PN-ABE-203

64512

PRIMARY HEALTH CARE OPERATION RESEARCH REPORT FROM FSESP-BRAZIL—JOHNS HOPKINS UNIVERSITY

on

COMMUNITY HEALTH WORKERS COMMUNITY WATER SUPPLY FINANCING

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January 1985

Acknowledgements

Dedicated to the Brazilian and North American pioneers who created and developed SESP. With special thanks to Drs. Aldo Villas Boas, President of Fundacao SESP, who provided encouragement and overall guidance; to Dr. Jacques Manceau, Director of Biostatistics and former Director of FSESP, who advised in planning and analysis and will implement changes in the Health Information System to enhance supervision; to his associates, Mr. Mario Reyes, Mr. Modesto and Miss Maria de Concecao, for help in analysis; to engineers Gondim, Camacho Leal, Grynfogiel, and Zadir for the water supply research planning and analysis; to Dra Emingarda whose diarrhea study provided essential information; and, most of all, to the FSESP workers and supervisors in the field whose reports and comments provide the basis for this report.

And at Hopkins to Mrs. Bremer who edited, typed, and retyped this report; to Mss. Ruehsen and Burger who assisted in analysis; and Drs. Kawata, Storms, Parker, and Salkever who gave valuable consultation.

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I. EXECUTIVE SUMMARY

This report provides primary health care officials in developing countries, AID, and PRICOR with detailed analysis of two components of primary health care: 1) the selection, training, supervision, and effectiveness of Community Health Workers (CHWs) and 2) Community Financing of Water Supply. The body of the report is divided into the two major components for the convenience of readers who are interested only in one of the components. Methodology, Results, and Conclusions are presented separately for each component.

This study does not follow the typical pattern of other PRICOR studies as it presents the end results of many, earlier, operational studies and resultant changes.

The sources of information are current data and historical records of 40 years of operation of Fundacao SESP, an organization providing rural health care to over 13 million people in rural Brazil. The history of FSESP and other points of importance in FSESP's successful operation are described in detail. (The background of FSESP is summarized in both the CHW and Community Water Supply sections for convenience of readers interested in only one subject.)

To make our findings pertinent to the needs of primary health care officials in other developing countries, we surveyed primary health care planners from twelve other countries. Their stated priorities for relevant information are presented in section II.B of this report.

Community Health Workers

Data on Community Health Workers (Visitadoras) was obtained from a review of the history of the FSESP visitadora a review of the literature on ancillary health

personnel to serve as background for the visitadora (CHW) study; a review of two evaluations of other CHW programs in Brazil, a time study carried out with 31 visitadoras (CHWs); and a detailed analysis of 1981 and 1982 annual service reports from 225 visitadoras (CHWs).

The major findings from the visitadora (CHW) program were:

A system that provides both supervision and back-up supports of vital importance to the success of CHWs;

Adequate compensation is essential to maintain morale and quality of work of CHWs;

The rigorous selection process and carefully planned training program produces highly motivated, competent health professionals;

Routine service statistics must be analyzed, condensed, and appropriately displayed before they are of value for evaluation and supervision.

Specific findings are presented in Section IV of this report.

Community Water Supply

Data for the community financing of water supplies was obtained from the historical records of FSESP, from a review of the worldwide literature on community financing of water supply to provide a context for the FSESP findings, and from a major survey of 48 water supplies to determine the means of financing, the levels of financing, the factors contributing to the extent of coverage of the FSESP systems. A special, prospective study was carried out by FSESP on the effect of the introduction of water supplies on diarrheal disease.

The major findings were:

Most communities are able to pay for both maintenance and operation of water supplies if a suitable financing system was used;

Some communities are even able to pay for capital construction debt repayment;

Diarrhea rates in communities with new water supplies are reduced in comparison to control areas;

FSESP water supply financing systems have spread to PLANASA (the national water supply program) and to state water authorities.

Details of water supply financing are presented in Section V of this report.

Conclusion

The full report should be useful to readers with interest in: the history of a successful AID health program; the planning of primary health care programs; and the potential and problems of primary health research using routine service statistics.

The Community Health Worker section, as a separate entity, should be valuable to: LDC planners of rural, periferal, health services; AID primary health care programs; planners for expanded immunization programs using static facilities; and private voluntary organizations planning rural primary health care programs.

The Community Water Supply Financing section, as a separate entity, should be useful to: LDC, rural, water supply planners; water supply funding agencies; and evaluators of rural communities' ability to pay for other health services.

Most importantly, this report should lead readers to further inquiries for details of program operation. The authors, both Brazilian and American would welcome such inquiries, as we believe that FSESP's program, unique in quality and duration, has much of value to offer to the field of primary health care.

II. STUDY PURPOSE

A. Goals and Objectives

The Agency for International Development, in support of the concept of Health For All By The Year 2000 and primary health care, formulated a request for proposals with the following goals:

> "The goal of this primary health operations research project is to contribute to the improvement of the efficiency and effectiveness of primary health care (PHC) programs in developing countries. In order to achieve this goal the project will develop and support operations research activity in closing the knowledge gaps impeding efforts to design, implement and sustain primary health care programs in developing countries."

The Primary Health Care Operations Research project (PRICOR), seeking to assist AID in reaching their goals, formulated the following elaboration of the AID goals in calling for PRICOR funded research proposals.

> "...the most serious health problems in developing countries are infant, child, and maternal mortality and morbidity. These problems are gravest in rural and marginally urban areas where health services are the most limited.
>
> "Various health interventions exist which could have a dramatic impact on these problems if only ways could be found to get them to the target populations. Among the most efficacious of these interventions are:
>
> - immunizations (DPT, polio, measles),
> - treatment for infant respiratory infections,
> - oral rehydration therapy,
> - malaria prophylaxis and treatment,
> - tetanus immunization for pregnant women,
> - nutrition monitoring,
> - family planning
> - water supply
>
> "...Preliminary proposals are solicited in three priority areas: 1) Community financing of PHC services; 2) The role of the community health worker; and 3) Community organization of PHC services.

"1. Community Financing of Primary Health Care Services

"Research on financing is encouraged to: 1) account for the ability and willingness of local communities to pay for particular services; 2) address both the efficiency (e.g., administrative costs compared to total revenues generated) and equity (e.g., who pays and who benefits from the services) of the financial schemes; 3) account for cultural, political, and administrative factors that affect the design and operation of the schemes; and 4) show how community financing schemes fit into a larger national or regional health financing context.

"2. The Role of the Community Health Worker

A number of questions remain as to how best to select, prepare, use, support, supervise, and compensate these workers."

The Johns Hopkins University, concurring with these goals, has developed, as specific objectives, the analysis of two components of a highly successful program of delivery of primary (and back-up secondary) health care in the rural areas of Brazil over the past 40 years. The two components form the objectives for: a) community health workers: the selection, training, supervision and effectiveness of the visitadora; and b) the community financing of water supplies.

B. Rationale for Study: Survey of Primary Health Care Planners from Other Countries

The approved preliminary proposal for this project stated:

> "The new programs to provide primary health care for all by the year 2000 can derive great benefits from the experiences gained over 40 years of continuous operation of a highly successful nationwide program to provide rural health care in Brazil."

To determine exactly which FSESP experiences would be of greatest interest to planners for primary health care in developing countries, we queried health planners from 12 developing countries to determine their major interests in information coming from this study.

We had representatives from Gujarat State in India; Sokoto, Adembra, and Borno States in Nigeria; Ethiopia; Sind State in Pakistan; Indonesia; Egypt; Kenya; Zaire; Benin; Liberia; Nepal; and Bangladesh. Responses to open-ended, structured, interview forms are divided into the two areas of interest: a) the use of visitadoras, and b) the community financing of water supplies. Our informants also expressed great interest in many other aspects of the FSESP program, should we undertake any further study of the organization.

1. Use of Visitadoras

   a. What are the backgrounds and prerequisites for admission to the visitadora program? How are they selected?

   b. What is the content of the training of visitadoras? How is effectiveness of training program measured? How does the training relate to the present duties? Is there any retraining or in-service training for visitadoras? What is the rationale for the length of training of the visitadora? Would a shorter period or a longer period be more appropriate? Where does training take place? What are the various interventions that the visitadoras are trained to carry out.

   c. What is the system of evaluation or supervision of the visitadoras? Are there any measures of the effectiveness of the visitadora

program? How much of the work of the visitadora is without direct supervision? How is the performance/productivity of these workers measured? Is there any measurable effect on community health?

d. What are the incentives? What are the levels of pay in comparison to other workers with similar backgrounds? Would the community pay for the visitadora if the FSESP program withdrew? What are the expenses of the support system backing up the visitadora program?

e. What are the local conditions, the setting in which the visitadora works? What are the political factors in setting up a program of this kind? Do the state and national governments recognize this type of worker? Is there any opportunity for upward mobility? Does the community feel that the visitadora is a member of the health system for their community? What are the specific skills of visitadoras? What is the system of referral? What is the control of local community over visitadora?

2. Financing of Community Water Supplies

Areas of interest to respondents:

a. Extent and mechanism for central or state government collaboration in financing with communities? The exact sources of finance within the community. Private individuals? Community government? Private companies? How were communities convinced to contribute? Does the community really pay for water supplies or is it done through state or central government? Describe the mechanisms used to collect money for both capital construction and for maintenance of the system.

b. What was the background information on the systems in terms of sources of water, distance to source, types of treatment, types of distribution as background? How was the maintenance handled? Specifically, who does the maintenance and who pays for it? What is the difference between administration/organization of supplies in large communities and in small communities? What are the patterns of authority? Do these vary by community? What are the linkages between the authorities and the members of the community? Are any of the systems governed by democratic process? Are there appeals mechanisms? Are there any intersectoral programs to aid community financing of water supplies? What are the other agencies involved in water supply provision in rural areas? How is the work of different organizations coordinated? How can same program address large and small communities? What flexibility is required?

c. What is the effectiveness of the system? Has it shown any impact on mortality and morbidity from diarrhea? What is the outreach

of the system? What percentage of the population is covered? What percentage is unserved? How long does it take to reach 30 percent, 50 percent, 75 percent, of the population? What are the percentages of house connections with the various systems as compared to watering points? What difference does this make in morbidity and mortality? In user satisfaction? What is the community reaction now? Have there been many water supplies that have been started and abandoned because of lack of maintenance or lack of payment? What percent of connections are discontinued? What are the major reasons for failure of systems? What are the community contributions in labor and material (local material)?

III. BACKGROUND: FUNDACAO SESP'S FORTY YEARS OF EXPERIENCE IN A NATIONWIDE PROGRAM OF RURAL PRIMARY HEALTH CARE

Timothy Baker, M.D., M.P.H. (JHU) and Mary Young, M.D., Dr.P.H. (IBRD)

Introduction

For over 40 years, an exemplary, yet little known, program of rural primary health care has been operating in Brazil. This program is not a small, pilot, demonstration, or research project, but extends to all of the 21 states of Brazil and reaches over 13 million people. The program pioneered in efforts such as rural water supply development, use of home health visitors, immunization programs, and other elements that are important parts of the primary health care programs being promoted by AID, WHO, UNICEF, and other institutions.

Information on the programs of Fundacao SESP (Servicios Especial de Saude Publica) will have interest and value to an international audience of readers.

Information has been obtained from FSESP reports, Brazilian colleagues, field visits to Brazil, and the insights of the current President of Fundacao SESP. Brazilians and non-Brazilians collaborated to provide a balanced and unbiased appraisal of the substantial accomplishments of the organization. Planners and developers of rural primary health care services in many countries should find useful ideas that might be adapted to their own local circumstances. Some primary health care experts may even decide to visit the FSESP program to observe it in action. Others may write to FSESP for further information.

History

The history of FSESP is long and complex. The bare elements give readers the background to understand program development. The simple statement of

facts and dates misses the excitement of the pioneers (such as Marcolino Candau, past Director-General of WHO, and Ernani Braga, the WHO Chief of Training) trying new concepts of primary care—moving out into remote, hostile environments to bring health services to the rural poor.

SESP was initiated in Brazil in 1942, following a meeting of Foreign Ministers of the Americas which recommended development of cooperative health and sanitation service projects between the United States and Latin American countries. These programs were called Servicios and were the forerunners of the U.S. foreign aid program. The interest of the United States originated from recognition of the importance of bilateral cooperative endeavors to improve the economy, health, and education in Latin American Republics. Participation of the United States in SESP was dictated by the necessities of World War II. The initial SESP programs were established in the Amazon Valley to protect the health of workers collecting natural rubber, and in Rio Doce Valley to protect workers in the iron mines and quartz localities.[5]

SESP was created as an autonomous body attached to the Ministry of Education and Health,[5] and has remained relatively free from political interference. It was assigned the functions of promoting and executing activities for prevention and control of disease, provision of health services, basic sanitation services, and health and sanitation education in rural areas.

In 1943, at the end of the first year, Brazil and the United States renewed the contract for U.S. cooperation until 1948 and later extended it to 1960.

In the early years, 1942-45, U.S. financial contributions were substantial. By 1945 Brazilian funding exceeded that of the United States. Participation of U.S. personnel followed the same pattern, decreasing as the program trained enough competent Brazilians to take over they key roles.

From 1942-60, SESP progressed from an emergency institution created under strains of war, to a service with permanent responsibility for rural medical care.

SESP organized and operated public health services and water supply systems primarily in rural developing areas at the invitation of local and state government.

In 1957 the United States announced its intention to withdraw its participation in SESP, requesting the Brazilian government to take steps to set up a permanent, purely Brazilian, organization for SESP by January 1960.

In 1960 a law was passed in the Brazilian Congress which made SESP a permanent Foundation (FSESP),[3] controlled by a deliverative council and administered by a superintendent (later president).

Although some critics have called SESP an "imported institute," by 1960 it was clearly Brazilian in orientation, direction, and financing.

The period 1960-64 was beset with many difficulties. FSESP attempted a new strategy of cooperative health service in which the states participated and contributed in financing the services. Often the states did not pay their contribution and the national funds were reduced after the international support was withdrawn. SESP faced a period of insecurity with dangers of the organization dissolving. But, by 1964, FSESP obtained sufficient national funds to continue its work. FSESP now has its own administrative process, specified jurisdiction and a budget assured by law.[4]

Today, FSESP is the foremost Brazilian service which encompasses the entire field of medical care and public health within one administrative pattern.

Three levels of administration have been developed within FSESP--central, state, and local. Progress has continued in financing and training of personnel, and developing and promoting rural primary health services appropriate to the resources of the local community.

Review of Programs

Overview

FSESP has had capable enlightened leadership to accomplish the difficult task of incorporating preventive medicine and public health into curative medical programs. FSESP has emphasized developing basic sanitation programs so that essential preventive services are provided through its 615 health units (Dec. 1982). Today, immunization, prenatal care, child care guidance, contact follow-up for VD, TB and leprosy, health education, nursing care, and home visiting are integrated in most FSESP health units. In villages, basic sanitary activities include small water supplies, construction of public lavatories, privies, and water reservoirs. These programs have affected most states in Brazil and now operate or assist states in operation of 615 health units and subposts in 18 states.[8] In these states, FSESP, unlike state services, has concentrated its program in rural areas outside of the capitol cities. FSESP has developed a rural health program with outstanding organization of services, maintenance of professional standards, and logical choice of program priorities.[2]

In addition, FSESP has provided the health services for major national development projects such as: (1) the Trans Amazon Highway spanning two states; (2) BR-364, the new road linking Cuiaba and Porto Velho in the northwest; (3) the Araguaia-Tocanting Development Project spanning three states in a politically important area; and (4) the Jari Development Project in the Amazon Basin.

Maternal and Child Health

FSESP has made a vital contribution to the decrease in infant mortality through the introduction of rehydration units serving children in an outpatient setting. Children coming to the health center with severe diarrhea and dehydration are directed immediately to the rehydration unit, with no time wasted in the

waiting room or in registration. Assessment and management are started effectively and efficiently with well-trained personnel. In addition to treatment, a component of health education of mothers' proved highly successful. FSESP has now had over 25 years of successful experience with rehydration centers[1] and almost 10 years of experience with the most cost-effective oral rehydration.

Other programs such as improvement of water supplies, development of a privy program, distribution of milk and instruction of mothers in the essentials of child care, have all contributed to displace gastroenteritis as a leading cause of death in FSESP areas.

In their maternal and child health program, FSESP offers prenatal care, safe, supervised deliveries, postnatal care, and virtually complete care for the infant and child up to five years of age. Decrease in maternal deaths can be attributed to the intensive training programs for midwives. The midwife, along with prenatal screening by visatadora and doctor, and back-up availability of physicians for difficult deliveries, provide vital maternal service to the rural aeas. FSESP maternal and child health clinics are utilized by essentially all economic levels of rural communities. There is continuity of preventive care for children including immunization, anticipatory guidance, basic health education in nutrition and feeding, and curative pediatric service.

FSESP thus offers an example for maternal and child health programs for other countries.

Medical Care

FSESP has accepted the responsibility for meeting the primary needs for medical care in rural areas. It assists the community in promoting health, prevention, diagnosis and treatment of disease through 371 primary health care units, 198 health centers, and 46 rural hospital health centers.[8] FSESP health units

care for all ages and provide prenatal, infant care, sanitary education, home sanitation, and control of transmittable diseases.[6]

In addition to primary care, FSESP provides excellent secondary hospital care. The records, logistics, and quality of care are splendid examples of what can be accomplished in providing hospital care for rural populations. The standard of medical care in FSESP health units is well above the average for rural Brazil. The significant factors in maintaining the high level of medical care are: FSESP's system of supervision and reporting, and the attention devoted to maintaining a splendid espirit de corps. In many localities the successful FSESP medical care program paved the way for public health programs with their more lasting effect.

Malaria Control Program

The malaria control effort was one of the most successful programs conducted by FSESP. Many of FSESP's leaders had gained experience in mosquito control in the National Yellow Fever and Malaria Services. The sharp decline in malaria incidence in FSESP areas resulted from intensive residual DDT programs which augmented the routine national malaria program. The FSESP program in the town of Breves achieved the first recorded complete control of malaria through residual insecticides.[7] Prophylaxis with atabrine initially and the newer drugs such as chloroquin was used as a supplemental measure in the Amazon Valley. Thus, FSESP demonstrated the feasibility of incorporating malaria control into a comprehensive rural health program.

Rural Water Supplies

Water supply has been the top priority for FSESP engineers. The first water supply projects were in the Amazon and Rio Doce Valley towns where FSESP

started its work. In governador Valaderes the water supply expanded as the city grew from 10,000 to 200,000 inhabitants.

The majority of water systems have been installed in towns with populations of less than 10,000. In 40 years of service, FSESP has constructed over 1,000 public water systems. Under earlier programs that provided service to small towns without charge to consumers, development of water supply systems were limited by the small amount of funds appropriated by the central government. FSESP developed strategies to encourage community assistance and municipio participation in maintenance of the projects. In almost 40 years of experience, FSESP has learned much about the effectiveness of various strategies for water supply development. Technology was not the entire answer; innovative management and financing mechanisms were equally important.

FSESP encountered difficulties in the State Cooperative Services, when the anticipated financial participation from the states was not obtained. Therefore, alternative financing mechanisms were developed such as state autonomous administration assuming responsibility for construction, maintenance, control, and finance of systems. FSESP/state cooperative program has led to development of community water and sewage boards (Servicio Autonomo Agua e Esgoto—SAAE). These services are often staffed by former FSESP trainees.

The FSESP water supply personnel were interested in and had awareness of community conditions and local leadership structure, and experience in pooling efforts. Municipios can adjust the scope of service and extent of coverage based on the area's economic capacity and geographic density.

FSESP's simplified methods of execution and decentralization of water supply construction and operation, tailored to the socio-economic condition of Brazil, are an excellent example for other developing countries.

Sewage Disposal Systems

Sewage systems and sewage treatment plants have been of lower priority than water supplies. Privy and septic tank construction programs are not a major FSESP activity, due to lack of financial resources and community priority in the rural areas. However, 88 sewage systems had been constructed by FSESP by 1982.

Dental Health

FSESP offered services in topical applications of fluoride and mass treatment of caries, particularly in the younger school-age group. These programs are carried out by the health centers and health posts of FSESP. More importantly, FSESP also provided fluoridation of the water supply in many localities. Countrywide programs are still limited by the high cost of fluoridation, but use of the more abundant, inexpensive compound—calcium fluoride, "flourita" is under research and experimentation.

Government Relations

FSESP has special characteristics that contribute to its success. It has had the administrative and technical flexibility to adapt rapidly to its tasks. It has developed vast experience working with rural communities. It has developed a set of democratic and rational principles for organization and administration which were different from many government health programs. It benefitted from being created as a bi-national program, independent of most governmental bureaucracy. FSESP's career corps of the public health personnel are selected for their technical competence and ability to implement programs, not for narrow political considerations. Emphasis is placed on service at the local level.

During its early years, FSESP worked at the municipio level: managing health centers, sanitation programs, and hospitals with objectives of providing

services and "demonstrating" that such service can be established at the municipio level. Later, FSESP adopted the policy of having municipios participate in support of operations. Over the years, FSESP expanded its relationships with state governments, through cooperative joint planning and financing.

The law which created FSESP in the late 1950s changed SESP from a bi-national to a Brazilian agency. Specified objectives for FSESP include, among others, coordination, organization, administration of services in states whose government requests them. Provision of public health services is now a state responsibility, and FSESP's maximum contribution can be made by assisting the states in meeting their responsibility.

FSESP is a semi-autonomous service within the Ministry of Health. The overall control of FSESP is a deliberative council of seven persons of which the Minister of Health is only one member. A board of control, with only one of its three members from the Ministry, is in charge of inspection and financial arrangements.

Training

The most important achievement of FSESP is its record of training of health personnel. "From its beginning, SESP properly took the view that improvements in public health could be made only if Brazilian personnel were trained and if administration and operation of the program were the responsibility of Brazilians and awareness that better health systems need the infrastructure."[2]

"Better qualified doctors, nurses, and engineers provided an ever expanding corps of well-trained and dedicated people for FSESP, and other official agencies and private organizations as well. Of equally far-reaching significance has been FSESP's contribution to the development of professions of sanitary engineering, nursing, and dentistry in Brazil."[2] It has been said: "FSESP is a university." Table III-1 confirms this statement.

Table III-1

HEALTH PERSONNEL PROVIDED TRAINING
DIRECTLY OR INDIRECTLY BY FSESP
1942-1982

Physicians	1830	Sanitary Auxiliaries	1307
Dentists	546	Hospital Auxiliaries	2756
Engineers	931	Dental Auxiliaries	144
Graduate Nurses	1877	Other Auxiliaries	671
Undergraduate Nurses	311		
Visitadoras	1062		

FSESP has provided for not only formal training in public health, but also on-the-job training and experience to the doctors, engineers, nurses, and auxiliary personnel working for FSESP. In addition to training its own personnel, FSESP also provides training to people outside of its organization. With the recognition that an organization cannot function without auxiliary personnel, especially in view of shortages of professional personnel, FSESP programs train sanitation auxiliaries, health visitors, attendants, laboratory technicians, and midwives. Such personnel provide an important link between the health center and the local community. FSESP played an active role in administration, financing, and technical assistance in nursing schools, and schools for undergraduate nursing training. The FSESP School of Nursing in Manaus set a standard for excellence and practicality in nursing training. FSESP has thus materially advanced nursing practice.

Conclusion

Over the past 40 years, FSESP has accomplished the following achievements in rural primary health care:

1. provided over 6 million clinic visits;
2. immunized over 20 million children;
3. made almost 4 million sanitation inspections;
4. provided 12 million people with safe water;
5. made almost 3 million home visits;
6. trained or supported training for approximately 2,000 public health physicians, 3,000 nurses, 1,000 engineers, 500 dentists, and 5,000 other health workers;
7. provided the back-up secondary health services of 3 million rural hospital days.

Factors contributing to these remarkable achievements include:

1. the spirit of dedication of the staff;
2. emphasis on inservice training and education of key personnel;
3. relative freedom from bureaucratic red tape;
4. emphasis on innovation, evaluation, and revision of programs;
5. adequate pay and job security.

Developers of rural primary care in other nations would gain much useful practical information from a careful study of the FSESP model.

References

1. Aranjo Morais, N. and Jorge de Almeida, A. O Servico de Reidratacao Nas Unidades Sanitarias do SESP. Rio de Janeiro, 1956.

2. Baker, T., Bright,M., and Wolman, A. Brazil-U.S. Cooperative Health and Sanitation Program, 1942-1960.

3. Brasil. Lei No. 3750, April 11, 1960.

4. Britto, Raymundo. Programada Acao 1967-1971. Ministry of Health, 1971.

5. FSESP-Boletin Comemorativo do 10 Aniversario do SESP do Ministerio do Educacao e Saude 1942-1952. Rio de Janeiro, 1952.

