

# RAPID ASSESSMENT OF SENEGAL'S ACCELERATION PHASE

Submitted to UNICEF

November 1987

## Resources for Child Health Project

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SENEGAL'S ACCELERATION PHASE**

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## FORWARD

Senegal is among the eighty nations which have signed a declaration to achieve Universal Childhood Immunization by 1990. During the 1984 Bellagio Conference focusing on "Protecting the World's Children", representatives from Senegal volunteered their country as a possible model for successful immunization acceleration activities in Africa. On September 5, 1986 during the visit of the UNICEF Executive Director, the President of Senegal announced his commitment to achieve a target of completely vaccinating 75% of children 0-23 months of age by April 7, 1987, World Health Day.

Senegal's national immunization campaign has been the focus of global attention. Under the difficult circumstances found on the African continent, Senegal is an example of how political commitment and intensive mobilization of national resources can be used for achieving the goal of Universal Childhood Immunization (UCI) by 1990. In fact, Senegal's significant achievement in increasing full immunization coverage by a factor of 3 in rural areas, a factor of 1.5 in urban areas, and 1.2 in the Dakar region should provide considerable encouragement to other nations committed to UCI by 1990.

This Rapid Assessment Report of the national acceleration describes the essential events in the planning and implementation of the campaign which took place between November 15, 1986 and April 7, 1987. It analyzes also the successes and the drawbacks of this particular effort in light of its contribution (or lack of) to the strengthening of routine immunization services. The results and lessons relevant to other African national EPI who are planning such accelerated immunization efforts are also presented. Senegal's experience should be of value to other nations in addressing the important issue of not only how to accelerate but also to sustain immunization activities.

## PREFACE

The following report summarizes the findings and conclusions of a Rapid Assessment mission completed between June 29 and July 22, 1987, less than three months after the last round of the immunization campaign. Although much of the impact of the campaign can be described, many effects are difficult to observe so soon after completion of the Acceleration. The timing of this evaluation was important, however, to assure that observations and recommendations made during the assessment could be used promptly by the national EPI for management of post-campaign immunization activities.

The Rapid Assessment methodology does not attempt to provide a comprehensive program evaluation. It should be used as a management tool to identify the key areas of focus for the EPI, and, in some cases, to provide recommendations on future actions. Because the report must be short and concise, detailed explanations or justifications could not always be provided.

The objectives of the mission can be summarized as follows:

- o An analysis of the rationale for an acceleration of the EPI;
- o A critical review of the organization and implementation of the different phases of the Acceleration;
- o A detailed analysis of the cost components of the Acceleration Phase;
- o An analysis of the impact of the Acceleration Phase on vaccination coverage, on strengthening of the EPI, on strengthening of the MOH health services, on collaboration between the MOH and other Ministries, on creating and maintaining a public demand for immunization services.
- o An analysis of the cost-effectiveness of different immunization strategies in Senegal; and
- o An appraisal of the likely sustainability of the results obtained so far.

To fulfill its assignment, the evaluation team used the following approach:

- o One team member participated as a supervisor for the Dakar Region for the national immunization coverage survey, and was one of the authors of the final coverage report;
- o Each team member spent one week in the field with counterparts assessing the current state of the EPI and documenting the magnitude of involvement

of communities, community leaders, civil servants, health workers at all levels of the system, regional medical officers, radio stations, and religious leaders in the Acceleration Phase. Seven out of the 10 regions of Senegal were visited;

- o All team members interviewed key participants in the campaign and the EPI; and,
- o The team reviewed existing documents on the EPI and the Acceleration, including the coverage survey, materials prepared by UNICEF/Dakar, results from a survey of mothers undertaken simultaneously with the coverage survey, and reports prepared by the EPI team in the MOH.

The members of the Rapid Assessment Mission team included: Dr Pierre Claquin, Associate Director for EPI, Resources for Child Health Project, REACH (an AID centrally-funded project), Dr. Sally Stansfield, Public health consultant, Ms. Logan Brenzel, Technical Associate in Health Care Financing, REACH, and Mr. Iain McLellan, Social Mobilization Expert, Productions NordSud. Mr. Stephen Woodhouse, Senior Health Education Officer, provided an initial assessment of the first round of the Acceleration Phase and reviewed an earlier version of the present draft.

The team was also joined by two senior members from UNICEF New York headquarters: Dr. Samir Sanad Basta, Chief, Programme Evaluation Section who was later replaced by Mr. James Mohan, Senior Programme Officer, Africa Section.

The earlier version of the present draft was reviewed by UNICEF STAFF members: Samir Basta, David Parker, Steve Woodhouse, and Gerson Da Cunha. Their valuable insights were incorporated as much as possible in the final version of the document.

## ACKNOWLEDGEMENTS

Principal contacts interviewed by the team during the assessment are listed in Appendix A. The team would like to thank the Senegalese Government, the Ministry of Health (in particular, the Honorable Minister, the Director of Health and the national staff of the EPI) for the hospitality and the collaboration they have extended to the team in Dakar as well as in the field. The team particularly appreciated the independence with which it was able to work.

The team is grateful to the UNICEF office in Dakar (and particularly to its representative Mr. Mukalay Mwilambwe and his senior program officer, Mr. Richard Bridle) for the constant support they gave to the team. A special mention should be made of Dr. Augustino Paganini who was a driving force of the Acceleration Phase and who gave the team significant insights on the history of UNICEF's involvement.

It is nearly impossible to acknowledge and thank all the persons with whom the team was able to interview and work. However, Dr. Olivier Fontaine from ORANA, Michel Garenne from ORSTOM, Dr. Jean-Faul Chaine from HIID/JSI, and Mr. Mamadou Toure from the Ministry of Health should be mentioned.

Last but not least, the team would like to thank the UNICEF/New-York staff for their contributions to this document.

## EXECUTIVE SUMMARY

Although Senegal made a commitment to Universal Childhood Immunization at the 1985 Bellagio Conference, in the summer of 1986, less than 20 percent of children 0 to 5 years of age were completely vaccinated. On September 5, 1986, the President publically declared that Senegal would reach 75% coverage by April 7, 1987, and officially launched an Acceleration Phase for the EPI, which continuously mobilized the nation between November 1986 and April 1987.

The results of this unprecedented effort include:

1. A generation of children has benefitted from a significant improvement in vaccination coverage: between November 1986 and July 1987 the rates increased; for BCG, from 33 to 92%; for DPT/P1, from 37 to 81%; for DPT3, from 7.6 to 47%; for measles, from 20 to 63%. Thirty-five percent of are now completely vaccinated compared to 20% before the Acceleration Phase.
2. The present level of coverage might prevent 57% of the deaths directly attributable to the EPI-preventable diseases. Of this figures, 40 percentage points could be attributed directly to the Acceleration Phase.
3. The Acceleration Phase provided an opportunity to reassess the role of fixed health centers in the delivery of vaccinations, which had been minimal compared to mobile teams. Under the Acceleration Phase, 650 fixed health centers received cold chain equipment, vaccines and injection devices. Their staff received some (re)training. This strategy has significantly increased the accessibility of vaccination services.
4. Thanks to intensive social mobilization efforts made during the Acceleration Phase, a definite awareness of EPI-related matters has been created among the general public that is likely to last.
5. A striking feature of the Acceleration Phase was the dialogue and collaboration between civil servants and the general public and between the staff of different Ministries in Dakar, as well as at regional or departmental levels. The Acceleration confirmed that, "where there is a (political) will, there is a way!".

However, the Acceleration Phase goals were not only to protect a single cohort of children (a temporary benefit) but rather to strenghten the institutional capability of the EPI to sustain the Acceleration Phase's achievements. Several drawbacks in that respect were identified:

1. The Acceleration Phase was not stressed enough as a step in a global and long-term process but was regarded as an end in itself. By providing cold chain equipment, vehicles for

routine supervision, and by creating public awareness and support, and increased credibility of the health workers, the Acceleration Phase should have created the environment for a sustained EPI.

2. There was no detailed Plan of Operation for the post-Acceleration period, resulting in a quasi-vacuum of immunization activities after April 7. This is shown clearly by the distribution of measles vaccine doses over time, as well as by team field visits. The alleged causes for the slackening of activities include: the breakdown of mopeds, the lack of butane gas for the cold chain, the lack of funds to buy gas for the mopeds, and the lack of supervision. After April 7, there has been almost no media message related to EPI. In short, no post-Acceleration Phase strategy was prepared to strengthen the EPI logistics and its maintenance capability, which is essential to long-term success.

3. The Acceleration Phase suffered from hasty preparation:

- a. Training or retraining of vaccinators was too superficial and not enough emphasis was given to training about the vaccination schedule, as well as the safety of injection practices;
- b. There was no monitoring of the cold chain and there are several documented episodes of cold chain breakdown, raising concerns about the potency of the vaccines injected;
- c. The massive participation of the public was not adequately captured; only 35% of the contacts between vaccinators and children led to a child receiving all the antigens for which he was eligible. Fifteen percent of all measles doses administered were given before the correct age.

4. Although public participation was high and enthusiastic, participating mothers still had a superficial understanding of the diseases for which their children were being vaccinated and the exact vaccination calendar. Mothers trusted the predominant rumour at the time, which was that vaccination was good, and came back when they were told.

5. The full cost of the Acceleration Phase was significant (nearly \$5 million dollars), and UNICEF contributed \$4.6 million dollars to the full cost of the the Acceleration Phase. Cash expenditures for the campaign totalled 3.5 million dollars, and the Government of Senegal made additional expenditures of \$60,800 for the effort. The cost per fully vaccinated child was estimated to be between \$ 27 and \$19, which is higher, though of the same order and magnitude, than other West African countries. The financial impact of the fixed facility strategy on the recurrent costs of providing immunization services and the capability of the government to

finance the EPI in the future has not been addressed. The absence of financial planning may jeopardize the sustainability of the EPI.

In conclusion, the Acceleration Phase had an electrifying effect on the political, administrative and social structures of Senegal. For 6 months the country was constantly mobilized. The immediate results have been significant.

Although the Acceleration Phase has resulted in major improvements in the institutionalization of routine services, it is too early to decide how much the Acceleration Phase has contributed to the sustainability of its immediate achievements. The first test will be probably at the time when the Senegalese EPI will have to decide whether they need another Acceleration Phase to maintain the present coverage among the next generation of its children.

## **I. BACKGROUND**

### **A. Health Status and System of Senegal**

Children under age five represent approximately 17% of the total population, which by most estimates now exceeds seven million people. Yet this age group accounts for 56% of all reported deaths, and nearly 17% fail to live to their fifth birthday. The infant mortality rate (IMR) is estimated to be close to 140 per 1000 live births, placing it among the highest in the world. Principal causes of mortality include measles, acute respiratory infections, and diarrheal disease. Appendix B presents additional health information for Senegal.

The health system in Senegal is pyramidal in structure, with technical direction and financial resources flowing from the central level in Dakar to each of 10 regions and 30 departments. In each region, a Regional Medical Center has responsibility for the administration and operation of all curative and preventive health services. In addition, the Service des Grandes Endemies also have regional headquarters which are responsible for the tasks of the mobile teams. A legacy of the French colonial medical system, the Services des Grandes Endemies (until recently) was a vertical program relying on mobile teams to control endemic diseases, such as malaria, leprosy, and schistosomiasis and was the vector for the delivery of vaccinations.

At the departmental level, health centers and health posts provide most of the basic curative and some preventive health services. Nevertheless, these centers have been fraught with problems of insufficient supplies and difficulty in performing outreach activities because of financial and material constraints. The regional supervisor, based at the Regional Medical Center, undertakes routine supervisory rounds at designated health centers, though in practice, the quality and frequency of these visits is not consistent throughout the health system.

Although other interventions are specified as national priorities in Senegal's plan for development of the health sector, strengthening of immunization activities has been selected for early action. Global interest in UCI and the promise of donor support have undoubtedly affected the unfolding of events, but the intensive effort to improve vaccine delivery is a clear reflection of the national health policy. EPI activities have, in fact, been characterized by the Minister of Health as the "locomotive which can lead the way for other primary health care services" selected to enhance child survival in Senegal.

### **B. The EPI in Senegal Prior to the Acceleration**

The Expanded Programme on Immunization (EPI) was first established in two regions, the Casamance and Thies, in 1979, and it subsequently provided immunization services in eight regions previously served by the Service des Grandes Endemies. The primary strategy for vaccine delivery was based on mobile vaccination teams, as few fixed centers were fully functional for the EPI.

As a result, Senegal had historically poor immunization coverage rates, and only 17% of children under two years of age were completely vaccinated (WHO, 1984). Based on data from the 1987 national survey, the estimated coverage rates prior to the acceleration phase for each vaccine were BCG= 33.4%, measles= 20%, yellow fever= 23.9%, DPT3= 7.6%, and polio= 7.6% (see Appendix C).

To address poor coverage rates and low population access to immunization services, a new EPI was launched in 1985 which focused on the creation of a mobile team in each department, equipping all fixed centers for vaccination services, and beginning immunization services in these fixed centers. Efforts would be such that during each three month period, 10 departments would become fully operational. Within 18 months, the government expected to have in place a strong system of immunization.

## **II. DESCRIPTION OF THE ACCELERATION PHASE**

### **A. Background of the Acceleration**

The activities of the EPI remained at a low level, despite efforts to improve coverage through technical and financial inputs from national and outside sources. Therefore, political motivation and commitment was needed to galvanize the nation as to the urgency of the need to acceleration immunization activities and to the high priority of the EPI for child survival. The required political commitment was obtained during a visit by the Executive Director of UNICEF with President Abdou Diouf. Following their meeting, the President announced that Senegal would reach a coverage level of 75% by World Health Day (April 7, 1987). Overnight, the EPI became a national focus, requiring not only a total commitment from the health system, but also involving community and religious leaders, civil servants, and the public itself.

### **B. Implementation of the Acceleration**

Planning and preparation began immediately after the Presidential declaration in September 1986, and a task force was established to provide technical support to the UNICEF office in Dakar. The President's call to action for the campaign emphasized that, although immunization efforts were to be coordinated by the Ministry of Health, other ministries were expected to support the efforts, including the Ministries of Education, Planning and Cooperation, Social Development, Youth and Sports, Communications, and Decentralization.

A national inter-ministerial committee was created to provide coordination of the campaign efforts. Under this committee, two subcommittees were organized, one to provide general technical guidance and a second to coordinate the social mobilization effort. A similar inter-ministerial committee was replicated at the regional level to provide campaign coordination in each of the 10 regions.

The strategy for the acceleration of EPI activities represented a radical departure from the earlier mobile team approach. The objective of the new strategy was to permit integration of immunization services into the established health care delivery system based upon 650 health care

facilities as fixed centers for vaccination. Only the remotest areas without access to any health care facility would be served by mobile vaccination teams.

An implementation plan, prepared by the Ministry of Health and UNICEF/Dakar outlined several phases of the acceleration.

## FIGURE 1

### Campaign Chronology

Phase 1: The official launching of the Acceleration Phase took place on November 15, 1986 (as the first round);

Phase 2: Between January 5-10, 1987, the first of three intensive six day rounds took place;

Phase 3: Second intensive round was held between February 16, and 21, 1987;

Phase 4: The third intensive round took place between March 23 and 28, 1987; and,

Phase 5: April 6, 1987 onwards was a period of evaluation and maintenance.

In addition to the radical change in strategy, the Acceleration Phase provided an opportunity for changes in the following:

#### 1. Immunization Schedule

Prior to the Acceleration, two standard vaccination schedules existed in the country. In the Dakar region, the EPI included one dose each of measles, yellow fever, BCG, and three doses each of oral polio, and DPT. Outside of the Dakar area, children were immunized with two injections of a vaccine combination of DPT and polio (Immovax) at three and six months of age. Measles was given at nine months.

Since January 1987, a third dose of DPT was added to the immunization schedule outside the Dakar area in order to increase protection against pertussis. This change in vaccination schedule occurred before the first round, causing some confusion for communications messages and in vaccine technique at health centers.

During the campaign, tetanus toxoid (two doses) was administered to pregnant women throughout the country, though the primary focus was children.

## 2. Target Population

Despite conflicting messages at the start of the acceleration phase, the campaign focused on children less than two years of age, although no child between 2 and 5 years was denied vaccination. Prior to the campaign, the EPI provided vaccination to children under the age of five years.

## 3. Logistics and Supplies

A significant benefit of the Acceleration Phase was the level of material resources which were provided by UNICEF in order to strengthen the health infrastructure in fixed health facilities at the most peripheral levels. Supplies included vehicles and mopeds, cold chain equipment, syringes, needles, and steam sterilizers. Materials were ordered to adequately equip each health center with sufficient resources to implement the accelerated strategy and to continue with vaccination activities after April 1987.

In addition, UNICEF purchased 24 vehicles for use during supervision rounds of the EPI and during the Accelerated Phase. These vehicles were placed in each department in eight regions, leaving Fatick and Kaolack (USAID-supported regions) with their own resources. A total of 669 Italian mopeds were ordered and distributed throughout the country to facilitate outreach and supervision activities at the health post level during the acceleration phase. Each head of the health post was expected to provide outreach services within a 15 km radius. Mopeds were ordered in March 1986 and were received seven months later in October in-time for distribution. An order of 10 Italian vehicles did not arrive in time for the Acceleration, though they were ordered in July 1986.

Following an assessment of the cold chain in December 1985 which outlined the basic national needs for cold chain equipment at the central, regional, departmental, and village levels, UNICEF purchased freezers, refrigerators, cold boxes, vaccine carriers, and the necessary equipment for the central cold store in Dakar. The goal was that each regional medical center would be equipped with a freezer and refrigerator; each department level center with a refrigerator; and each health post with a cold box. The ordering of cold chain supplies began in April 1986 and were received and distributed prior to most of the acceleration activities.

Initially, distribution was planned in a phased manner by region, based on a UNICEF plan for the Acceleration Phase: Dakar, Diourbel, Louga, Thies, Kaolack, Fatick, Tambacounda, St. Louis, Ziguinchor, Kolda and the army medical system. However, the distribution of cold chain equipment was temporarily halted after cold chain equipment and other supplies were sent to Diourbel, because the Ministry of Health did not agree with the distribution plan. At this point, the government took over the distribution of supplies, sometimes placing duplicate supplies in the same center. With a change in the leadership of the EPI within the Ministry of Health in the fall of 1986, a new inventory of cold chain equipment and other supplies occurred. The new distribution plan which was drawn up between the Ministry and UNICEF followed the training schedule so that health workers would receive training on the use of new equipment before or at the time that equipment arrived.

#### **4. Training**

A total of 839 vaccinators, 59 supervisors, 53 social mobilization workers, and 41 local mass media workers were trained within a 9 month period on a regional basis. Training generally followed the distribution of supplies to a particular region so that trainees would benefit from practical experience with the new supplies and equipment prior to the first round of the campaign.

Those who attended a training seminar were given a document entitled, "Guide a l'usage des agents de sante qui administrent les vaccins." This 26 page document with 10 illustrations and two sample vaccination cards was adapted for Senegal from a World Health Organization publication. It was criticized by many of those interviewed by the assessment team as being written in language too technical for its intended audience.

#### **5. Supervision**

Because of the anticipated demands on health center staff and the increased chances of problems arising during the Acceleration Phase, a supervision system for monitoring the vaccination activities in the fixed centers was developed. During each vaccination round, each supervisor was to visit each of his assigned fixed centers four times, in order 1) to monitor the vaccine stock, 2) to supervise the activities, 3) to collect data on the number of vaccinations administered, and 4) to resolve any problems which developed over the course of the Acceleration Phase at the center. Each supervisor was responsible for between five to eight vaccination sites, depending upon the distance between the centers.

All government primary health care supervisors participated in this effort, and additional temporary supervisors were recruited from regional and departmental levels, including village chiefs, school teachers, administrators, and community leaders. The fuel and vehicles needed for supervision were to be donated by the local authorities.

#### **6. Social Mobilization**

Social mobilization was the key feature of the Acceleration Phase. Immediately following the Presidential declaration, an assessment was performed by a UNICEF staff member to identify potential constraints to launching an accelerated immunization campaign and to draft a plan of action for social mobilization. This plan was proposed to the government in late October 1985 and included:

- a) activities to increase the motivation of health personnel;
- b) more strategic use of religious authorities in the country;
- c) active participation of village chiefs, trade unions, and youth movements;
- d) a more systematic use of the media with greater decentralization and improvement in message design through systematic analysis; and
- e) establishment of national and regional coordinating mechanisms.

The initial assessment found three potentially limiting factors for social mobilization and proposed solutions. First, too high a UNICEF profile might result in a lower sense of government responsibility for the campaign. To remedy this situation it was proposed to have more government involvement in decision-making. Second, health and field personnel were poorly motivated, which would lead to lack of planning and coordination at lower levels. UNICEF proposed a decentralized approach to planning and creation of regional committees. Third, among the planners of the Acceleration Phase, there was insufficient knowledge of how the population perceived vaccination which might have resulted in improper message design and delivery. To counter this problem UNICEF assisted the government to launch the first Knowledge, Attitudes, and Practices (KAP) Survey in health to determine audience characteristics.

UNICEF efforts were concentrated on instilling a sense of ownership and defining UNICEF role as being catalytic. In addition, by the end of January 1987, a detailed plan of action for the social mobilization component was developed for each participating Ministry.

Following the first round of the Acceleration Phase, a series of meetings were convened between UNICEF, MOH and other ministries to assess the progress and to plan for future intensive rounds. The roles of other ministries, such as the Ministry of Social Development, were augmented in order to make the social mobilization component more effective.

The President sent letters to the governors asking them to participate in the campaign, who then in turn disseminated the information to their subordinates. In most areas, local leaders called meetings or went door-to-door to inform people of EPI and organize their participation in cooperating with EPI.

The vast majority of Senegalese are Moslem and the religious leaders were requested to discuss the importance of vaccination during Friday prayers. Religious leaders (Imman) quickly responded to the call of the President for support and spoke of EPI in their sermons, announced dates and times of vaccination sessions and even allowed the minaret loud speakers in some areas to be used to inform the public. The Imman also were interviewed on the radio in vernacular languages and even used their own radio and television time to speak about EPI. For example, in Diorbeld field interviews showed the religious leaders appeared to have taken their role as community mobilizers seriously.

Despite this apparent involvement, less than 2% of mothers surveyed mentioned the importance of religious leaders as a source of their knowledge about the Acceleration Phase. This figure should be interpreted carefully, as men have greater access to religious leaders than women.

The Catholic Church, which represents 6 percent of the population, also lent its resources to the social mobilization effort. The Church's network of health clinics run by nuns were very actively involved in the delivery of vaccines.

Throughout most of the Acceleration Phase, the participation of teachers depended on individual initiation and motivation. For example,

teachers in a number of communities organized improvisational youth theatre groups, and in Ziguinchor, a group produced a very compelling drama that addressed the topics of resistance to the EPI and the dilemma of traditional versus modern medicine.

The Ministry of Youth and Sports developed a two-pronged approach to social mobilization. The first was to use sports events as a forum to inform large groups of people about EPI. For this purpose banners with EPI slogans printed on them were purchased, t-shirts sporting the EPI logo were given out and stadium loud speakers used to speak about the EPI. Popular athletes were also encouraged to talk about the EPI. Traditional forms of entertainment such as "tam-tams", dancing, theatre and singing were used to attract attention to EPI at sports events and marches for youths through communities. Though these activities had a high profile, they were limited to urban areas.

Second, the most important contribution of this ministry was to mobilize youth organizations to conduct door-to-door canvassing to urge mothers to bring their children to be vaccinated.

## 7. Communication Channels

The Ministry of Communications embraced the challenge of gearing its media infrastructure to the EPI Acceleration Phase. Due to the nature of its work, the Ministry of Communications was perhaps the most flexible and easy to mobilize of government ministries. An information committee was formed, met frequently and had good contact with both the Ministry of Health and UNICEF. The Ministry of Communications generated extensive coverage of EPI right from the beginning of the Acceleration Phase.

Senegal has been a leader in Africa in employing the communications media in support of development initiatives. Like other African countries it has a strong oral tradition and a high illiteracy rate. But it has made efforts to reach the population through radio. There are four regional radio stations and its rural radio service has been flourishing for over two decades. The national and regional radio was mobilized to broadcast promotional messages for the campaign. Because the initial KAP survey showed that 95% of households had access to radio, social mobilization efforts were aimed at this venue. The mothers' survey found that fewer than 30% of women thought radio to have been an important source of information.

Television in Senegal proved to much more difficult to mobilize in support of EPI than radio. Due to a shortage of portable recording equipment, editing facilities, and funds for shooting outside the Dakar studios, the impact of television was limited. At any rate, only a small percentage of homes in Senegal have televisions and the broadcast signals don't cover much of the country. A mere 2 percent of mothers nationally said they heard about EPI from the television and most of them lived in the Dakar area. However, despite these handicaps, the television service did gear its efforts to EPI. The evening news programs in French and the national languages have the priority when it comes to access to the limited O.R.T.S. production facilities. The news devoted air time to covering EPI activities especially if the President or a Minister was involved.

