse	1	50,970 "	1.5	6	4,587 "
Promoters	7	21,485 "	1.5	17	38,350 "
Auxiliary nurse	4	30,518 "	1.5	100	183,108 "
Subtotal					230,632 "

2 Registration papers 5,000 pesos

3 Transport 10,000 "

Total channeling costs: 245,632 pesos

C National Campaign Days (Three)

1 Personnel:

a) At health centers

Type	No.	Gross monthly salary and allowances	Fraction of time devoted to immunization	Subtotal
Doctor	1	50,970 pesos	3/22	6,951 pesos
Head nurse	1	50,970 "	3/22	6,951 "
Promoter	1	21,485 "	3/22	2,928 "
Auxiliary nurse	1	30,518 "	3/22	4,161 "
Medical recorder	1	47,996 "	6/22	13,090 "
Subtotal				34,081 "

b) At each of 48 vaccination posts

Type	No.	Gross monthly salary and allowances	Fraction of time devoted to immunization	Subtotal
Doctor	1	50,970	3/22	17,646 pesos
Auxiliary nurse	1	30,518	3/22	
Promoter	1	21,485	3/22	
Volunteers	2	13,224	3/22	
Subtotal (48 posts)				847,008 pesos

2 Equipment

16 vacuum flasks × 2,400 = 38,400 pesos
 26 cold boxes × 220 = 5,720 "
 24 flags × 300 = 7,200 "

Subtotal 51,320 pesos

3 Vaccines

OPV: 7,930 doses + 20% wastage × 2.3 pesos per dose = 21,887 pesos
 DPT: 7,930 doses + 25% wastage × 3.4 pesos per dose = 33,702 "
 Measles: 2,644 doses + 80% wastage × 7.7 pesos per dose = 36,646 "

Subtotal 92,235 pesos

4 Nonreusables		
10,574 vaccination needles × 15.15 pesos		160,196 pesos
5 Vehicles		
Fuel + depreciation (5 vehicles × 3 days at 4,500 pesos per vehicle/day)	67,500	"
6 Food allowance		
100 pesos per person per day	36,000	"
7 Share of national promotion, publicity, and administration costs		
150 million pesos—10,000 vaccinating posts	15,000	"
	Total campaign days	1,303,340 pesos
	Total channeling	245,632 pesos
	Total channeling and campaign costs:	1,548,972 pesos

Childhood Immunization Reaches 50% Worldwide

WHO Director-General Halfdan Mahler recently reported that 50% of the world's children are now being immunized with BCG, DPT, poliomyelitis, and measles vaccines. His statement, addressed to the XI Scientific Meeting of the International Epidemiological Association, was made in Helsinki, Finland, on 9 August 1987.

This immunization picture contrasts markedly with the situation prevailing as late as 1974, when estimates based on the quantities of vaccines being used showed that coverage of children below one year of age was well below 5%. Overall, it is felt that the WHO Expanded Program on Immunization (EPI) is now preventing over 175,000 cases of poliomyelitis annually in the developing world, and is preventing more than a million deaths a year from measles, neonatal tetanus, and pertussis.

According to EPI Director Ralph Henderson, this progress represents a major public health gain. Nevertheless, it provides no grounds for complacency; for immunization coverage is poorest against the two diseases, measles and neonatal tetanus, that cause the greatest mortality; and if the EPI's 1990 goal of universal childhood immunization is to be realized, then the pace of the world's immunization programs must continue to increase.

Source. World Health Organization, Press Release WHO/24, 10 August 1987