6. FSESP 15 Anos de Cooperacao Brasil-Estatos Unidos no Campoda Saude Publica. Rio de Janiero, 1955.

7. FSESP 30 Anos de Atividades em Saude Publica (1942-1972). Rio de Janeiro, 1972.

8. FSESP. Plano de Trabalho e Orcamento Ministry of Health. Rio de Janeiro, 1983.

IV. COMMUNITY HEALTH WORKERS: THE VISITADORAS

Lani Rice, Corinha Fischer, and Timothy Baker

A. Introduction

Emerging from its strong push toward industrialization and economic ascendancy during the 1960's and 1970's, Brazil provides an interesting synthesis of complex development issues. With the largest population and land mass in Latin America, it faces a peculiar mix of the urban-industrial problems of the developed powers as well as the traditional symptoms of poverty which persist in regional pockets of underdevelopment. Urban areas absorb 68 percent of the total population of some 124 million and currently experience an average annual growth rate of 4.1 percent. Brazilian planners must, therefore, formulate strategies to cope with the immediate needs of exploding urban centers like Sao Paulo and Rio de Janeiro and to simultaneously address the roots of this rapid rural-to-urban migration in the historical underinvestment in other areas of the country.

An overview of demographic and socio-economic indicators is given in Table IV-1. These statistics signal both substantial progress in Brazil's demographic transition and the need for continued effort to achieve a wider distribution of the benefits of modernization. With the world's seventh largest population, Brazil's efforts to improve the living standard of its people offer important insights for health planners and program managers in other countries. This study aims to describe some of the lessons learned from the Brazilian experience in the health field by examining the successful implementation of PHC services in rural and marginally urban communities by the visitadora sanitaria, a community-based health worker of the Fundacao Servicos de Saude Publica (FSESP).

Table IV-1

DEMOGRAPHIC AND SOCIO-ECONOMIC INDICATORS

CBR: 30 CDR: 9 IMR: 77 0-4 Mortality: 7

Total Fertility Rate: 4.1

CGP Per Capita: $1,665 (1980)

1977-1980 Annual Gowth Rate of GDP: 4.1 %

Adult Literacy Rate: 74% (1980)

Access to Water Supply System: 75% urban, 46% rural population

Source: PAHO, Las condiciones de salud en las Americas, 1977-1980, 1982, World Bank, 1982 World Development Report, IBGE, 1981.

The Fundacao SESP is a public foundation linked to the Ministry of Health that provides essential sanitation and primary health care services in 16 states and 2 federal territories of Brazil. FSESP evolved out of a Brazilian-American joint-funded program (SESP) which was created to provide public health services in the Amazon basin and other mining areas in order to facilitate the extraction of rubber and minerals during World War II. When U.S. assistance to SESP ended in 1960, the Fundacao SESP was set up to continue the service's well-respected accomplishments in the delivery of rural health services.

While the state Secretaries of Health are primarily responsible for the health services infrastructure in each state, the federally supported Fundacao SESP extends these services to rural and periurban communities in areas of special economic importance, such as agricultural colonization or industrial development projects, which typically cannot be covered by the limited resources of the state Secretaries. Although federally funded with central administration in Rio de Janeiro, FSESP has decentralized administrative and supervisory activities within its 18 regional directorates. The Fundacao SESP is thus able to complement state-supported services by directing its efforts at populations with difficult access to existing health and sanitation resources.

The areas reached by FSESP programs today are concentrated in the most rural and economically underdeveloped states of the country, particularly in the North and Northeast. Populations served are predominantly rural, living in small, scattered communities. Transportation and communications are often difficult and economic opportunities limited. Agriculture, upon which most of the population depends, is subject to frequent droughts which aggravate the already precarious economic base and encourage the flow of migrants to the cities.

The pattern of health problems experienced by such communities is predictable: elevated infant and child mortality attributable to an environmental context of inadequate sanitation, infectious disease and undernutrition; endemic communicable diseases, many of which are preventable through better sanitation, personal hygiene and immunization; and high incidence of complications of pregnancy, delivery and puerperium, completed by the low frequency of births assisted by trained midwives or physicians.

Although that government has taken an increasingly major role in the financing and administration of health care services, imbalances in the distribution of medical resources persist in the less developed regions of the country. For 1980, Brazil reported 12.5 physicians, 1.4 nurses, and 12.6 nursing auxiliaries per 10,000 population (Conselho Federal de Medicina, Conselho Federal de Enfermagem, PAHO, 1982). While considerable expansion of physician and nurse training centers has occurred in the past decade, national health manpower/population ratios do not reflect the abiding preference of physicians for urban practice. The geographical distribution of physicians in 1980, as shown in Table IV-2, provides one index of the distribution of health care resources.

Although theoretically an adequate number of physicians is available to provide medical care in Brazil, the greater incentives for practice in the larger population centers make reliance on auxiliary health workers inevitable in the smaller and more remote communities. In 1976, Brazil embarked upon a national program to extend basic health services to the interior, beginning in the Northeast and later expanding to the Central-West and North. The primary level health worker in this program was known as the <u>atendente</u>, or health attendant. The atendente received 2-3 months training and worked exclusively within a rural health post. While auxiliary health workers have been used in the Brazilian health

Table IV-2

POPULATION/PHYSICIAN RATIOS BY REGION, 1980

Region	Population	Number of Physicians Physicians	Population per Physician
North	5,890,663	3,978	1,480
Northeast	34,885,745	22,991	1,516
Southeast	51,727,924	91,720	564
South	19,035,500	20,819	914
Central-West	7,551,668	9,618	785
BRAZIL	119,061,500	149,126	798

care delivery system for a long time (primarily associated with hospitals), only in the last ten years has their role focused specifically on the delivery of PHC services in rural communities.

This movement toward expanded use of CHWs has been evidenced in the Fundacao SESP as well. As stated before, the programs of FSESP have been designed to comprehensively address the needs of communities which have not been adequately served by the state public health infrastructure. This objective is achieved through its network of rural health posts, centers, and hospitals in which FSESP personnel provides basic sanitation and health assistance at the local level that are supported by more technical medical care available through referral. The primary level health worker in this integrated system is the visitadora sanitaria, or community health visitor.

The visitadora has been part of SESP since 1942, when the position of SESP visitadora was created to provide home visitation, carrying out health education activities and following up infectious patients. The concept of the visitadora had been introduced previously in Brazil by the National Department of Health during the mid-1930's. The early visitadoras served as extension workers for hospitals and were not used at the health post level. During the 1950's, SESP's primary health care worker was the atendente, who provided services within the health post and who did not go out into the community. By the 1960's, it was recognized that this arrangement was not the best scheme for extending public health services to rural populations, since the fixed-based nature of the atendente encouraged a heavily curative orientation to the services provided.

The use of visitadoras, instead of the atendentes, in the health posts was initiated in a few areas as early as the 1950's. It was not until the 1970's that the visitadora became the main community health worker in the SESP system. This

reorientation in the role of the health post worker (i.e., from a clinic-based to a combination approach using home visiting) stemmed from the perceived limitations in the scope of work that could be carried out by the atendente. When the SESP network of health posts and support units underwent significant expansion beginning in 1979, much effort was directed at redefining the role of the visitadora as a rural health worker, including revision of the training course and preparation of a new visitadora manual for use in the health post.

Thus, throughout the past 40 years, both the training and scope of responsibilities of the visitadora have been adapted to changing needs and views on her role as a community health worker. The visitadora today receives five months of intensive training in fundamental principles and techniques of preventive health care. Her major functions are community outreach, home visitation, and clinic-based provision of preventive and first-aid services.

The visitadora is not exclusively a rural-based CHW, however, visitadoras are found in all levels of FSESP health programs. Of the nearly 900 visitadoras currently employed by FSESP, roughly 40 percent work in health posts, with the rest concentrated in larger health centers and rural hospitals. The visitadora's scope of activities is the broadest in the health posts, where she, together with the male sanitation auxiliary, is responsible for carrying out a full program of public health interventions.

The operational objectives of the visitadora program within the health posts can be summarized as follows:

1. To establish a widely accessible first link in the health care system at the community level, which will serve as a source of health education, primary care and referral.

2. To provide primary prevention for the health problems of infants, children, and mothers through immunizations, nutrition education, pre/postnatal care, well-baby checks, and simple treatments.

3. To enact local communicable disease control, particularly for tuberculosis and Hansen's disease, through case detection and follow-up, health education, and administration of prescribed therapeutic regimen.

It is in the health posts, therefore, that the activity of the visitadora is of greatest relevance to community-based PHC. The goals of this study are to describe the main components of the visitadora program, to document visitadora service outcomes, and identify the salient factors which facilitate her effective performance. It is expected that this information will be useful to decison makers in developing countries who are trying to find ways to improve their own CHW programs.

B. Methodology

The results of the visitadora study are presented in eight parts: (1) role, (2) selection, (3) training, (4) supervision, (5) compensation, (6) total costs, (7) productivity/coverage/quality, and (8) comparison with other programs of the visitadora program in the health posts are discussed. Information in these eight sections is based on a review of FSESP current and historical documents, interviews with senior FSESP officials in the central and regional headquarters, a survey of expenditures in the Regional Directorates, and field visits in several states to several health posts, support units, and a FSESP visitadora training course. In addition, officials from other health agencies were consulted. Data from other agencies including earlier studies of FSESP were reviewed.

The analysis of two years of service data from the 225 health posts reporting for all of 1981 and 1982 throughout Brazil was made using initial computer compilations from FSESP and further analysis at JHU. (In some cases, the atypical urban health posts in Minas Gerais were dropped from the analysis.) Issues of particular interest were the volume of services delivered, quality, coverage, and the time spent on different prescribed tasks. This analysis establishes mean levels of visitadora performance and variation among the visitadoras under study. The constraint of performing different parts of the analysis in different sites caused problems in communication and slowed the analysis process.

To determine the total output of a visitadora one must combine the various services of the visitadora: immunizations, home visits, etc. It was, therefore, necessary to determine and apply unit times for each of the various services.

We initially planned to determine time per service using Functional Analysis. However, as an alternative, FSESP surveyed a sample of visitadoras and

visitadora supervisors. Information was obtained from 39 visitadora stations from nine states.

A simple questionnaire with detailed instructions was prepared, listing 32 services or types of work of the visitadora. The visitadoras were asked which services they provided during the previous month and how much time they spent on each of those services. They were also asked to identify the services provided and time spent on each during one specific day.

The survey return rate was 75 percent overall. There were no returns from visitadoras in the States of Bahia, Goias, Amazonas, Para, and one return from Maranhao.

Our estimates of the costs of services offered by the visitadora was based on converting the average salary of the visitadora and estimated supervision expenses, plus training costs amortized over a 15 year period. (The visitadoras recruited early in the program have had up to 40 years of service.) Information is unavailable on visitadoras recruited in the recent expansion. The costs of construction was obtained from the engineering and construction section of FSESP and amortized over 30 years. Equipment was amortized over 10 years. Supply cost information was obtained from the regional office.

Existing FSESP service statistics include estimates of populations in the immediate area (resident) and in the surrounding area not covered by any other health unit (non-resident). Brazilian demographers are generally dissatisfied with the quality of local area census information so FSESP estimates are the best demographic information available about the populations potentially served by the health post. However, even the FSESP estimates are soon outdated by very high levels of internal migration in most states. Our combined estimate was made as follows:

The population base for the study of visitadoras was obtained from three sources. The first source was the 1980 census with projections to 1982 made by the Brazilian Institute for Geography and Statistics (IBGE). The second source was the investigations of households made by the FSESP sanitarians. The third source was the population estimate for the campaign against malaria (SUCAM). Direct census projections, adjusted with FSESP and SUCAM information, were used to estimate the population of a whole municipio (county), or districto (district) of a municipio. (FSESP or SUCAM figures are more accurate than the projections by IBGE in places where the population has grown rapidly.)

In areas smaller than districts, no census information is available. Therefore, populations are estimated using FSESP information, adjusted as necessary with SUCAM data.

The FSESP information covers only the immédiate, hearby, area designated by FSESP as "resident" population (R). The outlying, "non-resident" (NR) population is available only for whole districts and municipios where covered by the census. Our analysis of the penetration of visitadora services into the most rural, scattered population surrounding the small villages where the health posts are located is based only on those districts and municipios for which census data is available. No other information exists to calculate the remote rural population potentially served. Virtually complete information on rural population was available for five states: Goias, Minas Gerais, Bahia, Cerea and Paraiba; essentially no information on the remote scattered rural population existed for four states: Maranhao, Piaui, Rio Grande de Norte and Alagoas. About one-half of the health posts had information on the remote scattered rural "non-resident" populations in the remaining states. Thus, our analysis of coverage is better for the nearby "resident" population R in the close vicinity of the health unit than for the peripheral "non-resident" population NR.

C. Results

1. Role of the Visitadora

The visitadora is the fundamental community health worker in the FSESP system, working out of the simplest level of service delivery, the health post, or elementary unit. She is intended to provide the first contact with the health care system for the rural population she serves, which may range in size from a few hundred to several thousand people. Together with the sanitation auxiliary, who is also based in the health post, the visitadora carries out the FSESP program, emphasizing preventive measures for maternal and child health, communicable disease control, and health education.

The visitadora's main functions fall into seven broad areas: maternal health, young child health, school health, communicable disease control, curative care, health education, and indirect services. A detailed outline of the major activities and specific tasks within these functional categories is presented in Table IV-3.

The suggested schedule of visitadora activities, based on a 40-hour work week, provides for half of each day to be spent in home visits and follow-up of infectious patients, with the other half to be spent in the health post performing routine consults and providing first-aid services. Because each post is staffed by a visitadora and a sanitation auxiliary, the latter provides some back-up support for the visitadora by attending walk-in cases while she is carrying out home visits. In some health posts, the sanitation auxiliary assists with immunizations and other tasks as needed. This strategy of two complementary workers per health post is designed to provide continuous full-time service at the health post as well as community outreach through home visitation.

Table IV-3

OUTLINE OF VISITADORA FUNCTIONS

FUNCTION	ACTIVITIES	TASKS
MATERNAL HEALTH	PRE-NATAL CARE	Register pregnancies in the community. Complete 5 pre-natal visits (2 with visitadora, 3 with physician), performing checks on BP, weight, urine, VDRL. Identify high risk pregnancies. Educate mothers about risk symptoms, prevention of infection, nutrition, preparation for delivery, and care of newborn.
	DELIVERY	Orient traditional birth attendants and provide with sterilized equipment and supplies. Register births.
	POST-PARTUM CARE	Visit mother and newborn in home. Advise mother on breastfeeding and infant care, weigh baby, and make appointment for vaccination at two months. Administer BCG to newborn.
INFANT AND CHILD HEALTH	HEALTH CHECKS	Register child; weigh; immunize. Instruct mother on child care and feeding, and on prevention of diarrhea and accidents.
	ASSISTANCE TO MALNOURISHED CHILD	Weigh regularly, referring to Gomez table. Distribute food supplements. Educate mother on feeding and child's nutritional needs.
		Recognize signs of dehydration. Administer oral rehydration therapy. Educate mothers on care and feeding of child with diarrhea. Provide with anti-diarrhetics (non-antibiotic) in accordance with standing orders. Direct indicated cases to support unit.
SCHOOL HEALTH	PREVENTION	Administer appropriate vaccines to school children. Orient teachers to educational activites in school health.
	CARIES PREVENTION	Carry out weekly fluoride rinse with school children. Direct teachers in continuation of dental health program.

Table IV-3 (continued)

OUTLINE OF VISITADORA FUNCTIONS

FUNCTION	ACTIVITIES	TASKS
CONTROL OF COMMUNICABLE DISEASES	EPIDEMIOLOGIC SURVEILLANCE	Collect data on number of inhabitants, births, deaths, and illnesses and report as indicated. Encourage civil registration of births and deaths. Visit suspected cases of communicable diseases. Report unexpected increases in morbidity and mortality (in persons and animals). Collect specimens for laboratory examination. Participate in epidemiologic investigations.
	CONTROL OF PREVENTABLE DISEASES	Carry out immunization program, following established norms and schedule.
	CONTROL OF TUBERCULOSIS	Carry out BCG vaccination according to established norms. Screen patients for respiratory symptoms at elementary unit and during home visits. Collect sputum samples suspected cases and contacts. Register smear-positive cases and monitor attendance at scheduled appointments for treatment. Make home visits to new cases and non-attenders. Monitor contacts for symptoms.
	CONTROL OF HANSEN'S DISEASE (Principally in Amazonas)	Refer suspect cases for medical examination. Register confirmed cases and administer treatment according to norms. Educate patient and family about prevention and rehabilitation of physical disabilities. Monitor attendance of cases for treatment and follow-up. Visit cases in home.
CURATIVE	FIRST AID	Administer first aid to accident cases; treat common illnesses following standing orders.
	SUPPORT SERVICES ON DAYS OF PHYSICIAN VISIT	Screen patients for physician consultation. Prepare patients for examination. Distribute medications and apply injections as directed.

Table IV-3 (continued)

OUTLINE OF VISITADORA FUNCTIONS

FUNCTION	ACTIVITIES	TASKS
COMMUNITY EDUCATION	PROMOTION OF COMMUNITY HEALTH ACTION	Orient local leaders (e.g., TBAs, traditional healers, teachers) as to the importance of their collaboration and promotion of health activities and the use of health services.
	HEALTH EDUCATION	Work with teachers on school health education activities. Carry out health education in groups (of mothers, pregnant women, etc.) to identify prevalent problems in the community and to devise solutions.
INDIRECT SERVICES	MAINTENANCE OF ELEMENTARY UNIT	Maintain patient records. Collect service data and prepare monthly reports. Order supplies as needed. Sterilize delivery equipment for equipment for midwives.

The availability of greater health care resources and permanent medical staff at an accessible support unit is an important variable which must be considered along with specific substantive tasks to define a health auxiliary's role. Experience from FSESP's own 40 years of work in rural health services delivery and from other countries suggests that linkage of CHWs to other health services is a key determinant of their effectiveness and acceptance by the community. That is, the willingness of community residents to accept the preventive advice of CHWs such as the visitadora is often contingent upon their perception that immediate needs for curative services are also being met. Curative care at the elementary unit level is provided by a physician from the support unit during periodic (usually weekly) visits. Although her role is not primarily curative, the visitadora is trained to provide first-aid services as well as simple treatments for common illnesses (e.g., ORT for mild to moderate diarrhea cases) in accordance with physician's standing orders. Visitadoras are also trained to provide injections when prescribed by the visiting physician. When further treatment is required, patients are referred to the nearest support unit or are scheduled to see the FSESP physician at the next visit. The visitadora's role as a referral agent is supproted by the FSESP policy of giving referred patients priority at the support unit (patients without referral are also attended but may face a longer wait if not emergency cases).

Because of her training and her linkage to the health care system, the visitadora also serves as a resource person for the traditional birth attendants in her community. The routine duties of the visitadora do not include performing deliveries, although such training is part of the visitadora's formal preparation. Rather, the visitadora provides supplies (sterile delivery kits) and technical orientation for the lay midwife in a cooperative working relationship. For example, local midwives assist the visitadora in identifying pregnant women in the

community for prenatal care. The midwives in turn receive antibacterial eye ointment for newborns and regular resterilization of the delivery kits. The visitadora, therefore, does not compete with the traditional birth attendant, who remains a respected leader in the community.

Two other characteristics of visitadoras should be noted inasmuch as they reflect particular values of decision variables with regard to role definition. The first is the exclusive, full-time nature of the visitadora's position. Like other FSESP employees, the visitadora may not work part-time or provide services within any other system than that of FSESP. By requiring exclusive service, FSESP also guarantees its workers the security of full-time, continuous employment. The second characteristic is the control of the central FSESP authorities over the specification of visitadora tasks. That is, although she is a community-based health worker, her scope of activities is not determined by the community in which she works. Each visitadora is trained following a specific national protocol and carries out a standardized program of health services, with presumably little variation in daily activities between health posts. FSESP officials feel that these requirements are important both in instilling a feeling of professionalism in the visitadoras and in maintaining the high standards of performance expected of Fundacao SESP employees.

2. Selection

Selection for the position of visitadora is based on a competitive screening process. Acceptance into the visitadora training program has three prerequisites: (1) completion of six years of primary school education; (2) minimum age 19—maximum age 25 years; (3) successful results of interview, knowledge test, psychological test, and health exam.

When a new health post is constructed or a visitadora position in an existing unit becomes available, qualified candidates are recruited within the community. In most cases this procedure insures that the visitadora is a resident of the community in which she serves. Because of the difficulties in obtaining education in rural areas, it is not always possible to find young women who have completed six years of school. In these circumstances, candidates are recruited from nearby towns.

The selection process is carried out by a nurse from the Section of Selection and Training of the Regional Directorate. FSESP officials feel that the directive role of the regional nurse, who is in most cases an outsider, contributes to the impartiality of visitadora selection. The nurse first conducts a screening interview with all of the young women who have presented themselves as candidates. This interview process is essentially eliminatory and is intended to identify those candidates with the personal qualities and aptitudes which will contribute to their successful function as a visitadora (e.g., outgoingness, good communications skills). Those candidates who successfully pass the interview are administered knowledge and psychological tests. A general physical exam, including lab tests and x-rays, is performed by a FSESP physician for the candidates who pass the interview to insure that they are able to undertake the level of activity expected of a visitadora. The candidate who receives the highest marks from the tests and interview is chosen to undergo visitadora training.

Selection for visitadora training is highly competitive, partly due to the limited alternative employment opportunities available to young women in rural communities. Visitadoras who were interviewed during a recent training course reported that as many as 50 to 250 other candidates applied for the position they obtained.

3. Training

When a group of 8-12 visitadora candidates has been selected in a given region, a training course is organized by the FSESP Division of Human Resources. An instructor is identified from the FSESP pool of supervisory nurses who have completed the two-month "training of trainers" course. In some instances, the nurse instructor may be the actual supervisor of some of the visitadoras she is training.

The visitadora training course is five months in duration, comprising four months of theoretical and practical instruction, and one month of internship at a rural hospital or support unit where she engages in daily service activities under the guidance of the existing staff. Over the 40 years during which FSESP has employed visitadoras, both the length and content of the training course have been extensively modified. A compromise was sought between the need for a minimum level of knowledge about the broad range of public health problems experienced by the community and the costs of an extended training course. At one end of the spectrum, the two-month training of the atendente was considered insufficient for the role requirements of the visitadora. When the visitadora training was revised in 1979, a period of five months was chosen as enabling the visitadora to acquire an adequate knowledge base and the necessary practical experience to effectively carry out her duties. The amount of didactic lecture time was reduced and greater emphasis was placed on practical exercises.

This intensive course is carried out in an accessible central location within the region in order to minimize the transportation costs of bringing together trainees from various states. Students are provided with a stipend to cover all travel and living expenses during the visitadora course. During the period of the course, the trainees and the FSESP instructor share a house together. This

practice not only reduces the per diem expenses of the training but also provides a setting for extended interaction between teacher and students. Sharing the household duties reinforces concepts which are included in the training, such as personal hygiene, maintenance of the health post, and interpersonal relations. For many visitadora candidates, the training course is the first time they have lived away from home; the experience of living with the nurse and the other trainees is felt to help prepare them for their new role as visitadora.

The training course is divided into 11 instructional modules that encompass the range of functions and activities which the visitadora discharges. An outline of the content areas of visitadora training and of the hours devoted to each module is shown in Table IV-4. The educational strategy followed in the five-month course emphasizes the practical application of learned techniques and procedures. Daily sessions of six (theoretical) or seven (practical) hours are conducted five days a week for the first four months of training. Demonstrations, role-playing, brief written assignments, and actual patient contact are used to reinforce the topics introduced in formal lectures. In addition to the instruction of the supervisory nurse, "guest lectures" by state health educators or other FSESP personnel are included as appropriate. After completing the formal coursework, the visitadora trainees spend their final month in active service, usually working in a support unit or in a health post with an experienced visitadora.

Much attention is given to evaluation of trainees' performance during the course. The instructor's impressions and observations of each candidate are recorded during the initial week of training on the personal data records. Objective tests of the trainees' understanding of the material are given at appropriate intervals (six one-hour tests in all).