The national newspaper, "Le Soleil", has a circulation of 30,000 and an estimated readership of five times that number. "Le Soleil" informed opinion leaders about EPI through its daily coverage of the Acceleration Phase. During the campaign, 90 articles were printed in the national newspaper.

Interviews in the field with village leaders demonstrated the importance of two specific pieces of printed matter for promoting the EPI. The first was a leaflet with the President's photograph which conveyed his personal message about vaccination. This leaflet gave an official endorsement to the Acceleration Phase. The second was a poster of a famous Senegalese singer promoting vaccination. This poster was so popular that most of them unfortunately were removed from health facilities and public buildings to be displayed in private homes.

### **8. Monitoring and Evaluation**

For each vaccination site, forms were developed which collected information on the date, name, address, and age of each child or pregnant woman, the type of vaccine(s) to be administered, and the vaccination status (whether the child or woman should return to the next round for the remaining doses. It was decided that for every vaccinator at each site there should be two individuals responsible for registering children in order to promote a fluid process at the vaccination site. These registration clerks were either health personnel, school teachers, or other local authorities (religious leaders, village chiefs, or rural council presidents) who had received some training prior to the start of the Acceleration Phase.

All data were to be analyzed by the supervisor of the health facility and discussed with the facility nurse during the supervision session. From the health post, the data sheets were then to be sent to the chief medical officer of the department and the region, who would then transmit the information to the national EPI office in Dakar. At each level, the data were to be analyzed and problems resolved.

After each round of the campaign, coverage data were calculated and feedback on impact on coverage reported to the government. This feedback was instrumental in improving the situation from one round to the other: for example, social mobilization efforts were improved between the first and second rounds.

## **III. ACHIEVEMENTS OF THE ACCELERATION PHASE**

### **A. Immunization Coverage**

In July 1987, an international team conducted a survey using the traditional WHO cluster sample technique. Because the MOH wanted to have coverage figures for each department of the country (30), the survey was large in scope, sampling approximately 210 children between 12 and 23 months of age in each of 29 departments, for a total sample of 6000 mothers. A national coverage survey was not performed prior to the Acceleration Phase, and the pre-Acceleration coverage was estimated at 20% of children fully immunized based on data collected during the July survey.

Figures 2 and 3 and Tables 1 and 2 present the results of the coverage survey, which may be summarized:

o The acceleration phase produced a significant increase in the vaccination coverage rate among the children covered by the study. The rural areas benefitted the most from the campaign which multiplied the coverage of children completely vaccinated nearly three times, followed by the urban areas, which increased coverage 1.5 times and Dakar, which increased by 1.2 times (see Table 2).

o The vaccination coverage levels were: BCG=92%; DTP3 and Polio3: 47%; measles: 63% ; yellow fever: 72% as of July 1, 1987. Such results are extremely encouraging, considering the coverage levels as of November 1986.

o Thirty-five percent of children were found completely vaccinated. Although this figure represents an improvement from a pre-Acceleration figure of 20%, current rates would have been higher if a more effective use of vaccination sessions had taken place. The survey found that 15% of all measles doses were given before the required age of 9 months and that only 37% of the children benefitted fully from all the vaccination sessions or clinics they attended. Vaccination prior to the accepted age and insufficient intervals between doses resulted in a loss of approximately 10 percentage points in the final calculation of coverage completely vaccinated children.

TABLE 1

Vaccination Coverage by Antigen and by Geographical Region  
(in percent)

REGION/ ANTIGEN	BCG	DPT/P1	DPT/P2	DPT3	MEASLES	YELLOW FEVER	COMPLETELY VACCINATED
DAKAR	93	76	70	57	59	67	39
URBAN	93	81	70	48	64	74	37
RURAL	90	82	69	44	65	73	34
TOTAL SENEGAL	92	81	69	47	63	72	35

o The distribution of vaccination rates by age at time of vaccination and by antigen shows that the acceleration phase was also an opportunity to vaccinate children over a year and those who had been missed by the routine EPI strategies before the acceleration. This trend was predominant in the rural areas of Senegal.

o Figures 1 and 2 show how much immunization activity dramatically increased during each round of the Acceleration Phase.

TABLE 2

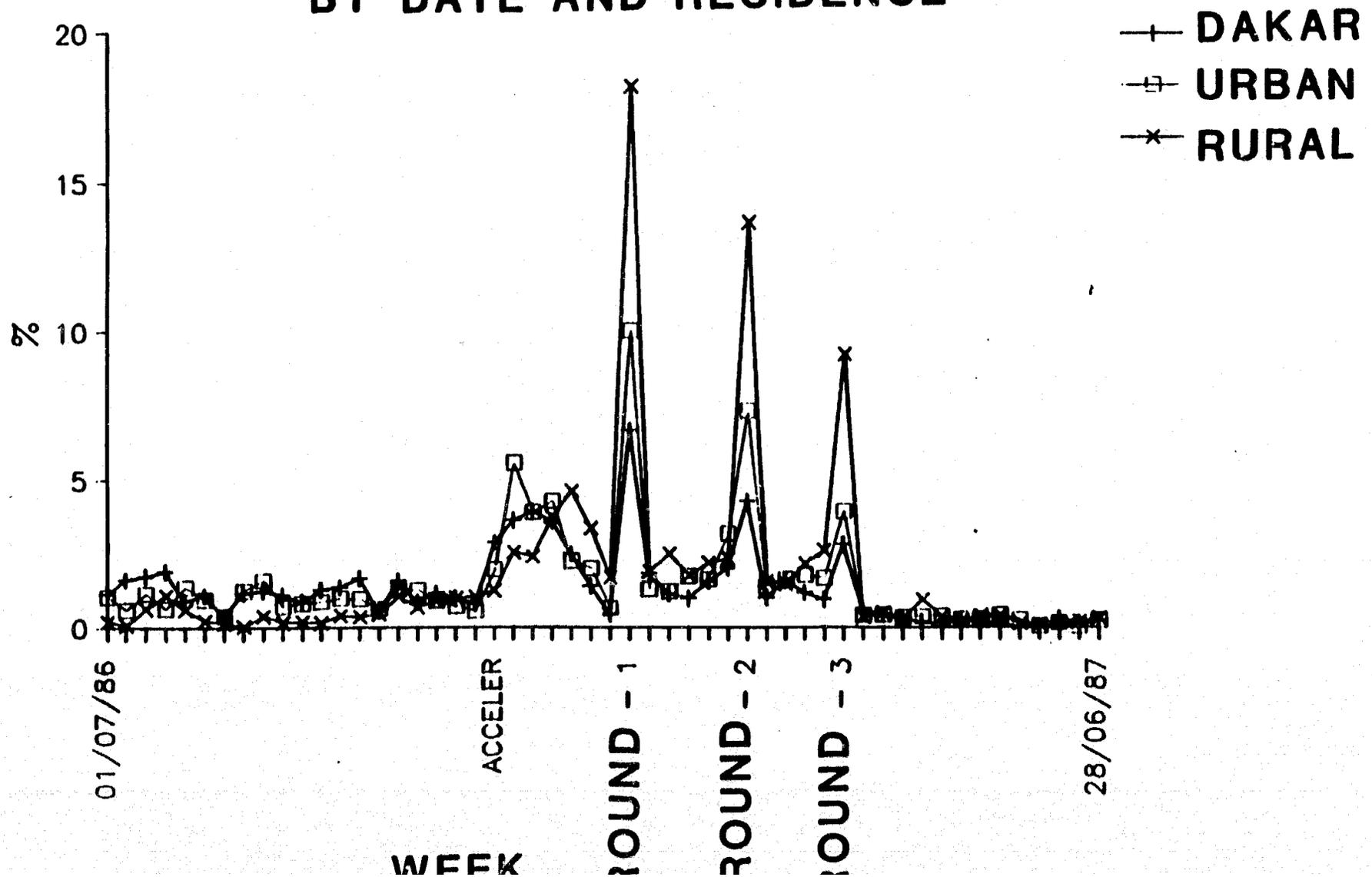
Contribution on the Acceleration Phase to the Distribution of Doses by Antigen between July 1986 and June 1987

ANTIGEN/REGION	DAKAR	URBAN	RURAL
BCG	0.88	1.15	2.62
DPT/P1	0.92	1.24	2.57
DPT/P2	1.22	1.73	7.93
DPT3	2.04	3.57	35.98 <sup>a</sup>
Measles	2.09	2.64	4.88
Yellow Fever	2.28	2.72	5.04

<sup>a</sup> DPT3 has only recently been added to the vaccination schedule in rural areas, accounting for the dramatic increase.

# FIGURE 1

## DISTRIBUTION OF DOSES OF VACCINE BY DATE AND RESIDENCE





## B. Potential Impact on Morbidity and Mortality

To calculate how many cases of EPI-preventable diseases were avoided and the potential impact on the mortality rate as a result of the Acceleration Phase, a matrix including the MOH figures for the incidence of EPI-preventable diseases and the vaccination coverage figures before and after the Acceleration phase was designed and used. The results are shown below:

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### 1) Morbidity and Mortality as of November 1, 1986:

DISEASES	PREVENTED		NOT-PREVENTED	
	CASES	DEATHS	CASES	DEATHS
MEASLES	49400	1482	210600	6318
PERTUSSIS	5824	58	98176	982
POLIO	68	0	1232	6
TOTAL		1540		7306

### 2) Morbidity and Mortality as of July 1, 1987:

DISEASES	PREVENTED		NOT-PREVENTED	
	CASES	DEATHS	CASES	DEATHS
MEASLES	155610	4668	104390	3132
PERTUSSIS	39104	391	64896	649
POLIO	458	2	842	4
TOTAL		5061		3785

### 3) Contribution of the Acceleration Phase to the prevention of cases and deaths

DISEASES	CASES	DEATHS
MEASLES	106210	3186
PERTUSSIS	33280	333
POLIO	390	2
TOTAL		3521

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Based on this analysis, as of July 1, 1987, 57% of the possible deaths related to EPI-preventable diseases were prevented. The Acceleration Phase alone was responsible for 40 percentage points of this savings.

### C. Infrastructure Development

One of the greatest benefits of the acceleration phase may be the increase in credibility of the health worker at the most peripheral level. The Acceleration Phase provided the typically under-supplied health posts with material resources and gave the health workers high exposure within the communities they serve. There appears to be an improved perception of what the health worker can provide among the population, in addition to vaccination services. This increase in credibility may be one determining factor in the sustainability of the EPI and of the success of introducing additional preventive health services at the community level.

### D. Monitoring and Evaluation

The Acceleration Phase also resulted in major gains in the development of a standardized reporting and evaluation mechanism for the EPI. In mid-1986, the Ministry of Health, with the assistance of UNICEF, developed monthly reporting forms for the numbers of doses of each antigen administered to children less than 24 months, the number of doses of tetanus toxoid administered to pregnant women, and the number of children completely vaccinated for health health center. In addition, forms were also developed to record the number of cases of vaccine-preventable disease seen monthly in health centers.

These forms are bound in convenient booklets and are being maintained by health staff. The data collected on these forms are sent from the health posts and departmental health centers to the regional health centers for tabulation. This information is then passed on to the national level in Dakar for analysis. These data will hopefully be used to plan EPI strategies and to assess the impact of vaccination on the disease burden of the population.

### E. Training

A total of 15 training sessions on the use of new equipment, on vaccination technique, and on vaccination schedules were held in each of the nine regions of Senegal. These sessions were funded by UNICEF and were typically aimed at regional supervisors and health workers at the departmental level.

Based on interviews within the country, questions about the quality of these training sessions were raised for two principal reasons. First, cold chain equipment often did not arrive in time for adequate training in its use and maintenance, and the changes in the vaccination schedules during the Acceleration Phase made parts of the initial training obsolete.

### F. Impact on Social Awareness

Social mobilization was considered by many medical professionals, non-medical government workers, communicators, field workers and political leaders interviewed by the evaluation team to be the single most determining factor in the success of the EPI Acceleration Phase.

The fact that the whole country focused its attention on a health care initiative increased the morale of health professionals and inspired them to work long hours in often difficult situations. It also exposed other sectors of society to the problems of primary health care and increased the identification of health as being a major priority area.

Immunization was kept in the public eye for five months. During this time immunization went from being relatively unknown phenomenon to having the highest profile of Senegal's health services. The social mobilization component succeeded in creating an atmosphere in which the population was not only aware of the need to vaccinate but demanded it as well.

These impressions were corroborated by a national survey of mothers which took place in July 1987 at the same time as the coverage survey. A total of 5,756 mothers were interviewed by the trained surveyors to determine how they were informed about vaccination, what their knowledge level was regarding the specific diseases which are prevented by vaccination, and whether they knew what vaccination was for. Some of the results of this survey are presented below:

**TABLE 3**  
**Results of the Mothers Survey**  
**Following the Acceleration**

Communication Channel	Percent of Mothers
Radio	24.7
Newspaper	0.2
Television	2.2
Health worker	27.6
Village chief	18.5
Bards	2.3
Family and friends	21.0

**NB:** Percents do not add to 100 because null responses removed.

Radio broadcasts from the national station and some regional stations reached 95 percent of the country. Radio proved to be a very effective means for informing the population about the EPI Acceleration Phase. Of the mothers interviewed, 24.7 percent said they heard about EPI by listening to the radio. In fact, radio proved to be one of the most

important sources of information, after health workers (28%), but preceding word-of-mouth (21%), village chiefs (18%) and other media.

#### G. Intersectoral Collaboration

Another major achievement of the Acceleration Phase was to involve all sectors on a health issue. The principal collaborator was the Ministry of Social Development which saw the immunization campaign as a means of mobilizing their staff around a development issue. With its network of 1,380 women's groups, which have an average of 100 members in each, and 460 field workers the Ministry of Social Development was well placed to mobilize mothers for EPI at the village level. The Ministry's field workers worked closely with health professionals and village health committees and played an important role in counting and registering children.

Despite the relative lack of supportive didactic material on EPI for use in the field, the field workers were one of the most important players in motivating mothers to bring their children to be vaccinated and explaining why they should. Social Development field workers and health professionals at the village level are used to collaborating. In many cases, the field workers would speak to mothers about vaccinations while they were lined up waiting for their children to get shots.

The Ministry of Social Development also produced an excellent radio program in several local languages which explained EPI in easy to understand terms. The program was broadcast on the national network and also sent to the regional stations.

#### H. Inter-donor Collaboration

In contrast to the degree of intersectoral collaboration, there was little practical collaboration among the donor community in the country. The fact that, despite their commitment to child survival, neither the World Health Organization, the United States Agency for International Development, or the French Technical Cooperation took an active role in the Acceleration Phase was a surprising finding of this evaluation.

#### **IV. COSTS AND COST-EFFECTIVENESS**

##### **A. Mobilization of Resources**

A significant amount of financial, personnel, and material resources were mobilized in order to support the magnitude of effort during the Acceleration Phase. Each Ministry which participated in the social mobilization campaign donated whatever was necessary to get the job done, including transportation, material resources, and personnel time. The National Army played a role in the internal transportation and distribution of materials and supplies before the Acceleration Phase to regional and peripheral level health facilities. Social, political, and religious organizations devoted their resources toward the goal of spreading the vaccination message to the population. In addition, several donor organizations, most notably UNICEF, but also including World Vision and Catholic Relief Services played a role in social mobilization and delivery of vaccination services. Therefore, the campaign was a testimonial to the level of generosity and volunteerism of the Senegalese population in order to move toward a national goal.

Unlike other campaign efforts in African countries, the Senegal experience relied heavily on resources which were currently available within each of the ministries that participated in the national effort. What did occur was a major reorientation of expenditures towards the acceleration effort at all levels. Ministries donated resources for transportation during social mobilization efforts; health facilities used their semi-annual budgets for supervision and transportation expenses.

Fortunately, the Acceleration Phase coincided with the end of a fiscal semester in June 1987 so that shortages of resources for other health care activities after the Acceleration Phase were minimized, as facilities received their next semi-annual allotment from the Ministry of Health at the central level.

##### **B. Full Costs of the Acceleration Phase**

Costing studies of immunization programs provide important information about how much of a level of investment is being made for a given benefit, what are the most costly aspects of campaigns and routine programs, and who is bearing the burden of paying for certain aspects of the EPI. Expenditure data provide an estimate of how much money is being spent during a particular period of time. These differ from the full costs of the EPI which include the value all inputs, whether they be paid for in cash or donated. Full costs and expenditures are compared in this evaluation. Appendix D contains additional information on expenditures, UNICEF contributions, costs of other strategies, and future costs of the EPI.

Like the analysis of the impact of the campaign, the full cost evaluation is equally complex because of the change in EPI strategy from a predominately mobile team to a fixed center approach. Investments in material resources before the time frame of the Acceleration Phase (November 15, 1986 to April 15, 1987) prepared the way for a fixed facility strategy. These investments made the Acceleration Phase possible and are

therefore counted toward the total full cost. All costs were converted to 1987 U.S. dollars using an official exchange rate of 325 CFA/1US dollar and an inflation rate of 10%.

All resource costs, including the cost of personnel time and media time devoted to the campaign effort, were included in the full cost evaluation. However, it was not possible to estimate the cost of the contribution of the religious community, the contribution of the National Army, and the contribution of social mobilization efforts at the most peripheral level because the level of inputs could not be quantified. There is no record of how many people participated in the social mobilization effort at the village level. In addition, the opportunity cost of focusing on one intervention, immunization, to the rest of the national health activities could not be estimated.

The full cost of the Acceleration Phase was approximately 4.98 million, and the cost breakdown is found in Table 4 (Appendix D contains detailed cost information). Approximately 93% (\$4.6 million) of the total cost of the Acceleration Phase was for recurrent costs: those that will continue over time, such as salary and transportation costs.

UNICEF was responsible for a major proportion of the total inputs to the EPI (71% or \$3.5 million), with the Government of Senegal accounting for the balance. Most of the contributions of the government were not additional expenditures but donations in-kind. Financial commitments from the Government to the EPI may only arise when donors and the Ministry of Health begin to jointly plan the financing of program needs and resources over time.

Vaccine costs accounted for the largest proportion of total costs (35%), followed by salary and transportation costs (18% and 18%), respectively. Media costs associated with production and transmission of radio, television, and print media, accounted for 10 percent of total. Salary costs are mostly attributable to the magnitude and intensity of effort devoted to planning and implementing the Acceleration Phase. Transportation costs primarily relate to per diems for training sessions and air freight costs for shipments of cold chain, vaccination equipment, and vehicles to Senegal.

TABLE 4

Breakdown of Full Costs and Expenditures  
for the Acceleration Phase

CATEGORY	TOTAL FULL COST	PERCENT	TOTAL EXPENDITURES	PERCENT
A. SALARIES	910,343	18%	212,753	6%
B. VACCINES	1,742,205	35%	1,045,805	30%
C. TRANSPORTATION	884,261	18%	884,301	26%
D. COMMUNICATIONS	488,076	10%	0	0%
E. SUPPLIES				
Vaccination	150,661	3%	150,661	4%
Audio-Visual	5,336	0%	5,336	0%
Training	18,045	0%	18,045	1%
Butane	70,100	1%	70,100	2%
Mobilization	160,648	3%	160,648	5%
Evaluation	632	0%	532	0%
Cold Chain	15,781	0%	15,781	0%
Subtotal	421,203	8%	421,203	12%
F. OPERATING COSTS	186,376	4%	11,058	0%
G. COLD CHAIN MAIN	11,379	0%	11,379	0%
SUBTOTAL RECURRENT	4,643,849	93%	2,586,499	75%
<hr/>				
A. BUILDINGS	28,671	1%	0	0%
B. VEHICLES	214,595	4%	567,396	16%
C. EQUIPMENT				
Cold Chain	30,140	1%	114,531	3%
Vaccination	50,446	1%	153,588	4%
Audio-Visual	7,815	1%	29,698	1%
Other	3,057	0%	13,854	0%
Subtotal	91,458	2%	311,671	9%
SUBTOTAL INVESTMENT	334,724	7%	879,067	25%
<hr/>				
II. TOTAL	4,978,574	100%	3,465,566	100%

The relatively large vaccine costs may be attributable to the high cost per dose (\$0.69) of the injectible polio-diphtheria-pertussis-tetanus vaccine, compared with the other vaccines (\$0.03 for OPV and \$0.03 for DPT). The cost per dose for the injectable polio vaccine clearly should be a factor in planning the financial sustainability of the EPI in Senegal.

#### C. Expenditures for the Acceleration Phase

The total expenditures for the Acceleration Phase were approximately 3.5 million dollars. Vaccines accounted for the greatest proportion of expenditures (30%), with transportation (26%) and vehicles purchases (16%) following. The MOH spent \$50,000 on fuel and other ministries spent \$10,800 on transportation, bringing the total additional expenditures for the government to \$60,800.

The major differences between expenditures and full costs (\$1.5 Million) are for the imputed value of salaries, communications, overhead costs, and buildings, and the full resource use of vehicles and equipment.

#### D. Full Costs of Program Components

Acceleration full costs were also separated into the key functional components of EPI, including the development and maintenance of the cold chain, procurement of vaccines, training, supervision, evaluation, vaccine delivery, and social mobilization. Table 5 shows that procurement of vaccines accounted for most of the resources for the Acceleration Phase (37%). Social mobilization and vaccine delivery were also large components, at 23% and 22%, respectively. Over 80 percent of all costs were attributable to three major activities: buying vaccine, mobilizing the population, and administering the vaccines. Training and cold chain maintenance were among the lowest categories (excluding special studies and overhead expenses).

**TABLE 5**

**Full Cost and Expenditure of  
EPI Program Categories**

<b>CATEGORY</b>	<b>FULL COST</b>	<b>PERCENT</b>	<b>EXPENDITURE</b>	<b>PERCENT</b>
DELIVERY OF VACCINES	1,071,184	22%	485,337	14%
PROCURE VACCINES	1,819,033	37%	1,045,805	30%
DEVEL/MAIN COLD CHAIN	211,121	4%	211,791	6%
TRAINING	92,100	2%	18,045	1%
SUPERVISION, MGMT PLANNING	434,812	9%	909,424	26%
SOCIAL MOBILIZATION	1,143,787	23%	783,475	23%
GENERAL OVERHEAD	186,377	4%	11,058	<1%
EVALUATION	20,160	<1%	—	NA
RESEARCH AND STUDIES	—	NA	—	NA
EPI SURVEILLANCE	--	NA	632	<1%

**E. Comparison with Costs of Other Strategies**

The Acceleration Phase represented a departure from the previous mobile team strategy and involve primarily the French as donors. The annual operating cost of the mobile teams is estimated at \$455,000 in 1987, or one-eighth the cost of the Acceleration (see Appendix D). Salaries are the highest component of mobile team costs (32%), because one-third of the personnel of the Service des Grandes Endemies spend their time on immunization.

**F. Cost-effectiveness of the EPI**

The effectiveness of the EPI was measured in three ways: 1) the number of doses administered for each type of strategy for a particular time period, 2) the number of children completely vaccinated, and 3) the number of potential deaths averted through the vaccination efforts over the past year.

Table 6 presents the results of the cost-effectiveness analysis for the Acceleration Phase. Over one million doses of vaccine were administered to children less than 2 years during the period between October and April 1987. Figures for the number of doses were collected by

UNICEF and the Department of Hygiene and Public Health during the Acceleration Phase. The result is a cost per dose of \$1.24. This cost is high compared to other UNICEF campaigns, but it does not include doses administered to older children, which would lower this figure.

The July 1987 national coverage survey found 35% of children between 12 and 23 months completely vaccinated, and a 15 percentage point increase was attributed to the Acceleration Phase. For the "worst case" scenario of cost per fully vaccinated child, one could assume that the coverage increase for the 0 to 5 year olds was the same as for the 0 to 2, or 15%. In the "best case", it was assumed that for children between the ages of 2 and 4 years, coverage of children completely vaccinated would be at least 50% and 30 percentage points could be attributed to the campaign. The population of children less than five was assumed to be 1.2 million, and the range of children completely vaccinated was between 180,000 and 255,000, depending upon "worst and best case" coverage assumptions.

The cost per fully vaccinated child ranged from \$27 to \$19, which are slightly higher than earlier reported figures for campaigns in West Africa. The cost per death averted, based on data from Section III.B was \$1,400.

TABLE 6

Cost-effectiveness of the Senegal Acceleration

INDICATOR	WORST CASE	BEST CASE
Full cost of the Acceleration <sup>a</sup>	\$4,928,788	
Number of EPI doses administered <sup>b</sup>	3,973,284	
Cost per dose	\$1.24	
Number of fully vaccinated children <sup>c</sup>	180,000	255,000
Cost/fully vaccinated child	\$27.38	\$19.33
Number of occasions of deaths averted	3,521	
Cost/death averted	\$1,400	

<sup>a</sup> 99% of total full cost used to adjust for tetanus toxoid doses and reported in 1987 dollars.