Table IV-4

OUTLINE OF VISITADORA TRAINING

Instructional Module	Hours		
	Theoretical	Practical	Total
1. Integration of the visitadora with the health team and the community	7.5	15	22.5
2. Environmental health and sanitation	7.5	13	20.5
3. Nursing care	16.5	15	31.5
4. Community health education	10	22	32
5. Role of the visitadora in FSESP medical and health services	8.5	27	35.5
6. Communicable disease control	38	88	126
7. Maternal health	24	153	177
8. Care of the newborn and premature infants	10.5	52	62.5
9. Child (0-6) health	14	31	45
10. Treatment of common illness	1	—	1
11. First aid	6.5	20	26.5
Fifth month internship	—	160	160
TOTAL	144	596	740

At the end of the course, the instructor completes a lengthy two-part evaluation of each visitadora trainee. The first part consists of a three-step (good/regular/deficient) rating of the visitadora's mastery of the technical tasks and procedures which she is expected to carry out (e.g., measurement of blood pressure, application of intravenous injection, completion of laboratory registration form, etc.). This assessment is filled out continuously during the training. The second component of the final evaluation consists of the instructor's comments on the visitadora's personal qualities and comportment. Specifically, the instructor is required to assess the visitadora's appearance, manners, voice and language, sociability, collaboration, initiative, responsibleness, receptivity, emotional equilibrium and discipline. The instructor reviews the content of both parts of the evaluation with the visitadora, discussing the positive and negative points of the training course outcome.

Following her graduation, the new visitadora undergoes a 90-day probation period in her home community, after which her formal preparation is complete. She is first formally presented as the visitadora in a meeting to which the entire community is invited. During this presentation, the new visitadora is introduced by the nurse supervisor from the support unit and her role and responsibilities as the community health worker explained. In communities where a new health post is being opened, the new sanitation auxiliary will often be presented as well and the complementary activities of the visitadora and sanitation auxiliary described in terms of their interaction as a health team. In-service training to introduce the visitadora to new procedures is done either by the supervisor during her regular visits or at the monthly visits of the visitadora to the support unit when she draws her salary and obtains supplies.

4. Supervision

Direct logistical and technical support of the visitadora is provided by a FSESP nurse supervisor from the support unit, who visits the health post about every two months to observe the visitadora in carrying out her routine activities and instructs her on her practices of interventions Although the community has no formal role in the supervision of the visitadora, during her visit the nurse will talk with community leaders to determine their satisfaction with the visitadora's performance. Contact with the nurse is actually much more frequent than bimonthly, since most visitadoras go to the support unit every month to draw their pay and obtain supplies.

Indirect supervision of the visitadora occurs weekly during the visit of the FSESP physician to the health post. The visitadora screens patients to see the doctor and assists during patient examinations. In some areas, a FSESP dentist also visits the health post regularly to carry out a program of preventive treatment and extractions for school children. Supervision of the visitadoras is facilitated by this frequent contact with personnel from the different service units in the FSESP system through regular visis and referral.

Prior to 1979, direct supervision of the health posts was the responsibility of personnel at the Regional Directorate (state) level. In the late 1970's, a movement towards more decentralized administration within the Fundacao SESP and the expansion of the visitadora program shifted the direct supervisory functions to the staff in the support units. A regional nurse supervisor now visits each health post only about once a year. Occasionally, FSESP staff from the central level visit the posts when on field trips.

5. Compensation

FSESP officials feel that a strong contributing factor to the effectiveness of SESP programs is the ability of the Fundacao to attract quality personnel. As was noted earlier, large numbers of candidates seek each visitadora position, permitting a rather selective screening process to be carried out. FSESP is able to recruit strong candidates in large part because the salary offered for the visitadora position is high relative to alternative employment opportunities for young women in rural areas. The starting salary for a visitadora as of April 1983 represented about four times the standard minimum salary (salario minimo), an extremely low base wage which is used to reference salaries throughout Brazil. Teachers, for example, receive a salary of about one salario minimo or even less in rural areas.

Perhaps more important than the actual amount of the visitadora wages is the job security which FSESP employment provides. Salaries are paid on a regular basis and are not dependent upon local availability of funds, such as municipal budgets. FSESP is entirely financed by the federal government to deliver services in areas of special national interest or where state health departments are unable to provide adequate coverage.

Visitadora compensation (which also includes 27 percent of salary paid in Social Security benefits or encargos sociais, as required by law) is adjusted twice a year on set dates to reflect inflation and devaluation of the cruzeiro. Salary increases of 5 percent are made for all FSESP employees with each additional five years of service. A dual pay scale based on length of service is also in effect for visitadoras. At the time of major expansion in the visitadora program in the 1970's, it was decided that some mechansims should be created to reward long-standing service in SESP, such as that of those visitadoras trained in the 1940's and

1950's who were still working. The categories of "A" and "B" visitadoras were, therefore, designated to reward those visitadoras with 25 years of service or more. The salary of the small proportion of "B" visitadoras with extensive service is about 20 percent higher than the starting salary for "A" visitadoras. This combination of short-term and long-term rewards for remaining within the health service are cited by FSESP officials as contributing to the relatively low attrition rates which have historically been found in the visitadora program.

Salaries for visitadoras with the same length of service are uniform throughout Brazil. Since differences in the cost of living exist between regions, it may be argued that compensation of visitadoras is in effect not uniform, if identical nominal wages do not have the same purchasing power throughout Brazil. FSESP officials, who consider the uniform salary to be an appropriate administrative policy, emphasize the fact that the large pay differential afforded to FSESP visitadoras (3-5 times the salario minimo) more than compensates for any disincentive effect that might be produced by regional differences in the cost of living. The alternative of creating a salary scale more closely related to variations in regional economic indicators is considered to be impractical for the centrally administered FSESP. The philosophy of regularized training, required full-time activity, uniform standards, and equal salary for equal length of service is strongly rooted in the organization of FSESP and is felt to engender the high standards of performance for which the Fundacao SESP is recognized.

6. Costs

An analysis of the annual costs of the services of the visitadora and the sanitation auxiliary in the FSESP health posts is presented in Table IV-5. Figures shown represent costs in cruzeiros for December 1982, at an exchange rate of Cr.225.00/U.S.$1.00. Information on costs was obtained from sources at the

Table IV-5

ANALYSIS OF ANNUAL COSTS OF FSESP HEALTH POSTS
(in Cruzeiros, December 1982)

Capital Costs		
Construction of health post[1]	Cr.	156,800
Furnishings[1]		18,816
Equipment[2]		84,672
Subtotal	Cr.	260,288
Training Costs[3]		
Visitadora: 324,450 ÷ 30 years	Cr.	10,815
Sanitation Auxiliary: 115,820 ÷ 30 years		3,860
Subtotal	Cr.	14,675
Operating Costs		
Salaries[4]	Cr.	2,252,214
Social Security benefits (27% of salary)		612,252
Supplies		907,445
Direct supervision (from support unit) 6 x 8,333 per visit)		50,000
Subtotal	Cr.	3,821,911
TOTAL ANNUAL COST OF HEALTH POST	Cr.	$4,096,874
	U.S.	$ 18,208

(U.S. $1.00 = Cr. $225.00)

[1] assumes 30 year use; total construction cost = 4,704,000; total furnishings costs = 564,480

[2] assumes 10 year use; total equipment costs = 846,720

[3] includes salaries of trainers, travel and per diem, materials

[4] of both visitadora and sanitation auxiliary

central and regional levels. Although this study has not been directly concerned with the work of the sanitation auxiliary, the cost analysis is made for the health post as a unit, including both the costs attributable to the visitadora as well as to the sanitation auxiliary. This approach is considered reasonable since the two health workers function as a team.

Capital costs (construction, permanent equipment, and furnishings) for the health post are amortized to reflect a 30-year expected use of the building and furniture, and a 10-year epxected use of the original equipment. Training costs, which include the salaries of trainers, travel and per diem, and materials, are also amortized based on an assumed 30 years of service for each auxiliary. Operating costs include salaries of the visitadora and sanitation auxiliary, 27 percent Social Security benefits, supplies and direct supervision from the support unit. Costs for supervision from the regional and central levels are not considered significant and are, therefore, not included.

The total cost of the FSESP program at the health post is estimated at approximately U.S.$18,200 per year. The average size of the population in the direct catchment area of the health posts (the "resident" population) is 1,000-2,000; the "non-resident" population in the larger catchment area of a health post varies in size from 0-10,000 in the communities under study. Since utilization of the visitadora's services by the non-resident population varies greatly among health posts, measurement of coverage by the visitadora is usually limited to the resident population. If the estimated annual cost of the health post is divided by the of both visitadora and sanitation auxiliary

average size of the resident population (1,000-2,000), a per capita approximation of the cost of the services of the visitadora and sanitation auxiliary lies in the range of $9-20 per year.

In relation to typical per capita health expenditures by Ministries of Health in developing countries, the cost of the visitadora program appears relatively high. This fact is recognized by FSESP officials, who maintain that effective PHC services are not necessarily inexpensive and assert that it may not be realistic to always expect the implementation of primary health care to be low cost, particularly in economically depressed rural areas such as those where the Fundacao SESP's programs mainly operate. One of the principal rationale for the continued existence of a special public health service such as the Fundacao SESP is that its target communities are precisely those which would have great difficulty financing even services of much lower cost and quality. In the case of the communities served by FSESP visitadoras, the Brazilian government has assumed the full responsibility for providing health services.

7. Analysis of Productivity, Coverage, and Quality

The services delivered by the visitadoras of the FSESP system in 1981 and 1982 are analyzed to provide information of value in planning similar services in Brazil and other countries.

a. Productivity: types of services provided by visitadoras, units of each service provided, variation among states and within states, estimated time per unit of service, variation in total estimated service time.

b. Coverage: based on estimates of both the "resident" and "non-resident" population served, variation in coverage.

c. Quality: immunization series completed, pregnant women seen before the fifth month, home visits to pregnant women.

a. Productivity

Our initial task in the measurement of productivity was to identify the major activities of the community health worker. This task was

accomplished by review of the annual (1982) output from the 306 health posts established before 1983.

The major services of the visitadora in terms of volume and professional judgment of importance of the service were:

- Home visits to pregnant and parturent women and children
- "Nursing" consultations (that is, consultations provided by the vistadora)
- Assistance in physician consultations (during weekly or bi-weekly visits), screening patients, having records ready, talking with patients after the physician consult, etc.
- Immunizations (DPT, measles, polio, BCG)
- Lab tests of urine samples of pregnant women, collection of blood for serology, etc. (not all analyzed in detail)
- Minor treatments such as first aid, bandaging, etc.
- Injections of medicine following orders of the visiting physician
- Dental prevention treatment in schools was not analyzed in detail in this report, as our Brazilian colleagues felt this service was of little importance.

Non-recorded services included health education talks, meeting with health clubs, record keeping, stocking medications, and supervision. The figures that follow show that roughly half of the estimated time of the visitadora was spent in these non-recorded activities and "non-productive" activities.

Table IV-6 shows the numbers of services in all health posts operating for all or part of 1982 as an index of total volume of major services.

Table IV-6

NUMBERS OF SERVICES BY VISITADORAS (CHWs)
IN 1982
(in thousands)

	Pregnant Female	Puerperal & Newborn	0-4	+5	Total
Home visits	11,	11,	62,	5,	89,
Visitadora consult	45,	-	139,	12,	196,
Doctor consult	54,	8,	127,	167,	356,
Immunizations	28,	-	367,*	89,	484,
Lab-urine tests	56,	-	4,	-	60,
Treatments					169,
Injections					251,
School dental					173,

Note: Some visitadoras worked for only a few months of 1982.

*Half of these immunizations were for infants under one year of age.

The other services (approximate volume of services for all health posts in parentheses) of the vistadora include:

- Assisting in recording dental treatments (16,000)
- Other lab work, including preparation of material for fecal exam (30,000), collection of blood for syphilis tests (25,000), slide preparation for TB/sputum examinations (13,000), collection of blood for typing, blood counts, etc. (2,000), collection of material for leprosy examination (1,000), other examinations of secretions (1,000), other laboratory examinations (1,000).
- Anti-syphilitic treatment for pregnant women (1,000)
- "Crede" for the newborn (as part of post-partum visits) approximately (10,000)
- Provision of milk to pregnant women (11,000)
- Provision of milk to nursing mothers (7,000)
- Treatment of dehydrated children (8,000)
- TB control including: visitadora consults on TB (2,000); doctor consults on TB (2,000); registration of new TB cases (300); children started on TB chemoprophylaxis (60)
- Leprosy control including: registration of leprosy cases (100), injections for leprosy cases (3,000)
- Examinations for cervical cancer (700)
- Minor surgical procedures (2,000)

In addition to the work at the health post carried out by the visitadora, a number of sanitation tasks are performed by the sanitary assistant. Sanitation work is not a function of the visitadora but the sanitary assistant will,

on occasion, assist the visitadora in her work and take over some of her functions when she is sick. For background, the major functions of the assistant sanitarian are:

Sanitation inspections (27,000 per year) for all health posts

Sanitation visits (207,000)

Connection to water supply (2,200)

Improvement and construction of wells (200)

Installation of reservoirs (2,000)

Construction of public bathing and washing facilities (4,000)

Installation of tanks for public laundry (2,000)

Latrines constructed (3,000)

Connection to sewage systes (200) Connection to sewage systems (200)

The preceding information is total volume of services per year for all health posts in 1982. We also analyzed the volumes of services for individual health posts in 1981-82 for the nation and individual states.

Table VI-7 shows the distribution of the number of services per visitadora (CHW) in the State of Ceara for two major functions. There are large variations of number of services among units (more than double many cases) showing that even in a well-supervised, standardized system, differing local needs, acceptance of service and attributes of visitadora and the supervisor result in variable service allocations. Reasons for the variations and their implications are discussed later.

Table IV-7

DISTRIBUTION OF VOLUME OF SERVICES IN CEARA

No. of M.D. Consultations	No. of Visitadoras	No. of Immunizations Provided	No. of Visitadoras
300	1	1,000	10
400	2	2,000	15
500	1	2,000	15
600	0	3,000	5
700	1	4,000	4
800	7	5,000	0
900	14	6,000	3
1,000	4	7,000	0
1,100	6	8,000	1
1,200	1		
1,300	1		

The results of the time study are shown below. The services listed and median times per service were as follows:

A. Consultations by visitadora:

1. to pregnant women: 18 minutes per service
2. to children 0-4 years: 14 minutes per service
3. to older children and adults: 12 minutes per service
4. TB: 16 minutes per service
5. leprosy: 16 minutes per service

B. Visits:

6. to pregnant females: 39 minutes per service
7. to puerperal females: 44 minutes per service
8. to the newborn: 41 minutes per service
9. to children 0-4: 23 minutes per service
10. to older children and adults: 27 minutes per service
11. to TB patients: insufficient replies to analyze
12. to leprosy patients: insufficient replies to analyze

C. Immunizations:

13. oral--polio: 3 minutes per service
14. injectable--DPT, measles and tetanus toxoid: 6 minutes per service

D. Laboratory work:

15. urine examination: 8 minutes per service
16. preparations of the sputum slides: 11 minutes per service
17. other slide preparations: insufficient replies to analyze
18. collection of blood for VDRL: 7 minutes per service

E. Treatments:

19. first aid measures: 8 minutes per service

20. injections: 7 minutes per service

21. emergency treatments: insufficient replies to analyze

Functions not performed as discrete units, such as health education, sterilization of supplies, record keeping, etc., were tabulated separately. In the time reports for these activities there were several unusually high values, thus both means and medians are reported. Note: The numbers in parentheses represent an expansion from the estimated daily time to the estimated monthly time using 22 working days per month. These values are consistent with field observation of visitadoras' work in Rio Grande de Norte and Minas Gerais.

F. Health education for:

		Mean	Median
22.	pregnant females:	(2150	1400) minutes per month for health eduction to all
23.	mothers:		
24.	indigenous midwives:		
25.	others:		

G. Other:

		Mean	Median
26.	preparation and sterilization of material	614	418 minutes per month
27.	preparation of daily work plans	(374	286) minutes per month
28.	not occupied with any special task	(1738	660) minutes per month
29.	preparation and triage of patients for doctors, and—		
30.	distribution of medication and orientation	520	480 minutes per month (15 minutes per patient seen)

G. Other (continued):

		Mean	Median
31.	completion of statistical forms,	292 for all	240 minutes per month
32.	preparation of monthly report, and		
33.	preparation of supply requests		

The survey method presents obvious reliability problems and a simple functional analysis study to determine the actual times devoted to each activities would have been preferable. Hopefully this type of analysis can be carried out by FSESP in the future; they have detailed instructions which should make it possible for the supervisors in the various regions to carry out such a study.

From the survey data, the times for consultations, immunizations, lab work and home visits appear to conform closely to the standards used by the supervisors to evaluating the visitadoras' work. The major exception to this was evident in estimates for home visits which included travel time; this reinforces the need for a future functional analysis study to determine the real times and variation from one visitadora health post to another, and from one state to another.

The standard times used by nurse evaluators in supervising visitadoras are: registrations—10 per hour; nursing consultations--3 per hour for pregnant females, 4 per hour for TB and leprosy; immunizations--10 per hour in the campaign; home visits—1.5 per hour for newborn and post-partum (excluding travel) and 2 per hour for defectors and TB and leprosy cases; and laboratory services--6 per hour.

The median times calculated from the survey per activity (shown above) were multiplied by the total number of services provided to obtain the

distribution of total time for each of the seven major services we analyzed for the separate states. This measure of productivity is called "total proxy hours." It is not a measure of actual time, but of productivity. It does not include time spent on community activity (see Table IV-8). The information provides a useful initial step for a supervisor to take in reviewing the productivity of the visitadoras. Some of the visitadoras appear to have more estimated time than is available in their work year (1800 hours); this is explained by the following: 1) the median estimates of time for tasks are over-estimates for the more efficient visitadoras, and 2) the sanitary assistant performs some of the visitadora activities in some units. Again, these complications underscore the importance and necessity of carrying out time studies by a Health Functional Analysis to determine the true time values for program planning and supervision.

The "proxy hours" spent by visitadoras on individual activities also shows great variation. Table IV-9 shows the allocations in "proxy hours" for two specific activities, consultations and immunizations for all visitadoras. There is remarkable variability in time spent on these activities, even assuming that extreme outliers may represent errors in recording, transcribing or punching. Figures IV 1-3 present the median "proxy hours" for each state for each major activity. These figures show the variation among the states in levels of specific activities (unit times are constant). The "total proxy hours" indicate great variability, which prompts the questions: Is this variability desirable in all cases? Should the state supervisors be made aware of the differences?

b. Coverage

Table IV-10 shows the percent prenatal coverage, the number of pregnancies estimated for health post areas divided into the number of pregnant women registered during the year times 100. The percentage coverage is more

Table IV-8

DISTRIBUTION OF PRODUCTIVITY "TOTAL PROXY HOURS" OF ALL VISITADORAS (CHWs)

"Total Proxy Hours" Per Year	Number of Visitadoras
0	5
500	92
1,000	96
1,500	26
2,000	3
2,500	2

1 CHW in excess of 5,000 " proxy hours" assumed to be a data recording or punching error.

Table IV-9

DISTRIBUTION OF "PROXY HOURS" OF VISITADORAS (CHWs)

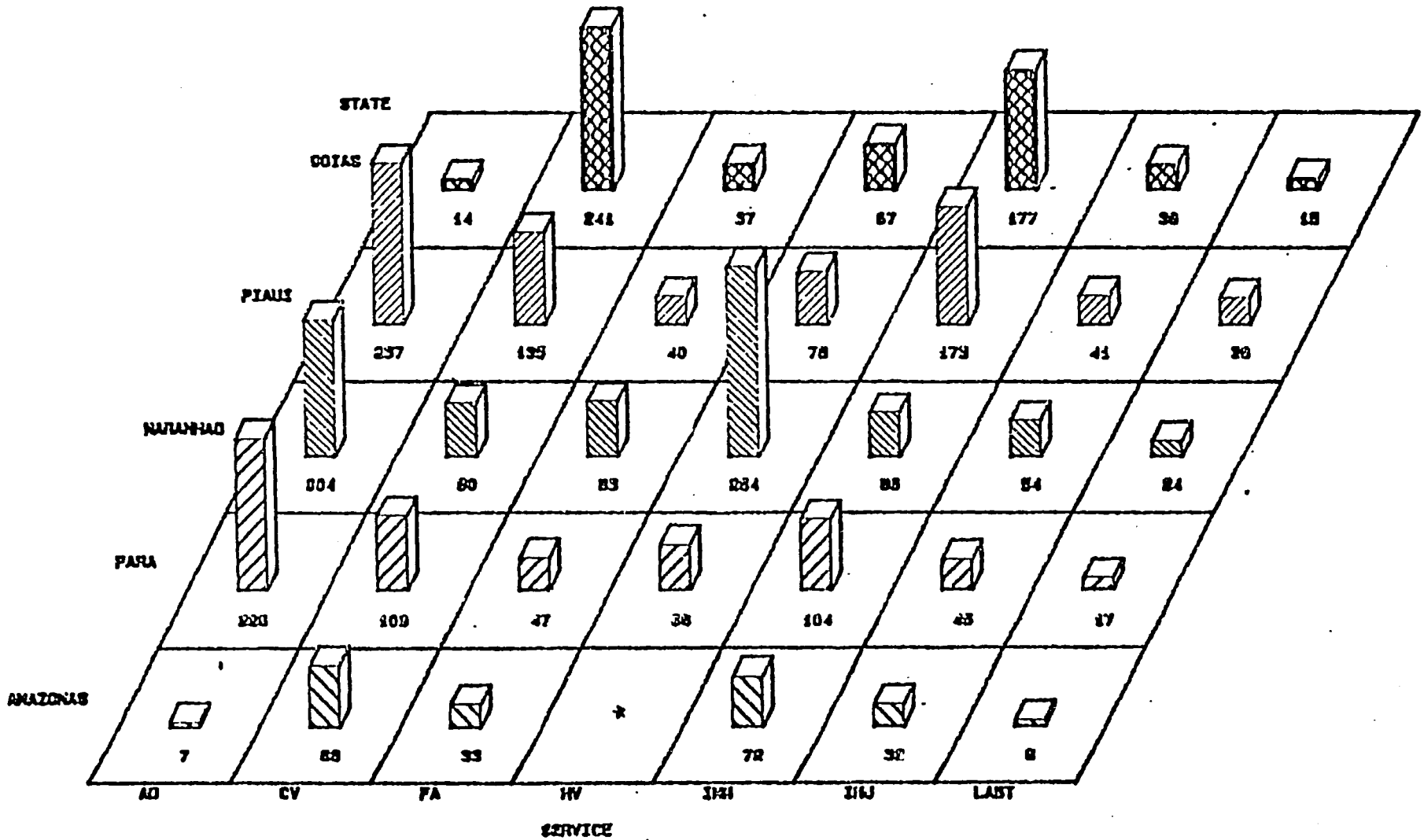
"Proxy Hours"	No. of Visitadoras	"Proxy Hours" for Immunizations	No. of Visitadoras
0	38	0	12
100	118	50	69
200	42	100	50
300	17	150	33
400	7	200	21
500	1	250	16
600	1	300	5
700	0	350	6
800	1	400	6
		450	0
		500	2
		550	2
		600	2
		650	0
		700	0
		750	1

Figure IV-1

SERVICES IN "PROXY HOURS" FOR VISITADORAS

PER YEAR BY STATE OF BRAZIL, 1981

AD = ASSISTING DOCTOR CV = CLINIC VISITS FA = FIRST AID
HV = HOME VISITS IMM = IMMUNIZATIONS INJ = OTHER INJECTIONS
LABT = LAB TESTS