<sup>b</sup> Figure represents doses for target population of children ages 0-23 months.

<sup>c</sup> Figure represents 15% of children between ages 12 and 23 months (302,250 x 1:5 = 45,338) from 1987 survey data showing campaign contribution of 15% coverage.

#### IV. LESSONS LEARNED

##### A. Major Accomplishments

The highlights of the Acceleration Phase center around two major areas: 1) the campaign increased the demand for immunization services in the public, and 2) the means to implement the campaign were provided.

Senegal's experience with social mobilization during the EPI Acceleration Phase will serve as an important reference for other African countries wishing to follow the same road. Despite a number of obstacles, vaccination became a high profile health initiative and a groundswell of public support resulted in a definite success. Several lessons can be learned:

1) it is possible to mobilize both the health sector and non-health sector resources of a country around a single social issue very rapidly for as long as six months;

2) the general population can be highly motivated to participate in a health improvement campaign;

3) by concentrating attention on vaccination, the habit of vaccination can be developed in a mobilization campaign and EPI given the highest profile of health services; AND,

4) a social mobilization campaign creates a whirlwind of excitement and activity, boosts morale of health workers, enhances their credibility, and inspires non-health sector participation and focuses attention on health questions.

As a result of social mobilization, mothers brought their children and themselves to health centers for vaccination. Over one million doses of vaccine were administered and 35% of the child population was completely vaccinated. Coverage for individual vaccines tripled in rural areas; and coverage for BCG (92%), DPT/P1 (81%), yellow fever (72%), and measles (63%) are among the highest rates ever reported for a West African country.

In response to this newly created demand for services, the government with support from UNICEF, provided the means to meet the needs. 650 health centers were furnished with cold chain equipment, vaccination supplies, record-keeping materials, and supervision systems. In addition, the government responded to the challenge by re-training its health workers.

The EPI was strengthened in two ways: a new strategy was put in place in fixed facilities and the vaccination schedule was improved by adding a third dose of DPT to protect against pertussis. The fixed center approach reflects the national policy to strengthen the health infrastructure, and may pave the way towards integration of immunization services with other primary health care interventions. In addition, the acceleration of EPI provided an energizing boost to immunization activities, and in many cases, an increase in the credibility of the health system for other health service delivery tasks.

## B. Areas for Improvement

Although the Acceleration Phase resulted in major achievements in the development and launching of a mass immunization effort, there were several instances where the opportunities presented by the national program were not used to their fullest extent.

1. **Interministerial Collaboration:** At the national level interministerial coordination of the social mobilization campaign suffered from a number of handicaps. It should be noted that the Ministry of Communication and the Ministry of Health worked well together. However, the other ministries were rather critical of the way the mobilization campaign was run at the national level, and felt that the MOH was not yet ready to accept non-medical professional expertise in public health matters.

The Ministry of Health wanted to maintain control over social mobilization and was reluctant to provide other ministries funds for activities over which it had no control. In a number of cases, plans which were submitted to the Ministry of Health by other ministries were criticized or approval delayed. It never was made very clear to the collaborating ministries what was expected of them and their relationship with the MOH remained undefined throughout the Acceleration Phase.

The social mobilization committee which was established at the national level met only three times during the Acceleration Phase and the individuals representing the ministries were not the same at each meeting. By comparison, the technical committee met four times as often and established a good working relationship.

The net result of these difficulties was that each ministry tended to go off in its own direction with little overall support, and these intersectoral meetings were discontinued after World Health Day.

2. **Communications Messages:** The communications component of social mobilization suffered from several difficulties. With many different sources of information and levels of intervention, it was difficult to ensure consistent and uniform message diffusion. Moreover, there appeared to be too much of a focus on the organizational aspects of the social mobilization campaign, rather than on the content of communications messages. In fact, of the more than 40 radio messages developed for the campaign, only four referred to specific information about immunization: side effects, age groups, and diseases. Most of the messages were highly promotional in nature (i.e., Vacciner vos enfants) which may have led to confusion and motivated mothers for the wrong reasons (e.g., to prevent AIDS or an upcoming epidemic).

The household survey of mothers showed that roughly 40% of mothers did know the diseases against which vaccines protect. The majority (57%) could name at least one disease (usually measles, whooping cough or polio). But, more often than not, also named illnesses not affected by vaccinations such as diarrhea and malaria. Only 2.1 percent were able to name the seven diseases. The public was also confused over the age of the children to be vaccinated, the number of shots to be administered and the interval between

doses.

Spot advertisements were often crowded with too much information at one time, programs in EPI designed for rural listeners at times were broadcast at inconvenient hours for the audience and educated journalists sometimes had difficulty explaining their program ideas on EPI to their less sophisticated collaborators who were responsible for converting the ideas into local languages on the air. Therefore, one may conclude that although the population was highly mobilized, a significant proportion of the population is still misinformed about the benefits of immunization.

**3. Financing of the Campaign:** The accelerated effort was almost entirely financed by UNICEF, with ministry contributions mostly being in-kind labor and mobilization efforts. The benefits to Senegal, in terms of development of the infrastructure needed to support vaccination activities in fixed centers, were great. However, the major drawback was that no plan on the future financing of immunization after the acceleration has been made. There is no allocation from the Government of Senegal for EPI specifically in 1987 or in the 7th Development Plan for Health, and the GOS relies on foreign aid for this program (almost exclusively).

UNICEF could make greater contributions to immunization program sustainability if they would also encourage national financial commitment to the EPI, as well as participate in the programming of funding during the acceleration phase and in the years immediately following in order to sustain the level of activity and to institutionalize the program.

In addition, it appears that the traditional donor policy to pay honorariums, high per diem rates, and rental fees for media equipment has resulted in an escalation of the cost of implementing strategies and poses problems for their sustainability.

**4. Training:** Although training sessions were held in each region regarding vaccination technique, vaccine handling, and social mobilization, several technical aspects appear to have been overlooked. Training appeared to have been superficial. During field visits, many health workers interviewed had not seen the training manual prepared by UNICEF before. In many cases, the assessment team witnessed incorrect vaccination techniques, such as re-using needles for multiple injections, which has certain health consequences. Without pre-tested, audio-visual and graphic-heavy training and resource materials the efficiency of the training sessions and the availability of health workers to retain what they have learned and share that information with people outside the health sector was reduced.

The vaccination schedule and number of doses changed midstream of the campaign. No provision was made to re-train health workers on these changes, which may be linked to lower than expected coverage rates. A special analysis performed on the 1987 coverage survey data showed that 15 percent of all measles doses were administered at an earlier age than was appropriate. In addition, many children did not receive all of the antigens for which they were eligible at a given vaccination session, with respect to their age and vaccination status. Therefore, the health workers and those responsible for triage were directly responsible for lower vaccination coverage rates than expected, and it is estimated that coverage

of fully vaccinated children would have been 10 percentage points higher if all contacts had been satisfactory. These results also highlight that although use of non-health personnel may contribute toward the goal of high coverage, untrained or poorly trained personnel can detract from a program's effectiveness.

**5. Supplies and Logistics:** The major lesson to be drawn from the Senegal experience regarding purchase of material resources is that the problem of "appropriate technology" seems to persist. Through the support of UNICEF, campaigns are an opportunity to purchase needed materials. However, these materials need to be selected on the basis of their appropriateness to the Senegalese context: whether the material good is durable, whether the necessary spare parts and technical expertise in repair exists, and whether the technology of the use of equipment can be easily transferred. The vehicles and mopeds that were purchased were inappropriate, are in need of repair after only a few months (the spare parts are not available in Senegal), and the mopeds cannot be used during the rainy season. In addition, the mopeds are not large enough to transport a vaccine carrier and/or butane gas cylinder: two essential supervision activities for the maintenance of the EPI.

The reception of materials in-country was occasionally delayed which posed problems for internal distribution and preparation for the acceleration phase. Most of the equipment was sent by air to Dakar, resulting in high transportation and customs costs for the campaign. 150 cold boxes were ordered in October 1986 and sent by a special air shipment in order to arrive in time.

The plan for internal distribution of UNICEF-procured materials and supplies was not clearly negotiated with the Ministry of Health at the outset which resulted in problems of control over the timing and location of distribution. Most regions received supplies in October, November, and December of 1986, just before the first round of the Acceleration.

The acceleration phase provided an excellent opportunity to re-evaluate the internal supply and distribution system for vaccines and vaccination equipment. However, no concerted efforts were made to revamp the vaccine inventory system at the Pharmacie National d'Approvisionnement (PNA) or to re-structure the centralized nature of distribution within the country. Vaccination equipment has traditionally been sent from the central level to the periphery, rather than being generated from the needs at the lowest levels of the health infrastructure. Syringes and needles are ordered nationally once a year, with each center receiving their yearly allotment. This system provides an incentive for the health worker to "guard" their supplies because they only receive them once a year, which may pose serious health problems resulting from multiple injections and unsterile conditions. The acceleration would have been an excellent time to evaluate and improve an ordering and supply system throughout the country which did not take place.

**6. Integration with Other PHC Activities:** Interviews documented that during the Acceleration Phase for the EPI, other primary health care activities of the Ministry of Health ground to a halt. There is no question that the Acceleration Phase for the EPI became the number one priority for the President and the Ministry of Health of Senegal.

Therefore, it is not surprising that most other primary and preventive health activities came to a halt during the acceleration period. What is encouraging, however, was that basic curative services continued to be provided during the Acceleration at all levels of the health infrastructure.

In terms of cost, most program managers of health projects claimed that the implementation of their programs were delayed between November and April, the duration of the Acceleration Phase. In the long-run, this delay may be overcome because of the popular interest in vaccination and primary health activities generated by the campaign. The population may be more willing to accept or be more able to demand preventive health care activities, and the health care system may be more primed to provide services on a decentralized basis.

The planning of the intensive rounds would have been an excellent opportunity to involve and mobilize other ministries in primary health care in general, and to integrate common aspects of all PHC programs (health education, social mobilization, and planning).

7. **Planning:** Planning for the acceleration was done with a quick fix to immunization coverage in mind to produce quick results. Not enough emphasis was given to strengthening and institutionalizing the routine services for the long-term. After each round, immunization activity dropped (see Figures 1 and 2). One would expect that immunization activity would increase dramatically during each round, but that the baseline level would not be the same between them, as did occur. After the Acceleration one sees that activity did fall off, either because the target population was used up (unlikely because of 35% coverage rates and because of the continuous cohort of children eligible for measles vaccination), that health workers were tired, or that other health problems (such as cholera) took precedence.

Following the campaign, almost all EPI-related radio and television messages stopped, which is another indication of the campaign mentality. What should have taken place is that the acceleration be part of an overall plan of operation for the EPI, not the entire focus itself. In this way, the rationale for and linkages between the routine strengthening of the system and the acceleration would have been made in the minds of the national EPI, the MOH, and transmitted down the system to health workers. Instead, the campaign was pushed onto the system without regard for where it was leading the EPI.

Another aspect of planning that was overlooked was the amount of time necessary for adequate planning of all campaign activities. The experience of Senegal shows that three months is too short to mobilize the population, the health and other sectors into full speed operation. Many of these areas of improvement could have been prevented if planning had begun earlier.

8. **Vaccine Safety and Potency:** Although during the Acceleration the vaccine turnover rate would have been sufficiently high as not to pose a great threat to vaccine potency, there were numerous documented reports of cold chain breakdowns. There was no systematic plan for monitoring the cold chain during the Acceleration Phase and this activity was not included

as one of the supervisor's tasks for the Acceleration Phase.

Currently, the cold chain is not being carefully monitored which raises the issue of vaccine efficacy. There are no 3M monitoring cards in place, thermometers to monitor refrigerators in the field are broken, and resources for the required kerosene and butane are limited, raising legitimate concern on the real gains resulting from the increase in the number of vaccination centers.

In addition, the WHO-recommended policy of one dose-one syringe was irregularly practiced, presumably because of past experience with shortages of supplies for the EPI. There was still a conservation of syringes at health posts during the Acceleration Phase. All of these factors raise the issue about how safe and effective the EPI really is in preventing disease in the long-run.

**9. Monitoring and Evaluation:** A wide variation in the timeliness and accuracy of reporting of doses and disease remains. Delays in reporting in some regions after the acceleration phase may be attributable to the heavy load of cholera patients and focus on attenuation of the epidemic. In other cases, it may be due to lack of adequate supervision of health post activities or to lack of motivation on the part of the health worker.

In addition, adequate reporting on vaccine inventory and cold chain quality is still missing in the EPI. The Acceleration Phase would have been an excellent opportunity to design and develop a vaccine inventory and monitoring system at the central, regional, and peripheral levels. Although forms exist to track the receipt and use of vaccines, there seems to be significant variation in the quality and accuracy of this reporting.

## V. SUSTAINABILITY OF ACCELERATION ACHIEVEMENTS

### A. Issues

Because each year a cohort of newborn children are at risk of contracting communicable diseases, immunization must be an ongoing activity at each health center. The enormous achievements in vaccination coverage rates in Senegal for 1987 must be maintained at the same level or else the investments made during the acceleration phase will be lost. But how can these results be maintained and what factors will improve the sustainability of the EPI in Senegal?

#### 1. Financial Sustainability

The Acceleration Phase was used to "launch" an immunization strategy through fixed facilities rather than relying solely on mobile teams. The end result has been the equipping of 650 health centers with cold chain equipment, vaccination supplies, vehicles for outreach activities, and vaccines. Almost all of the capital investment was made by UNICEF in Dakar, and continued investment of this magnitude is unlikely, leaving the Government of Senegal, other donors, or the population to finance the continuing costs of the EPI.

The design of the fixed facility strategy will result in a high recurrent costs. The vaccination schedule using two doses of Immovax, plus a third dose of DPT, has high associated unit costs at \$0.69 per dose compared with \$0.03 per dose of DPT and oral polio. In fact, the use of Immovax resulted in a 20% increase in the cost of the acceleration phase over a hypothetical case using DPT and OPV. Currently, the Government of Senegal imports most vaccines, except for BCG and yellow fever which are produced locally by the Pasteur Institute. UNICEF has been responsible for purchasing 85% of all doses of vaccine and 90% of the total cost of vaccine for 1986, with the French Technical Cooperation contributing to 14% of the total cost and the government contributing 1% for the same year. This pattern has implications for the sustainability of the EPI in the event that donors no longer finance the cost of vaccine, shifting this burden to the MOH.

Another design feature which has high recurrent cost implications is the type of cold chain equipment purchased for use at the health post level, which requires butane gas for operation. On average, a 12.5 kg butane cylinder will last for approximately one month, resulting in monthly replacement costs of \$36.00. Without the kerosene or butane, the cold chain will fail, and therefore, the cost must be financed on a continual basis to maintain the effectiveness of the program.

Finally, the type of mopeds which were purchased for the acceleration phase have run into dis-repair four months after initial use. The USAID Sine-Saloum project estimates that the average annual maintenance and repair cost for mopeds is approximately \$100.00. Therefore, the implications for the recurrent cost burden to the Government of Senegal was not taken into account prior to launching the acceleration phase through fixed centers. The question arises, then, where will the resources necessary to maintain the cold chain and to continue the outreach

activities required for high coverage levels come from?

Table 7 estimates the routine costs of operating the national EPI through fixed centers. The costs of personnel and general overhead costs of running the health center are not included, because they do not represent additional costs to the Ministry of Health of implementing the EPI through health centers. The government will continue to make salary payments on the same level as before to its health personnel.

This table shows that if each health center was to continue to implement the EPI using the injectible polio vaccine, Immovax, and DPT 3 (Option 2), the average recurrent cost per health center would be approximately \$3,900 per year. These estimates assume 100% coverage of an average population of 30,000 served by each health center at a growth rate of 5.4% per year, resulting in 500 newborns per center per year. A slightly less expensive option would be to alter the vaccine schedule to include DPT and OPV, which would result in an annual cost of approximately \$3000. The savings at the national level would be approximately \$600,000 per year which exceeds the current cost of the Services des Grandes Endemies.

If the population was asked to pay 50 CFA per vaccination card per child, then the expected revenue each year would only be around \$80 per center, or between 2 and 3% of the funds necessary to operate either option for the EPI in the facility. The charge of 50 CFA is equivalent to what is currently being charged at health centers at the department level for each child consultation, though the population is charged 25 CFA at lower levels.

The table continues to describe alternative financing patterns for a typical health center. If the population were to be responsible for financing 100% of the operating costs of the EPI in their health center, then they would be required to pay close to 2000 CFA or \$6.00 per child (Option 1). These costs are higher for the injectible vaccine (2500 CFA or \$8.00 per child). At a level of 25% population financing, the charge would be 500 to 600 CFA per child, with the remaining balance to come from either the Ministry of Public Health or donors.

The issue of community participation in financing of preventive health care programs is not new in Senegal. Prior to the acceleration phase, the population was required to pay for vaccination services as part of the price for a consultation in a health facility (25 or 50 CFA). Each mother could expect to pay up to 250 CFA or less than one dollar, to fully vaccinate her child. During the campaign, the President decreed that vaccinations would be provided free-of-charge to the entire population, and this policy has remained in effect since the last coup de poing in April 1987.

TABLE 7

ESTIMATION OF THE COST OF THE EPI  
IN AN AVERAGE HEALTH POST

CATEGORY	COST CFA OPTION 1	COST 1987*	COST CFA OPTION 2	COST 1987*
<b>A. COSTS</b>				
TRANSPORTATION	280,800.00	864	280,800.00	864
VEHICLE MAIN	32,750.00	101	32,750.00	101
VACCINES	125,385.00	386	391,218.75	1204
SUPPLIES	526,435.00	1620	526,435.00	1620
COLD CHAIN MAIN	24,333.33	75	24,333.33	75
<b>TOTAL COSTS</b>	<b>989,703.33</b>	<b>3045</b>	<b>1,255,537.08</b>	<b>3363</b>
<b>B. REVENUES</b>				
50 CFA/CARD	25,000.00	77	25,000.00	77
100 CFA/CARD	50000.00	154	50000.00	154
<b>C. COST/CHILD</b>				
1. 50 CFA/CARD	CFA	US**	CFA	US**
100% FINANCING	1979	6	2511	8
75% FINANCING	1485	5	1883	6
50% FINANCING	990	3	1256	4
25% FINANCING	495	2	628	2

NB: MODEL ASSUMES 100% COVERAGE OF NEWBORN POPULATION OF 500 PER YEAR  
GROWTH RATE OF APPROXIMATELY 5 PERCENT; HEALTH CENTER TO VISIT  
EACH OF 6 VILLAGES ONCE A MONTH IN A RADIUS OF 15 KM.

In interviews with health professionals, local officials, and the population itself, it was discovered that they believed the public would be willing to contribute again for vaccination services, especially since they have now seen the health benefits associated with them. Nevertheless, it is clear from the foregoing analysis that reverting to the previous pricing policy for consultations will not cover the cost of running the immunization program in fixed facilities. Consideration needs to take place now as to what would be a fair price to charge, whether to charge per vaccine (which would tend to negatively effect a mother's incentive to return with her child for the full course of immunizations) or for a vaccination card (which may increase the value of the card in the eyes of the family and thereby improve the chances that the card will be kept in the home for the life of the child), and how to implement the policy (by Presidential Decree or by local jurisdiction).

Another factor affecting the financial sustainability of the EPI relates to how the program is being financed by the Government of Senegal. Currently, there is no budget line-item for the EPI (as is the case for many other preventive programs such as diarrheal disease control through ORT). This means that there is no specific allocation by the MOH to the program, though there were special payments made for the Acceleration Phase and for vaccine. The operating funds for the program will come out of national allocations to the regions which are not differentiated from the funds needed to implement other health priorities. These allocations to the regions (regional medical centers and regional offices of the Service des Grandes Endemies) have remained constant since 1982, and have not reflected the growing demands of the population and changes in modes of operation. In fact, most health facilities do not receive enough resources to operate their programs to full capacity.

Because the MOH budget has been decreasing in proportion to total budget since 1974 and currently rests at 5.0% of total, therefore, fewer and fewer resources are available for health and the EPI must compete for resources within a limited and decreasing budget. There is no guarantee that, faced with changing health priorities, the MOH will be able to support the routine demands of the recurrent costs of the EPI, as currently organized.

The implementation plans and budgets for the EPI should originate at the regional level, taking into account the needs and organization of the program in that particular region. In this manner, the cost of the EPI can be traced through the ministry system and can be monitored at the level of implementation. In addition, financial shortfalls can be predicted and hopefully ameliorated either through greater central level allocations or through donor financing.

With respect to donors' contributions to the EPI, UNICEF has played the primary role over the past few years. The World Health Organization has provided some training, but has not made significant financial commitments to the program. The French finances the immunization activities of the mobile teams and will continue to do so in the future, exclusive of the fixed facility strategy. USAID has focused on a large primary health care project in two regions which has included immunizations, but has not provided assistance at the national level in

strengthening the EPI. Other, smaller donors have participated, though usually on a smaller scale and within a defined geographic area (see Appendix E).

Donor support to the EPI is subject to the priorities of the governments and organizations which provide resources, and therefore, these funds are not a reliable alternative for the future sustainability of the program. Donors need now to plan with the Ministry of Health on which aspects of the operating or capital costs they wish to finance, and for how long. In this manner, the gaps in financing could be identified and hopefully resolved through additional government outlays or private contributions. What is clear from the previous discussion is that the financial sustainability of the EPI can only be addressed through a combination of financing plans, and that no one source of funds will be able to cover the recurrent costs of the program as it now stands.

## 2. PHC Strategy

The strategy for the acceleration of immunization activities was selected to enhance the primary health care infrastructure. The several rounds of Acceleration clearly created brief interruptions of other health care services and, at least at the central level, distracted attention for several months from the development of other vertical programs as well as comprehensive projects. However, the primary health care infrastructure has been strengthened by the acceleration of immunization activities, and now stands ready to resume providing more comprehensive services. The Ministry of Health has stated its interest in integrating developed immunization services as a "locomotive" which may be used to pull along other services.

This post campaign period is an ideal time to cautiously introduce new interventions while continuing to refine the system for delivering immunizations. There is a well developed strategy to improve access to and use of ORT through SANAS (Service de l'Alimentation et de la Nutrition Appliquee au Senegal) in the Ministry of Health. Unfortunately, however, there has been little coordination to date to assure that management, training or evaluative systems are complementary. Both programs have used a vertical approach to delivery, although their concerns in development of the health infrastructure are similar.

## 3. Vaccine Choice

The choice of an injectible polio vaccine was embraced by UNICEF officials, both in the U.S. and in Dakar for use in Senegal. The original vaccine was being used in a field trial in one region (Kolda) by APMP (Association pour la Promotion de la Medecine Preventive) under a mobile team strategy. Two doses of vaccine were being administered at three month intervals in order to confer adequate protection.

However, the Acceleration Phase modified the vaccination schedule to two doses of Immovax at one month intervals with a third dose of DPT to fully protect against pertussis. There have been no efficacy trials of two doses only of the Immovax vaccine given at one month intervals, and therefore, regardless of the relatively high coverage levels, the exact

level of immunity provided by the Acceleration Phase cannot be definitely ascertained.

The benefits of the two-dose injectible vaccine are that it minimizes the number of necessary contacts, several antigens can be given at once, and cold chain requirements are lessened. On the other hand, the unit cost (\$0.69) is high for governments and two doses of vaccines provides only a 50 % protection against pertussis, making it the vaccine of choice in remote areas but of dubious benefit for urban and peri-urban strategies.

The Acceleration Phase's main benefit has been found to be the change in immunization strategies it induced: there are now more than 600 fixed centers equipped to deliver immunizations for a catchment area of 15 kms, representing 60% of the total population at risk. The team firmly believes that for the fixed center strategy, the vaccine to be used should be the one which allows the earliest possible protection for the least cost: the association DPT and oral polio vaccine, which allows a child to be fully protected as early as 14 months of age against poliomyelitis, tetanus, diphtheria, and pertussis, for which 65,000 cases are reported a year, even after the Acceleration.

#### **4. Social Mobilization**

Without a doubt a large amount of goodwill and enthusiasm has been created among all those who participated in the EPI Acceleration Phase for social mobilization. Those interviewed uniformly like the idea of social mobilization and welcome the possibility of future involvement.