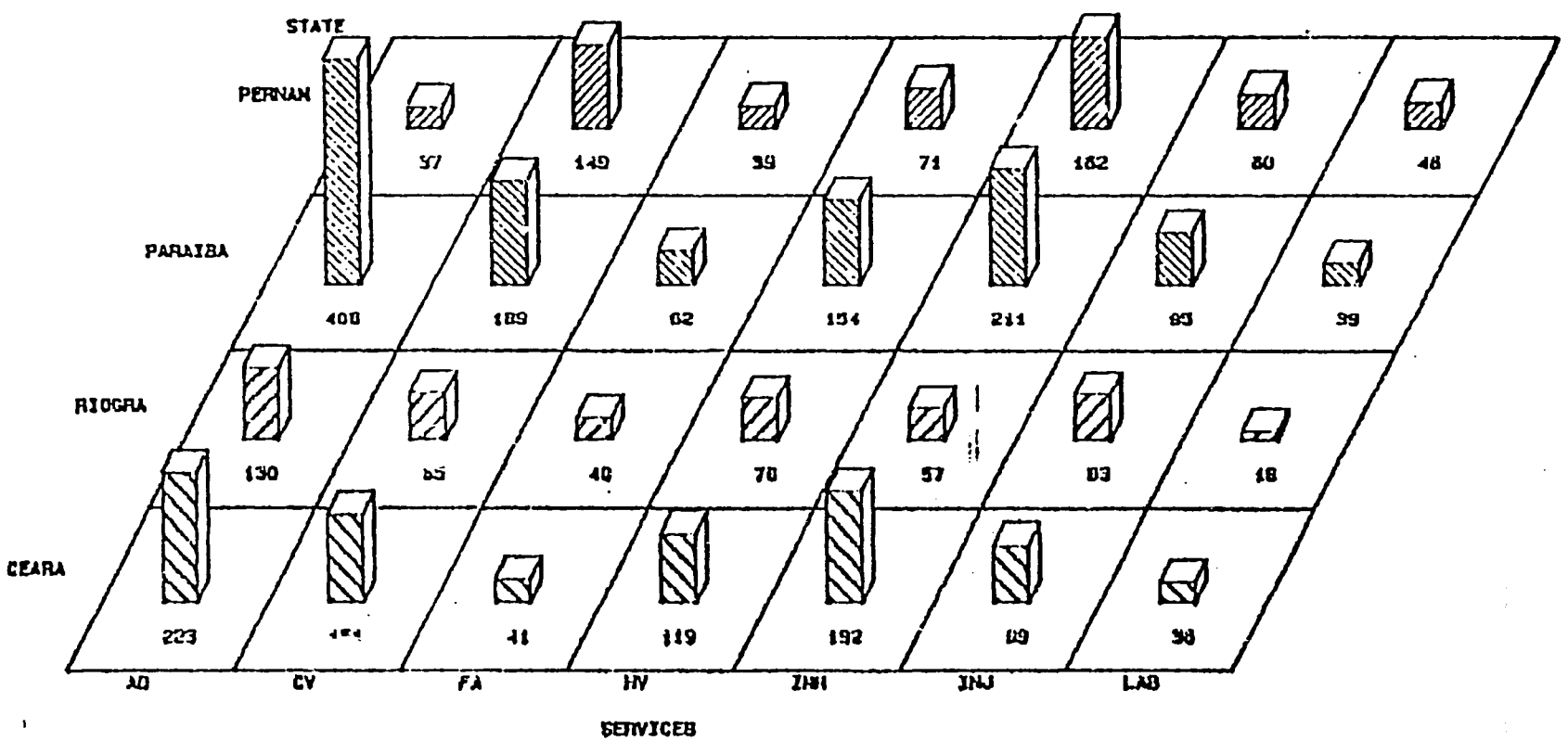
FOR THE NORTH, MIDNORTH AND WEST REGIONS OF BRAZIL

* inadequate data

Figure IV-2

SERVICES IN "PROXY HOURS" FOR VISITADORAS
PER YEAR BY STATE OF BRAZIL, 1981

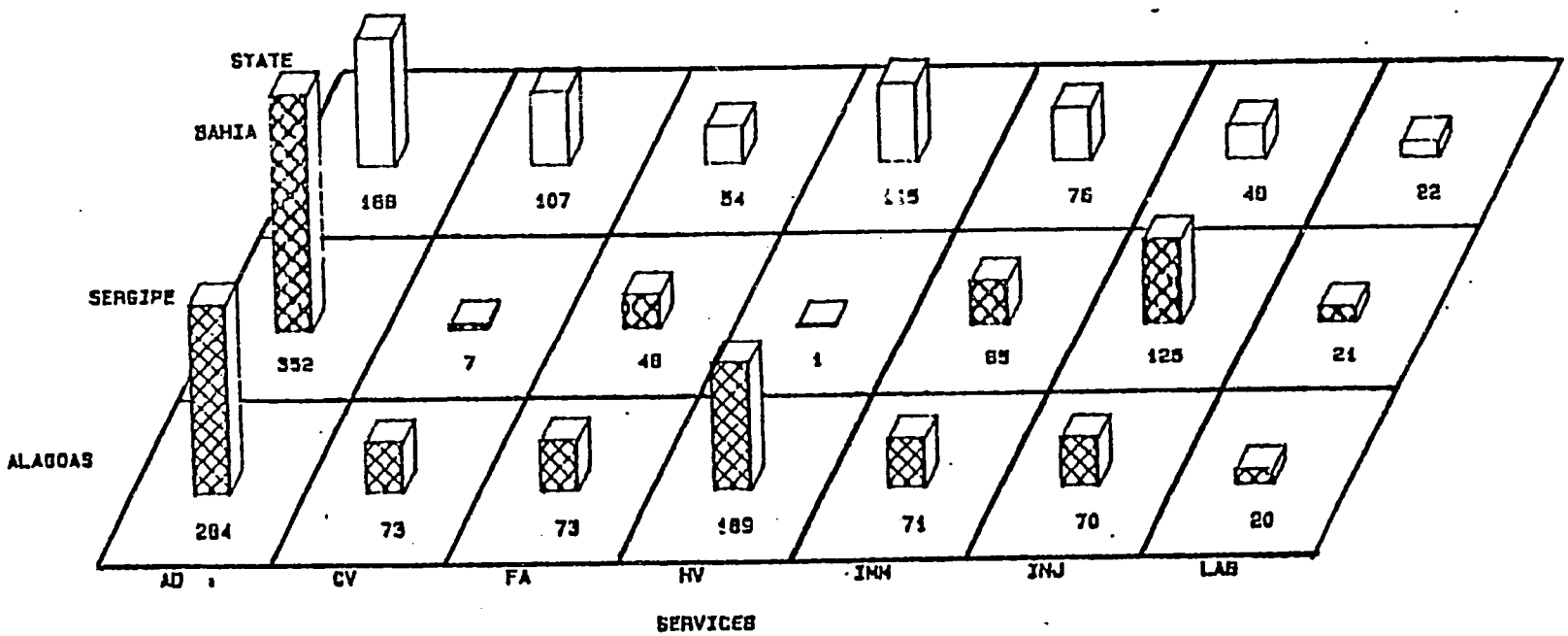
AD = ASSISTING DOCTOR CV = CLINIC VISITS FA = FIRST AID
HV = HOME VISITS IMM = IMMUNIZATIONS INJ = OTHER INJECTIONS
LABT = LAB TESTS



FOR THE NORTHEAST REGION OF BRAZIL

SERVICES IN "PROXY HOURS" FOR VISITADORAS
PER YEAR BY STATE OF BRAZIL, 1981

AD = ASSISTING DOCTOR CV = CLINIC VISITS FA = FIRST AID
HV = HOME VISITS IMM = IMMUNIZATIONS INJ = OTHER INJECTIONS
LAB = LAB TESTS



FOR THE NORTHEAST REGION OF BRAZIL
(continued)

Figure IV-3

Table IV-10

PERCENT PRENATAL COVERAGE
(Pregnant Women Registered Over Estimated Live Births Times 100, Average 1981 and 1982)

	Nearby "Resident"	Outlying "Non-resident"
Amazonas	71	.1
Para	130	*
Marinhao	117	*
Piaui	130	*
Ceara	101	48
Rio Grande de Norte	125	*
Paraiba	129	*
Pernambuco	112	45
Alagoas	88	*
Sergipe	78	27
Bahia	92	18
Minas Gerais	87	*
Goias	97	68

*Base population data not available for whole state.

than 100 for all but six states. This can be explained in part by underestimation of birth rates for those areas of the state with health posts, and in part by misidentification of non-residents as residents. This potential explanation requires extensive demographic study for confirmation.

The important implication of these data, however, is that in the majority of states the FSESP visitadora reached most pregnant women within her immediate area (i.e., the resident population). The one state with insufficient coverage of pregnant women was Amazonas, where only 71 percent of the pregnant women (estimated by resident births) were seen by the visitadora. The very difficult transportation in the Amazon basin jungle area may limit coverage. The rates less than 100 percent in Sergipe, Minas Gerais, and Alagoas will be called to the attention of the state nursing supervisors.

Table IV-10 shows a very different picture of coverage for the non-resident population in states where the size of that population is known. As noted earlier, the non-resident population is extremely difficult to determine in areas where FSESP has not carried out a census of households. Table IV-10 shows coverage of the non-resident population, ranging from 0.1 percent in Amazonas to 68 percent in Goias in 1982—a surprisingly high figure considering the distance from the health posts. In the state of Para where transportation is also difficult because of jungle conditions, in one area with known non-resident population of more than 5,000, 17 percent prenatal coverage of all births was achieved. Even more surprising is one health post in the state of Goias, the visitadora achieved 90 percent coverage of a population of 9,000 in the outlying area in 1982.

Further information on the extent of coverage of the population can be seen in Table IV-11, showing the number of curative injections per capita for both the nearby "resident" and outlying "non-resident" population for 1981 and

Table IV-11

CURATIVE INJECTIONS PER 100 INHABITANTS—
RESIDENT AND NON-RESIDENT POPULATION
(Average 1981 and 1982)

	Resident	Non-Resident
Amazonas	32	1
Para	47	*
Marinhao	32	*
Piaui	27	*
Ceara	29	10
Rio Grande de Norte	82	*
Paraiba	77	*
Pernambuco	37	5
Alagoas	41	*
Sergipe	61	12
Bahia	36	5
Minas Gerais	*	*
Goias	17	2

*Base population data not available for whole state.

1982. The range is from 0.8 injections per capita in Rio Grande de Norte to somewhat less than 0.2 injections per capita in the state of Goias. This does not mean that 80 percent of the resident population in Rio Grande de Norte received injections, because some patients received more than one injection during the year. However, it does indicate a relatively high degree of coverage for curative injections.

The non-resident population received less than one-tenth as many injections per capita per year as the resident population, indicating that the coverage of curative medicine as measured by injections was very low for this outlying population. More importantly that "curative" services had lower coverage of outlying populations than preventive services.

Table IV-12 indicates the number of pregnant women registered by the health posts who received one or more home visits. In 1982 with the exception of Sergipe, where only an average of 28 percent of the women received home visits, prenatal home visiting coverage was acceptable. In Paraiba in both 1981 and 1982 pregnant women received more than one home visit. The variation in coverage should be a finding of considerable interest to the supervisory and evaluation staff in Fundacao SESP.

A coverage pattern similar to that for pregnant women is seen in the age 0-1 resident population registered at the health posts compared to the estimated age 0-1 population in the non-resident area. There are more 0-1 registrations than the calculated birth rate would indicate. Coverage was also examined with regard to immunizations given to the registered 0-1 population. The results for 1982 are presented in Figure IV-4. There is greater coverage for DPT and polio than for measles. FSESP officials are seeking solutions to this problem as well as exploring the basis for differences between states..

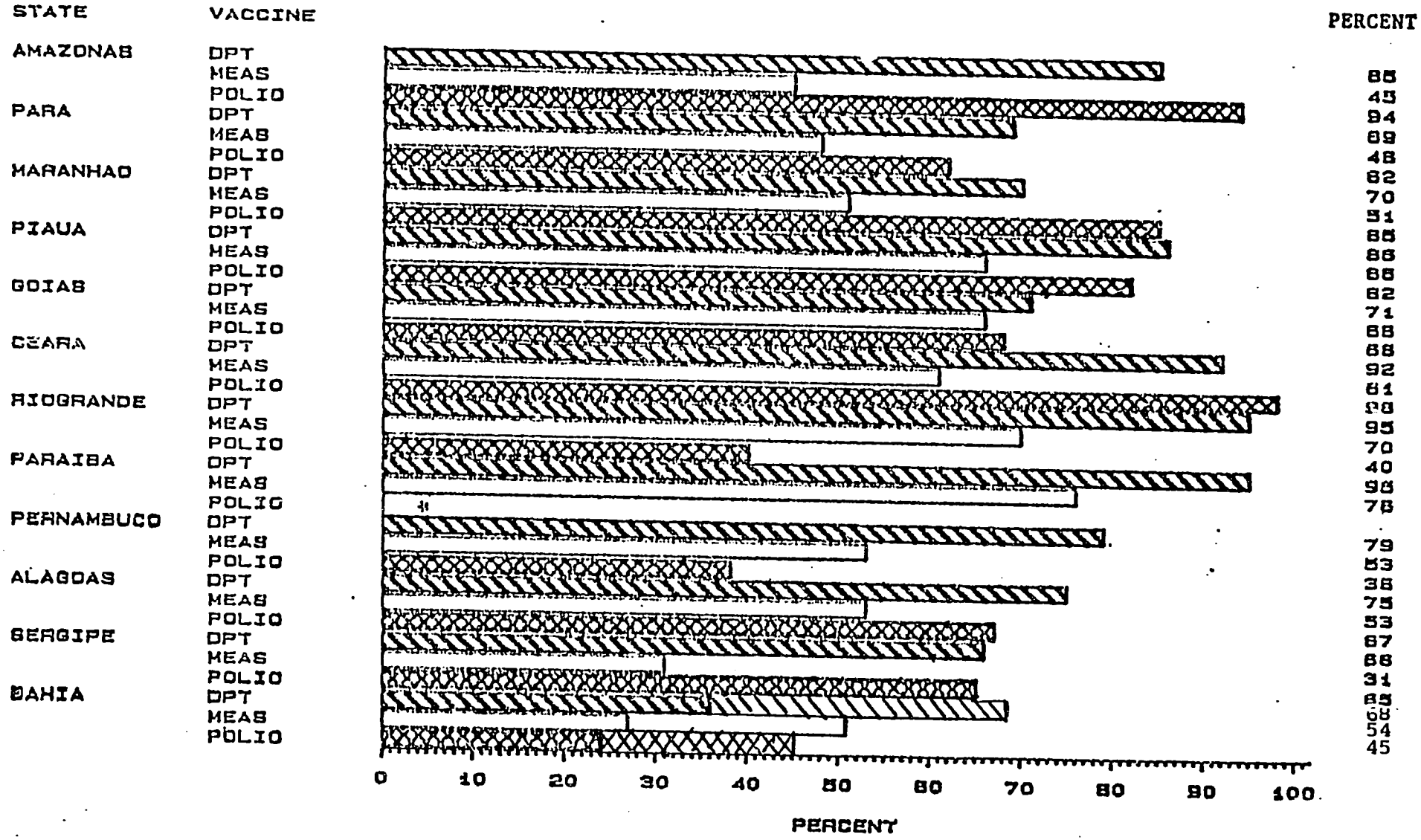
Table IV-12

HOME VISITS PER 100 PREGNANT WOMEN REGISTERED--
RESIDENT POPULATION
(1981 and 1982)

	1981	1982
Amazonas	113	93
Para	39	63
Marinhao	68	97
Piaui	47	44
Ceara	89	79
Rio Grande de Norte	81	88
Paraiba	132	119
Pernambuco	62	70
Alagoas	92	91
Sergipe	21	28
Bahia	54	56
Minas Gerais	42	61
Goias	25	40

PERCENT COVERAGE OF DPT, MEASLES AND POLIO

VACCINATIONS BY STATE OF BRAZIL



1982
(1st dose)

* inadequate data

Figure IV-4

Figures IV-5-7 show that there is little difference between the results of 1981 and 1982 for DPT immunization coverage and fairly large differences in coverage for polio and measles in some states. The reasons for annual variation are being sought.

Table IV-13 shows that coverage in non-resident population for immunizations is better than for curative injections. This is evidence of successful implementation of FSESP policy, which emphasizes prevention.

c. Quality

The quality of care was estimated by three measures. The first measure was the percent of immunization series that were completed. Figure IV-8 shows the percentage of third polio doses among 0-1 population that have had first polio doses by state. Ther percentages vary from 39 to 99, providing useful information for state supervisors. Figure IV-9 shows the number of third doses for DPT in relation to first doses by state, which varies between 59 and 100, less variation among states from polio, but still showing reason for concern in the less-effective states.

A second measure of quality of care is the percentage of pregnant women seen before the fifth month in pregnancy. As Table IV-14 shows, the percentages for most states are quite satisfactory. All of these measures of quality are independent of population and include only patients registered thus avoid the problems of estimations of population covered.

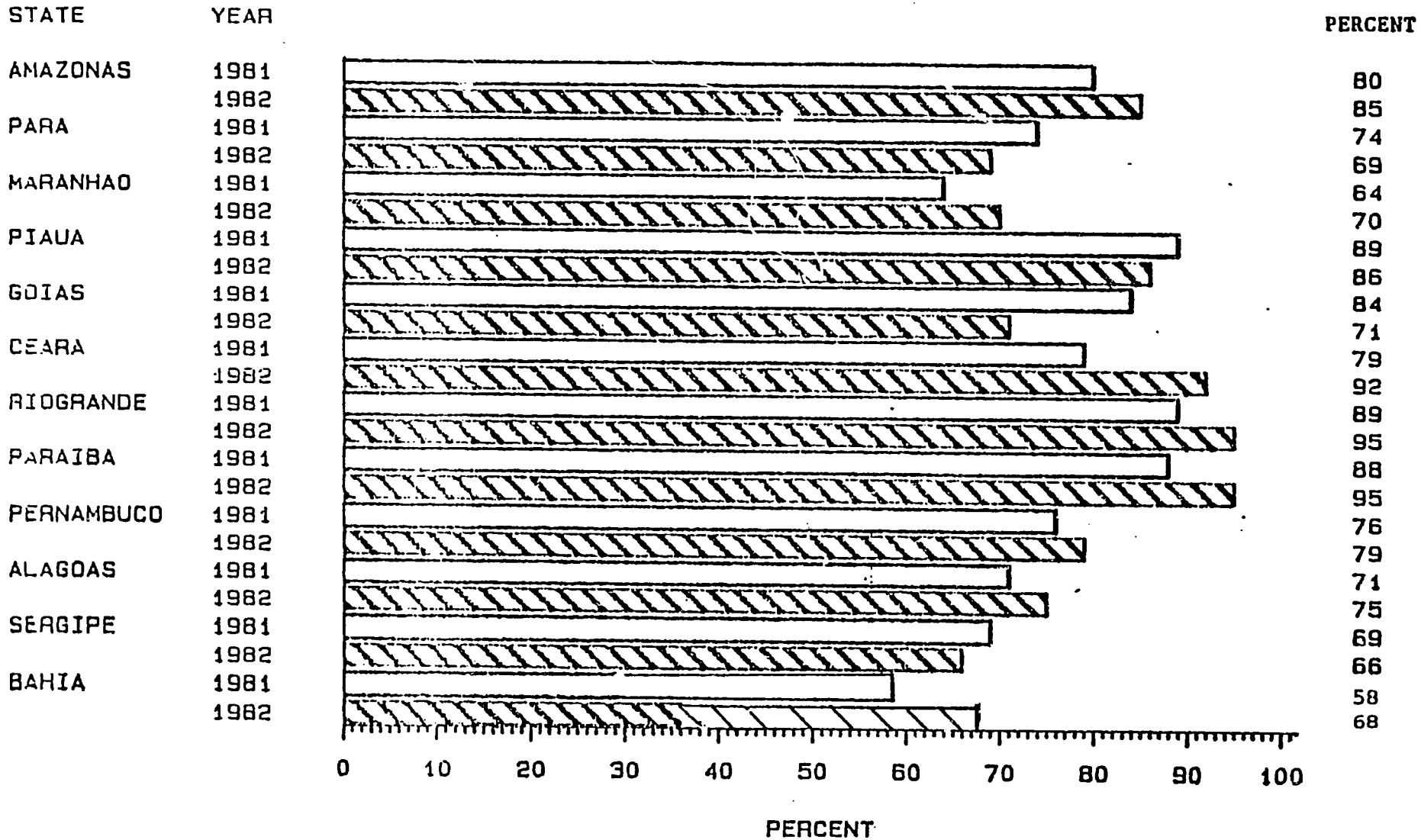
The third measure of quality, which also could be considered a measure of coverage, is the number of pregnant women receiving home visits from the visitadora, shown in Table IV-12. Since this table is calculated from the number of home visits to pregnant women, divided by the number of pregnant women registered, and oe woman may have several visits, it is possible to have

Figure IV-5

PERCENT COVERAGE OF DPT VACCINATIONS

PERCENT COVERAGE OF DPT VACCINATIONS

BY STATE OF BRAZIL



1981–1982

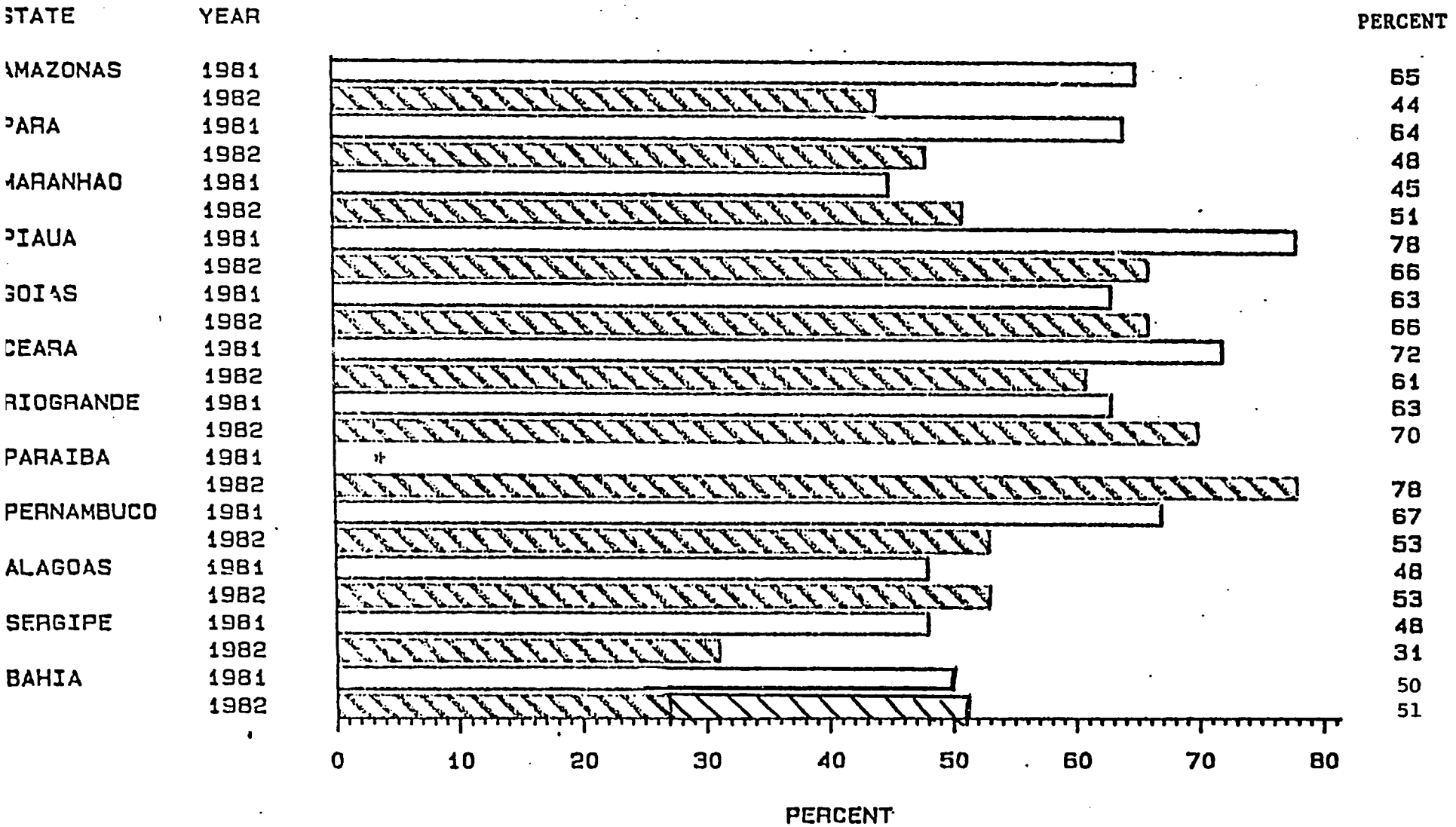
(1st dose)