The challenge will be to harness and guide that energy and enthusiasm. The motor to keep the momentum created for EPI going or concentrate it on other health initiatives is clearly the Ministry of Health. To facilitate the goal of improving future social mobilization campaigns the Ministry might consider:

a) creating permanent inter-ministerial structures for social mobilization at the national, regional and local level. For example, an interministerial committee involving the Ministries of Communication, Social Development, Education, Youth and Sports, Decentralization, Health and others, could ensure that the social mobilization network is maintained. At the regional level, social mobilization committees might be placed under the jurisdiction of the Bureau Organisation et Methode, Cellule d'Enfance, or Jeunesse et Femmes;

b) improving the level of cooperation and communications between all the major players in the health sector, Ministry of Health, NGOs, international organizations, and bilateral agencies, to avoid duplication of effort and to get maximum use of experience and resources during social mobilization campaigns; and,

c) establishing a centralized audio-visual material production unit and resource centre at the Ministry of Public Health which could produce materials to be used in the field, guide national level media and support the production of materials at the regional level which are attuned to local language and culture.

## **5. Integration**

There are existing or planned programs in Senegal to promote other CSDR interventions including ORT, nutrition (including growth monitoring, nutritional rehabilitation and promotion of breast feeding), and birth spacing. The benefits associated with integration of these efforts with those for other CSDR activities. Duplicate structures for management, supervision, and evaluation, for example, need not be created. Significant savings may also result in the integration of systems for supply of expendable commodities, training and health education.

## **6. Relevance of Acceleration for Other Child Survival Activities**

There is existing or planned national coverage with CSDR interventions including immunization, ORT, nutrition (through nutritional rehabilitation centers), and birth spacing. An outline of major projects with CSDR interventions is presented in Appendix ?.

### **B. Recommendations**

Through the Acceleration effort, several concrete lessons have been learned which provide direction for the future of the EPI in Senegal and for UNICEF/Dakar.

#### **1. National EPI**

Immediate attention should focus on the development of a mid-term strategy for immunization which addresses the key issues for sustainability.

In order to maintain and, where possible, to raise the level of protection of children that has been achieved through this substantial human and material investment in Senegal, the following recommendations are made.

1. Concentrate the EPI effort on the target group of children under one year of age.
2. Strengthen the strategy of fixed centers by 1) ensuring maintenance of equipment that is in place (cold chain and injection and sterilization equipment), 2) setting quantified monthly targets for vaccination at the local level, 3) conducting regular supervision of all local vaccination centers, from the departmental and regional levels, and 4) modifying the vaccination calendar for children with access to fixed centers, to BCG and oral polio from birth, 3 doses of DPT and oral polio at one-month intervals, beginning at age 6 weeks, measles and yellow fever at age 9 months.
3. For populations with less access to fixed centers, the vaccination calendar should be BCG and DPT/polio at 3 months, DPT/polio at 6 months, and DPT3, measles and yellow fever at 9 months;
4. Reduce the number of missed opportunities for vaccination by

emphasizing, especially through training, that health staff administer the vaccines indicated for each contract, based upon the child's age and vaccination history;

5. Develop an operational research program to improve monitoring of vaccination performance at the local level and explore the possible use of village-level surveillance for births and deaths, and therefore determination of vaccination target population;

6. Conduct a national evaluation of vaccination coverage in June 1988, to measure achievement of the objective of 80% coverage that has been set by the President for April 1988; and,

7. Greater attention should focus on tetanus toxoid immunization of women prior to delivery. Systematic immunization of all women of child-bearing age should be considered. Essential to this strategy will be a record of immunization such as a women's health card, in order to monitor progress and coverage.

## 2. UNICEF/Dakar

Without the assistance of UNICEF/Dakar, the acceleration effect would probably not have happened. and the individuals who devoted their time to the acceleration helped to serve as a catalyst. UNICEF personnel were involved in all aspects of the campaign, and helped to monitor, plan, and prepare for its implementation. However, the Rapid Assessment team would like to make the following recommendations:

1. UNICEF should now encourage and participate in the development of a national EPI plan of operation which includes a plan for cold chain monitoring, and maintenance, training of health workers, development of a viable and effective supervision system, vaccine procurement and distribution, and evaluation of the program. The national plan on operation should be based on regional needs.

2. UNICEF should assign immediately an EPI technical expert to replace Dr. Paganini to assist in the maintenance of vaccination coverage results. This individual should sit fulltime with the national EPI.

3. A mechanism for inter-donor collaboration needs to be developed, not only for EPI, but for other child survival programs. The absence of the WHO participation in the Acceleration, as well as that of USAID and the French Technical Cooperation, was regrettable. UNICEF/Dakar should increase its efforts to bring these essential partners on board.

4. The relationship between UNICEF and the MOH need attention. UNICEF should support rather than drive the system.

5. Plans should be made now concerning future funding of the EPI (for what types of costs and for how much) and shared with the MOH. Attention needs to be paid to the high recurrent costs of the fixed facility strategy.

6. The choice of Immovax vaccine in fixed centers does not seem

relevant any more and should be reconsidered carefully in terms of cost, efficacy, and appropriateness to the Senegalese context.

7. Steps to re-kindle social mobilization activities for the EPI and other child survival activities should be taken.

## **APPENDIXES**

- A. Persons Contacted**
- B. Basic Data on Senegal**
- C. Social Mobilization Plan of Action**
- D. Summary Results of the Coverage Survey**
- E. Additional Cost Information on the EPI**
- F. Child Survival Activities in Senegal**
- G. Principal Documents Reviewed**

## APPENDIX A

### Persons Contacted

#### Ministry of Health, Government of Senegal

Madame Marie Sarr Mbouj, Minister of Health  
Dr. Birame Diouf, Adjoint Minister of Health  
Mr. Thierno Niang, Cabinet Minister  
Mr. Pathe Farr Ddiouf, Public Information  
Dr. Colonel Sy, Director, Department of Hygiene and Public Health (DHPS)  
Dr. Fode Diouf, Director, Service des Grandes Endemies, DHPS  
Mr. Mamadou Toure, Administrator  
Dr. Ousman Diouf, Director, National Direction for Health Education, MOH  
Malick Fall, Health Educator, National Service for Health Education, MOH  
Ibrahim Leye, Social Assistant, National Service for Health Education, MOH

#### Other Government of Senegal Ministries

Abdourahman Cisse, Director of Information, Ministry of Communication  
Momar Nar Diop, Director of Publicity, O.R.T.S. television  
Amadou Lamine Samb, Coordinator for the EPI, O.R.T.S. radio  
Moustaphe Gueye, Television Coordinator for the EPI, O.R.T.S.  
Mactar Kamara, Journalist, O.R.T.S.  
Ndeye Soukey Gueye Cisse, Ministry of Social Development  
Cheikh Tioiane Cisse, Executive Secretary for the Actions of the Rural Expansion Centers, Ministry of Decentralization  
Djime Diaite, Chief of the Division of Studies and Projects, Ministry of Decentralization

#### Regions Visited

Diourbel  
Fatick  
Kaolack  
Kolda  
Louga  
St. Louis  
Tambacounda

#### UNICEF/Dakar

Mr. Mukalay Mwilambwe, Representative, UNICEF  
Mr. Richard Bridel, Senior Program Officer  
Dr. Augustino Paganini, Primary Health Care Advisor  
Mr. Niame, Program Officer  
Mr. Norbert Engels, Communications Officer  
Mme Henrietta Kone, Communications Assistant

Mr. Martin Murama, Supply Officer  
Mr. Bruno Messou, Supply Officer

International Donor Agencies

Mr. Dennis Baker, Acting Health Officer, USAID  
Mme Fatimata Hane, USAID  
Dr. Jean-Paul Chaine, Harvard Institute for International  
Development  
Dr. Anne-Marie Kimball, Columbia University  
Dr. Suzanne Prysor-Jones, PRITECH, Management Sciences for Health  
Ms. Wendy Newcomer, Child Survival Project Manager, Catholic  
Relief Services  
Ms. Cynde Robinson, Programming and Training Officer, Peace Corps  
Ms. Joyce Mellin, Peace Corps Volunteer, Ziguinchor  
Dr. Milton Amayun, Supervisor, World Vision Project, Louga  
Dr. Michel Garrenne, ORSTOM (Organisation de la Recherche  
Scientifique et Technique pour les pays d'Outre-Mer)  
Dr. Olivier Fontaine, ORANA  
Mr. Eric Lemoussaye, FAC (Fonds d'Assistance et de Cooperation)  
Dr. Martin Schlumberger, APMP (Association pour la Promotion de  
la Medicine Preventive)  
Dr. Bruno Floury, OCCGE (Organization pour la Cooperation et  
Coordination de la Lutte contre les Grandes Endemies)

## APPENDIX B

### Basic Data on Senegal

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Total Population	6,200,000 (1976)
Children 0-1 years	278,278
Children 0-4 years	1,200,000
Women 15-44 years	1,470,000
Annual Population Growth Rate	2.8
Infant Mortality Rate	140
Infant deaths per year	41,000
Child deaths (1-5) per year	70,000
GNP/capita	440 (1983)
Female literacy	14%

**APPENDIX C**

**Summary Results of the Coverage Survey, July 1987**

**RAPPORT D 'EVALUATION DE LA COUVERTURE VACCINALE  
DES ENFANTS DE 12 A 23 MOIS EN REPUBLIQUE DU SENEGAL**

**au 01 / 07 / 1987**

**Dr Pierre Claquin (1)**

**Dr Fodé Diouf (2)**

**Dr Bruno Floury (3)**

**M. Michel Garenne (4)**

**Dakar le 27/08/87**

**(1) REACH, J.S.I., Washington, D.C.**

**(2) Directeur du Service National des Grandes Endémies, Ministère de la Santé Publique, Dakar.**

**(3) OCCGE, Unité de Vaccinologie, Bobo Dioulasso.**

**(4) ORSTOM, UR Population et Santé, Dakar.**

## REMERCIEMENTS

Les membres de l'équipe internationale d'évaluation tiennent à exprimer leurs vifs remerciements au Gouvernement Senegalais, au Ministère de la Santé Publique ( et en particulier aux responsables du Programme Elargi de Vaccination ) pour l'excellent accueil dont ils ont bénéficié pendant tout leur séjour au Senegal , aussi bien à Dakar que dans les départements où l'enquête s'est déroulée .

L'équipe des évaluateurs tient à souligner l'importance des efforts qui ont été déployés par les autorités Senegalaises pour que cette enquête se déroule dans des conditions d'indépendance et de rigueur qui confèrent aux résultats la fiabilité requise.

Les évaluateurs ont particulièrement apprécié la collaboration des responsables du bureau UNICEF de Dakar auxquels ils expriment leurs remerciements pour avoir considérablement facilité leur tâche .

Enfin une mention spéciale est adressée à l'équipe de l'ORSTOM dont la célérité et la rigueur ont permis l'analyse en profondeur des données de l'enquête .

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## 1- RESUME

Entre le 15 novembre 1986 et la fin mars 1987 un effort massif d'accélération du Programme Elargi de Vaccination a été entrepris en République du Sénégal . A l'issue de cette campagne, une enquête nationale de couverture vaccinale portant sur un échantillon de 6216 enfants âgés de 12 à 23 mois a montré les résultats suivants ( à plus ou moins 10 % ) :

- BCG : 92 %
- DTC-P 1 et DTCP1 : 81 %
- DTC-P 2 et DTCP2 : 69 %
- DTCP complet : 47 %
- Rougeole : 63 %
- Fièvre Jaune : 72 %

Le taux d'enfants complètement vaccinés est de 35 % .

Cette augmentation marquée de la couverture vaccinale par rapport à une enquête nationale effectuée en Juillet 1984 a été particulièrement sensible en milieu rural où la couverture a été multipliée par trois , nette en milieu urbain ( multipliée par 1.5 ) et dans la région de Dakar ( multipliée par 1.2 ) où la couverture vaccinale était , de toute façon , relativement élevée .

L'analyse détaillée des résultats , notamment l'étude de la distribution des dates auxquelles les vaccins ont été administrés , a bien mis en évidence le rôle déterminant de la campagne sur l'amélioration de la protection des enfants contre les maladies cibles du PEV . L'analyse a aussi révélé qu'un nombre important de séances de vaccination ont été mal utilisées : soit que le vaccin ( notamment la rougeole ) ait été administré avant l'âge requis , soit que l'enfant n'ait pas reçu tous les antigènes auxquels il pouvait prétendre à cette séance, compte tenu de son âge et de son statut vaccinal antérieur . Ce type novateur d'analyse d'une enquête de couverture classique devrait être généralisé car il s'est révélé pertinent pour mettre en évidence la dynamique des activités du PEV .

La campagne d'accélération a permis le renforcement de la stratégie fixe au niveau national.

Les résultats acquis au prix d'une mobilisation considérable de ressources humaines et matérielles ne pourront être maintenus que grâce à un effort soutenu de supervision , de formation du personnel et de maintenance des ressources en place .

## 2- LE PROGRAMME ELARGI DE VACCINATION DU SENEGAL (PEV)

Decidé en 1978 , le FEV au Senegal a été élaboré en 1979

pour devenir effectivement operationel en 1981 . Malgre ces premiers efforts, des taux encore eleves de mortalite infantile dus aux maladies cibles evitables par la vaccination ont conduit le gouvernement Senegalais a renforcer les activites du PEV en elaborant un nouveau programme qui, presente en 1984 , a la Conference de Bellagio a obtenu le soutien de la communaute internationale.

La strategie adoptee par le PEV est mixte, associant l'utilisation des centres fixes et le recours aux equipes mobiles :

- dans toutes les communes du Senegal, les centres de PMI et les postes de sante fonctionnent comme postes fixes de vaccination. En milieu rural, ils assurent egalement la couverture des populations vivant dans un rayon de 15 kms , grace a un systeme de vaccination itinerant ( activites avancee ).
- les equipes mobiles operent en dehors du rayon d'action des centres fixes .

Deux types de calendrier vaccinal sont en vigueur au Senegal:

- pour la region de Dakar :
  - BCG et Polio oral a la naissance
  - DTC et Polio oral 1 a trois mois
  - DTC et Polio oral 2 a six mois
  - DTC et Polio oral 3 , Rougeole et Fievre jaune a 9 mois
- pour le reste du pays , utilisation du vaccin polio concentre injectable en association avec les autres antigenes:
  - + calendrier jusqu'au 2/1/87
    - \* habitat disperse : BCG et DTCP 1 de 3 a 8 mois  
Rougeole, Fievre Jaune  
et DTCP 2 de 9 a 14 mois
    - \* zones d'acces facile : BCG et DTCP 1 de 3 a 5 mois  
DTCP 2 de 6 a 8 mois  
Rougeole et Fievre Jaune: 9-11 mois
  - + a partir du 3/1/87 , les responsables du Ministere de la Sante Publique ont introduit une troisieme injection de DTC systematiquement dans toute la zone ou elle n'existait pas . Le calendrier vaccinal est des lors devenu :
    - BCG et DTCP 1 a 3 mois
    - DTCP2 a six mois
    - Rougeole, Fievre Jaune et DTC 3 a 9 mois.

Avant novembre 1986 la couverture du pays etait encore faible. En novembre 1986 les autorites sanitaires du pays ont lance une operation massive dite "phase d'acceleration" qui avait pour but de porter la couverture vaccinale a 75 % au 06/04/87. Cette phase a consisté essentiellement en "operations coup de poing" centrees sur une semaine, au cours desquelles une

sensibilisation a été faite en utilisant tous les médias, en particulier la radio, et les moyens nécessaires ont été mis en oeuvre au niveau de chaque département pour assurer la réussite de cette campagne de masse: les dispensaires ont été équipés, les infirmiers formés et sensibilisés, la chaîne du froid assurée et les circonscriptions médicales ont vu leur matériel de vaccination renforcé. Les dates de ces opérations coup de poing sont les suivantes:

- le 15/11/87 : lancement de la campagne par le Ministre de la Santé Publique .
- période du 17/11/86 au 29/11/86 : début de l'accélération
- semaine du 05/01/87 au 10/01/87 : 1° opération coup de poing
- semaine du 16/02/86 au 22/02/87 : 2° opération coup de poing
- semaine du 23/03/86 au 28/03/87 : 3° opération coup de poing

Elles étaient donc espacées de 6 semaines l'une de l'autre.

### 3- L'ENQUETE NATIONALE DE COUVERTURE VACCINALE

#### 31 . METHODOLOGIE

##### 311 . METHODE D'ENQUETE

L'enquête de couverture a été réalisée par une équipe indépendante comprenant des spécialistes venant de différentes institutions nationales, régionales ou internationales (MSP, OCCGE, REACH, APMP, ORSTOM) coordonnée par l'Unité de Vaccinologie de l'OCCGE. L'analyse informatique a été effectuée avec le soutien technique de l'ORSTOM par les quatre auteurs du rapport. La liste des superviseurs de l'enquête figure en annexe 1.

Cette enquête avait pour but d'évaluer la couverture vaccinale à la date du 01/07/87 par sondage au niveau de chaque département. Elle s'est déroulée du 30/06/87 au 08/07/87. Chaque département a été considéré comme un univers au sein duquel on a tiré au hasard 30 grappes de 7 enfants selon la méthodologie préconisée par l'OMS, ceci quelle que soit la taille du département. Les résultats sont donc indépendamment représentatifs de chaque département du Sénégal.

La population cible de l'enquête était les enfants de 12 à 23 mois au 30/06/87, c'est à dire nés entre le 01/07/85 et le 30/06/86. Comme il apparaît sur le schéma de Lexis (Annexe 2), ces enfants ont tous eu la possibilité d'être vaccinés complètement au cours des opérations coup de poing.

Il y a 10 régions et 30 départements au Sénégal. Le sondage a été réalisé à partir des listes de villages et de communes urbaines du recensement de 1976. Le tirage a été systématique, proportionnel à la taille de chaque village ou commune urbaine. Le sondage initial était donc de 30x30 grappes, à choisir dans un village ou dans une commune urbaine (les grandes comptaient plusieurs grappes). En raison de difficultés de communication liées à la saison des pluies, le département de Bakel n'a pas pu être enquêté et donc les résultats portent sur 29 groupes de 30 grappes, soit 870 grappes de 7 enfants environ.

Les résultats sont présentés par département. Cependant, nous avons regroupé les grappes en trois grandes zones de résidence:

- la région de Dakar (encore appelée indifféremment le Cap Vert dans ce rapport), qui avait une histoire plus ancienne de vaccination et une stratégie vaccinale différente des autres régions (DTC et Polio oral)..
- le milieu urbain, hors Cap-Vert. Il a été défini comme les grappes incluses dans une agglomération ayant au moins le rang de chef-lieu d'arrondissement (population comprise entre 5000 et 25000 habitants).
- le milieu rural: le reste du pays.

Pour l'enquête sur le terrain 120 enquêteurs ont été recrutés, en général des étudiants. Les enquêteurs ont travaillé en binôme. Il y avait un ou deux superviseurs pour les 6 binômes de chaque région. Sur le terrain l'enquêteur procédait de la manière suivante: en milieu rural il avait le nom d'un village correspondant à une grappe. Il devait choisir au hasard une concession de départ et cheminer de proche en proche de concession en concession jusqu'à avoir 7 enfants éligibles (12 à 23 mois au 30/06/87). En milieu urbain il pouvait y avoir plusieurs grappes dans la même commune. Le superviseur devait alors tirer au hasard des quartiers à partir d'une carte; on procédait alors dans les quartiers choisis comme en milieu rural.

Lorsqu'une concession était commencée on devait inclure tous les enfants y résidant. Ainsi donc on pouvait avoir plus de 7 enfants dans la grappe s'il y avait plusieurs enfants éligibles dans la dernière concession. Le choix au hasard de la première concession était fait soit aléatoirement à partir d'une liste des concessions du quartier, soit en choisissant une direction au hasard, en faisant la liste des concessions dans cette direction et en en choisissant une au hasard dans cette liste.

Lorsqu'un enfant éligible était repéré, on demandait à la mère de présenter la carte de vaccination de l'enfant et on regardait la cicatrice du BCG. Sur la carte on vérifiait les noms et prénoms de l'enfant ainsi que la date de naissance. S'il y avait un doute sur la date de naissance on interrogeait la mère sur l'âge ou la saison de naissance de l'enfant. Du fait de l'imprécision de ce type d'investigation il est possible qu'il reste des erreurs d'âge dans l'enquête qui peuvent avoir des conséquences sur l'évaluation de la couverture (certains vaccins ayant été invalidés du fait de l'âge inadéquat à la vaccination). Enfin l'enquêteur relevait à partir de la carte les dates des différentes vaccinations sur la fiche d'enquête. Si une vaccination n'avait pas été faite, la date était laissée en blanc.

Si l'enfant n'avait pas de carte de vaccination, l'interrogatoire portait sur l'âge de l'enfant et l'enquêteur vérifiait la présence d'une cicatrice de BCG. Toutes les autres vaccinations étaient considérées comme manquantes.

L'essentiel des données démographiques et les critères du sondage sont résumés dans le tableau 1. Puisque le nombre d'enfants à enquêter est fixe dans chaque région le taux de sondage varie considérablement: il est de 6.7 /1000 à Dakar et de 121.9 /1000 à Dussouye. Pour la présentation des résultats nationaux on a donc dû pondérer les effectifs des échantillons nationaux en fonction de la population en 1976. qui a servi de

base de sondage. Le système de poids utilisé est donné dans le tableau 1. Cependant, comme on le verra ci dessous, du fait de la grande homogénéité d'ensemble des résultats, la moyenne pondérée est très voisine de la moyenne simple non pondérée des différents échantillons. Dans les tableaux la mention "ensemble" indique une moyenne non pondérée et la mention "Sénégal" indique une moyenne pondérée en fonction des effectifs de chaque département.

## 312 . METHODE D'ANALYSE DES RESULTATS

Au total 6216 enfants ont été retenus pour l'analyse. Quelques cas ont été éliminés lors du traitement informatique:

- les enfants non éligibles, soit par erreur de l'enquêteur, soit par erreur de transcription de la date de naissance
- les enfants dont la date de naissance était incompatible avec deux dates de vaccinations. Dans le cas où une seule date de vaccination était incompatible, elle a été supposée inconnue, mais l'enfant a été gardé pour l'analyse.

### 3121. Criteres de validite des vaccinations

Conformement a la methode recommandee par l' OMS , l'analyse de la couverture vaccinale s' est effectuee a partir des informations portees sur la carte de vaccination, a l'exception du BCG qui a ete valide au vu de la carte ,( quelque soit l'age auquel il a ete administre ) ou de la cicatrice .

Les criteres de validite retenus pour les autres vaccins sont les suivants :

- La rougeole est valide si elle est administrée au moins 273 jours après la naissance (39 semaines, ou environ 9 mois).
- La fièvre jaune est valide si elle est administrée au moins 187 jours après la naissance (26 semaines, ou environ 6 mois).
- Le DTCP1 est valide s'il est administré au moins 6 semaines après la naissance.
- Le DTCP2 est valide s'il est administré au moins 28 jours après le DTCP1 (et que le DTCP1 est valide).
- Le DTCP3 est valide s'il est administré au moins 28 jours après le DTCP2 (et que le DTCP2 est valide).

Dans tous les autres cas, si le vaccin a été fait on le compte comme invalide.

Pour chaque vaccin on a donc 4 possibilités:

- non fait (A)
- fait et valide (B)
- fait et invalide (C)
- ne sait pas s'il a été fait (D). Cette rubrique correspond aux enfants pour lesquels la mere n'a pas presente de cartes mais qui avaient une cicatrice BCG .

Pour tenir compte de la proportion non négligeable d'enfants ( 15 % ) qui , en l'absence d'une carte de vaccination indiquant leur statut vaccinal, ont cependant été en contact au moins une fois avec le PEV ( comme en témoigne leur cicatrice BCG ) et malgré la pratique classique d'exclusion de ces cas dans l'analyse de la couverture vaccinale, il nous a semblé intéressant de créer une rubrique supplémentaire intitulée " Approximation de la couverture " qui figure au tableau 3 et dans les résultats par départements ( A01 à A32 ) . Elle a été calculée de la façon suivante :

On a supposé que les enfants avec cicatrice BCG , mais sans cartes de vaccination , avaient reçus les mêmes antigènes que les enfants en possession de leurs cartes . En appliquant à la première catégorie les taux de couverture de la seconde, on obtient , pour chaque antigène , un chiffre qui, ajouté à la couverture vaccinale initiale, donne l'approximation .

Les calculs sont faits selon les formules suivantes:

Proportion de valides =  $B/(A+B+C+D)$   
 Estimation de la couverture =  $B/(A+B+C)$   
 Approximation de l'invalidité =  $C/(B+C)$

Ont été considérés comme complètement vaccinés les enfants ayant reçu au moins l'une des séries suivantes :

A : BCG , DTC-P 1 , DTC-P 2 , DTC-P 3 , Rougeole , Fièvre Jaune  
 B : BCG , DTCP 1 , DTCP 2 , DTC 3 , Rougeole et Fièvre Jaune

Comme cela a été indiqué au paragraphe 2 , ce n'est qu'à partir du mois de janvier que le troisième DTC a été ajouté au calendrier vaccinal ( pour la partie du pays qui bénéficiait d'un protocole simplifié ). Ainsi les enfants ayant reçu le BCG, les deux DTCP , la rougeole et la fièvre jaune avant le 2/1/87 peuvent être considérés comme LOGIQUEMENT VACCINÉS en regard du calendrier vaccinal en vigueur à cette période . Pour tenir compte de ce facteur dans l'analyse, nous avons présenté au tableau 2 une colonne intitulée " ENFANTS LOGIQUEMENT VACCINÉS " ( ELV ). Cette rubrique n'est évidemment pas assimilable à celle des " Enfants Complètement Vaccinés " .