Figure IV-6

PERCENT COVERAGE OF MEASLES VACCINATIONS

PERCENT COVERAGE OF MEASLES VACCINATIONS

BY STATE OF BRAZIL



1981–1982

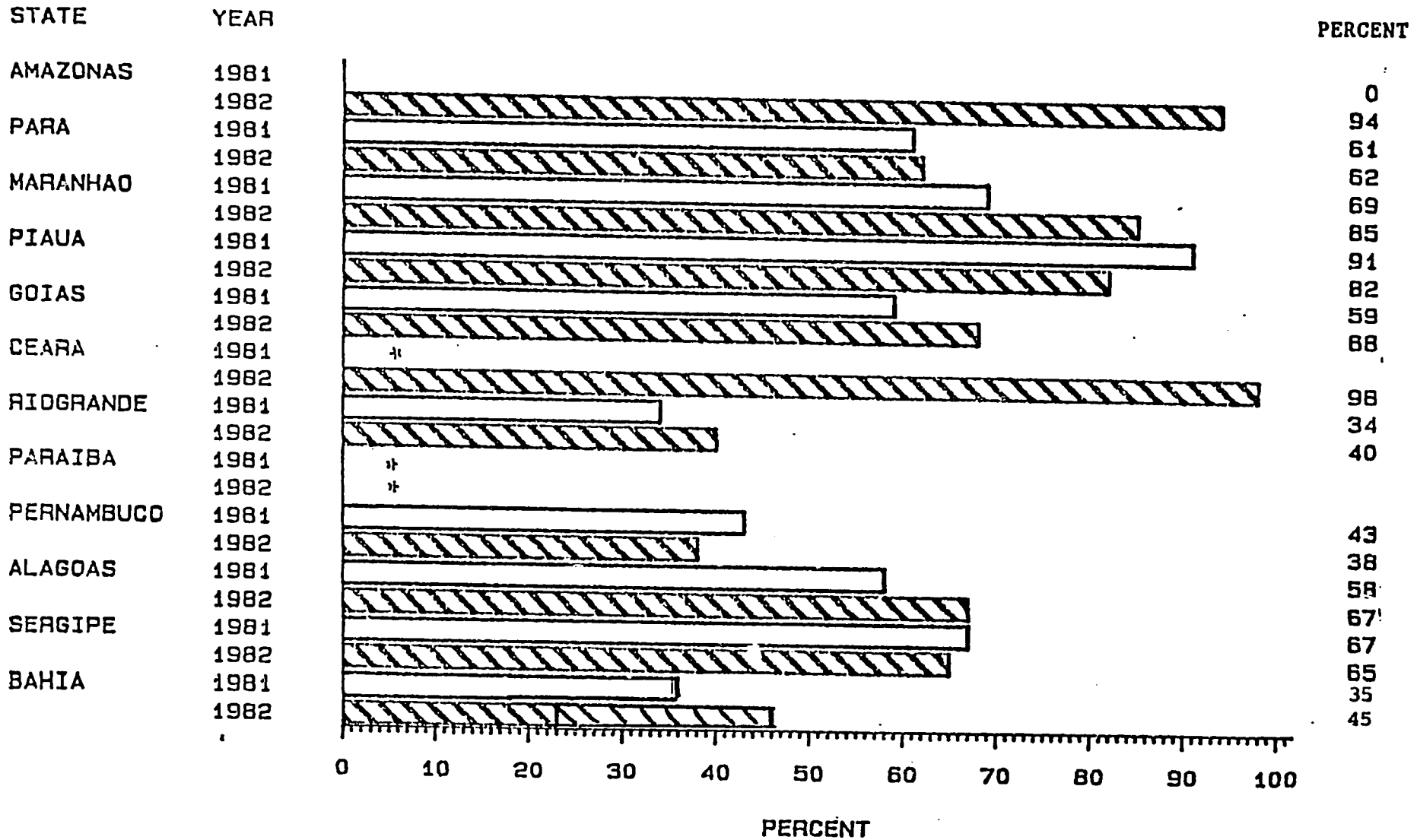
* inadequate data

Figure IV-7

PERCENT COVERAGE OF POLIO VACCINATIONS

PERCENT COVERAGE OF POLIO VACCINATIONS

BY STATE OF BRAZIL



1981–1982

(1st dose)

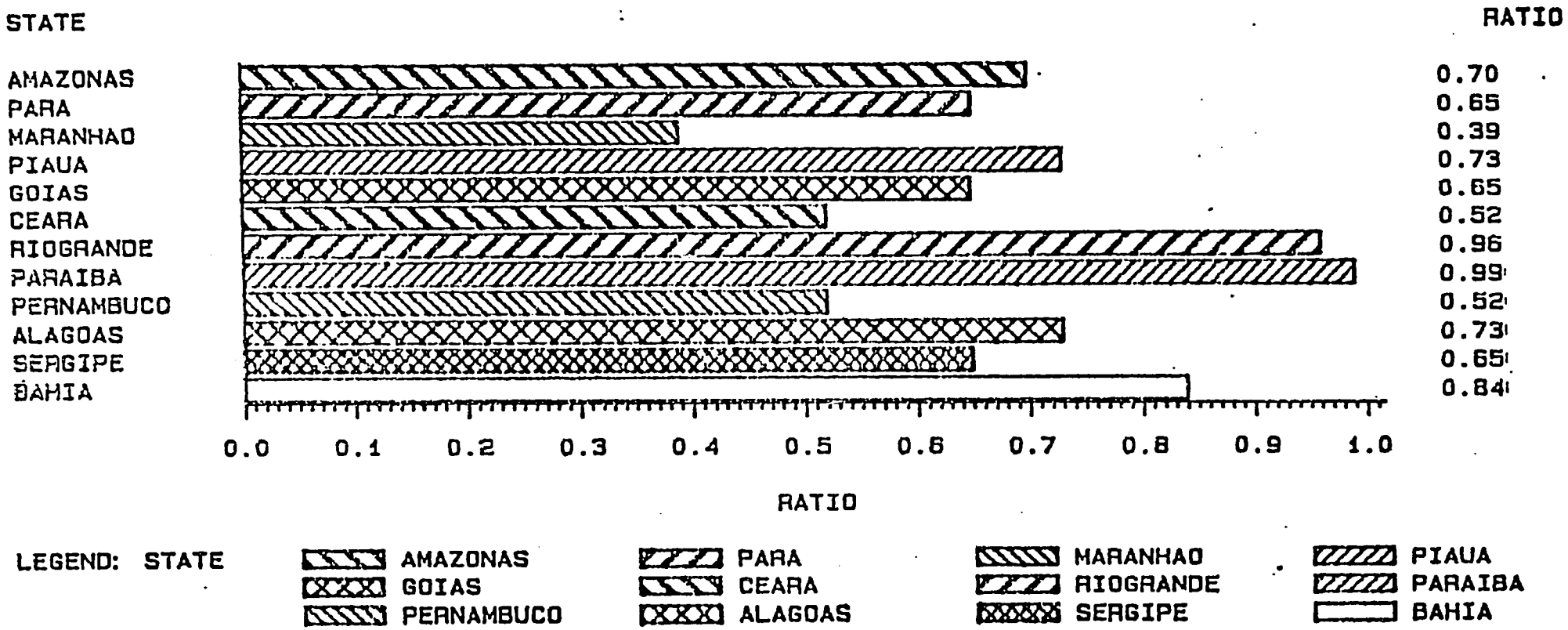
* inadequate data

Table IV-13

COMPARISON OF PREVENTIVE AND CURATIVE COVERAGE FOR NEARBY AND DISTANT POPULATIONS, 1982
(Ratios of Coverage of Nearby to Distant Populations)

	BCG Immunizations	Curative Injections
Ceara	2:1	3:1
Pernambuco	3:1	11:1
Bahia	4:1	15:1
Goias	2:1	7:1

RATIO OF 3rd DOSE TO 1st DOSE
FOR POLIO VACCINATIONS

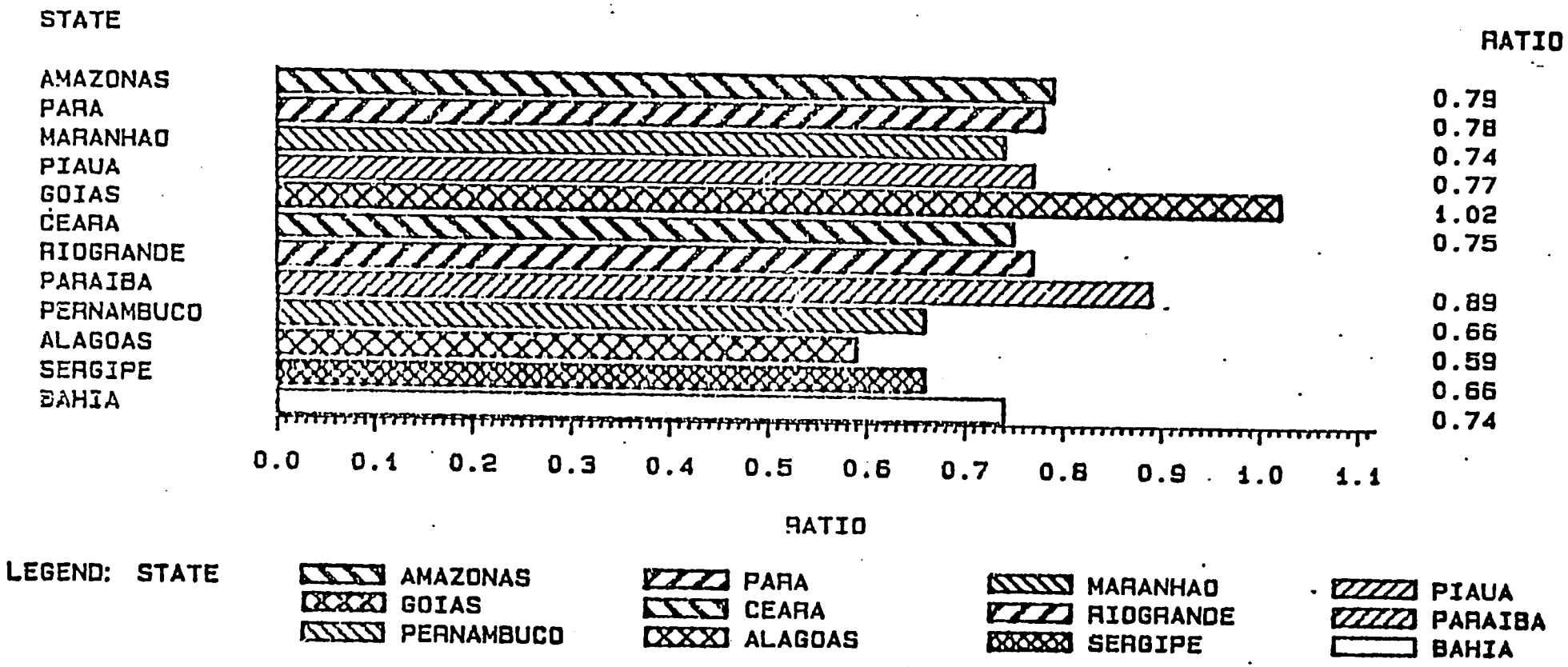


1981

Figure IV-8

Figure IV-9

RATIO OF 3rd DOSE TO 1st DOSE
FOR DPT VACCINATIONS



1981

Table IV-14

PERCENT PREGNANCY REGISTERED BEFORE FIFTH MONTH

	1981	1982
Amazonas	74	65
Para	65	65
Marinhao	75	75
Piaui	75	81
Ceara	82	85
Rio Grande de Norte	87	85
Paraiba	94	95
Pernambuco	65	72
Alagoas	73	75
Sergipe	76	79
Bahia	77	79
Minas	77	75
Goias	53	58

rates over 100. There are great variations in rates in two adjacent states of similar socio-economic development. For example, in Alagoas almost all pregnant women are visited, while in Sergipe only one-fourth of the pregnant women who registered are visited. An important task of national and regional supervisors is to determine the reasons for this difference.

There are also large differences in rates from year to year which should be of concern to the supervisors at state and national level.

8. Comparison with Other Community Health Worker (CHW) Programs

The results of two Brazilian programs that have attempted to adopt the FSESP visitadora (CHW) concept are instructive PIASS (program of health and sanitation for interior rural areas) and the Miniposts in Rio Grande de Norte have been evaluated. The National School of Public Health evaluated the PIASS program in the state of Pernambuco in 1980 and the World Bank evaluated the Minipost program in 1975. These evaluations identify important components of the FSESP system of community primary health care that were missing in the other programs and caused problems.

Evaluation of PIASS in Pernambuco

Four investigators evaluated programs that had been in operation for four years in Bom Conselho County in the Caranhuns health region and Passira County in the Limoiero health region. Information was gathered through observation of participants in the program, interviews and review of data available locally and in the state office of PIASS.

The evaluation team observed that the work of the health posts was basically injections and simple curative procedures, rather than expansion of public health/preventive services that would have a greater impact on the health of the people.

Perhaps the reasons for the lack of emphasis on preventive measures in the PIASS program rests in training and in supervision. The PIASS training was reported as considerably shorter and more traditional than the training of the FSESP visitadoras and does not have as much practical experience as the FSESP courses.

The supervision of PIASS health posts was reported as minimal. It is supposed to occur twice a year, but in one of the regions studied, a supervisory visit had occurred only one time during the total operation of the project, and in the other region no visits had occurred. It was reported that the supervisory visit was superficial.

Thus, it seems that even if there are objectives for securing public health coverage of the population, without an appropriate training program and appropriate supervision, the goals will not be reached.

Evaluators stated that there was always a degree of influence from the local political leaders in the selection of personnel. This is unlike FSESP where the selection is made strictly on the basis of merit.

Another conclusion of the PIASS evaluation was that the health posts supervisory and referral health centers worked separately, without integration, and the population did not use health posts as an entre' into the health system.

In FSESP the entire referral pattern has been carefully planned and works well.

The Minipost Program of Rio Grande de Norte

The World Bank reports that although only 17 percent of the population is in the capital city of Natal, 58 percent of physicians, 90 percent of nurses, 100 percent of nutritionists, auxiliary nurses, sanitary inspectors of the

state health secretariat are in Natal. This imbalance is in sharp contrast to FSESP which pays adequate salaries for personnel working in the interior and has rural health centers well staffed with physicians, nurses, and auxiliaries. The Bank report notes that in their review of the records for 31 health miniposts, "... performance still needs to be substantially improved. Low vaccination rates, primarily in the cases of BCG and measles, are due to the limited supply of vaccines; low laboratory test rates reflect deficient integration of miniposts with the health center level." These unsatisfactory results, in comparison to the FSESP visitadora program, may reflect several differences in implementation program for the miniposts. In training, the minipost community health workers were trained for only three months. FSESP visitadoras have 60 percent more training time. It is also noted that "refresher and in-service training courses seem to be poorly structured and held on a rather irregular basis." This may be contrasted with FSESP's program of regular supervisory visits and sessions held at the referral and supervision health center for all of their visitadoras, on a regular basis throughout the year.

The report notes that "probably the most serious obstacle to efficiency and effectiveness of community based health service, is posed by the virtual lack of medical supervision by higher tiers of the official health system—moreover, referral is poorly organized with people depending largely on self-referral to urban hospitals." This is in strong contrast to the FSESP program which provides frequent and regular supervision and has an effective referral system.

Another stated problem in the implementation of the minipost program is that "most municipalities pay extremely low salaries to the community health workers--in some cases corresponding to less than 25 percent of the legal minimum wage. Payment is usually delayed by 1-3 months. In some cases salaries

are not being paid at all." This is in strong contrast to FSESP where the salaries are attractive and paid regularly.

The fact that the minipost community health worker gives high priority to public health/prevention may be based on the training program which, although inadequate in time, was designed by FSESP, and thus placed high priority on prevention.

The back-up services, in a few cases, were provided by FSESP and according to the report "there is still a substantial difference between the quality of services provided to the health miniposts by the understaffed and underfinanced facilities of the health department, and the effectively operated health centers of Fundacao SESP."

In conclusion, it appears that in comparison to two other programs, the FSESP program is far more effective in providing needed preventive health services to rural areas through community health workers for four reasons: longer training (5-6 months); better supervision; an effective referral system; and adequate salaries, paid on a regular basis.

References

1. IBRD Office Memorandum June 11, 1975. Health Annex of Rio Grande de Norte appraisal report.

2. National School of Public Health, mimeographed document, Evaluation of the Program of "Interionization" of Health and Sanitation—Pernambuco.

3. Personal communications: Dr. Ernami Braga, Director of the National School of Public Health; Dr. Gerson Norhona, Director Health Programs, MOBRAL.

D. Discussion and Conclusions from the Visitadora (CHW) Study

1. Variation in Productivity

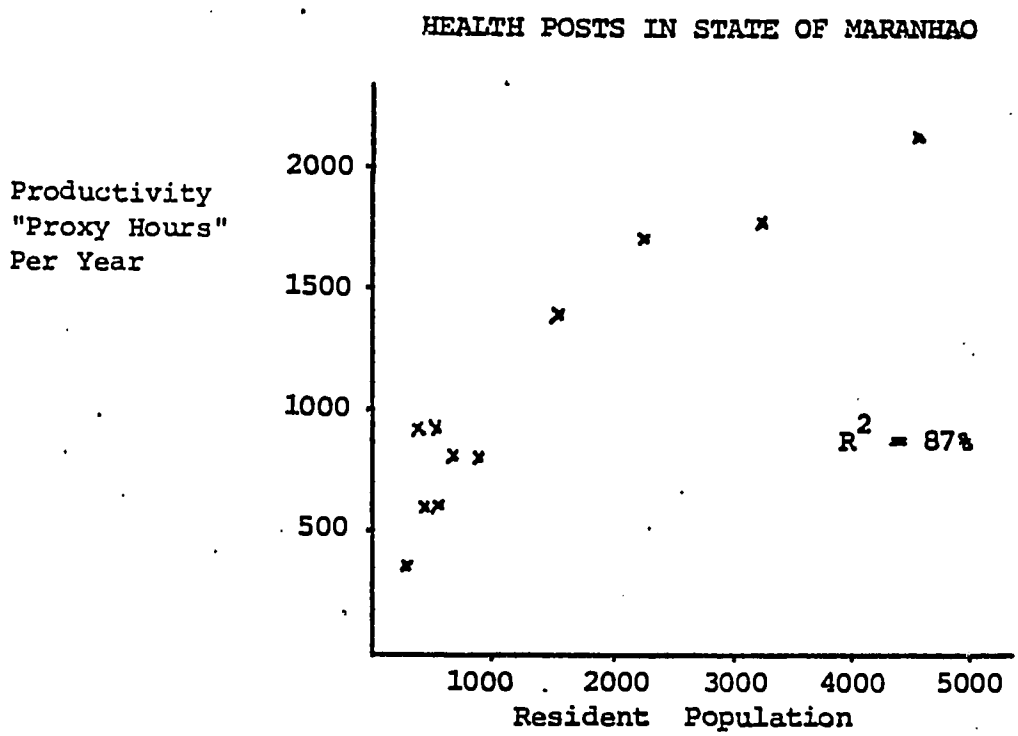
As described under Results, we found great variability in productivity among visitadoras.

How can the range of productivity among the units be explained? Our first approach was to plot the service time against the resident population for the health posts. As may be seen in Figure IV-10 for the health posts of the state of Marinao, there is almost perfect correlation of resident population with total productivity. (Regression analysis with population as an independent variable gave an R^2 value of 87 percent when corrected for degrees of freedom.) The states of Sergipe, Pernambuco, Rio Grande de Norte have R^2 values of 30-40 percent, corrected for degrees of freedom and Minas Gerais and Para have R^2 values of 70-80 percent. These are large R^2 values for social data. However, when we extended this analysis to include all states, any semblance of a meaningful relationship between size of resident population and total productivity disappeared. The other independent variables such as average travel time to health post for the resident population, availability of other health services, economic and educational levels of the community were unavailable in the service statistics. In addition, vitally important but virtually immeasurable factors, such as personality of the visitadora and attitude of the community, were unavailable.

We originally thought that the number of years that a health post had been open would be an important determinant of productivity. This does not appear to be true; we looked at the question of length of operation of 12 units and found that within the initial 6-9 months of operation, the visitadora had built up her work load to a plateau, indicating that years of operation was unlikely to explain variation in productivity.

Figure IV-10

RELATIONSHIP OF PRODUCTIVITY AND POPULATION SERVED



2. Cost estimates should be of considerable value to primary health care program planners in Brazil as well as in other countries. The costs are relative; the information from the Brazilian context cannot be transferred directly to another country where the wage structure, cost of supervision, and other inputs may be very different. However, relative costs of different services, and variations, as well as the method will be useful in other countries. The major conclusion is that high quality primary health care, using a CHW is not cheap.

3. Problems in the Use of Service Statistics

We were dealing with one of the most sophisticated, reliable, and mature health information systems for rural health services available anywhere in the world. However, we encountered numerous problems in using this information for operations research on primary health care.

The first major problem encountered was one of the priorities of the personnel. FSESP supervisory personnel had been requiring community health workers to collect information but had not carried out extensive analysis, an activity requiring time, a computer (in most cases), and the sophistication to use the computer. No preliminary analysis was undertaken at the state or regional level; the figures were simply collected and sent to the central office in Rio. The Rio office used these figures for annual reports and occasional studies by the central research group. The data is now available on computer, but the routine printouts are not helpful to the supervisors at either the state or national levels.

Second, knowledge of the work of individual visitadoras is required to determine whether apparent variations in levels of activity reflect incorrect data recording or actual differences in behavior. Instructions for completing forms were unclear and FSESP supervisory personnel in Rio occasionally disagree on the definition of various categories within the routine reports. Availability of

information on computer tapes does not mean that the computer personnel have the skills or interest necessary to analyze information in a manner that will be useful to supervisors.

We met several times with the computer and data processing personnel and the CHW program supervisors to start the process of joint development of programs for analysis and feedback of information to the state regional supervisors. Using the analysis, productivity, quality and coverage could be increased for those health posts well below the norms.

In summary, we feel that the analysis of existing health information system records, although difficult, was a rewarding task that will potentially result in the improvement of primary health care services for the beneficiaries of the system.

4. Improved Reporting and Analysis System

In reviewing our analysis with the FSESP authorities, the following changes in the reporting and analysis system have been proposed.

a. Non-essential reporting of very small numbers of services should be curtailed. For example, there are many units of information on leprosy and cervical cancer covering few new patients. The time spent by the visitadora compiling this information, the supervisors reviewing it, and the data processors analyzing it, could be better spent in more productive activities.

b. The data processing unit should prepare state summaries showing the distribution of number of services for the major services to aid the state supervisor. These summaries would make sense of the mass of data collected from the health posts which, in current form, make it difficult for the supervisor to compare the work of different visitadoras. In fact, a supervisor in one state identified one visitadora in her service as the most productive, but that visitadora

was actually one of the least productive as measured by recorded information theoretically available to the supervisor. This system of analysis should have general relevance to other countries as well.

5. Application of Results from this Study

Two meetings were held to present the results of operational research on the primary health care community health worker to the national director of supervision and the director of program evaluation.

The meetings were held jointly with the data processing staff to permit exchange of information between the two concerned groups. The supervising nurse, Lucia Matsuoka, and evaluator, Dr. Abigail Vallis de Oliveira, presented their interests and needs to the data processing systems development group, Mr. Enoque and Ms. Mario Conception. During these meetings, results from the analysis of FSESP done at Hopkins was presented in various formats to determine which format would be most easily understood by the supervisors at the regional level. A tentative decision was reached by the working group to use figures of "proxy hours" spent for each activity and total "proxy hours" for all activities for each health post within one regional directorate, plus median "proxy hours" for each activity total of all activities for all other states. In this way, the regional supervisor could compare her state's median values with those of neighboring states that have similar transportation and population distribution characteristics; she could also compare the individual health posts within her own state. It was also felt that a graph presenting total time of services in relation to the population would be extremely useful to the supervisors.

A second meeting was held with Dr. Manceau, the Director of Statistics for FSESP to confirm the decisions of the working group for a more streamlined analysis of data that would enable the supervisors to use the information

effectively to increase productivity and monitor distribution of time among various services. Final details will be worked out in future meetings.

During the analysis, we noted that there were "high volume producers" (a large volume of service, many different functions) among the visitadoras, as well as "low volume producers" (profiles). Information of this kind is useful to the person planning community health worker programs in recognizing the possible differences; it is also valuable information heretofore unavailable in an analyzed form allowing improvement of supervision within the SESP system.

6. Approximately 7 percent of the time of the visitadora is spent in filling in records. Although this is much less than the time spent in many health services, FSESP officials believe that some efficiencies could be obtained in streamlining the record keeping system. We concur, but emphasize the fact that without the comprehensive records that FSESP maintains, no study such as this would have been possible.

V. COMMUNITY FINANCING OF WATER SUPPLIES

A. Methodology

There were five sub-studies under the water supply part of this project: 1) a review of the world literature on water supply financing, 2) a review of the development of the FSESP system of water supply financing and operation, 3) a study of the community health benefits of water supply introduction, 4) a survey of 48 BID financed water supplies, and 5) a review of the Inter-American Development Bank Constructi... Loan water supplies planned and operated by FSESP.

1. The literature search was carried out by Dr. Alan Sorkin, a health economist, and Dr. Kaz Kawata, a sanitary engineer with extensive less developed country experience. Automated searches of indexed articles and monographs were done, but the major yield came from the current ephemeral literature that was familiar to Dr. Kawata.

2. The review of the development of FSESP water supply financing schemes was done by Engineer Moitta by careful screening of the annual special reports of the Engineering Division of FSESP and the reports of other Brazilian water supply agencies and international lending institutions. The major input came from Engineer Moitta's years of experience as Director of the Research Unit of the Engineering Division and from interviews with his colleagues.

3. Methods for Water Supply Financing Survey

To examine the methods of community financing, we undertook one major study and obtained information from two ancillary sources which are described in the sections that follow.

a. Sources of Information

1) The Survey of Water Supplies: Information was gathered from a random sample of 54 water supplies serving populations from 1,200 to 70,000 and having been in operation from 5-35 years. A detailed questionnaire was developed to obtain information on: size of urban population, total number of households in the area to be served, number of households connected, total number of households on streets with water lines, charges for the minimum 15 cubic meters (cu.m.) per month, average charges per cu.m., charges for a domestic water connection, costs of operation and maintenance, extent (linear meters) of the water supply network, number of metered connections, number and percent of households by quality of housing, and years of operation of the system.

All but eight of the water supplies selected in the random sample returned questionnaires. One system provided only partial information. Several letters, phone calls and, in some cases, field visits with the supervising regional engineer of the system were necessary to get all the information required on the questionnaire. The principal investigator from Hopkins visited four FSESP water supplies for discussions with mayors and water supply managers about community financing.

To obtain a measure of the economic levels of the towns in the sample, information was obtained from the Instituto Brasiliera de Geografia e Estatistica (IBGE) on the municipal budgets for each of the 45 locations. The budgets were divided by the number of inhabitants to determine an approximate per capita measure of the wealth of the community.

Information from the Association of Brasilian Engineers on overall water supply construction in Brazil was obtained as a background source.

b. Analysis

Initially, we planned to examine the effect of community financing on water supplies, by comparing the economic and organizational factors in sites where Fundacao SESP water supplies had failed to those in which the water supplies were still functioning. However, only a few of the thousands of supplies developed by SESP had shut down for any reason. We found that the failures of those few water supplies had not been caused by economic or organizational factors concerned with community financing. The systems had failed because of technical and engineering considerations: dropping water tables, drying up of reservoirs, etc.

Second, we asked the engineers to define the factors related to community financing that led them to select one area over another. The engineers uniformly indicated that decisions to initiate a water supply in a given area were not based on any appraisals of community wealth or anticipated costs per cu.m. of water, within very broad limits. Decisions were based on political factors, such as the government's desire to develop an area; or engineering or hydrographic considerations, such as the reliability of the source or the potential for using gravity flow versus extensive and costly pumping.

When it appeared that community financing factors were not important in the selection or continuance of a water supply, we examined the factors influencing community financing as a determinant of the extent of coverage of the water supply. That is, we used the percent of households in the village connected with the water supply as an index of coverage. This is actually an inexact measure of coverage; some households may be reasonably well served by means of alternative arrangements (using the water from a neighbor's tap or a nearby watering point supplied by the system). However, the percent of households

connected to the system is the best available index of coverage, our dependent variable. We measured, as independent variables, community wealth, distribution of wealth, size of community, length of operation and water charges as factors affecting community financing.

Information from the survey was plotted on 2 x 2 correlation diagrams to explore promising explanatory independent variables that might explain the difference in percent connections, the dependent variable,* in the various localities.

Finding no patterns of correlation in national figures, we next examined states and combinations of states and tried combining several independent variables. Since the correlation diagrams, even those combining several variables, did not suggest either linear or second order, curvilinear relationships and the R^2 values were clearly not significant for national data, we elected not to carry out stepwise multiple linear, or curvilinear regression analysis.

4. Community Health Benefits--Diarrhea Morbidity Survey

One of our original objectives was to determine the effect of new water supplies in reducing diarrhea morbidity and mortality. Adequate records on diarrhea mortality/morbidity before and after installation of FSESP water supplies ten years ago were unavailable, despite my impression to the contrary. However, we obtained information from a special prospective study carried out by Dra. Ermingarda, the Chief of Research for Fundacao SESP in Rio Grande de Norte. In that study the Division of Studies and Planning of Fundacao SESP, under the

*Credit should be given to Dr. David Nicholas of PRICOR who suggested "percent connections" as a suitable, dependent variable when we learned that essentially no water supply system initiated by SESP had failed because of lack of community financing.)

general direction of Dra. Ermengarda, attempted to measure the effect of water supplies, waste disposal and general sanitation on levels of diarrhea in four localities in the state of Rio Grande de Norte.

Four villages with various attributes of sanitation, as noted below, were the subjects of a case-control study. The field work was carried out in phases: (1) establishing a preliminary definition of the research; (2) setting the parameters for selecting localities; (3) arranging with the regional directorate for final locality selection; (4) determining the characteristics and conditions of sanitation in the selected localities; (5) determining the needs for improving sanitation conditions; (6) developing the instruments of research to be applied at the local level over a period of one year by the sanitation visitors; (7) testing the model of research in the field to determine the number of visits necessary to meet the demands of the study; (8) applying the research instruments for one year; (9) processing the data after the observation period to estimate the rates of incidence in each situation; then (10) improving the conditions of sanitation (water supply and waste disposal) in the experimental area; (11) applying the research measurements during another year in this area; and (12) estimating the rate of incidence of diarrhea and comparing it to data from the first year in this experimental locality.

DIARRHEAL DISEASE STUDY VILLAGES

Locality	No. Houses	Sanitation Conditions
Mangabeira	145	1980—Without water supply and waste disposal 1981—Adequate water supply
Coqueiros	174	With water supply and waste disposal
Rego Moleiro	125	Adequate water supply—Borderline waste disposal
Laranjeiras dos Cosmes	166	Without water supply and waste disposal

(Mangabeira was the experimental village, studied before and after the installation of water supply.)

In addition to the central level technical personnel from the research unit and consultants from the Division of Engineering, a regional technical advisory group consisting of a physician, nurse, health educator, engineer and sanitary inspector participated in the study. At the local level, three sanitary visitors and one sanitary aid comprised the full-time working group which collected information on sanitation conditions, water supply, waste disposal and, most importantly, diarrhea incidence.

5. Construction Loan Repayment

A special report from the Inter-Americas Development Bank (BID) was analyzed to provide information on amortization ability of the 91 communities who received the construction loan.

B. Results

1. REVIEW OF LITERATURE

Financing Community Water Supply

The financing schemes used for rural and urban projects are often quite different. In urban projects the most frequently used approach is to set the water rate at a level which recovers the total costs (i.e., the operational, loan, and administrative costs, as well as a reserve for future expansion). Under this concept each project is expected to be a self-sufficient entity. Because of their size and the poverty of the rural population, rural projects usually cannot be financed in a similar manner.[1]

In Latin America, the financing of a project is usually made up of three elements: local contribution of labor, construction materials and/or cash (15-20 percent of the project cost); an international loan for pipes, fittings, and pumps (50 percent); and an annual grant to cover program overhead and operational expenses (30-35 percent). The cost of operation and maintenance, as well as partial repayment of the loan, is borne by the community, with the program covering the remaining loan expenses from its yearly appropriation (in one major country the rural aqueducts pay for all of the loan costs). In other parts of the world the grant portion is higher as the communities repay less of the loan costs.

At the present time, many governments are heavily subsidizing the construction and operation of rural water systems. Because of the uncertainty regarding continuation of funds, this type of subsidy requires a project by project approach. Rather than rely on government subsidies, experience has shown the benefits of using the revolving funds to support these programs. In addition, the revolving funds—once they become self-sustaining—can be used to supplement

community self-help for other undertakings designed to improve the level and attractiveness of rural living.[2]

Rural construction is frequently subsidized, at least in part, with national and state funds. It is also common to borrow funds abroad for such projects, including funds to cover some local currency requirements. Some countries have a policy of providing major concessions to local communities for repayment of debt on water and sanitation facilities, or make no effort to collect the full costs from those who benefit from the facilities. In such situations, it should be asked whether borrowing foreign funds (on which substantial interest is charged) makes good sense.

For a given investment over a 15 to 20 year period, a country may build more rural systems with its own money than it would with borrowed money by an amount equivalent to the interest paid. Moreover, if it obtains, for example, a 5 percent 20-year loan, it will pay $1.6 million in interest for every $1 million of principal received.

However, an alternative view is that systems will get constructed earlier with borrowed money, and so the anticipated improvements in public health and living standards will be realized almost immediately.[3]

Financing Operation and Maintenance

A rather common rule of thumb for water systems is that about half their total costs reflect operation and maintenance activities. Thus, every community, regardless of size, must generate revenue covering at least the full cost of operation and maintenance from the sale of water and services. Without adequate and continually available funds for the operation and maintenance of a system, investment in that system will prove unsound. This is true because the full

benefits of a water supply system or any other facility are realized only when the facility is available for people to use all of the time.

Systems which should operate for 25-30 years with good routine maintenance have frequently become inoperable after less than five years.

Most water supply cost estimates have overlooked the investments that will be needed for major repairs and replacements. At the municipal level, well-run water organizations can usually provide financing for some major items that wear out through reserves generated by operations. Generally, overall depreciation of a water system is commonly estimated at 1.5 to 3.0 percent of the facility's cost. Most international agencies recommend that charges for water cover depreciation or debt service, whichever is larger, along with the operation and maintenance costs. When the organizations responsible for providing water and sanitation services are following sound financial policies, it will normally be possible to absorb occasional large expenditures from built-up reserves.[4]

Subsidies for operation vary widely, ranging from the case in which the water utility is owned and operated by the regional agency, to others in which the entire operational responsibility is with the municipality. The majority of projects are somewhere in between, with federal or state agencies providing technical assistance and some financial subsidy.

Revolving Funds

A formal definition of the term revolving fund is "a fund that is continually replenished as it is used, either through further appropriation or by income generated by the activity that it finances."[5]

In terms of a rural water program, a revolving fund implies the establishment of a fund, on a regional or national level, to finance the construction

of the individual community projects. The loaned funds are recovered by having the assisted community make repayment to the revolving fund. As the repayments are made they are reloaned to finance additional projects. The method of obtaining the original financing for the fund, the terms of the loans, and the terms of the repayment, vary considerably. Various approaches have been evolved to adapt the fund concept to the social and economic potentialities of the community and to the financial realities of the country as a whole. The adaptation to local conditions is one of the strengths of this method of financing.

In general, the establishment of revolving funds has followed these general patterns:

1. A grant is used to obtain the initial funds. These funds are maintained by relending the payments as they are collected.

2. The fund is created by means of a loan, and then maintained by using the surplus in income produced by the difference between the payments and conditions for amortizing the loan and the payments made by the communities.

3. A third pattern is for the fund to be infused with the income generated by community reimbursement of a loan (national or international) which is serviced by the national government.

A major problem confronting most revolving funds is how to maintain their real value in the face of inflation.

Another problem relates to the fund's inability in most cases to cover foreign exchange needs. In those instances where a foreign loan is to be channeled through a revolving fund to help finance local projects, the communities and cities involved should repay the amounts borrowed to the fund. These repayments are made in local currency, and the involving fund, in turn, has to repay the foreign loan. If the government has arranged to make the necessary

foreign exchange available, there will be no problem with that particular loan. However, on loans made entirely in local currency, obtaining the foreign exchange needed to import equipment can pose a major problem.[6]

The government of Brazil has established a water and sewer revolving fund that makes loans to the states for the purpose of establishing loan funds that, in turn, are used to pay for the construction of small community water systems. Once the system is in operation, the consumer pays the state water agency on the basis of metered use or, in some cases, a flat rate. The rates charged vary among the states, with the poorer ones obtaining a lower rate of interest on loans from the federal government than the richer so that lower water rates can be charged. In all cases, however, the states must repay the loans to the federal government. The loans are indexed to the cost of living and, therefore, maintain their value, which is essential in a country where inflation ranges as high as 90 to 100 percent per year. Any subsidy to the local community in terms of reduced water rates is a matter of state policy.

Federal funds for water supply are administered by the Brazilian National Housing Bank (BNH), the custodian of social security funds. This federal agency has a cautious lending policy, and delinquency in amortization has not been a serious problem. In the states, however, there has been considerable difficulty in maintaining water rates at a level that will repay the cost of the system as well as covering operation and maintenance. Many of the states in the poorer parts of Brazil have had to subsidize smaller communities.[7]

The major difference between the Brazilian approach and what is normally understood as a water/sanitation revolving fund is that the funds, after being repaid to BNH, do not necessarily find their way back out to other water and

sanitation projects—because they may be used in a number of other sectors where BNH has interests.

Local officials throughout most of the history of Latin America have been appointed directly or indirectly by the federal government; therefore, local capabilities for planning and financing improvements, including water supply, have not been well developed and remain inadequate.[8]

There is not the tradition of local autonomy in Latin America that there is in the United States. Regionalization, therefore, comes easier. Although regionalization removes some local control, it has many advantages. For the small communities in Latin America, there is no alternative because they are unable to carry out such projects because of lack of funds, technical ability, or managerial capability.

At present, however, some institutions are experimenting with ways of using local capital to meet a significant portion of project costs and are discovering that the potential for using local capital has been seriously underestimated.

Case Studies--Guatemala and Panama

Since 1977, Agua del Pueblo, in cooperation with the Behrhorst Clinic Foundation and the Guatemalan Ministry of Public Health, has administered a program of "soft" project loans to communities from a revolving fund. An analysis of the costs for three communities that particiapted in this program in 1981 showed that community contributions of materials, contracted labor, and the value of voluntary labor, came to an impressive average of 81 percent of total costs. Amortization payments are recycled through the revolving loan fund and are used to make subsequent loans to other communities for water projects.

At the same time, the program develops invaluable local skills and experience in the management of credit. Most of these communities have no previous experience with credit. In several villages the experience acquired in managing project loans has subsequently been applied to securing loans from other institutions for additional self-initiated community improvements. For example, the village of Pacul negotiated another loan from the government's agricultural development bank shortly after the water project was completed. With this second loan, a small-scale irrigation system was built that resulted in significant improvements in crop yields.

A successful project loan program involves administrative and financial training for members of local water committees. They must manage the loan, maintain financial records, collect monthly payments from each family, and deliver payments to the water program offices. None of the water committees instructed in Agua del Pueblo are behind in their payments to the revolving fund.

Training village personnel in practical skills required for operation and maintenance of the program is essential for program success.

During construction of Agua del Pueblo projects, selected villagers are trained to identify system breakdowns, to repair pipes, to clean valves and tanks periodically, and to repair or replace faulty faucets. A maintenance fee of 35¢ per family per month is collected and the proceeds are retained in the community for this purpose. A small supply of replacement pipes, accessories, and a few simple tools for use in the village are included in the original project budget. Local water committee members are taught how and where to acquire other supplies when needed, and are encouraged to call on Agua del Pueblo officials if problems arise that cannot be solved locally. To date, all completed systems are fully operational. Some Agua del Pueblo assistance was required after the

disastrous 1976 earthquake to repair major damage promptly, but all routine operation and maintenance functions have been competently managed by trained villagers using locally collected funds.

A second example of a national program serving small villages is the one developed in Panama with the assistance of the Agency for International Development. In 1972 and 1976, loans totaling $13.3 million were approved by AID for improving rural health in Panama. Approximately $6 million was allocated for public health, primarily through construction of piped water systems for villages with 250-500 residents.[9]

Many of the systems were originally operated by diesel or gasoline pumps. Because of rising fuel costs, about half had been converted to gravity systems by 1980. A random evaluation at that time of 26 of the systems showed that 16 of them were functioning well with effective management, adequate maintenance, and regular collection of user fees. The other 10 were having some problems, but it appeared that they would be resolved in the near future.

This relatively successful piped water program has several important characteristics: (1) the existence of trained community personnel, (2) monthly charges for water ranging from $0.25 to $3.00 per household (the higher fees were for the fuel-operated systems), (3) community participation in the installation of the systems, (4) use of the system for most household needs, and (5) good quality water. In addition, the project was reported to be useful because the process of implementation encouraged self-reliance and the emergence of effective local leadership.

In the communities judged to be too small for piped systems, AID loans partially financed the installation of 1600 hand pumps. It was estimated that after some time, about half were not operative. An evaluation suggested that hand

pumps could be made more reliable if communities assumed some responsibility for pump maintenance and repair, and if pumps that were more easily repaired were used.

An evaluation team drew the following conclusions and conditions for success (most of the conditions are met by the FSESP systems):

1. The organization of a national effort to construct piped water systems is likely to be successful only if it is preceded by small-scale programs that permit development of managerial expertise and use appropriate system designs.

2. Rural piped water systems are more likely to remain in operation when there is demand for household water, when community residents participate in obtaining and maintaining the system, and when there is equal access to the water.

3. Small rural water systems require periodic monitoring and technical support to remain operational and safe. Regular inspection visits by a back-up team provide opportunities to resolve difficulties before they threaten the operation of the water system.

4. Some mechanism must be available to enable communities to finance the cost of expansion, major repairs, or conversions to alternative energy sources, i.e., program funding or revolving funds.

5. Chemical treatment or filtration may be avoided if groundwater is clear and potable, even in piped water systems larger than those contemplated under current AID loans. Therefore, this should be the solution of choice.

6. Training for rural sanitarians should be updated and the Division of Labor between engineers and village personnel reviewed.[10]

Footnotes

1. Donaldson, D., "Rural Water Supplies in Developing Countries," Water Resources Bulletin, Vol. 8, No. 2, April 1972, p. 394.

2. Ibid.

3. Shipman, H., "Strategies for Financing Water and Sanitation Projects," PAHO BULLETIN, Vol. 15, No. 3, 1981, p. 211.

4. Shipman, H., op.cit., p. 212.

5. Donaldson, D., "Rural Water Supplies...," op.cit., p. 396.

6. Shipman, H., op.cit., p. 213.

7. Wagner, E.G., "The Latin American Approach to Improving Water Supplies," Journal of the American Water Works Association, April 1983, p. 170.

8. Wagner, E.G., op.cit., p. 168.

9. Mechan, R. and Viveros-Lang, A., "Panama: Rural Water-Project Import Evaluation" (draft), Washington, D.C.: U.S. Agency for International Development, November 1981.

10. Donaldson, D., "Overview of Rural Water and Sanitation Programs for Latin America," Journal of American Water Works Association, May 1983, p. 229.

Additional Useful References

United Nations Water Conference, "Report on Community Water Supplies" (mimeographed), 1977, p. 14.

Pineo, C.S. and Subrahmanyam, D.U., "Community Water Supply and Excreta Disposal Situation in Developing Countries: A Commentary" (mimeographed), Geneva: World Health Organization, 1975.

Dieterich, B.H., "International Collaboration for Improving Water Supply in Developing Countries," Journal of the American Water Works Association, November 1977, pp. 587-588.

McGarry, M. and Schiller, E., "Manpower Development for Water and Sanitation Programs in Africa," Journal of the American Water Works Association, June 1981, p. 282.

The World Bank, "Appropriate Technology for Water Supply and Sanitation: A Summary of Technical and Economic Options" (mimeographed), December, 1980, p. 1.

Donaldson, D., "Rural Water Programs of Latin America," PAHO Bulletin, Vol. 8, No. 1, 1974, p. 45.

Saunders, R. and Warford, J., Village Water Supply: Economics and Policy in the Developing World (Baltimore, Maryland: The Johns Hopins University Press for the World Bank, 1976), p. 39.

Scrimshaw, N.S., "Synergism of Malnutrition and Infection: Evidence from Field Studies in Guatemala," Journal of the American Medical Association, Vol. 212, June 1970, pp. 1685-1692.

Cyjetanovic, B., "Sanitation Versus Valcination in Cholera Control: Cost Effectiveness and Cost-Benefit Aspects," in Strategy of Cholera Control (Geneva: World Health Organization, 1971), pp. 17-24.

Wjetanovic, B.; Grab, B.; and Uemura, K., "Epidemiological Model of Typhoid Fever and Its Use in Planning and Evaluation of Antityphoid Immunization and Sanitation Programs," Bulletin of the World Health Organization, Vol. 45, No. 1, 1971, pp. 53-75.

Saunders, R. and Warford, J., op.cit., p. 41.

Jordan, P., et al., Control of Schistomosa Mansoni Transmission by Provision of Domestic Water Supplies in St. Lucia: A Preliminary Report (New York: The Rockefeller Foundation, 1974), p. 36.

Saunders, R., "Economic Benefits of Potable Water Supplies in Rural Areas of Developing Countries," Journal of the American Water Works Association, June 1975, p. 315.

Moore, H.; de la Cruz, E.; and Mendez, O.V., "Diarrheal Disease Studies in Costa Rica: IV. The Influence of Sanitation Upon the Prevalence of Intestinal Infection and Diarrheal Disease," American Journal of Epidemiology, Vol. 82, February 1966, p. 162.

Rubenstein, A., et al., "Effect of Improved Sanitary Facilities on Infant Diarrhea in a Hopi Village, Public Health Reports, Vol. 84, December 1969, p. 1093.

Siegal, F.M., "Schistosomiasis Hematobia in Preschool Children in Ibadan, Nigeria," American Journal of Tropical Medicine and Hygiene, Vol. 17, May 1968, p. 737.

Levy, M. and Wadyki, W., "Lifetime Versus One-Year Migration in Venezuela," Journal of Regional Science, Vol. 12, No. 3, 1972, p. 407.

Riddell, B. and Harvey, M.E., "The Urban System in the Migration Process: An Evaluation of Step-Wise Migration in Sierra Leone," Economic Geography, Vol. 48, July 1972, p. 270.

White, G.; Bradley, D.; and White, A., Drowers of Water: Domestic Water Use in East Africa (Chicago: University of Chicago Press, 1972), p. 107.

Warner, D., Rural Water Supply and Development: A Comparison of Nine Villages in Tanzania, Economic Research Bureau Paper No. 69.17 (Dar es Saleem: University College, 1969), p. 14.

Nath, U.R., "The Cost of Water," World Health Magazine, April-May 1983.

Davee, R., "Rural Water Supply Services: Community Financing," Special Meeting of Ministers of Health Intem REMSA/INF112.

Wagner, E.G., "Simplifying Design of Water Treatment Plants for Developing Countries," Journal of the American Water Works Association, May 1983, p. 222.

Karp, A. and Cox, S., "Building Water and Sanitation Projects in Rural Guatemala," Journal of the American Water Works Association, April 1982, pp. 166-167.

2. FORTY YEARS OF EXPERIENCE OF FUNDACAO SESP IN COMMUNITY WATER SUPPLY AND SANITATION

Introduction

This paper presents a description and analysis of the work of Fundacao SESP from 1942-1982. The purpose of this organization was to provide for the Brazilian population, especially those living in small communities and rural areas and peripheries of cities, basic sanitation facilities, as well as potable water and sewage systems. These services have helped more than a thousand communities and approximately 12 million inhabitants. The pioneering activities of SESP in terms of technical adaptations, operations, financing, and policies have provided the basis for continuous improvement of the sanitary situation in Brazil. Some of the information in this paper focuses on the general sanitary situation of Brazil as well as Fundacao SESP. Although the Fundacao SESP has worked in all Brazilian states and territories, as well as the capitol cities, its attention has been focused on small communities and the rural, low-income areas. Today the Fundacao SESP has some 200 engineers, architects, chemists, and geologists employed in sanitation work. Most of these professionals have completed postgraduate or advanced courses. In addition, some 700 sanitary inspectors and auxiliary personnel for labor and administration are employed.

Development of Sanitation Activities

The original area of interest for SESP was determined by military requirements. After the war, the Fundacao SESP has helped to fill a gap in terms of providing basic sanitation to communities without these facilities. That gap resulted from an inadequate federal structure as well as limited state and municipal structures in the poor regions of the country. Thus, the Fundacao SESP, as a public health organization of the Ministry of Health, expanded its service

initially to the states of the northeast and southeast and, more recently, to the regions in the south and central west of the country.

Since Fundacao SESP is a public health institution, its sanitation activities represent an essential complement to the activities of preventive and curative medicine which the Fundacao carries out in communities within the interior of the region served. These act both as a substitution for, or as an addition to, the activities of the state health bodies. These health and sanitation services, in addition to representing a major benefit to the population, have also served as a model for state participation in these programs which are presently being fully developed by the State Secretaries of Health.

Experience in developing countries like Brazil shows that national public health organizations have a pioneering role as promoters and initiators of sanitation programs. This is especially the case in the smaller communities, villages, and hamlets of the less developed regions. These organizations reduce their activity in the larger urban centers, as well as when states and municipalities assume this responsibility in their own areas of service. Thus, Fundacao SESP is, by definition, a supplementary body, one which provides support to the state and municipal activities for health and sanitation.

In the selection of the communities that are to be assisted, it was decided to give priority to those localities where the sanitary situation was the most deficient. Other criteria included the receptivity of the community, location, and political and economic interest. Cost-benefit analysis, which is difficult to carry out, was not employed. Instead cost-effectiveness analysis was employed as a decision-making tool.

Appropriate Technology

The necessity of working in small, poor communities has caused the Fundacao SESP to adapt certain project dimensions, construction methods, and operational schemes to serve these communities. This has required research on the development or adaptation of appropriate technology to the conditions of the areas in which the projects are located. In so doing, this permits cheaper construction and easier operation or more simple maintenance; as well as or better utilization of labor and materials that have been provided locally.

It is possible to obtain good results at low cost with simple and appropriate technology that can be effective, efficient, and satisfactory no matter how small the project.