### 3122 . L'INCERTITUDE SUR LA MESURE

Deux types d'erreurs se conjuguent pour l'interprétation des résultats: l'erreur de mesure et l'erreur de sondage.

L'erreur de mesure provient de deux sources: les erreurs de dates (date de naissance, transcriptions des dates de vaccins) et les erreurs dues aux vaccins eux-mêmes.

civil n'a pas encore une couverture importante, les erreurs de date de naissance ne sont pas négligeables. L'enquêteur a en général fait de son mieux pour estimer la date de naissance des enfants, mais des imprécisions ont pu se produire en milieu rural.

Des erreurs de transcriptions dans les dates de vaccins ont été trouvées au cours de l'analyse. Ce sont par exemple les erreurs de concordance entre les dates de DTCP. Elles ne sont pas négligeables pour l'analyse: elles atteignent en moyenne 3.36 % de tous les enfants au Cap Vert, 2.20 % en milieu urbain et 1.56 % en milieu rural, soit 2.0 % pour l'ensemble du pays si on se rapporte aux enfants vaccinés seulement.

L'erreur dans l'estimation provenant des cartes non retrouvées est plus importante. Elle atteint 13.1 % au Cap Vert, 9.1 % en milieu urbain et 7.4 % en milieu rural, soit environ 10 % pour l'ensemble du pays. Pour donner une idée de l'ampleur de cette inconnue on peut considérer l'exemple suivant: une région est vaccinée à 75 % et à 95 % pour le BCG, mais 10% des mères des enfants vaccinés sont incapables de fournir la carte pour une raison ou une autre. On va donc observer 67.5 % d'enfants avec une carte et 7.5 % avec une cicatrice, sans carte. Si on calcule la couverture d'après la carte seulement on trouve 67.5 % ce qui sous-estimerait la couverture .

Pour résumer l'incertitude sur la mesure de la couverture vaccinale on peut dire que celle ci est de l'ordre de 2 % pour les erreurs de transcriptions et de l'ordre de 10 % pour l'inconnue pesant sur les enfants ayant une cicatrice de BCG qui n'ont pas présenté de carte. Cette erreur cumulée peut donc être aussi élevée que 12 % en moyenne, plus forte au Cap Vert (16.5 %) qu'en milieu rural (9.0 %).

Les calculs qui ont été proposés ci dessus permettent de réduire autant que possible ces incertitudes. En considérant que les inconnus sont autant vaccinés que les autres, on surestime probablement la couverture lorsque la carte n'est pas présentée, mais on la sous-estime lorsque la date est invalidée. Sans étude plus approfondie nous considérerons que l'incertitude due à la mesure sur les estimations de la couverture vaccinale est de l'ordre de 6 % .

### 3123. L'ERREUR DE SONDAGE

L'erreur de sondage a elle aussi deux composantes: l'erreur due à la taille de l'échantillon et l'erreur due à la méthode de sondage. Le sondage est assez complexe: sondage à 2 degrés, tirage systématique des unités primaires, effet de grappes dans le second degré. Par souci de simplification nous proposons au lecteur de s'en tenir aux formules recommandées par l'OMS (Henderson and Sundaresan, 1922). Dans un premier temps on considère le sondage comme aléatoire simple et on calcule un écart-type en fonction de la taille du sondage( $\sigma$ ). Puis on applique un coefficient de correction qui représente l'effet de la méthode de sondage (e). L'erreur type totale est le produit des deux ( $\sigma * e$ ).

L'erreur-type due à la taille de l'échantillon se calcule selon la formule classique des lois binomiales:

$$\sigma = \sqrt{p*(1-p)/N}$$

où p est l'estimation de la couverture et N est la taille de l'échantillon. Puisque N est à peu près constant dans tous les départements (214 en moyenne) on peut donner une idée de l'erreur de sondage dans différents cas de couverture :

couverture	écart-type	erreur relative	effet de méthode
p=95.0 %	$\sigma=1.5$ %	$\sigma/p = 1.6$ %	e=1.36
p=85.0 %	$\sigma=2.4$ %	$\sigma/p = 2.8$ %	e=1.58
p=75.0 %	$\sigma=3.0$ %	$\sigma/p = 4.0$ %	e=1.64
p=50.0 %	$\sigma=3.4$ %	$\sigma/p = 6.8$ %	e=2.02
p=35.0 %	$\sigma=3.3$ %	$\sigma/p = 6.8$ %	e=1.76
p=25.0 %	$\sigma=3.0$ %	$\sigma/p =12.0$ %	e=1.54
p=15.0 %	$\sigma=2.4$ %	$\sigma/p =16.0$ %	e=1.48
p=10.0 %	$\sigma=1.5$ %	$\sigma/p =21.0$ %	e=1.52

Pour les valeurs qui concernent cette étude, au niveau du département les erreurs-type de sondage sont donc de l'ordre de 2 à 7 % environ, ce qui donne des intervalles de confiance de 4 à 14 %. Ces valeurs sont plus faibles si on agrège les résultats au niveau des grandes zones de résidence.

Par souci de simplification on ne donnera pas tous les intervalles de confiance dans tous les cas. Les formules ci-dessus permettront de les calculer si nécessaire. Nous rappelons au lecteur que l'erreur de sondage n'est qu'une composante de l'incertitude sur les estimations et que dans la majorité des cas l'erreur de mesure est du même ordre de grandeur que l'erreur de sondage. Les petites différences doivent donc être interprétées avec la plus grande prudence, même si elles semblent significatives avec un test de Student.

## 32. RESULTATS

### 321. TAUX DE COUVERTURE

#### 3211. RESULTATS NATIONAUX

Ces resultats sont presentes dans les tableaux 2, 3 et 4 et se trouvent resumes dans le graphique 1 . Pour l'ensemble du Senegal et compte tenu de la precision de la methode d'echantillonnage , on observe que :

- 72 a 92 % des enfants sont en possession d'une carte de vaccination
- 53 a 73 % sont vaccines contre la rougeole
- 62 a 82 % sont proteges contre la fièvre jaune
- 37 a 57 % d'entre eux sont vaccines contre la diphterie, le tetanos, la coqueluche et la poliomyelite,
- 82 a 99 % ont reçu le BCG .

Enfin, avec les criteres stricts exposes au paragraphe 3121 , on peut dire que 35 % des enfants (+/- 10 % ) sont entierement vaccines .

#### 3212. RESULTATS SELON LES DEPARTEMENTS

L'ensemble des resultats de chaque departement est presente dans les tableaux annexes A01 à A29. Ils sont resumes dans les tableaux 2 a 4 . Les resultats sont relativement homogenes en ce sens que du fait des operations coup de poing toutes les regions ont été concernees au même moment par l'amélioration de la couverture vaccinale. Il existe cependant des differences notables entre les departements.

Le pourcentage des enfants sans cartes mais ayant une cicatrice du BCG varie de 2.8 % à Ziguinchor à 18.3 % à Fikine. Ces grandes differences rendent difficiles les comparaisons precises des couvertures vaccinales entre deux departements aussi extremes.

La couverture du BCG varie de 84.7 % (Linguere) à 98.1 % (Ziguinchor). Ces resultats très éleves montrent que la phase d'accélération du FEV a globalement touché l'ensemble de la population du Sénégal, y compris dans les regions les plus reculees. Dans l'ensemble c'est 92.4 % des enfants qui auront eu au moins le vaccin du BCG.

La couverture de la fièvre jaune varie de 58.3 % (Kolda) à 92.3 % (Ziguinchor). Celle de la rougeole de 58.1 % (Sedhiou) à 81.8 % (Ziguinchor). La plus faible couverture de la rougeole s'explique par la limite d'âge fixée à 273 jours pour être considerée comme valide.

La couverture en DTCP est beaucoup plus faible. Nous avons considéré comme complet les 3 possibilités: 3DTCP, 3DTC+3PO, 2DTCP+DTC. La couverture varie de 28.6 % (Nioro du Rip) à 80.2 % (Ziguinchor).

Pour les enfants dits complètement vaccinés (BCG + DTCP + ROUGEOLE + FIEVRE-JAUNE) la couverture varie de 19.1 % (Kedougou) à 66.5 % (Ziguinchor).

C'est le département de Ziguinchor qui apparait comme le mieux vacciné du pays; au contraire les départements périphériques sont les moins bien vaccinés: Kedougou, Nioro, Kolda, Sédhiou, Vélingara, Kebemer, Linguere et Mbacké.

### 3213. RESULTATS SELON LES GRANDES ZONES DE RESIDENCE

Si on observe de fortes différences au niveau des départements, l'ensemble est beaucoup plus homogène au niveau des 3 grandes zones de résidence: Cap Vert, Urbain hors Cap Vert et rural. Les résultats détaillés sont donnés dans les tableaux annexes A30 à A32 et ils sont résumés au bas des tableaux 2, 3, 4. Aux erreurs de mesure et de sondage près la couverture vaccinale semble voisine dans les trois zones: elle est peut-être légèrement meilleure au Cap-Vert qu'en milieu rural, le reste de la zone urbaine étant entre les deux. Les seules différences importantes entre les trois zones concernent le DTCP: les 3 injections ont été beaucoup plus fréquentes (68.0 % de couverture) au Cap Vert où les vaccinations ont été mieux réparties dans le temps qu'en milieu rural où l'essentiel a été concentré au cours des 3 opérations coup de poing (48.3 %). Cela n'a eu cependant que peu de retentissement sur la proportion d'enfants complètement vaccinés qui varie de 33.7 % en milieu rural à 39.4 % au Cap-Vert.

### 3214. ANALYSE DE L'INCOMPLÉTUDE DES VACCINATIONS

Le tableau 5 analyse le cas des enfants incomplètement vaccinés selon l'antigène manquant et la zone de résidence. Les deux principaux problèmes sont le DTCP et la rougeole. Le DTCP surtout lorsqu'il manque la troisième injection et la rougeole, soit qu'elle n'a pas été faite, soit qu'elle est invalide car faite avant 9 mois. Le BCG et la fièvre jaune ne jouent qu'un rôle mineur lorsque le DTCP et la rougeole sont complets (2.6 %).

des cas d'enfants incomplètement vaccinés).

Le DTCP et la rougeole semblent jouer des rôles équivalents pour rendre compte des incomplétudes de vaccination, et ceci dans les trois zones de résidence de manière à peu près analogue:

- DTCP et Rougeole incomplets : 35.9 % des cas
- DTCP seul : 31.9 % des cas
- Rougeole seule : 29.6 % des cas
- autres (BCG, FJ) : 2.6 % des cas.

La rougeole intervient à deux niveaux: si elle n'est pas faite ou si elle est invalidée. Les deux niveaux interviennent pour moitié approximativement, c'est à dire que les cas d'invalidation de la rougeole rendent compte d'environ 24 % des cas d'enfants incomplètement vaccinés. Ce rôle très important de la vaccination anti-rougeoleuse est à souligner, car c'est probablement la difficulté la plus simple à résoudre. Si toutes les vaccinations anti-rougeoleuses avaient été faites au bon âge le taux d'enfants entièrement vaccinés aurait gagné 9 points .

## 322. DISTRIBUTION DES AGES A LA VACCINATION

Il a semble instructif d'étudier pour quelques antigènes la distribution des âges auxquels ils ont été administrés et de comparer cette distribution entre les trois zones de résidence .

-- Rougeole ( Graphiques 2 et 5 ) :

Les graphiques montrent la forte proportion de vaccinations effectuées entre 9 et 12 mois pour les zones urbaines et une distribution plus étalée vers les âges élevés pour les zones rurales. Indépendamment de la zone de résidence , l'analyse montre la trop forte proportion des enfants vaccinés avant l'âge requis .

-- DTC-P 1 ( Graphique 3 ) :

Il existe un pic des vaccinations entre le 3<sup>ème</sup> et le 4<sup>ème</sup> mois pour les zones urbaines ( prédominant au Cap Vert ). Cependant un certain nombre d'enfants n'ont reçus leur première dose de DTC-P qu'à un âge avancé, vraisemblablement au cours de l'accélération . Ce phénomène a prédominé en zone rurale ainsi qu'en témoigne l'étalement total de la courbe.

-- BCG ( Graphique 4 et 5 ) :

La courbe de distribution des âges pour le BCG est pratiquement superposable à celle du DTC-P 1, traduisant la recommandation du calendrier national ( une vaccination à trois mois pour le BCG et le DTC-P 1 ), respectée en zone urbaine mais non en zone rurale .

### 323. IMPACT DE LA CAMPAGNE

Trois types d'analyses ont été effectuées pour apprécier l'impact des Journées " Coup de Poing " sur les scores de couverture vaccinale :

1- une première analyse présente, par zone de résidence, la distribution des dates auxquelles ont été administrées les vaccinations ( quelque soit l'antigène ). Le graphique 6a montre un premier pic modéré du 17/11 ( lancement de la campagne ) à la fin décembre 1986 et trois pics francs dégressifs pour chacune des semaines " Coup de poing ", avec une très nette prédominance de l'impact dans la zone rurale. Entre les pics l'activité vaccinale a été modérée, sans revenir toutefois au niveau antérieur à l'accélération. Par contre, dans les 12 semaines qui ont suivi la fin de l'accélération, l'activité a été minimale.

2- l'analyse de la répartition des vaccinations par antigène et par période d'administration montre bien l'impact net de la campagne d'accélération sur l'élevation du nombre de doses de rougeole et de DTC-P 3 ( graphiques 6b et 6c ). L'impact est moindre pour le BCG qui bénéficiait déjà d'un taux de couverture élevé ( graphique 6d ). Le tableau 6 présente la distribution des doses administrées au cours des différentes phases et la contribution relative de la campagne. Le coefficient de multiplication de 36 pour le DTC-P 3 en zone rurale doit être interprété en fonction de l'introduction par la campagne d'une dose qui ne faisait pas précédemment partie du calendrier vaccinal.

3- une dernière analyse a été effectuée qui extrait le statut vaccinal des enfants qui avaient au moins 12 mois lors du lancement de la campagne. Cette analyse qui porte sur un peu moins de 2000 enfants de l'échantillon est statistiquement justifiée. Les résultats sont consignés dans le tableau 7 pour chaque zone de résidence et pour l'ensemble du Sénégal.

### 33. DISCUSSION

Les resultats de couverture vaccinale par antigene pour l'ensemble du pays sont eleves et traduisent bien l'effort considerable entrepris par le Gouvernement Senegalais , le Ministere de la sante publique , tout le corps social Senegalais et leurs partenaires internationaux pour obtenir , au prix d'une mobilisation sans precedent , une amelioration notable de la protection des enfants contre les maladies cibles du FEV . Par exemple , en ce qui concerne la protection contre la rougeole ( une des causes majeures de mortalite infanto-juvenile en Afrique de l'Ouest ) , un taux situe entre 53 et 73 % a ete obtenu .

Cependant , les chiffres d'enfants completement vaccines sont comparativement bas . De tels resultats peuvent surprendre quand on sait que 83 % des enfants ont une carte de vaccination, que 92 % d'entre eux ont eu au moins le BCG et que 62 % ont eu dans leur vie au moins 3 contacts avec les services de vaccination .

Une analyse detaillee , pour chaque enfant , du nombre de seances de vaccination dont il a beneficie et de leur dates a permis d'avancer quelques hypotheses pour expliquer, au moins en partie , cette apparente discordance .

Les tableaux 8a et 8b resument cette analyse et mettent en evidence les " occasions manquees " d'ameliorer la couverture vaccinale :

-- soit que le FEV n'a pas su utiliser au mieux la presence de l'enfant a une ou plusieurs seances pour lui administrer tous les vaccins auquel son age et son statut vaccinal anterieur lui donnaient droit

-- soit que les vaccins ont ete administres aux mauvaises dates et ont du etre invalides lors de l'analyse . Par exemple , les cas d'invalidation de la rougeole decrits au tableau 9 montrent un taux de 15 % pour l'ensemble avec un pic de 50 % pour les enfants les plus jeunes

Enfin cette analyse a egalement pris en compte des series de seances qui aboutissent a un enfant completement vaccine mais au prix de 4, 5 voire 6 contacts avec les services de vaccination ( au lieu des trois qui auraient du suffire ). On trouvera en annexe un exemple de tels cas . Il convient toutefois de noter que l'analyse a compte comme seance mal faite tous les cas ou le troisieme DTC n'avait pas ete administre meme si la seance etait anterieure a l'introduction de cette troisieme dose dans le calendrier vaccinal ( a partir du 3 Janvier 1987 ). Compte tenu de l'importance operationnelle de ce resultat une analyse detaillee sera entreprise ulterieurement .

#### 4- CONCLUSIONS

La couverture vaccinale du Sénégal en ce qui concerne les vaccins du PEV a considérablement augmenté au cours de la phase d'accélération qui s'est déroulée du 30/11/86 au 29/03/87. Cette augmentation de la couverture a été particulièrement sensible en milieu rural où elle a pratiquement été multipliée par 3, un peu moins en milieu urbain (multipliée par 1.5) et moins sensible au Cap-Vert (multipliée par 1.2). Le résultat en a été que ces trois zones ont, au 01/07/87, une couverture approximativement comparable, c'est à dire que le milieu rural a pratiquement comblé son retard.

Le PEV touche maintenant virtuellement tous les enfants du Sénégal. (92.5 % par exemple sont vaccinés par le BCG). Cependant la couverture varie considérablement selon les antigènes considérés. Elle est de 72 % pour la fièvre jaune, de 63 % pour la rougeole et de 47 % pour le DTCP. Ceci donne un total de 35 % d'enfants complètement vaccinés (enfants nés entre le 1<sup>er</sup> juillet 85 et le 30 juin 86).

Les principaux problèmes qui se posent à l'amélioration de la proportion d'enfants complètement vaccinés sont : la troisième injection de DTCP, l'injection de vaccin anti-rougeoleux et la validité du vaccin anti-rougeoleux.

La moitié des cas d'enfants incomplètement vaccinés, le sont a cause de l'absence d'une troisième dose de DTCP ; un quart a cause de l'absence de rougeole et un autre quart a cause d'un vaccin anti-rougeoleux administré a un age inadéquat. Le rôle du BCG et de la fièvre jaune étant négligeable lorsque ces trois problèmes sont résolus. Si ces trois problèmes avaient été résolus lors de la phase d'accélération, la couverture aurait dépassé l'objectif de 75 %.

S'il y a maintenant peu de différences entre le Cap-Vert, le milieu urbain et le milieu rural, il existe de fortes différences entre les départements. Ceux qui sont les mieux vaccinés sont les départements de Ziguinchor, Oussouye, Bignona, Matam, Rufisque, Dakar et Bambey. Les départements les moins bien vaccinés sont ceux de Kedougou, Nioko du Rip, Kebemer, Linguere, Kolda, Sédhiou, Vélingara et Mbacké.

## 5- RECOMMANDATIONS

L'Equipe d'Evaluation suggere les recommandations suivantes afin de maintenir et si possible d'elever le niveau actuel de protection des enfants obtenu au prix d'investissements humains et materiels considerables :

- 51- CONCENTRER L'EFFORT DU PEV SUR LE GROUPE CIBLE DES MOINS D'UN AN
- 52- POURSUIVRE LE RENFORCEMENT DE LA STRATEGIE FIXE EN :
  - ASSURANT LA MAINTENANCE DES EQUIPEMENTS EN PLACE ( CHAINE DE FROID, MATERIEL D'INJECTION ET DE STERILISATION ) .
  - DETERMINANT AU NIVEAU PERIPHERIQUE DES OBJECTIFS QUANTIFIES MENSUELS DE VACCINATION
  - EN ASSURANT UNE SUPERVISION REGULIERE DE TOUS LES CENTRES DE VACCINATION PERIPHERIQUE PAR LE NIVEAU DEPARTEMENTAL ET REGIONAL .
  - EN MODIFIANT LE CALENDRIER VACCINAL POUR LES ENFANTS ACCESSIBLES A PARTIR DES CENTRES FIXES :
    - + BCG ET POLIO ORAL A LA NAISSANCE
    - + DTC ET POLIO ORAL EN TROIS PRISES A UN MOIS D'INTERVALLE A PARTIR DE SIX SEMAINES
    - + ROUGEOLE ET FIEVRE JAUNE DES 9 MOIS
- 53- POUR LES POPULATIONS MOINS ACCESSIBLES, LE CALENDRIER A TROIS PASSAGES PARAIT JUSTIFIE :
  - + BCG + DTC A TROIS MOIS
  - + DTC 2 A SIX MOIS
  - + DTC 3 , ROUGEOLE ET FIEVRE JAUNE A 9 MOIS
- 54- REDUIRE LES OCCASIONS MANQUEES DE VACCINATION :
  - + EN VEILLANT A CE QUE LE PERSONNEL DE SANTE ADMINISTRE L'ENSEMBLE DES VACCINS AUQUEL TOUT ENFANT PEUT PRETENDRE A CHACUN DES CONTACTS DANS LE RESPECT RIGOREUX DE L'AGE ET DES INTERVALLES .
- 55- DEVELOPPER DES PROGRAMMES DE RECHERCHE OPERATIONELLE SUR LA MISE EN PLACE DE SYSTEME DE MONITORAGE PERFORMANTS AU NIVEAU PERIPHERIQUE
- 56- PROCEDER A UNE EVALUATION NATIONALE DE COUVERTURE VACCINALE EN JUIN 1988 AFIN DE MESURER LE DEGRE D'ACCOMPLISSEMENT DES OBJECTIFS FIXES PAR LE CHEF DE L'ETAT POUR AVRIL 1988 .