To achieve this requires a certain deviation from traditional norms and standards. It also requires a sensitivity to both economic and social considerations, as well as ingenuity and the common sense to look for solutions that represent a balance between the ideal and reality, or the desirable and the viable. Finally, it requires always keeping in mind that when the many are lacking much of what is basic and essential, it is not good policy to give to a few that which is secondary or supplementary.

Some of the positive examples of this work are:

1. the Amazonas well and the water source from small facilities;
2. the dynamic filter for impounded water in small communities;
3. the rapid filter with increasing flow (contact clarifier);
4. the cocoa fiber and rice hull filter (note that this can also be carbonzied as activated charcoal);

5. the slow filter of increasing flow;
6. the use of nationally produced fluoride for the fluoridization of water;
7. the use of flexible rubber hose as a settling tank in tube wells;
8. the use of magnetic material in the treatment of water as a substitute for aluminum sulfate;
9. floculation in a settling tube, a practical device for the control of waste water around public stand pipes;
10. the use of porous concrete for the construction of filtering walls;
11. the local production of cement from rice hulls for the construction of sanitation facilities;
12. the use of natural limestone for the correction of Ph in the water;
13. the production of sanitary latrines using bamboo as the reinforcement for the concrete slabs, using blocks of clay and rice hulls for the latrine shelter, and palm fronds for its roof;
14. the development of a non-conventional sewer system simplified using small diameter tubing and the use of treated sewage effluent for irrigation.

Regarding financing and operations, Fundacao SESP has provided for the creation of municipal authorities (SAAEs) to adequately administer these services, and has promoted realistic rates based on the minimum salary or the ORTN which are less vulnerable to the effects of inflation.

Urban Vs. Rural

Although by definition the Brazilian urban population resides in cities and villages, and represents about 70 percent of the total population, it is also true that at least 50 percent of the population of the country lives in localities with characteristics which are essentially rural. Moreover, 70 percent of the urban communities have less than 5,000 inhabitants.

Furthermore, in all the cities of major size there exist peripheral areas, not urbanized, without water services, sewage, sidewalks, electric lighting, etc. Given this reality, the urban and rural dichotomy is theoretical and artificial, and it has caused difficulties in defining the eligible population for various basic sanitation programs which focus on this peripheral segment of the low-income population. For the Fundacao SESP, the traditional urban/rural classification does not constitute an important impediment in terms of service provision.

Integrated Planning

It is commonly believed that in a city there should be an "urban or collective solution" for sanitation problems. Nevertheless, a city of certain size generally represents or includes an essential area where the population is more concentrated and where most people have easy access to most facilities. Surrounding this central area there usually exists a suburban population which is more sparse and beyond the suburban, a peripheral area with characteristics which are essentially rural. An identical solution for the common problem is generally not practical or economic for the three areas. One should, therefore, plan and adopt, as far as the sanitary disposition of waste is concerned, a sewage system in the urban zone, septic tanks in the suburban zone, and sanitary latrines in the peripheral zone. Similarly, one can have a water supply system with private home

connections in the central zone, public stand pipes in the suburbs, and wells which are sanitarily protected in the peripheral area.

In this way we would be able to benefit rationally and economically all the population of a city and still avoid the costs and unjustifiable size of some of these systems.

This reasoning also applies to other sanitation activities. One can, for example, prohibit the existence of gardens or the raising of animals in the first zone; permit them in the second, within certain sanitary conditions; and support them in a third zone to help the nutrition of the population which is the most needy and which is the least able to acquire them.

What is necessary then is planning which is integrated, technically realistic, and economically viable. There is a need to create and discover new ideas, methods and processes instead of imitating or repeating solutions which have already proven many times to be inadequate to local conditions.

The Fundacao SESP is studying the costs, facilities, problems, and benefits of integrated planning in two urban areas.

Forty Years of FSESP Water and Sanitation Activities

Through 1982, 1,154 water supply systems were constructed with the following distribution:

I. North

Rondonia	6
Acre	7
Amazonas	25
Para	134
Amapa	2
Roraima	2
Total	176

II. Northeast

Maranhao	60
Piaui	36
Ceara	50
R.G. do Norte	35
Paraiba	54
Pernambuco	54
Bahia	184
Alagoas	81
Sergipe	45
Total	599

III. Southeast

Minas Gerais	180
E. Santo	86
Rio de Janeiro	1
Sao Paulo	1
Total	268

IV. South

Parana	22
Santa Catarina	37
Total	59

V. Central West

Mato Grosso	28
Mato Grosso do Sul	15
Goias	9
Total	52

Their distribution over the forty-year period was the following:

Period	No.	%
From 1942 to 1952	10	0.9
From 1953 to 1962	93	8.1
From 1963 to 1972	332	28.7
From 1973 to 1982	719	62.3
Total	1,154	100.0

Through 1982, systems of sanitary sewage were constructed or in construction with the following distribution:

State	No.
Rondonia	1
Maranhao	2
Ceara	9
R. Grande do Norte	2
Pernambuco	1
Alagoas	1
Bahia	6
E. Santo	16
Minas Gerais	44
Parana	1
Santa Catarina	5
Total	88

Operation and Maintenance

Initially, once they were constructed, the water supply systems and sewage services were handed over to the prefectures which were responsible for their operation and maintenance. Nevertheless, this approach has proven inappropriate in the majority of cases because of various factors such as local politics, insufficient service rates, irregular collection of revenue, or its diversion to other uses, and over-staffing. In addition, the use of poorly trained personnel has resulted in loss of efficiency and deviation from operational standards with a consequent decline in the quality and quantity of water distributed.

The technical assistance of the Fundacao SESP to the prefecture which resulted in the latter taking responsibility for water distribution and billing did not resolve these problems.

A satisfactory solution was found which would safeguard municipal autonomy. The solution resulted in the creation of municipal authorities called autonomous services of water and sewage with the acronym SAAE, whose administration was contracted by the Fundacao SESP. These were implemented initially in 1952 by Governador Valadares in Minas Gerais. This system had good success and was then extended to other cities and regions.

This operation, with adequate technical and economic support, gradually permitted the SAAE to realize surpluses which permitted the use of resources for reinvestment in the expansion of water systems and, in some cases, for the implementation or expansion of sewage systems.

Public confidence engendered by the efficient administration of the SAAEs was an important factor in the general acceptance of the water rates and in the allocation of municipal as well as state resources for these purposes.

The increase in the administrative tax charged by the Fundacao SESP (which is 5 to 10 percent of receipts), caused the Fundacao to create in 1968 using these revenues a revolving fund of investments which was designed to increase financial resources for the SAAEs.

During the 1964-1972 period, for example, the number of systems served by the SAAEs increased about 7 times, while the receipts and the operating surplus in real terms grew 12-13 times, respectively. Receipts per system served presented a growth of 64 percent in this period during which the population of localities served grew in a proportion of 1-4.6 and the population benefitted by home connections grew in the ratio of 1-9.5

For very small communities, the mini SAAE was created which is controlled and supervised by a regular SAAE which is nearby and of sufficient size.

At present, the Fundacao SESP administrates some 358 SAAEs, which includes 726 water supply systems and 51 sewage services. These SAAEs employ about 5,000 personnel who are municipal employees from these authorities.

Financing

The financing method used for the construction of basic sanitation services varies from case to case and includes community participation, subsidy, external financing, or some combination of these.

The resources provided by the beneficiaries, the federal, state, and municipal governments, and by international agencies are almost all used for financing the dirct cost of these works since they have been mostly constructed by the local administration.

In spite of the various financial methods used, the great majority of these services particularly in the smaller communities, were partially financed through subsidies.

It has been possible, even in the small communities, to obtain self-sufficient operations. However, it seemed essential from the economic conditions of the majority of the communities served by the Fundacao SESP, that some subsidy for construction of water systems and considerable subsidy for sewage system construction would be necessary.

In 1966, a $12.25 million loan was obtained from the Inter-American Development Bank for the construction of water services in 91 cities with populations between 5 and 40 million inhabitants in 14 Brazilian states. These cities today pay, through their service charges, some of the costs of this loan which represents about 25 percent of the total charges.

Charge Schedule

Although small local variations are permitted, rates are fixed by municipal decree as a percentage of the value of the ORTN (an index value based on minimum wage, to correct for inflation) and according to the category and type of construction.

An example of this tariff scheme is as follows:

	Category A (Residence)	Basic Consumption	Price Per Connection
1.	with limited consumption	-	18% ORTN
2.	Without limited consumption	15 m^3	26% ORTN
	Category B (Commercial)		
1.	Without consumption limit	30 m^3	50% ORTN

Estimate of consumption per connection per month (Category A)

- up to 50 m^2 of constructed area 10 m^3
- from 51-100 m^2 of constructed area 12.25 m^3
- above 100 m^2 of constructed area 15 m^3

Consumption in excess of the "basic consumption"

Prices per m^3 by size of consumption:

Category A

- Above 16 m^3 to 25 m^3	1.5% ORTN
- 26 m^3-36 m^3	1.7% ORTN
- 36 m^3-45 m^3	1.9% ORTN
- Above 45 m^3	2.1% ORTN

Category B

- Above 30 m^3-45 m^3	1.9% ORTN
- 46 m^3-60 m^3	2.1% ORTN
- 61 m^3-75 m^3	2.3% ORTN
- Above 75 m^3	2.5% ORTN

Sewage Services

Price: 33 percent of the account corresponding to the consumption of water.

Varying Prices:

Water connection:

1. with building connection up to 3/4" diameter

—in distribution network up to 100 mm (inclusive)—120 percent ORTN

--in distribution network 100-200 mm (inclusive)—150 percent ORTN

--in distribution network above 200 mm--200 percent ORTN

2. with building connection above 3/4" diameter

—in distribution network up to 100 mm (inclusive)—150 percent ORTN

—in distribution network 100-200 mm (inclusive)—200 percent ORTN

—in distribution network above 200 mm—250 percent ORTN

Sewage connection—120 percent ORTN

Restoration of water supply—25 percent ORTN

Emission of the second route of the account—8 percent ORTN

Reading of the water meter—16 percent ORTN

Water in public tap, per 20 liters or fraction thereof:

—public facilities (comfort stations)—108 (?) percent ORTN

—laundry facilities (per day)—25 percent ORTN

The prices of the connections include the connection joint (bracket), the pipe valve, labor, and perforation of the distribution line.

The price of the sewage connection includes the "T," the curve, and the hand labor for the connection of the discharge pipe to the sewer pipe.

Quality Control of Water

To control the quality of water in the water supply systems which it administers, Fundacao SESP has mounted a program which includes the five laboratories of the ETAs, and nine regional laboratories located in Manaus, Belem, Sao Luis, Fortaleza, Recife, Salvador, Vitoria, Belo Horizonte, and Cuiaba.

In addition, the quality of the water supplies in the states of Rondonia, Amazonas, Maranhao, and Paraiba is controlled by contract.

The cost of the work of these regional laboratories in 1982 was approximately ten cruzeros per inhabitant per year.

The major water quality problem encountered is the bacteriological level and, very infrequently, the physical qualities and chemistry of the water. The most frequent cause of the latter is defective chlorination or interrupted chlorination, principally in the small water supply systems. This is the case because the adequate operation of the chlorination system is vital for ensuring the distribution of good quality water.

Technical Publications

Of all the various technical documents about sanitation published by the Fundacao SESP, including manuals, norms and standards, that which has had the greatest utilization both in Brazil and abroad has been the Manual of Sanitation.

Published initially in 1947 as the Manual for Sanitary Protection, it was reprinted several times and progressively improved, and later published as the Manual of Sanitation.

Besides its utilization by technical and auxiliary personnel of the Fundacao, this manual has been widely used by the state and municipal Secretaries of Health, and by universities and institutions that have developed sanitation activities in Brazil.

In 1957, with the proper authorization, this manual was translated into Persian and published by the Ministry of Health of Afghanistan. Two years later, the same was also published in Persian by the Government of Iran. In 1982, the Government of Mozambique acquired 200 copies of this manual.

The last revision and edition of this document in 1981 brings together, in its 250 pages, practical information about sanitation based on the experience of the Fundacao SESP in forty years of sanitation work.

3. RESULTS OF SURVEY OF 48 WATER SUPPLIES

a. Wealth of the Area

We elected to look at individual states, rather than all states together since major differences in hydrographic conditions, availability of alternate water supplies, level of development, and other influences existed.

As seen in Figures V-1-3, some association exists between the wealth of the area served, as determined by the per capita municipal budget, and the percent of households connected in the states of Bahia, Minas Gerais, and Ceara. There is little or no effect of wealth of the community on percentage connections for Amazonas, Maranhao, and Pernambuco. The other states with only 1-3 supplies do not contribute to the analysis, possibly because of the small numbers of supplies in those states.

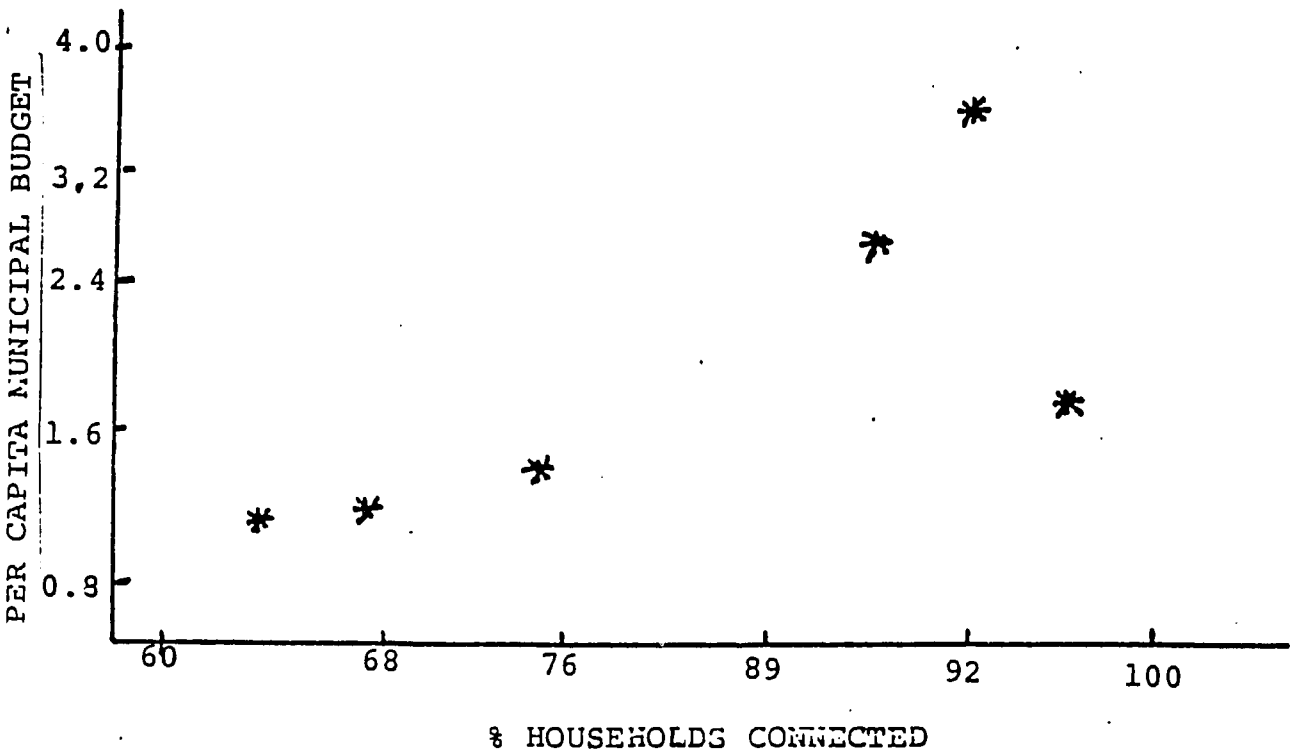
b. Charges for Water

The next variable affecting the level of community financing that we examined was the charge for water. We considered two variables: the minimum charge for 15 cu.m. and the median charge per cu.m. Since the minimum charge for 15 cu.m. showed little or no variation within states, we elected to use the median cost per cu.m. No relationship between charges and percent connections was apparent on a national scale. However, as will be seen in Figures V-4-5, charges for water were inversely related (as expected) to the percent connections in Amazonas and Ceara. In Figure V-6, Pernambuco, the charges for water surprisingly seem to relate directly to the percent connections (the higher the charge, the more households connected). FSESP is investigating this paradoxical

Figure V-1

% H.H. CONNECTIONS BY ECONOMIC LEVEL OF MUNICIPIO

STATE OF BAHIA



THE REGRESSION EQUATION IS
%CON1 = 61.8 + 9.07 MUNBUD1

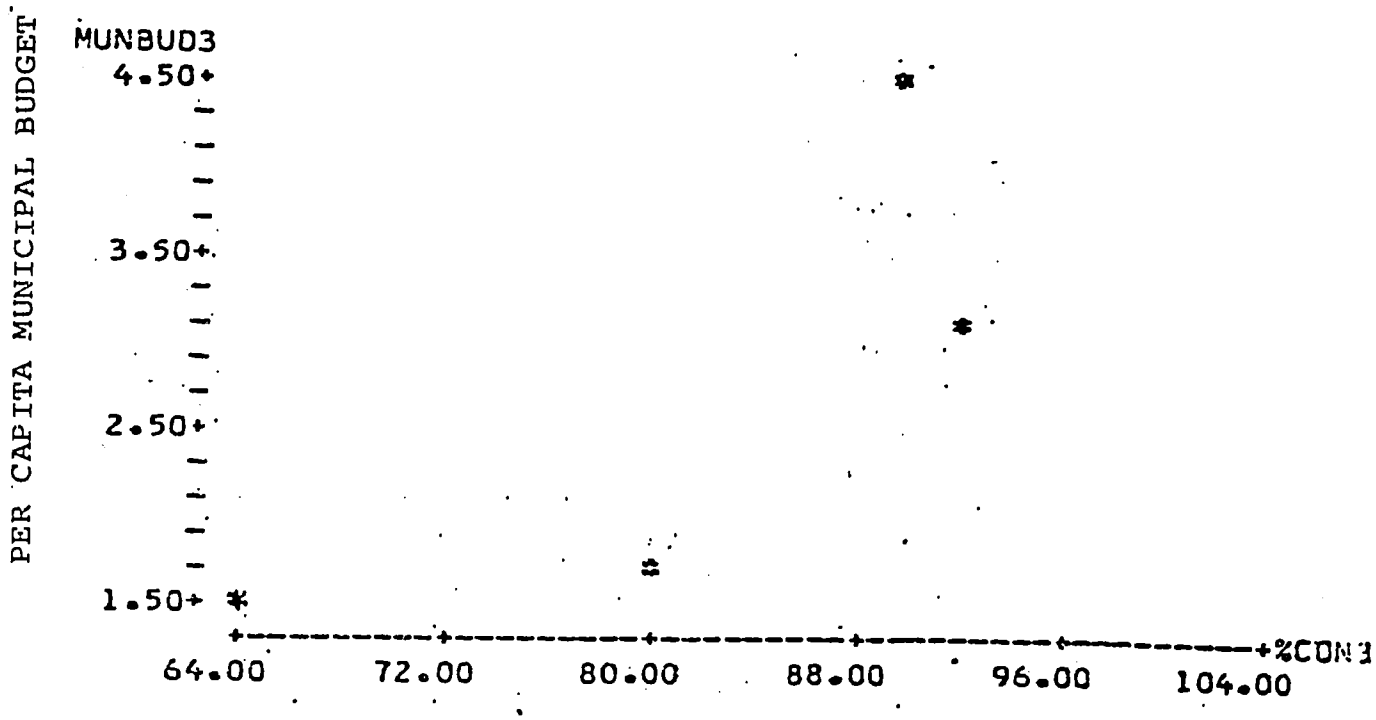
COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	61.770	8.401	7.35
MUNBUD1	9.075	3.608	2.52

S = 9.249

R-SQUARED = 61.3 PERCENT
R-SQUARED = 51.6 PERCENT, ADJUSTED FOR D.F.

Figure V-2

% H.H. CONNECTIONS BY ECONOMIC LEVEL OF MUNICIPIO
MINAS GERAIS STATE



PERCENT OF HOUSES CONNECTED

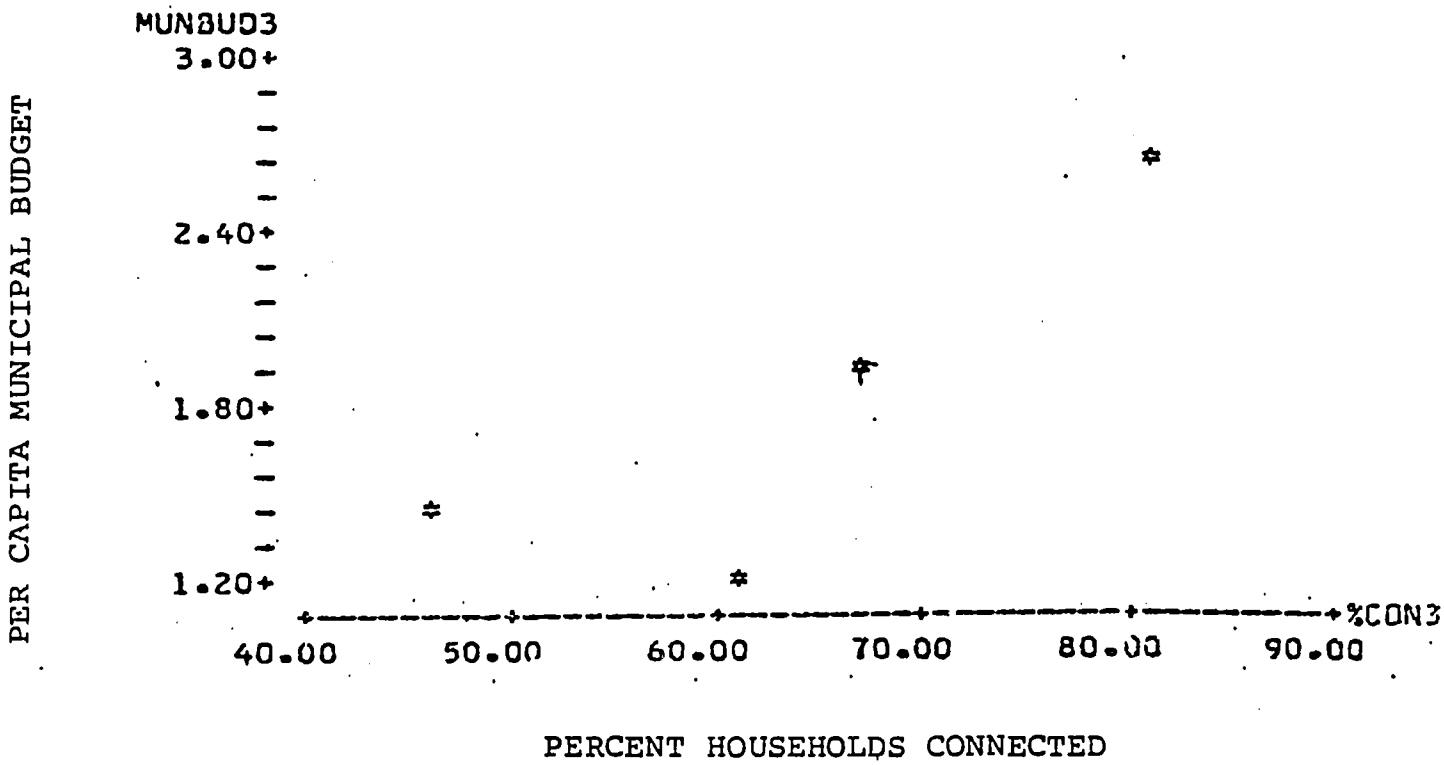
THE REGRESSION EQUATION IS
MUNBUD3 = - 3.71 + 0.0787 %CON3

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-3.705	3.841	-0.96
%CON3	0.07868	0.04665	1.69

R-SQUARED = 58.7 PERCENT
R-SQUARED = 38.1 PERCENT, ADJUSTED FOR D.F.