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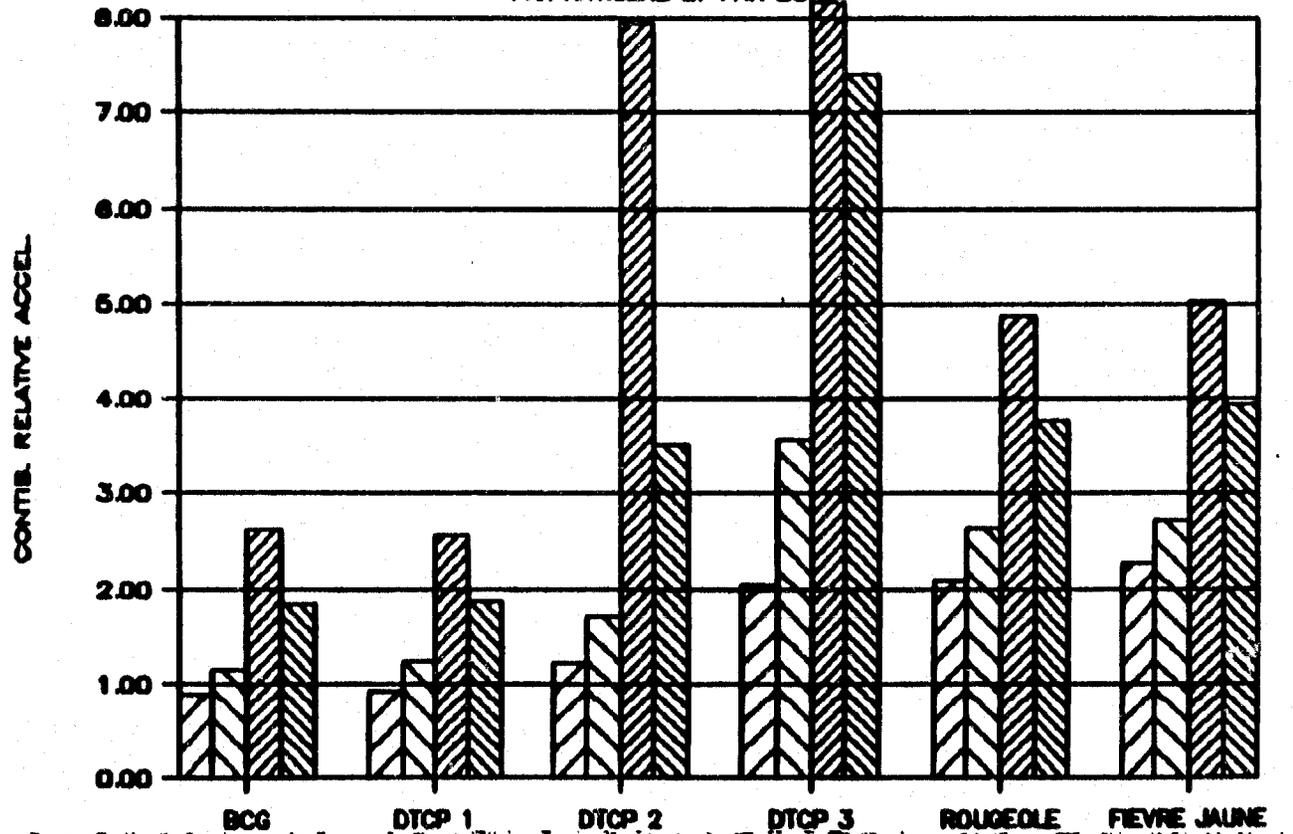
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## ANNEXE 1

NOM	INSTITUTION	REGION ENQUETEE
Dr. Pierre Claquin	REACH/USAID	DAKAR
Dr. Odile Leroy	ORSTOM	ZINGUINCHOR
Dr. Maria Eugenia Gomes do Esperito Sancto	OCCGE/CIE	DJOURBEL
Dr. Brigitte Helynck	OCCGE	SAINT LOUIS
Dr. Olivier Fontaine	ORSTOM	TAMBACOUNDA
Dr. Bruno Floury	OCCGE	KAOLAK
Mr. El Hadj Malick Diame	Ministere Sante	THIES
Dr. N'doye	OMS	THIES
Dr. Christiane Vallet	Enfance et Partage	LOUGA
Mr. Michel Garenne	ORSTOM	FATICK
Dr. Martin Schlumberger	APMP	FATICK
Dr. JF Mouilia Pelat	ORANA/OCCGE	KOLDA

# CONTRIBUTION RELATIVE DE L'ACCELERATION

PAR ANTIGENE ET PAR ZONE



CAP VERT
  AUTRE URBAIN
  RURAL
  SENEQAL

# COMPARAISON DE LA COUVERTURE VACCINALE

12-23 MOIS 7/84-87

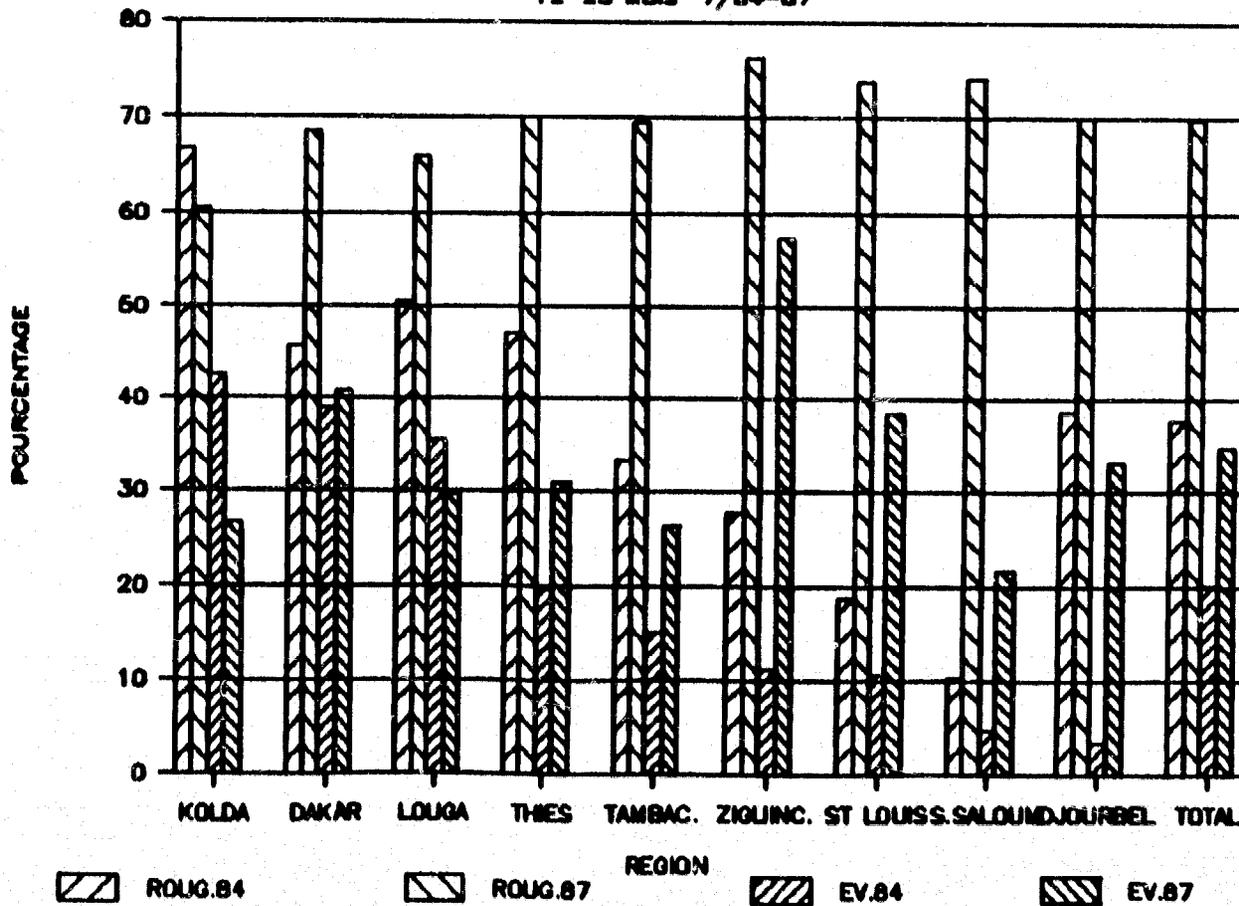


Tableau 1 : Poids des différents départements

Département	Population en 1976	Nb enfants 12-23 mois	Nb vus	taux de sondage	Poids du département
Dakar	518513	31900	212	6.65	3.12
Pikine	301739	18563	210	11.31	1.82
Rufisque	125417	7716	202	26.18	0.75
Bignona	150179	9239	226	24.46	0.90
Oussouye	27880	1715	209	121.87	0.17
Ziguinchor	104703	6441	215	33.38	0.63
Bambey	154731	9519	212	22.27	0.93
Diourbel	144057	8862	211	23.81	0.87
Mbacké	121749	7490	208	27.77	0.73
Dagana-S.Louis	202367	12450	214	17.19	1.22
Matam	169024	10398	222	21.35	1.02
Podor	138887	8544	213	24.93	0.84
Bakel	86011	5291	0	0.00	2.52
Kedougou	61688	3795	215	56.65	0.37
Tambacounda	126123	7759	215	27.71	0.76
Kaffrine	238096	14648	224	15.29	1.43
Kaolack	210260	12935	216	16.70	1.26
Nioro du Rip	131265	8075	218	27.00	0.79
Mbour	186558	11477	211	18.38	1.12
Thiès	255388	15712	204	12.98	1.54
Tivaouane	227875	14019	207	14.77	1.37
Kebemer	153084	9418	218	23.15	0.92
Linguere	92165	5670	216	38.10	0.55
Louga	169440	10424	223	21.39	1.02
Fatik	169749	10443	220	21.07	1.02
Foundiougne	102484	6305	217	34.42	0.62
Gossas	132013	8121	217	26.72	0.79
Kolda	123887	7621	213	27.95	0.75
Sedhiou	196329	12078	212	17.55	1.18
Velingara	91132	5606	216	38.53	0.55
Ensemble	4912793	302250	6216	20.57	29.56

Tableau 2 : Proportions d'enfants vaccinés selon l'antigène et le département (chiffres bruts d'après les cartes présentées, pour 100 enfants enquêtés)

Département	BCG	DTCP	ROUGEOLE	FIEVRE JAUNE	ENFANT COMPLET. VACCINE	ENFANT LOGIQT VACCINE
Dakar	94	62	59	68	41	42
Pikine	92	50	55	61	34	36
Rufisque	94	57	64	73	43	45
Bignona	96	65	71	85	50	62
Oussouye	97	75	70	88	55	63
Ziguinchor	98	77	80	90	67	76
Bambey	88	52	72	76	42	61
Diourbel	91	41	59	65	31	44
Mbacké	88	35	62	66	28	48
Dagana-S.Louis	93	52	67	75	36	51
Matam	91	52	73	78	48	64
Podor	89	38	71	73	31	46
Kedougou	89	30	66	77	19	40
Tambacounda	92	48	67	73	33	55
Kaffrine	91	39	78	83	32	51
Kaolack	93	40	66	75	31	48
Nioro du Rip	86	26	64	74	20	45
Mbour	95	46	57	67	32	46
Thiès	95	46	65	75	30	53
Tivaouane	93	39	68	75	31	58
Kebemer	89	32	60	65	24	42
Linguere	85	35	55	59	26	45
Louga	88	52	60	69	39	54
Fatick	85	45	66	78	33	51
Foundiougne	88	41	70	82	35	57
Gossas	89	53	62	74	38	52
Kolda	92	29	53	65	23	41
Sedhiou	96	45	52	70	28	48
Vélingara	94	38	60	73	29	45
Cap vert	93	57	59	67	39	41
Urbain	93	48	64	74	37	52
Rural	90	44	65	73	34	52
Sénégal	92	47	63	72	35	50

Tableau 3 : Approximations de la couverture vaccinale selon l'antigène et le département (valeurs nettes compte tenu des cartes non présentées parmi les enfants ayant la cicatrice du BCG; / 100 enfants de statut vaccinal connu)

Département	BCG	DTCP	ROUGEOLE	FIEVRE JAUNE	ENFANT COMPLET. VACCINE	N
Dakar	97	75	69	80	48	212
Pikine	92	64	67	74	41	210
Rufisque	94	64	71	80	47	202
Bignona	97	69	74	89	53	226
Oussouye	98	78	73	92	57	209
Ziguinchor	98	80	82	92	68	215
Bambey	89	55	75	79	43	212
Diourbel	91	47	66	73	35	211
Mbacké	88	44	70	75	32	208
Dagana-S.Louis	93	58	72	81	38	214
Matam	91	56	77	82	50	222
Podor	90	43	71	73	35	213
Kedougou	89	33	66	77	21	215
Tambacounda	93	53	73	80	36	215
Kaffrine	91	44	78	83	35	224
Kaolack	93	47	74	85	35	216
Nioro du Rip	87	29	70	81	21	218
Mbour	96	53	65	76	36	211
Thiès	95	46	71	82	33	204
Tivaouane	94	43	73	82	33	207
Kebemer	93	37	66	71	26	218
Linguere	85	41	64	70	30	216
Louga	89	58	67	76	43	223
Fatick	85	45	67	78	33	220
Foundiougne	88	44	74	87	37	217
Gossas	90	57	68	81	41	217
Kolda	92	32	58	58	25	213
Sedhiou	96	50	58	78	31	212
Vélingara	94	43	65	79	31	216
Cap vert	94	68	69	78	45	624
Urbain	93	54	70	82	40	1191
Rural	92	48	70	80	36	4411
Sénégal	92	53	70	79	38	6216

Tableau 4 : Pourcentage d'enfants complètement ou logiquement vaccinés selon le département (chiffres bruts d'après les cartes présentées, pour 100 enfants enquêtés)

Département	jamais vacciné	BCG + ROUGEOLE + F. JAUNE				incomplè- tement vacciné	NSP	total
		3DTCP	3DTC + 3PO	2DTCP +DTC	2DTCP			
Dakar	2.8	13.7	27.4	0.0	0.9	41.5	13.7	100
Pikine	6.2	8.1	26.2	0.0	1.9	40.5	17.1	100
Rufisque	5.0	7.4	35.6	0.0	2.0	41.6	8.4	100
Bignona	2.2	9.7	0.0	41.2	11.1	31.4	4.4	100
Oussouye	1.9	22.5	0.0	32.5	8.1	31.1	3.8	100
Ziguinchor	1.9	10.2	0.0	56.3	9.3	19.5	2.8	100
Bambey	9.0	0.0	0.0	41.5	19.3	26.9	3.3	100
Diourbel	3.8	1.9	0.0	29.4	12.8	41.2	10.9	100
Mbacké	6.7	0.5	0.0	27.9	19.2	34.6	11.1	100
Dagana-S.Louis	3.7	21.5	1.4	12.6	15.9	38.8	6.1	100
Matam	8.6	16.7	0.0	31.1	15.8	23.4	4.5	100
Podor	7.5	10.3	2.4	18.3	14.6	35.2	11.7	100
Kedougou	10.2	11.6	0.0	7.4	20.5	40.9	9.3	100
Tambacounda	6.1	21.9	0.0	11.2	21.9	30.2	8.8	100
Kaffrine	4.6	11.2	0.0	20.5	19.2	34.4	10.3	100
Kaolack	4.6	8.3	0.5	22.7	16.7	37.5	9.7	100
Nioro du Rip	6.9	12.4	0.0	7.3	25.7	40.4	7.3	100
Mbour	2.8	19.4	5.2	7.6	13.7	40.3	10.9	100
Thiès	2.9	19.6	0.5	10.3	22.6	35.8	8.3	100
Tivaouane	3.4	20.3	0.0	10.6	27.5	30.9	7.3	100
Kebemer	4.1	6.9	0.0	17.4	17.4	46.3	7.8	100
Linguere	14.8	9.3	0.0	16.7	19.0	26.9	13.4	100
Louga	10.3	13.0	0.0	26.0	15.3	25.6	9.9	100
Fatik	10.5	7.3	0.0	25.5	18.6	37.3	0.9	100
Foundiougne	6.9	7.4	1.4	25.8	22.1	30.9	5.5	100
Gossas	8.3	6.0	0.0	31.8	14.3	31.8	7.8	100
Kolda	5.2	3.3	0.5	18.8	18.3	45.1	8.9	100
Sedhiou	2.8	10.9	0.5	17.0	19.3	39.6	9.9	100
Vélingara	4.2	6.5	0.0	22.2	16.7	43.1	7.4	100
Cap-vert	4.7	9.8	29.7	0.0	1.6	41.2	13.1	100
Urbain	5.2	14.5	0.7	21.4	15.4	33.7	9.1	100
Rural	6.1	10.2	0.4	23.1	18.0	34.8	7.4	100
Sénégal	5.4	11.4	5.8	17.5	14.8	36.0	9.1	100

**Tableau 5 : Répartition des enfants incomplètement vaccinés selon l'antigène et la zone de résidence.**

Rougeole	DTCP complets		DTCP incomplets		ensemble
	BCG+FJ complets	BCG+FJ incomplets	BCG+FJ complets	BCG+FJ incomplets	
CAP VERT					
Valide	0	12	69	5	86
Invalide	45	10	11	3	69
Non faite	3	26	1	35	65
Ensemble	48	48	81	43	220
URBAIN					
Valide	0	13	92	15	120
Invalide	84	9	46	9	148
Non faite	2	21	0	75	98
Ensemble	86	43	138	99	366
RURAL					
Valide	0	26	373	77	476
Invalide	240	32	145	35	452
Non faite	4	109	2	349	464
Ensemble	244	167	520	461	1392
ENSEMBLE					
Valide	0	51	534	97	682
Invalide	369	51	202	47	669
Non faite	9	156	3	459	627
Ensemble	378	258	739	603	1978

Tableau 06 : Répartition des vaccinations selon l'antigène et la période de vaccination. FEV du Sénégal, 1987.

Antigène	avant la phase d' accélération (72 semaines)	pendant la phase d' accélération (20 semaines)	après la phase d' accélération (12 semaines)	contribution relative de la campagne
Cap - Vert				
BCG	354	96	2	.88
DTCP1	369	120	1	.92
DTCP2	262	193	7	1.22
DTCP3	123	222	17	2.04
Rougeole	146	278	16	2.09
Fièvre Jaune	129	279	16	2.28
Urbain				
BCG	533	345	8	1.15
DTCP1	543	424	5	1.24
DTCP2	341	485	25	1.73
DTCP3	112	399	66	3.57
Rougeole	236	641	24	2.64
Fièvre Jaune	226	637	26	2.72
Rural				
BCG	902	2467	43	2.62
DTCP1	987	2641	37	2.57
DTCP2	274	2727	139	7.93
DTCP3	38	1644	293	35.98
Rougeole	471	2729	118	4.88
Fièvre Jaune	453	2723	121	5.04

Tableau 7 : Statut vaccinal a la veille de la campagne des enfants de l'enquete ayant alors 12 mois ou plus

ANTIGENE	CAP VERT	AUTRE URBAIN	RURAL	SENEGAL
BCG	62.6	49.9	25.1	33.4
DTC 1	66.7	51.8	29.2	37
DTC 2	54.3	40.6	10.8	20.7
DTC 3	32.9	18	1.4	7.6
POLIO 1	63.5	50.6	28.2	35.9
POLIO 2	50.7	39.7	10.4	19.9
POLIO 3	42.9	13.9	1.1	7.6
ROUGEOLE	37.9	28.2	15.3	20
FIEVRE JAUNE	41.1	34.6	18.7	23.9
ECHANTILLON	219	411	1572	2202

Tableau 8a : Répartition des enfants vaccinés au moins 1 fois, selon le nombre de séances de vaccination et le nombre de séances bien faites.

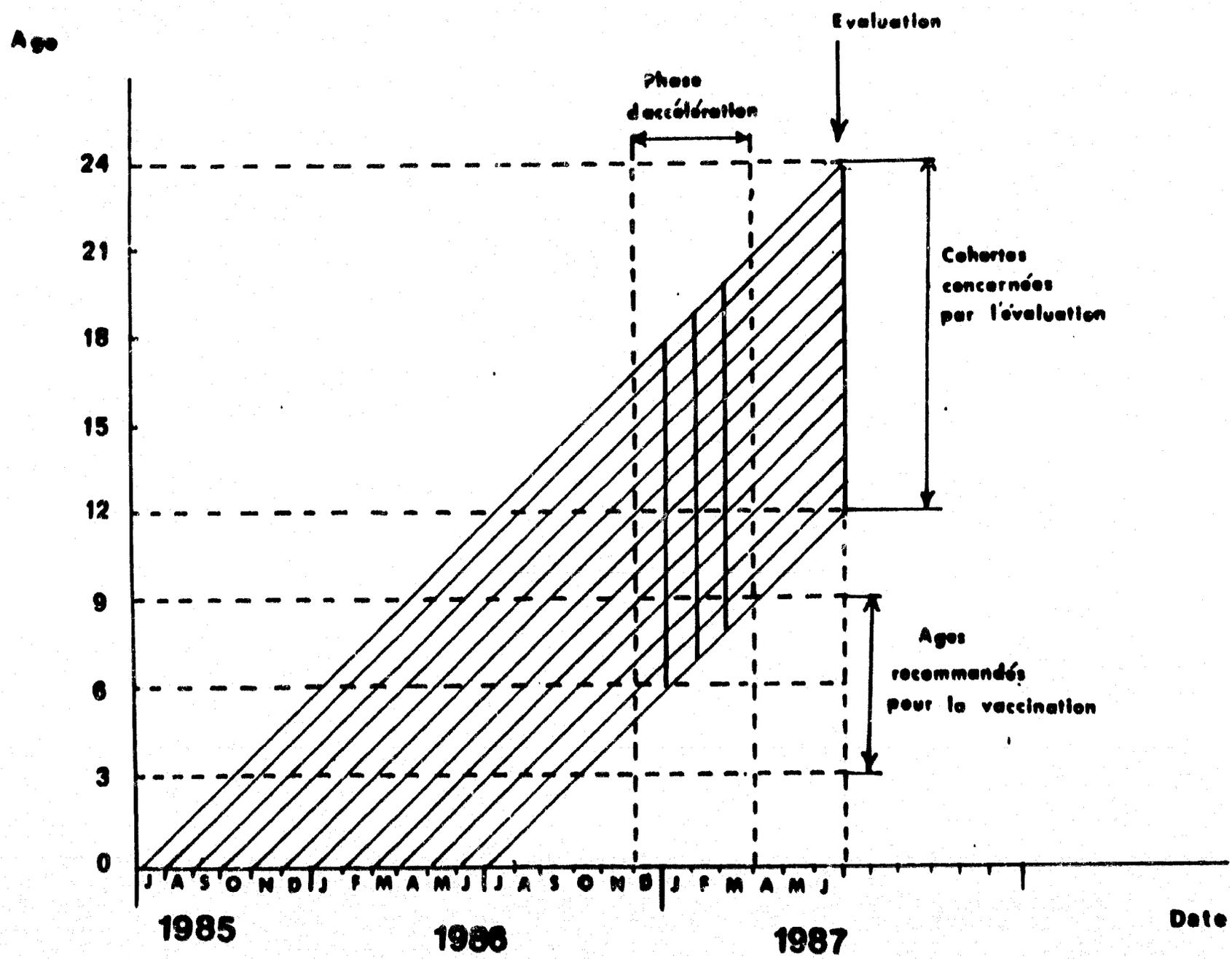
Nombre de séances faites	Nombre de séances bien faites					Total	% Bien faites	% tout Bien faites
	0	1	2	3	4			
1	389	317				706	44.9	44.9
2	467	314	528			1309	64.3	40.3
3	324	477	706	1018		2525	87.2	40.3
4	64	120	183	253	23	643	90.0	3.6
5	6	14	32	57	26	135	95.6	0.0
6	2	0	1	6	1	10	80.0	0.0
Ensemble	1252	1242	1450	1334	50	5328	76.5	35.0

Tableau 8b : Répartition des séances de vaccination selon le nombre et leur qualité. PEV du Sénégal, 1987.

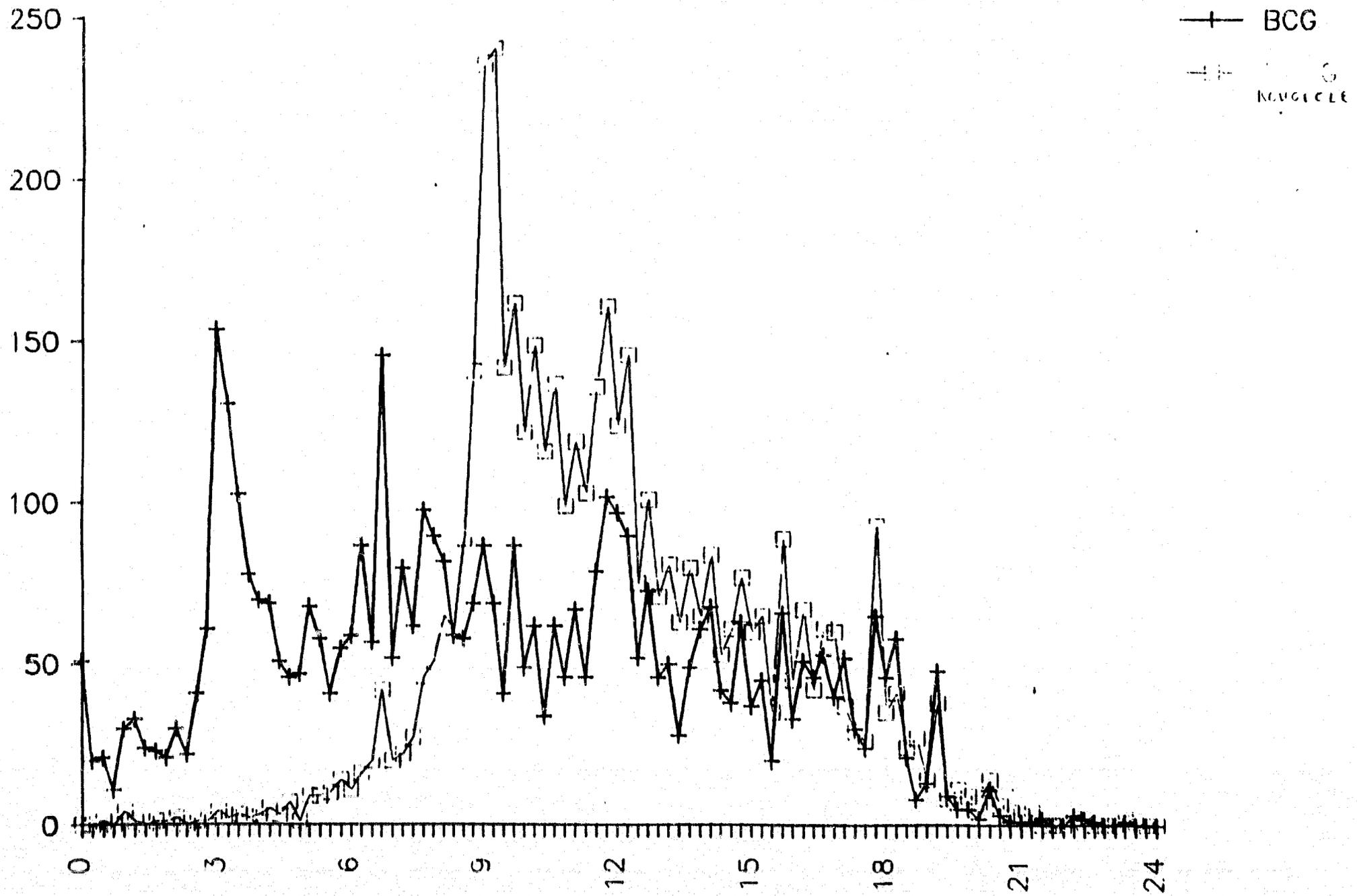
	Nombres de séances	% bien faites	% toutes bien faites
Dakar	511	80.6 (412)	28.2 (144)
Urbain	1007	78.0 (785)	32.6 (328)
Rural	3810	75.1 (2879)	37.3 (1414)
Ensemble	5328	76.5 (4076)	35.0 (1886)

Tableau 9 : Couverture vaccinale selon l'antigène et le mois de naissance, PEV du Sénégal, 1987.

Mois de naissance	N	BCG	DTCP	ROUG- EOLE	FIEVRE JAUNE	ECV	% ROUG invalide
Jul 85	570	89.0	46.7	78.8	83.3	39.7	7.5
Aug 85	542	90.9	50.1	79.3	83.4	38.7	7.9
Sep 85	491	92.4	53.9	80.1	85.9	42.9	8.2
Oct 85	500	91.6	53.6	80.9	84.4	45.2	5.5
Nov 85	405	92.8	52.8	78.6	83.2	41.5	8.8
Dec 85	523	90.3	51.4	82.2	83.9	41.8	5.9
Jan 86	586	93.5	51.7	84.6	86.1	44.1	4.4
Fev 86	468	93.7	47.1	80.0	83.6	40.0	8.1
Mar 86	500	92.4	55.5	70.5	83.0	42.0	15.9
Avr 86	479	92.7	54.8	54.8	78.9	34.9	31.7
Mai 86	551	92.7	46.5	48.1	70.1	26.3	33.9
Jun 86	601	92.0	50.6	39.3	57.1	22.3	50.2
Ensemble	6216	92.0	51.3	69.9	79.8	38.2	15.0



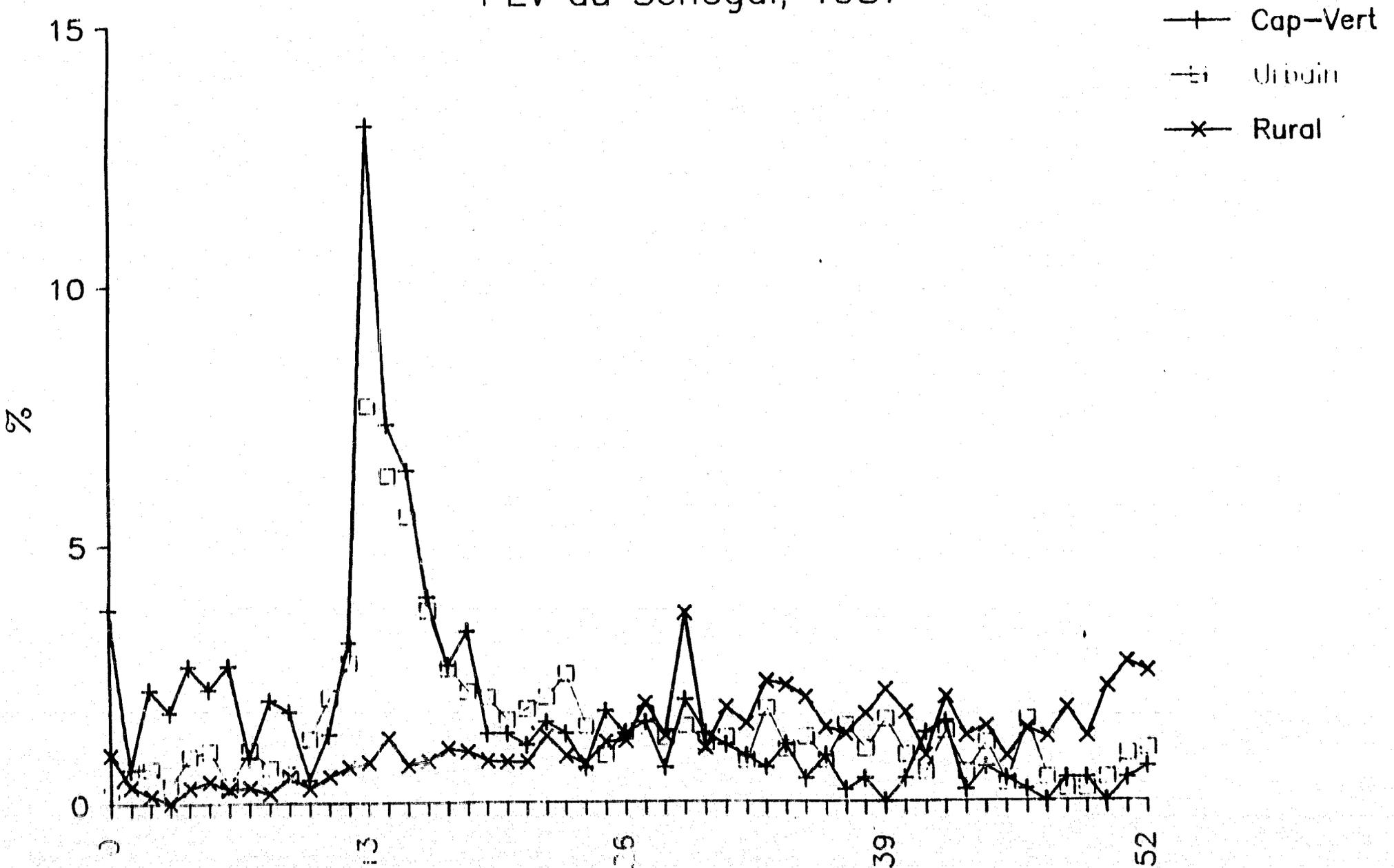
# REPARTITION DES VACCINS SELON L'AGE



Age en mois

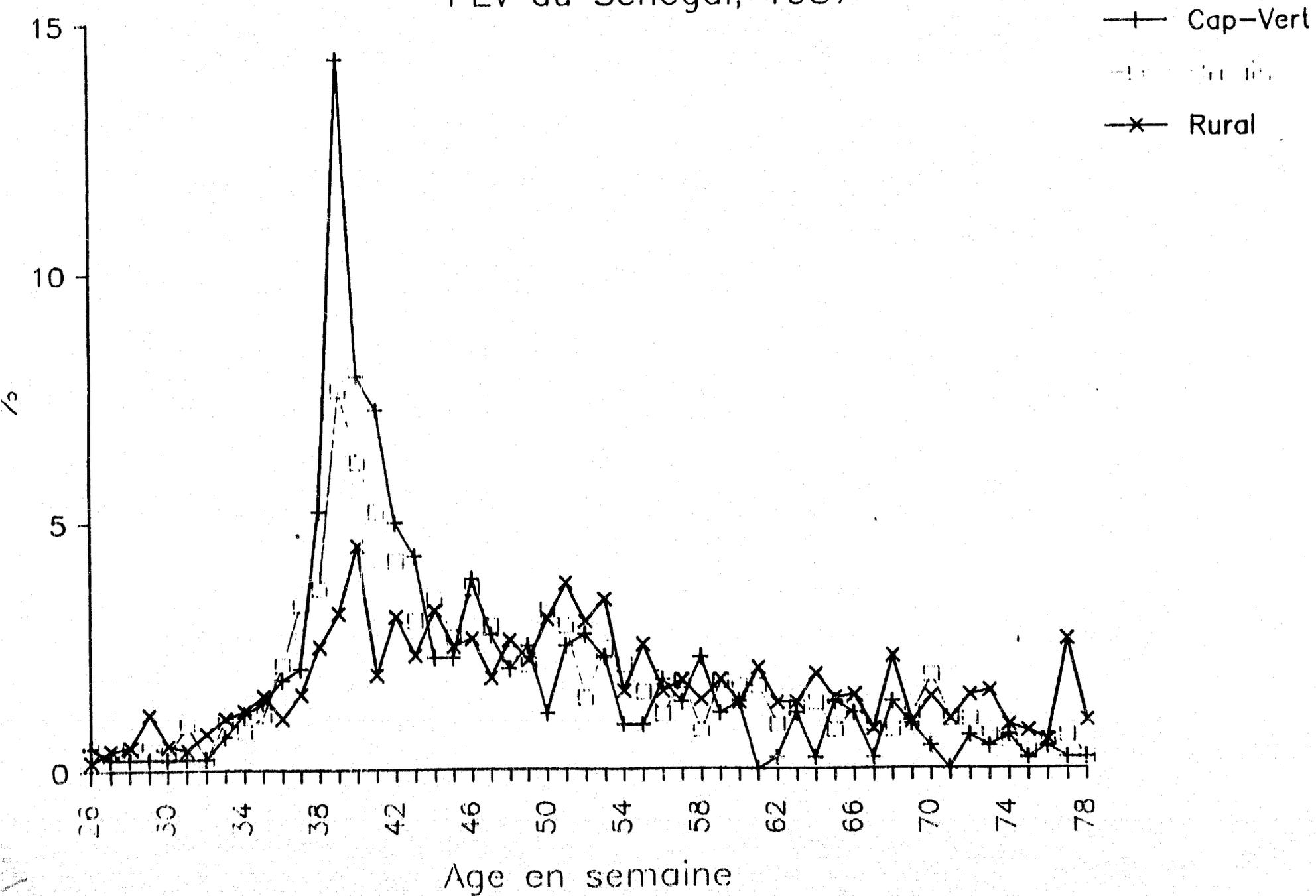
# AGE A LA VACCINATION BCG

PEV du Senegal, 1987



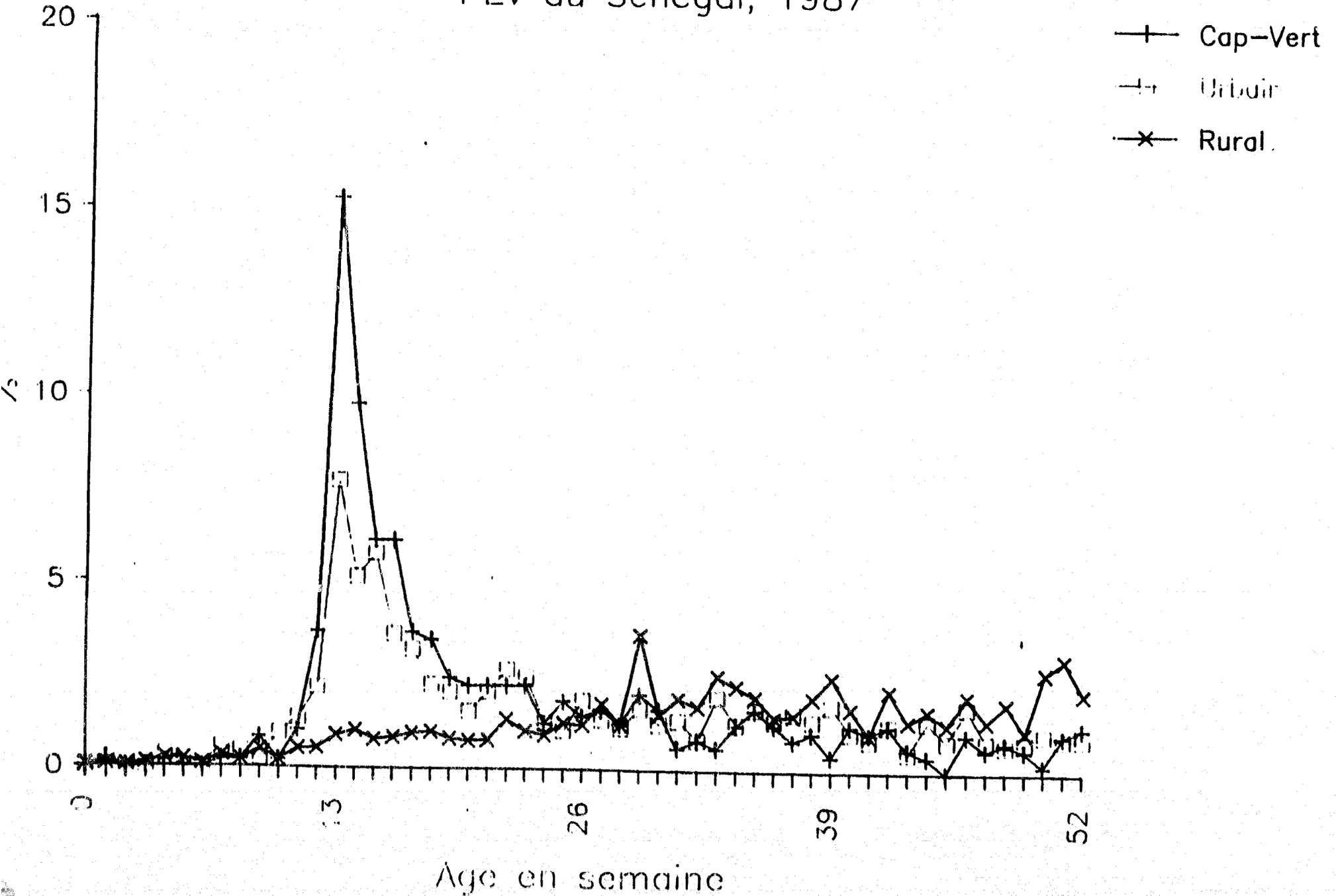
# AGE A LA VACCINATION ROUGEOLE

PEV du Senegal, 1987



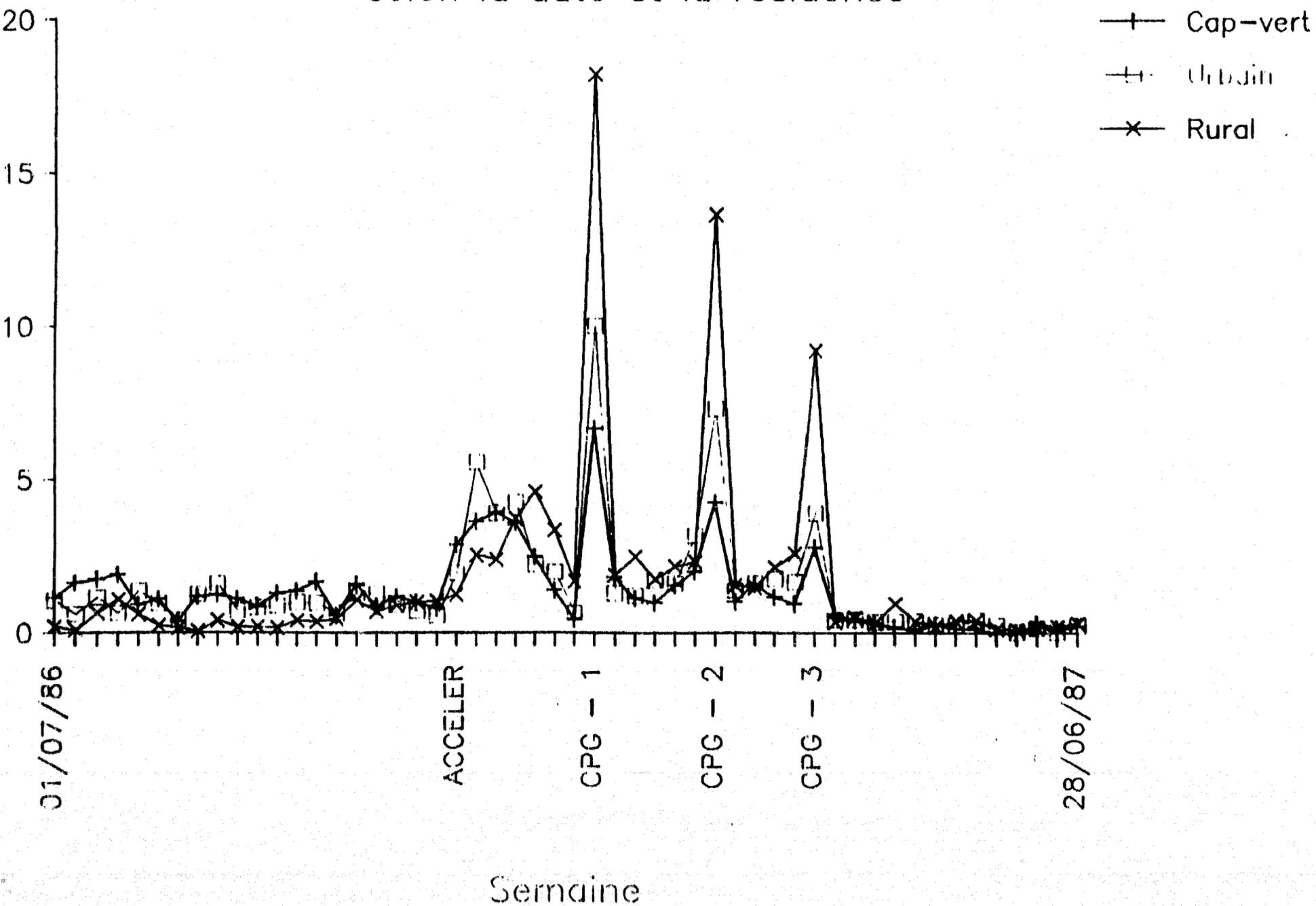
# AGE A LA VACCINATION DTC-P1

## PEV du Senegal, 1987



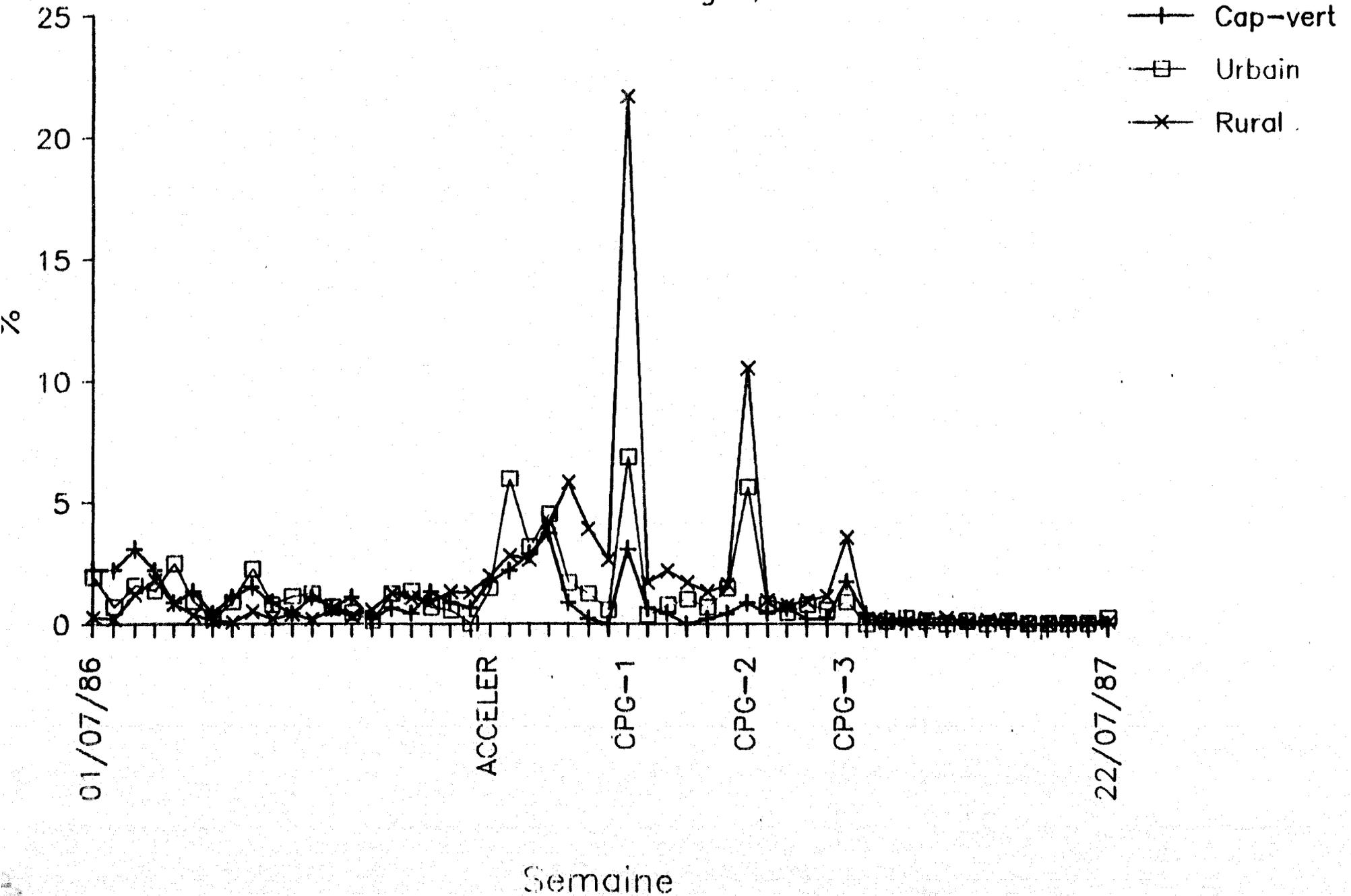
# DISTRIBUTION DES VACCINATIONS

selon la date et la residence



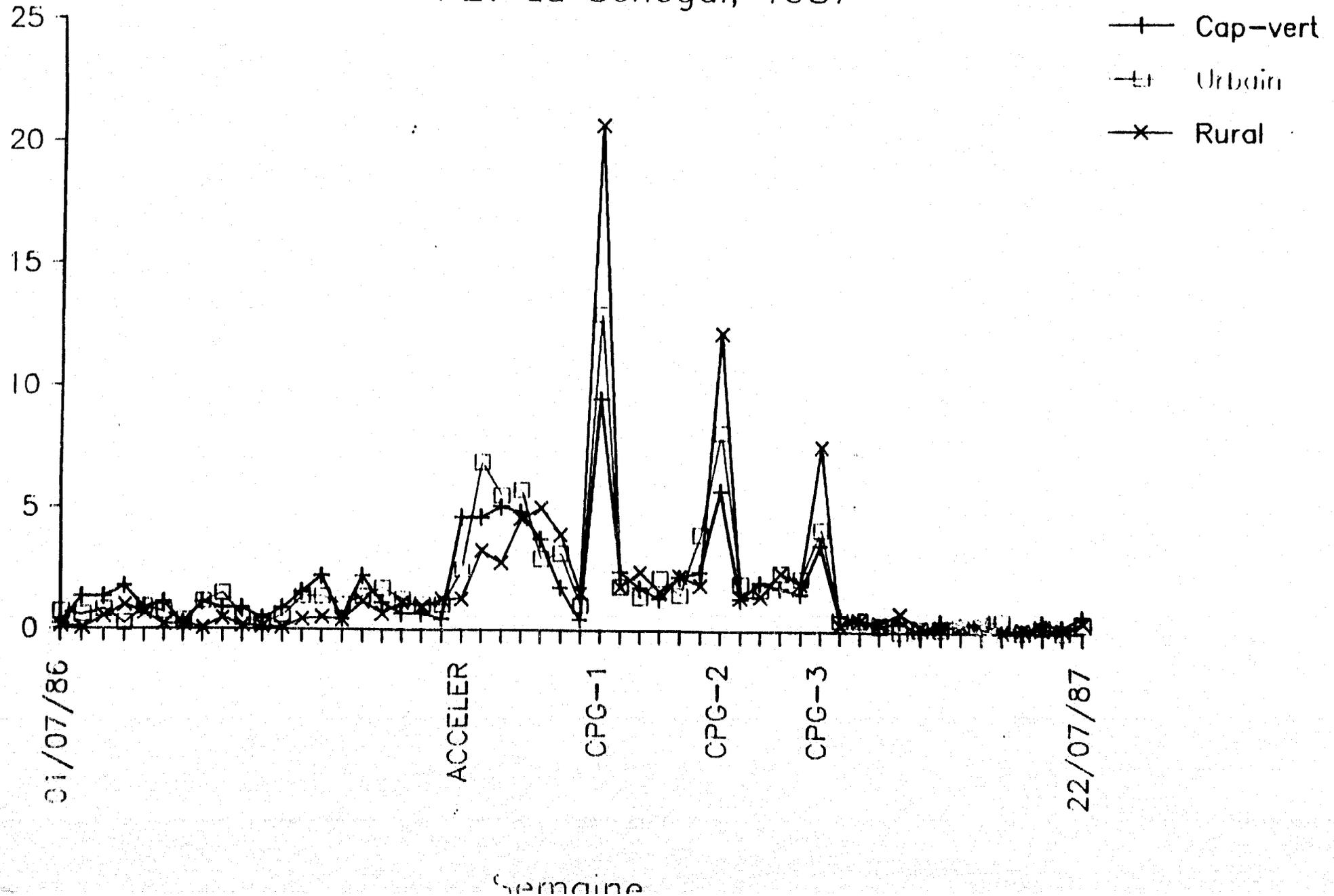
# VACCINS BCG SELON LA DATE ET LA RESIDENCE

PEV du Senegal, 1987



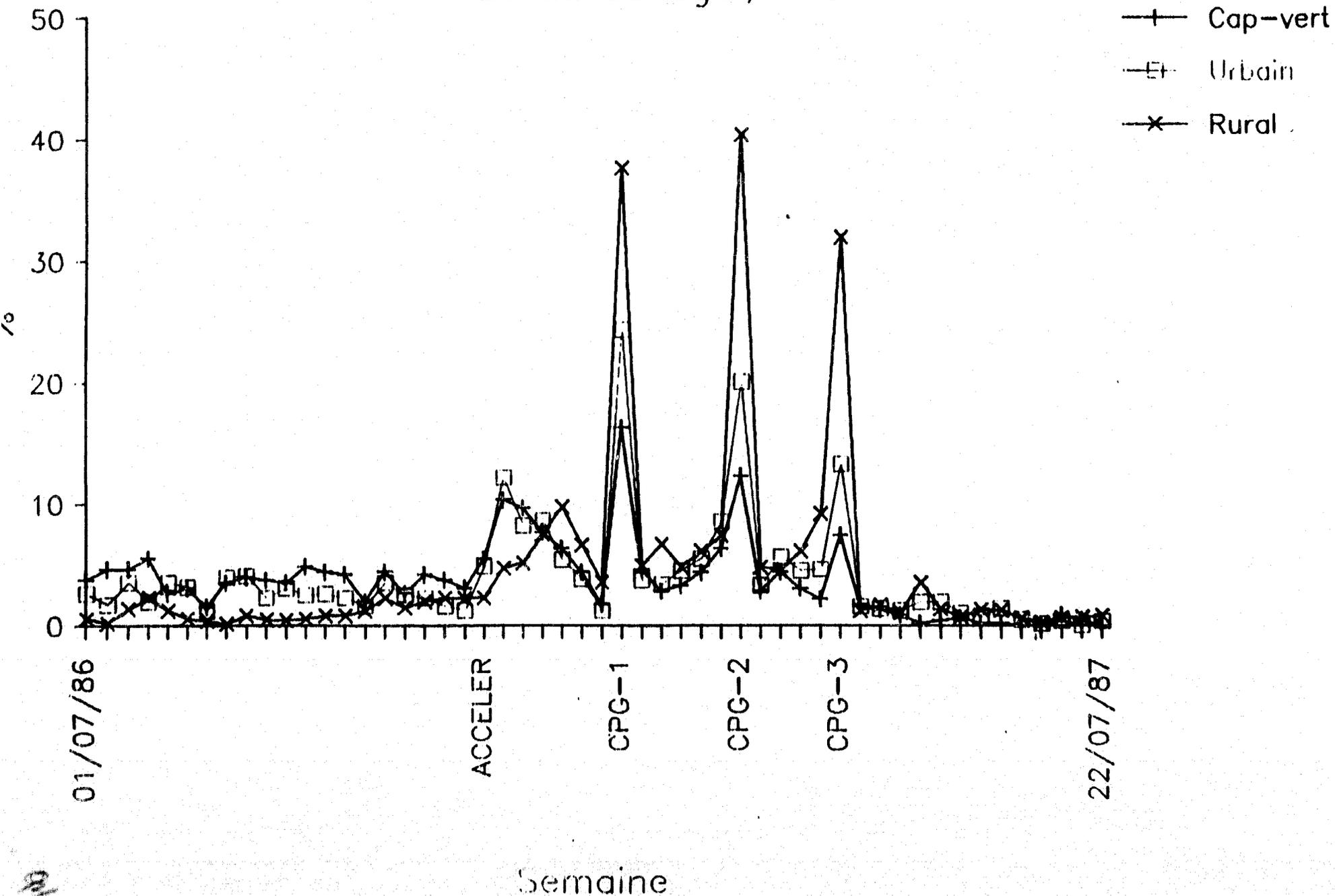
# VACCINS ROUGEOLE SELON LA DATE ET LA RESIDE

PEV du Senegal, 1987



# VACCINS DTCP SELON LA DATE ET LA RESIDENCE

PEV du Senegal, 1987



Liste des enregistrements, PEV-SEN

RG d GR NO dat-nais e CC date-BCG B D-DTCP1 1 d-DTCP2 2 D DTCP3 3 D-ROUGEL R D-FV. JN. F LCV

\*\* GR 08

01 1 08 7 03/09/85 1 1 15/10/85 1 03/01/86 3 05/03/86 3 29/10/86 3 21/06/86 1 21/06/86 1 2

\*\* GR 09

01 1 09 1 19/02/86 1 1 16/05/86 1 16/05/86 3 18/08/86 3 19/11/86 3 / / 0 22/11/86 1 8

01 1 09 2 09/03/86 1 1 27/06/86 1 27/06/86 3 09/09/86 3 09/12/86 3 13/12/86 1 13/12/86 1 2

01 1 09 3 09/08/85 1 1 03/01/86 1 03/01/86 3 03/06/86 3 / / 0 07/06/86 1 07/06/86 1 8

01 1 09 4 23/04/86 1 1 22/07/86 1 22/07/86 3 28/10/86 3 24/01/87 3 24/01/87 1 24/01/87 1 2

01 1 09 5 09/10/85 2 1 / / 1 / / 9 / / 9 / / 9 / / 9 9

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01 1 09 8 16/11/85 1 1 25/02/86 1 25/02/86 3 19/08/86 3 / / 0 06/09/86 1 06/09/86 1 8

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\*\* GR 10

01 1 10 1 13/05/86 1 1 26/09/86 1 26/09/86 3 26/11/86 3 05/01/87 3 06/02/87 8 06/02/87 1 8

01 1 10 2 15/03/86 1 1 01/07/87 1 27/03/87 3 / / 0 / / 0 27/03/87 1 27/03/87 1 8

01 1 10 3 06/08/85 1 1 29/11/85 1 29/11/85 3 07/05/86 3 27/04/87 3 10/05/86 1 10/05/86 1 2

01 1 10 4 08/08/85 1 1 12/11/85 1 15/11/85 2 13/03/86 2 14/04/86 2 17/05/86 1 / / 0 8

01 1 10 5 15/12/85 1 1 08/04/86 1 08/04/86 3 08/07/86 3 23/12/86 3 23/12/86 1 23/12/86 1 2

01 1 10 6 02/11/85 1 1 09/12/86 1 09/12/86 3 10/01/87 3 12/02/87 3 13/12/86 1 13/12/86 1 2

01 1 10 7 11/01/86 1 1 23/05/86 1 23/05/86 3 18/07/86 3 24/11/86 3 / / 0 / / 0 8

\*\* GR 11

01 1 11 1 26/01/86 1 1 12/03/86 1 07/05/86 1 25/07/86 1 19/11/86 1 19/11/86 1 19/11/86 1 1

01 1 11 2 03/02/86 1 1 01/07/87 1 27/11/86 1 22/12/86 1 06/02/87 1 27/11/86 1 27/11/86 1 1

01 1 11 3 07/01/86 1 1 28/01/86 1 10/05/86 2 10/06/86 2 10/07/86 2 12/08/86 8 / / 0 8

01 1 11 4 27/11/85 1 1 03/02/86 1 03/03/86 1 26/05/86 1 01/09/86 1 01/09/86 1 01/09/86 1 1

01 1 11 5 11/11/85 0 1 / / 1 / / 9 / / 9 / / 9 / / 9 9

**APPENDIX D**

**Additional Cost Information on the EPI**

**COSTS OF THE ACCELERATION PHASE FOR THE  
EXPANDED PROGRAMME ON IMMUNIZATION IN SENEGAL  
OCTOBER 1986-APRIL 1987 (1987 \$)**

CATEGORY	MINISTRY OF PUBLIC HEALTH	OTHER MINISTRIES	TOTAL GOVERNMENT	UNICEF	CRS	WORLD VISION	TOTAL DONOR	TOTAL COST
<b>A. SALARIES</b>	460,078 <sup>1</sup>	227,000 <sup>2</sup>	687,150	212,753 <sup>3</sup>	408 <sup>4</sup>	111,000 <sup>5</sup>	223,191	910,341
<b>B. VACCINES</b>	17,422 <sup>6</sup>	0	17,422	1,724,703 <sup>7</sup>	0	0	1,724,703	1,742,125
<b>C. TRANSPORTATION</b>	50,767 <sup>8</sup>	10,800 <sup>9</sup>	61,569	820,413 <sup>10</sup>	883 <sup>11</sup>	1,396 <sup>12</sup>	822,692	884,261
<b>D. MEDIA</b>	0	488,076 <sup>13</sup>	488,076	0	0	0	0	488,076
<b>E. SUPPLIES</b>								
Vaccination	0	0	0	145,661 <sup>14</sup>	0	5,000 <sup>15</sup>	150,661	150,661
Audio-Visual	0	0	0	5,336 <sup>16</sup>	0	0	5,336	5,336
Training	0	0	0	18,045 <sup>17</sup>	0	0	18,045	18,045
Butane	0	0	0	70,100 <sup>18</sup>	0	0	70,100	70,100
Mobilization	0	0	0	160,648 <sup>19</sup>	0	0	160,648	160,648
Evaluation	0	0	0	632 <sup>20</sup>	0	0	632	632
Cold Chain	0	0	0	15,781 <sup>21</sup>	0	0	15,781	15,781
Subtotal	0	0	0	416,203	0	5,000	421,203	421,203
<b>F. OVERHEAD COSTS</b>	92,016 <sup>22</sup>	45,416 <sup>23</sup>	137,432	46,857 <sup>24</sup>	88 <sup>25</sup>	2,000 <sup>26</sup>	48,945	186,377
<b>G. COLD CHAIN MAIN</b>	0	0	0	11,379 <sup>27</sup>	0	0	11,379	11,379
<b>SUBTOTAL RECURRENT</b>	620,205	771,372	1,391,657	3,232,388	1,409	10,396	3,252,193	4,647,044
<b>A. BUILDINGS</b>	28,671 <sup>28</sup>	0	28,671	0	0	0	0	28,671
<b>B. VEHICLES</b>	19,534 <sup>29</sup>	5,023 <sup>30</sup>	24,557	189,561 <sup>31</sup>	110 <sup>32</sup>	367 <sup>33</sup>	190,038	214,595
<b>C. EQUIPMENT</b>								
Cold Chain	0	0	0	30,140 <sup>34</sup>	0	0	30,140	30,140
Vaccination	0	0	0	50,446 <sup>35</sup>	0	0	50,446	50,446
Audio-Visual	0	0	0	7,815 <sup>36</sup>	0	0	7,815	7,815
Other	0	0	0	3,057 <sup>37</sup>	0	0	3,057	3,057
Subtotal	0	0	0	91,458	0	0	91,458	91,458
<b>SUBTOTAL INVESTMENT</b>	48,205	5,023	53,228	201,019	110	367	201,486	254,722
<b>II. TOTAL COSTS</b>	668,410	776,395	1,444,805	3,513,407	1,519	10,763	3,513,689	4,978,522

Footnotes to Table 4

<sup>1</sup>Based on the product of the average annual salaries for health workers, proportion of annual time spent on the Acceleration Phase and numbers of personnel. Proportion of time for health workers estimated on basis of seven full-time working weeks of the year or 35 days/220 days = 15 percent. Administration time was estimated through interviews. Salary estimates for health workers were taken from MOSP records, and for administration officials from interviews.

<sup>2</sup>Calculated in a similar manner as Footnote 1 above. The costs of coordinating committee personnel, communications personnel, ministries of decentralization, youth and sports, social development and education, and governors time are included. Costs were not estimated for the national army, religious leaders, village chiefs, and school teachers.

<sup>3</sup>Cost of UNICEF consultants, staff, and MOH salaries paid by UNICEF based on UNICEF records.

<sup>4</sup>Cost of supervisors time, based on interviews.

<sup>5</sup>Cost of supervisors time, based on interviews.

<sup>6</sup>Represents 1% of total vaccine costs, commensurate with traditional procurement patterns in Senegal.

<sup>7</sup>Represents 99% of total vaccine costs which were calculated based on number of doses administered and estimated wastage for each vaccine type.

<sup>8</sup>Based on two additional expenditures made by the MOH for fuel of 100,000,000 CFA and 6,500,000 CFA.

<sup>9</sup>Estimated expenditure by the Ministry of Social Development, Decentralization, and Youth and Sports of 4500 CFA (500 liters per each of 9 regions) for fuel at 260 CFA/liter.

<sup>10</sup>From UNICEF expenditure records.

<sup>11</sup>Based on CRS records during Acceleration for fuel.

<sup>12</sup>Based on World Vision records during the Acceleration for fuel.

<sup>13</sup>Estimated imputed value for all television and radio transmissions and printing of newspaper articles. Figures based on average cost/transmission or article for publicity multiplied by estimated length and frequency of broadcasts. For journal articles, the length (in words) of each article was counted, the size of the article determined and multiplied by the average cost of running an advertisement of the same size.

<sup>14</sup>From UNICEF records, and includes cost of syringes, needles, alcohol, etc. Assumed all supplies used during the Acceleration.

<sup>15</sup>From World Vision records.

<sup>16</sup>From UNICEF records and includes cost of batteries, cassettes, and other AV supplies.

<sup>17</sup>From UNICEF records and includes paper, pens, binders and other workshop material.

<sup>18</sup>From UNICEF CCFs for expenditures for butane and kerosene to run the cold chain equipment.

<sup>19</sup>From UNICEF SCFs and CCFs and includes cost of producing television spots and gifts during social mobilization campaign.

<sup>20</sup>Includes supplies for evaluation from CCFs.

<sup>21</sup>Includes cost for small cold chain supplies such as thermometers, cold dogs, and monitoring sheets, which were based on CCFs and SCFs.

<sup>22</sup>Estimated at 20% the cost of personnel based on interviews (similar to other rates found in West African countries).

<sup>23</sup>22

<sup>24</sup>Estimated as 20 percent of staff salaries plus \$11,058 from direct operating expenditures in rent, utilities and cleaning of EPI headquarters.

<sup>25</sup>22

<sup>26</sup>22

<sup>27</sup>Estimated from UNICEF CCFs.

<sup>28</sup>From an average construction cost of a health center 120,000,000 CFA (from interviews), a useful life of 25 years, proportion of time of 15 percent, and number of centers (127), plus the average construction cost of a health post of 1,000,000, the number of health posts (562), proportion of time of 15 percent, and average useful life of 25 years.

<sup>29</sup>Based on 9 vehicles for supervision per region at an average cost of 2,300,000 (from USAID and UNICEF records), an average useful life of 4 years, and use of 25 percent of the year for delivery of supplies, vaccine delivery, and evaluation and supervising, plus 2 vehicles at the central level.

<sup>30</sup>29

<sup>31</sup>Based on UNICEF SCFs for all vehicles, trucks, land rovers, and mopeds purchased for the Acceleration, adjusted for a useful life of 4 years.

<sup>32</sup>Based on CRS records of the use of one vehicle.

<sup>33</sup>Based on World Vision estimates of use of one vehicle.

<sup>34</sup>Based on UNICEF SCFs for refrigerators, cold boxes, alarm systems, and spare parts, adjusted for useful life.

<sup>35</sup>Vaccination equipment includes ped-o-jets and trays which were purchased adjusting for useful life. Figures based on UNICEF SCFs.

<sup>36</sup>Figures based on UNICEF SCFs for video equipment, computer terminals, etc. for the social mobilization component.

<sup>37</sup>Other equipment includes office and medical equipment which were used, adjusting for useful life.

EXPENDITURES FOR THE ACCELERATION PHASE FOR THE  
EXPANDED PROGRAMME ON IMMUNIZATION IN SENEGAL  
APRIL 1986-APRIL 1987 (1987 \$)

CATEGORY	MINISTRY OF PUBLIC HEALTH	OTHER MINISTRIES	TOTAL GOVERNMENT	UNICEF	CPS	WORLD VISION	TOTAL DONOR	TOTAL COST	PERCENT OF TOTAL
A. SALARIES	0	0	0	212,753	0	0	212,753	212,753	6%
B. VACCINES	0	0	0	1,045,805	0	0	1,045,005	1,045,805	30%
C. TRANSPORTATION	50,769	10,800	61,569	820,413	883	1,416	822,732	884,301	26%
D. MEDIA	0	0	0	0	0	0	0	0	0%
E. SUPPLIES									
Vaccination	0	0	0	145,661	0	5,000	150,661	150,661	4%
Audio-Visual	0	0	0	5,336	0	0	5,336	5,336	0%
Training	0	0	0	18,045	0	0	18,045	18,045	1%
Butane	0	0	0	70,100	0	0	70,100	70,100	2%
Mobilization	0	0	0	160,648	0	0	160,648	160,648	5%
Evaluation	0	0	0	632	0	0	632	632	0%
Cold Chain	0	0	0	15,781	0	0	15,781	15,781	0%
Subtotal	0	0	0	416,203	0	5,000	421,203	421,203	12%
F. OPERATING COSTS	0	0	0	11,058	0	0	11,058	11,058	0%
G. COLD CHAIN MAIN	0	0	0	11,379	0	0	11,379	11,379	0%
SUBTOTAL RECURRENT	50,769	10,800	61,569	2,517,611	883	6,436	2,524,930	2,586,499	75%
A. BUILDINGS	0	0	0	0	0	0	0	0	0%
B. VEHICLES	0	0	0	567,396	0	0	567,396	567,396	16%
C. EQUIPMENT									
Cold Chain	0	0	0	114,531	0	0	114,531	114,531	3%
Vaccination	0	0	0	153,588	0	0	153,588	153,588	4%
Audio-Visual	0	0	0	29,698	0	0	29,698	29,698	1%
Other	0	0	0	13,854	0	0	13,854	13,854	0%
Subtotal	0	0	0	311,671	0	0	311,671	311,671	9%
SUBTOTAL INVESTMENT	0	0	0	879,067	0	0	879,067	879,067	25%
II. TOTAL COSTS	50,769	10,800	61,569	3,396,678	883	6,436	3,403,997	3,465,566	100%

UNICEF EXPENDITURES FOR THE EPT

CATEGORY	ACCELERATION	PRE-ACCEL	TOTAL
<b>A. SALARIES</b>			
Staff	178,997.00	113,607.00	292,604.00
Consultants	12,245.00	0.00	12,245.00
MOH staff	21,511.00	21,511.00	43,022.00
Subtotal	212,753.00	135,118.00	347,871.00
<b>B. VACCINES</b>	1,045,805.00	508,002.00	1,553,807.00
<b>C. TRANSPORTATION</b>			
Air Freight	212,118.00	79,767.90	291,885.90
Customs	32,151.00	24,932.80	57,083.80
Per Diem	134,981.00		134,981.00
Vehicle Main	3,052.00		3,052.00
Fuel	438,111.00		438,111.00
Subtotal	820,413.00	104,700.70	925,113.70
<b>D. SUPPLIES</b>			
Vaccination	145,661.00	62,452.00	208,113.00
Audio-Visual	5,336.00	484.00	5,820.00
Training	18,045.00		18,045.00
Butane	70,100.00		70,100.00
Mobilization	160,648.00		160,648.00
Evaluation	632.00		632.00
Cold Chain	15,781.00	11,904.00	27,685.00
Subtotal	416,203.00	74,840.00	491,043.00
<b>E. OVERHEAD COSTS</b>	46,857.40	22,721.40	69,578.80
<b>F. COLD CHAIN MAIN</b>	11,379.00		11,379.00
<b>G. SUBTOTAL RECURRENT</b>	<b>2,553,410.40</b>	<b>845,332.10</b>	<b>3,398,742.50</b>
<b>A. BUILDINGS</b>	0.00	0.00	0.00
<b>B. VEHICLES</b>	567,396.00	106,037.80	673,433.80
<b>C. EQUIPMENT</b>			
Vaccination	153,588.00	0.00	153,588.00
Cold Chain	114,531.00	203,933.73	318,464.73
Audio-Visual	29,698.00	0.00	29,698.00
General	13,854.00	0.00	13,854.00
Medical	0.00	4,148.10	4,148.10
Subtotal	311,071.00	208,081.83	519,152.83
<b>D. SUBTOTAL INVESTMENT</b>	<b>879,007.00</b>	<b>314,119.63</b>	<b>1,193,126.63</b>
<b>TOTAL EXPENDITURE (1987)</b>	<b>3,432,417.40</b>	<b>1,159,501.73</b>	<b>4,591,919.13</b>

TOTAL VACCINE COST FOR THE ACCELERATION PHASE  
(FOR THE 0-5 AGE GROUP)

VACCINE	DOSES GIVEN	COST PER DOSE	WASTAGE	VACCINE COST
MERSLES	664,670.00	0.13	1.33	114,921.44
POLIO	274,402.00	0.03	1.33	10,948.64
BCG	604,014.00	0.04	2.00	48,321.12
Y. FEVER	661,436.00	0.21	1.33	104,739.07
DPT	274,402.00	0.03	1.33	10,948.64
INMOVAX/TTCO	1,494,360.00	0.69	1.33	1,371,374.17
TT	71,546.00	0.01	1.33	951.56
TOTAL				1,742,204.65
TOTAL EPI				1,741,253.09
% EPI				0.99

Based on figures from UNICEF for 0-23 months, adjusted for age distribution

### Footnotes to Table 5

<sup>1</sup>Salaries for health workers (\$431,878) + 75% of MOH transportation cost (\$38,077) + buildings (\$28,671) + 75% of vehicles of MOH (\$14,651) = \$513,276.

<sup>2</sup>From figures for vaccine procurement.

<sup>3</sup>25 percent MOH level (\$12,692) + 25 percent of other ministry fuel (\$2,700) + 25 percent of MOH vehicles (\$4,884) + salaries for health administration (\$24,138) + salaries for governors (\$4,615) and the Coordinating Committee (\$4,215) = \$55,243.

<sup>4</sup>Media cost (\$488,076) + 75 percent of other ministry transport (\$8,100) + other ministry vehicles (\$5,023) + salaries of the Ministry of Social Development (\$159,231), Communications (\$13,403), Decentralization (\$43,615), and Health Education (\$4,062) = \$721,510. 5. Cost of vaccination supplies (\$145,661) + the cost of vaccination equipment (\$50,446) + cost of other equipment (\$3,057) + 50 percent the cost of fuel (\$213,450) + 25 percent the cost of airfreight (\$41,860) + the cost of ground transportation (\$600) + 50 percent the cost of vehicles (\$94,781) + the cost of vehicle maintenance (\$3,052) = \$552,907.

<sup>6</sup>Cost of vaccines, customs duties, and cost of air freight (\$44,677).

<sup>7</sup>Cost of cold chain supplies (\$17,781) + cost of cold chain equipment (\$30,140) + cost of butane (\$70,100) + cost of cold chain maintenance (\$11,379) + 50 percent of air freight (\$83,721) = \$211,121.

<sup>8</sup>Cost of training supplies (\$18,045), per diem (\$66,815) and fuel (\$7,240) associated with the training sessions.

<sup>9</sup>Cost of UNICEF staff salaries (\$178,997) + cost of supervision rounds per diem (\$11,751) + 25 percent the cost of UNICEF vehicles (\$47,390) + 25 percent the cost of fuel (\$106,725) + cost of MOH salaries (\$21,511).

<sup>10</sup>Cost of UNICEF consultant (\$12,245) + cost of mobilization supplies (\$160,648) + cost of audio-visual equipment (\$7,815) + 25 percent the cost of fuel (\$106,725) + per diems and incidentals (\$38,964 and \$1,294), + 25 percent of vehicles cost.

<sup>11</sup>Cost of supplies (\$632), per diems (\$17,452) and fuel (\$2,076) = \$20,160.

APPENDIX E

Projects with Child Survival Activities

Title	Funding/ Implem. Agency	Activity Area	Interventions Provided
Projet Sante Rurale	USAID/	2 regions (Kaolack/Fatick)	Immunizations ORT Nutrition/Malaria
SANAS	USAID/MOH	6 regions	ORT Nutrition
	USAID/World Vision	Regional (Louga)	
Child Survival	USAID/CRS	Regional (Diourbel)	Immunizations ORT Nutrition
Sante Rurale	World Bank		
Projet du Developpement Sanitaire	UNICEF MFCAC AFVP/MOH	Regional (Tambacounda)	Immunizations ORT Nutrition Prenatal Care Malaria
Projet Sante Familiale	USAID/MSD	6 regions	Family Planning
Projet Belge Senegalais pour SSP Familiale	Belgium/ ORSTROM MOH	Department (Pikine)	Immunizations ORT Nutrition

## APPENDIX F

### Principal Documents Reviewed

"VIe Plan Reajuste de Developpement Economique et Social (1981-1985)",  
Ministere de Plan et de la Cooperation.

"VIeme Plan de Developpement Economique et Social: Orientations et Programmes  
d'Action Prioritaires (1985-1989)", Ministere du Plan et de la Cooperation.

"A Child Survival Implementation Plan for Senegal", prepared for the Office of  
Health, Population and Nutrition, USAID/Senegal, May 11-15, 1987, Management  
Sciences for Health.

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