Figure V-3

% H.H. CONNECTIONS BY ECONOMIC LEVEL OF MUNICIPIO
CEARA STATE



THE REGRESSION EQUATION IS
MUNBUD3 = - 0.58 + 0.0368 %CON3

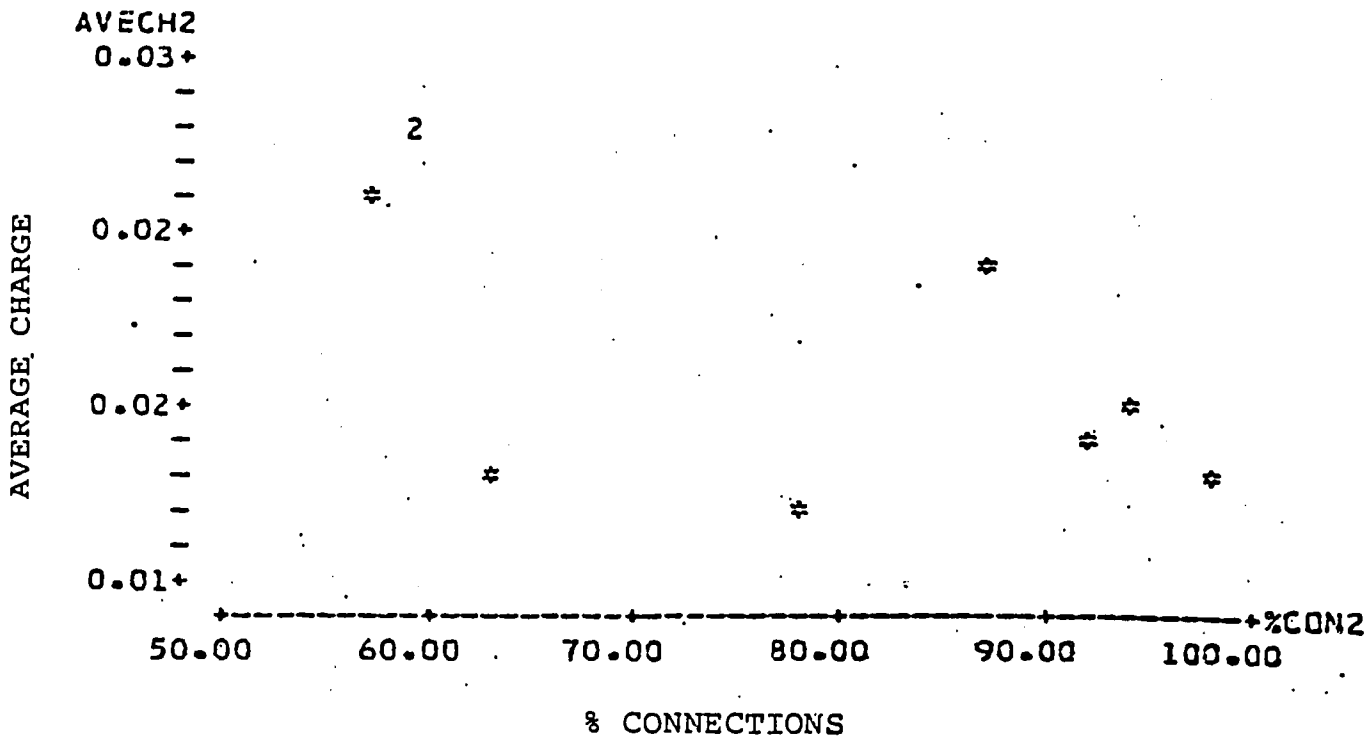
COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-0.579	1.128	-0.51
%CON3	0.03675	0.01735	2.12

R-SQUARED = 69.2 PERCENT
R-SQUARED = 53.8 PERCENT, ADJUSTED FOR D.F.

Figure V-4

CORRELATION OF AVERAGE CHARGE AND % CONNECTIONS

AMAZONAS

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THE REGRESSION EQUATION IS.
AVECH2 = 0.0368 -0.000214 %CON2

                                    ST. DEV.     T-RATIO =
COLUMN       COEFFICIENT            OF COEF.     COEF/S.D.
               0.036779            0.007414        4.96
%CON2        -2.137E-04          0.00009492       -2.25

S = 0.004554

R-SQUARED = 42.0 PERCENT
R-SQUARED = 33.7 PERCENT, ADJUSTED FOR D.F.
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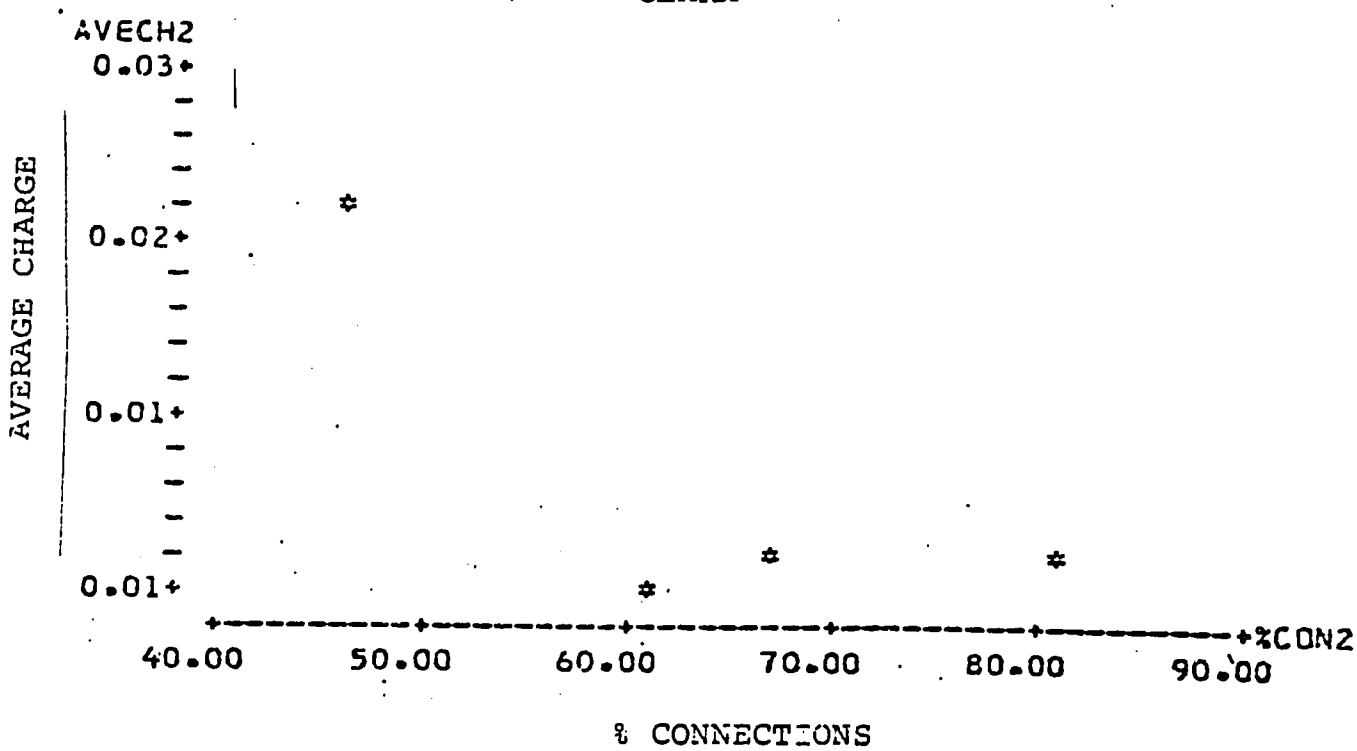
Figure V-5

CORRELATION OF AVERAGE CHARGE AND % CONNECTIONS

CEARA



THE REGRESSION EQUATION IS
AVECH2 = 0.0383 -0.000416 %CON2

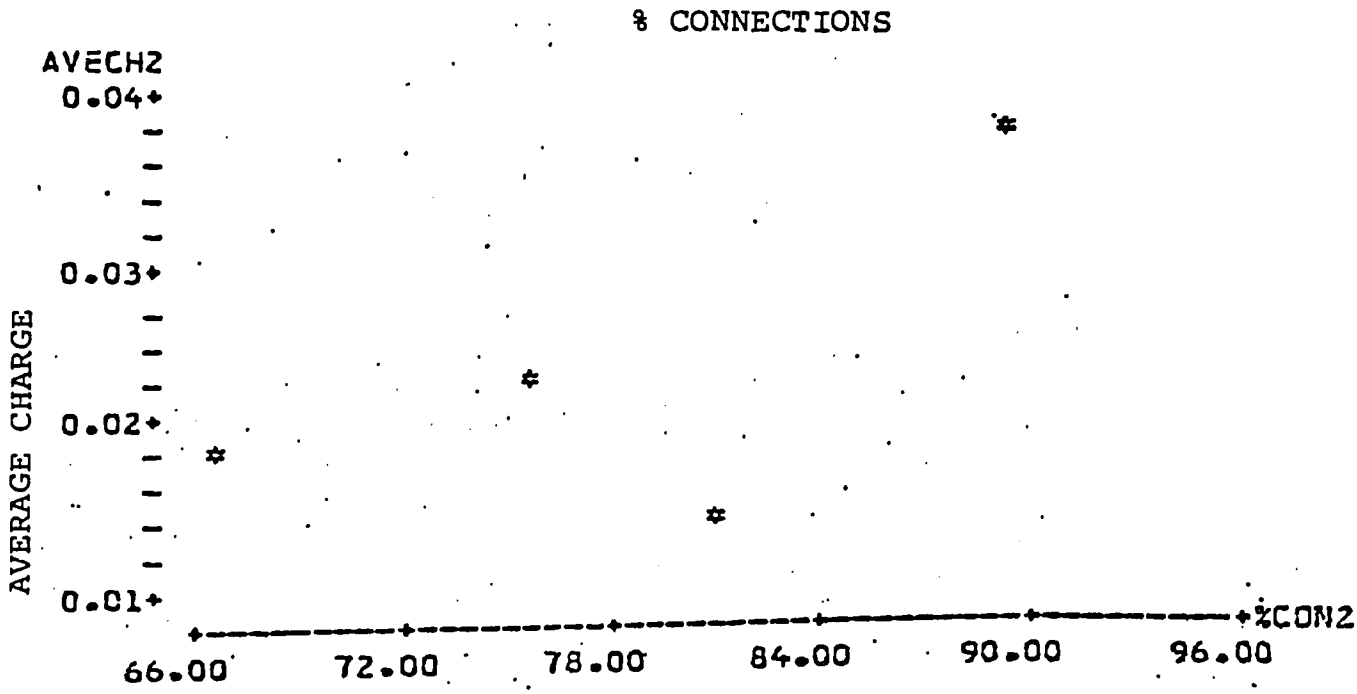
COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	0.03829	0.01423	2.69
%CON2	-0.0004159	0.0002188	-1.90

S = 0.005515

R-SQUARED = 64.4 PERCENT
R-SQUARED = 46.6 PERCENT, ADJUSTED FOR D.F.

Figure V-6

CORRELATION AVERAGE CHARGE
% CONNECTIONS, PERNAMBUCO



THE REGRESSION EQUATION IS
AVECH2 = - 0.0334 +0.000719 %CON2

wrong slope

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-0.03343	0.04244	-0.79
%CON2	0.0007187	0.0005399	1.33

S = 0.008959

R-SQUARED = 47.0 PERCENT
R-SQUARED = 20.5 PERCENT, ADJUSTED FOR D.F.

relationship. The R^2 values from regressing ability-to-pay plus water charges against percent connections show only a slightly better fit than by using wealth alone.

Figure V-7 for Bahia and Figure V-8 for Ceara shows the effect of combining ability to pay (per capita municipal budget) with median charges. Both figures show improvement from either variables examined alone. When all states are combined, the great differences hydrographic, economic, etc., among states conceals any measurable effect of charges and wealth of the community on the utilization of the water service.

In addition to the survey data, differing charges for water in the 91 BID/FSESP water supplies showed no apparent correlation with the percent of households connected.

c. Distribution of Wealth Within the Community

As a proxy measure for the distribution of wealth within the community, we used the percent of households in various housing quality groups. Increased percentages of houses of the poorest type were not correlated with lower percentages of households with connections. This finding was not anticipated.

d. Extent of Distribution System

The percent of households connected to the water supply system is very closely correlated with percent households on the street with a distribution line. This is not surprising, but has policy implications.

e. Minimum charges regressed on the percent connections showed a correct (negative slope) relationship, but the R^2 value was only 13.2.

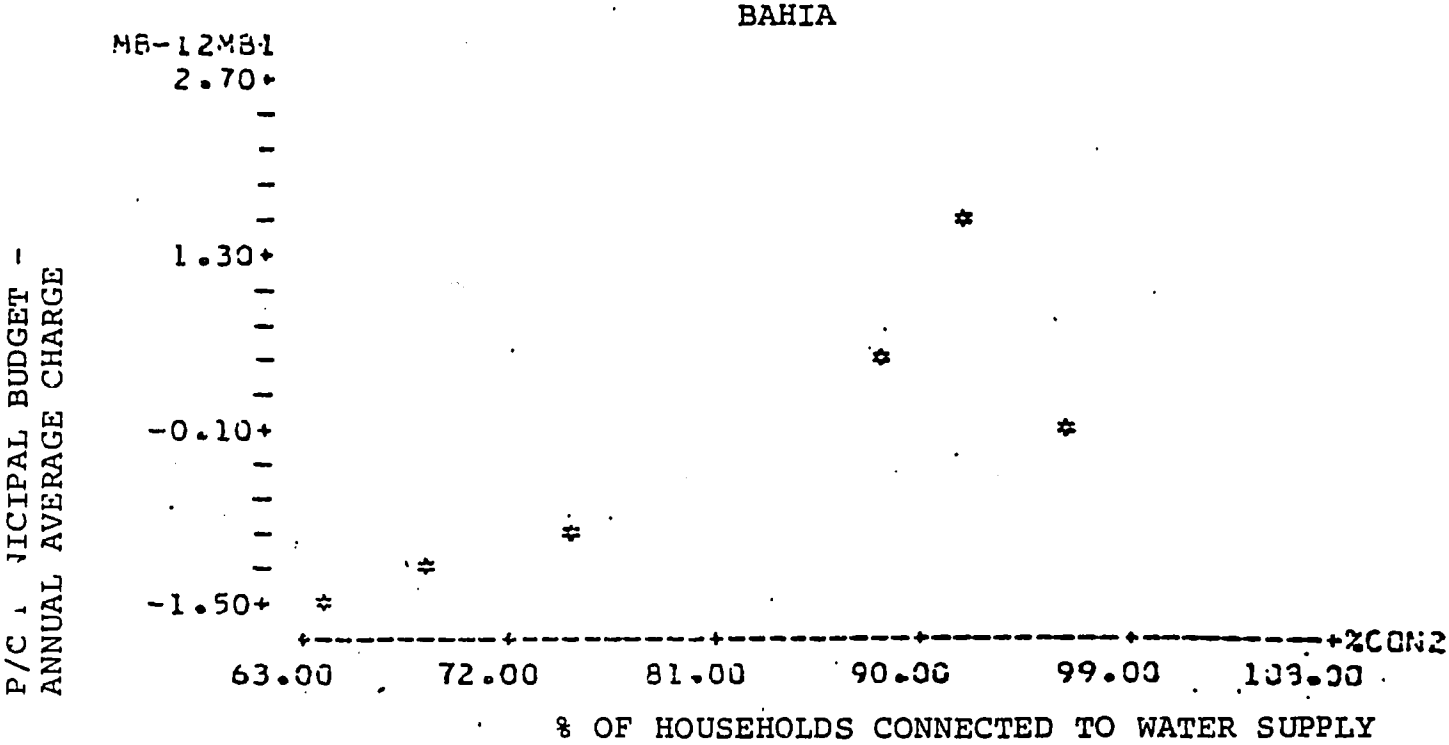
4. RESULTS OF THE COMMUNITY HEALTH BENEFITS STUDY

While it was not possible to calculate costs and effectiveness, the results of installing water supplies on diarrhea incidence will be of value to primary

Figure V-7

RELATION OF ABILITY TO PAY
MINUS AVERAGE CHARGE TO % CONNECTIONS

BAHIA



* COLUMN REPEATED

* ERROR * COMPLETION OF COMPUTATION IMPOSSIBLE

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THE REGRESSION EQUATION IS
MB-12MB1 = - 6.41 + 0.0765 %CON2

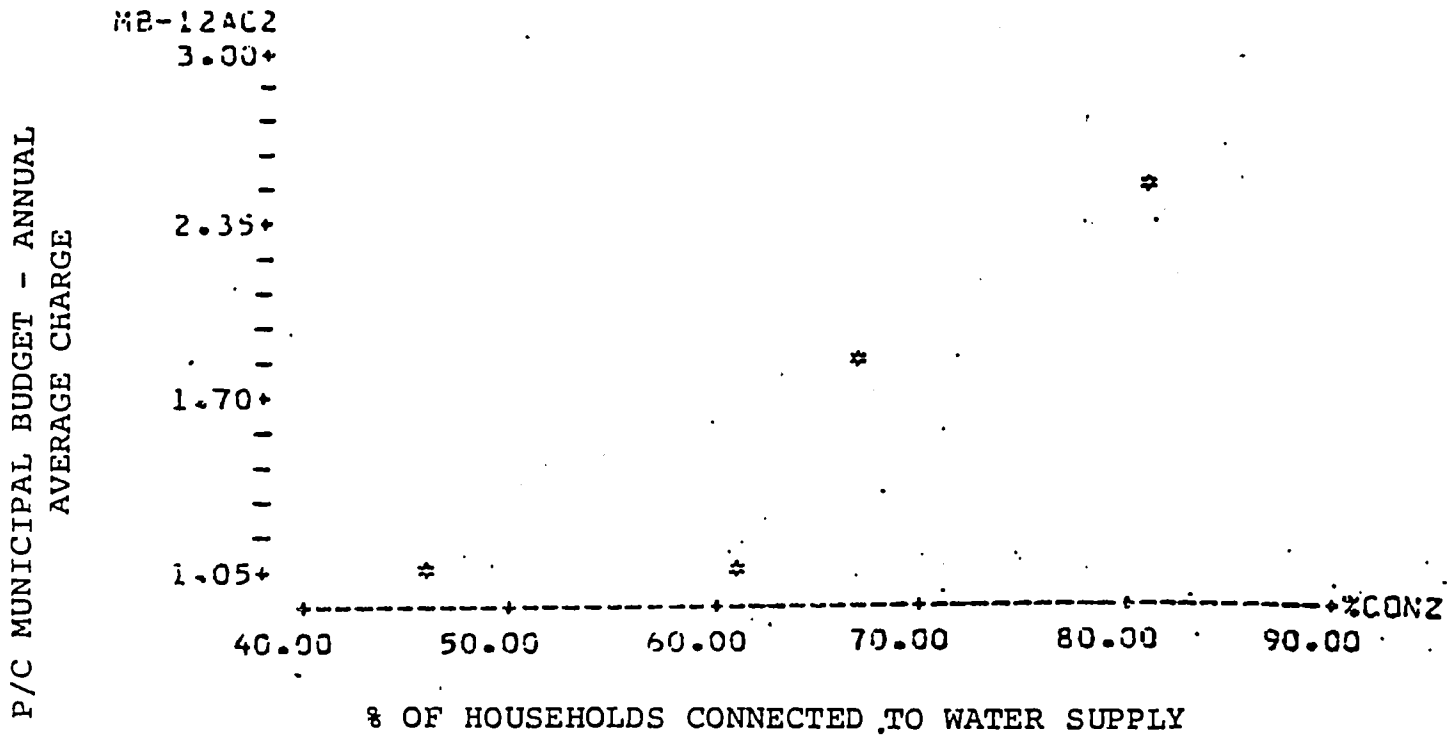
                                  ST. DEV.     T-RATIO =
COLUMN       COEFFICIENT          OF COEF.     COEF/S.D.
                  -6.415            1.823        -3.52
%CON2           0.07652           0.02235         3.42

S = 0.6644

R-SQUARED = 74.5 PERCENT
R-SQUARED = 68.2 PERCENT, ADJUSTED FOR D.F.
```

Figure V-8

RELATION OF ABILITY TO PAY
MINUS AVERAGE CHARGE TO % CONNECTIONS
CEARA



MB-12AC2 = - 1.04 + 0.0417 %CON2

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-1.0389	0.9624	-1.08
%CON2	0.04174	0.01480	2.82

S = 0.3731

R-SQUARED = 77.9 PERCENT
R-SQUARED = 69.9 PERCENT, ADJUSTED FOR D.F.

health care planners in showing the effect of water supply on diarrhea reduction. The results of the study were as follows.

The median family income for the four localities under study indicated that the localities had comparable economic levels.

	Median Worker Income
Mangabeira	3600 cruzerios
Coqueiros	2900 cruzerios
Rego Moleiro	4600 cruzerios
Laranjeiras dos Cosmes	2600 cruzerios

Distribution of income was relatively similar in all localities. The percentage of population with income less than 3000 cruzerios was 46 percent in Mangabeira, 52 percent in Coqueiros, 28 percent in Rego Moleiro, and 64 percent in Laranjeiras dos Cosmes.

The key results of this study are presented in the following table:

	Pop.	Cases	Rate/Cap.
Mangabeira			
Prewater supply, 1980	796	1154	1.5
Postwater supply, 1981	573	359	.6
Coqueiros	1093	476	.4
Rego Moleiro	710	508	.7
Laranjeiras dos Cosmes	718	792	1.1

The costs of treatment for diarrhea were cut by more than half in Mangabeira after installation of the water supply.

5. RESULTS OF THE FINANCING OF COMMUNITY WATER SUPPLIES BY THE INTER-AMERICAN BANK PROGRAM

Information from a large number of supplies, financed by the Inter-American Bank (BID), is presented to supply background information on the abilities of communities to cover amortized construction costs, as well as the operating and maintenance costs of the system.

In 1965-66 an agreement was developed between the Brazilian government (FSESP) and the Inter-American Bank for Development (BID) to assist 91 Brazilian communities in 14 states, covering a population of 1.6 million. The overall cost of the project was approximately $27 million (U.S.), $15 million of which was a BID loan. The loan burden per inhabitant was approximately $17.

The pioneering role of FSESP in developing sound construction and community financing principles may be partially explained by the fact that when the loan program started in 1967 FSESP had more sanitary engineers than any other governmental agency—160 engineers, of which 120 had completed post-graduate courses in public health.

The goals of this project were to provide water supplies in small communities with populations from 5-40,000 inhabitants ($12.25 m) and completing the water supply system in the capital city of Bahia, Salvador ($2.75 m).

The terms of the loan were a 20-year payback period with four years of grace with a twice yearly payment in cruzerios equivalent to the U.S. dollar value. The interest rates were fixed at 3 percent, appropriate for a concessionary loan at that time, and an additional .5 percent charge on funds not obligated. The payments were made in dollars, converted from cruzerios at the rate of exchange in effect at the time of disbursement. It was anticipated that the payments of reimbursement for the loan would be put into a rotating fund for subsequent disbursements.

There is a wealth of information in references (1 and 2) on the amounts and percentages of expenditures for the whole BID program, for various regions, and for the elements of water supply system presented. As expected, the major expenses were the distribution system, almost 40 percent, with the next largest part going to the treatment facilities. Although there is a wealth of material on the costs of the system that the community would need to bear, unfortunately, there is little or no information on the decision criteria that the engineers used in determining whether a community would or would not be able to meet the expenses of loan payback, operation, maintenance costs and debt servicing.

By 1980, 18 of the original systems had been taken over by state water supply organizations, 3 by the municipalities, and 70 remained under FSESP management. These 70 systems were evaluated thoroughly. Since all 70 systems under FSESP management were still in operation, the percentage of population served may be used as an approximate measure of success of the program. The percent coverage ranged from 45 to 99 percent of the estimated population. (It should be recognized that the estimated populations were for the year 1979, just before the decennial census of 1980. The population to be served is only an estimate and thus the percentage coverage is also an estimate.)

The water rates are available for all of the 70 locations under the management of FSESP. When compared to the percentage coverage no clearcut inverse relationship emerges, as might be expected if the water rates were a major factor in determining the percent of coverage. This information supports our own conclusions on the 45 areas that we analyzed in detail. Information on the relative wealth of communities with BID water supplies is not available.

Part of the evaluation of the BID systems included a check of the current estimated population with the projected population a decade earlier. The

projections ranged from underestimates of approximately 50 percent to overestimates of approximately 50 percent. Although the majority of estimates are within a narrower band than this, the problems with population estimates are one difficulty with which engineers must contend when planning for the community financing of water supplies.

The population covered uniformly shows an increase from 1970 to 1975 and 1975 to 1979. This increase is most marked in the earlier period. The overall coverage rate for all systems in all states increased from 69 percent in 1975 to 80 percent in 1979. These figures bear out our information on the increase in other FSESP supplies from 1979 to 1984.

Information is provided in the evaluation by on the number of connections per employee. Although the largest systems in terms of number of connections in all but two regions show the highest number of connections per employee, the overall national data does not show the expected clearcut effect of economies of scale. The information on number of connections per employee would be useful to serve as a standard on a regional basis to assist in supervision and management of community-financed systems. The connections per employee range from a low of 88 to a high of 330, with workers in the majority of the systems covering 150-250 connections.

In addition to the community financing for the payback of the original loan and the costs of operation and maintenance, sufficient funds were collected for extension of the water supply system in virtually all 70 localities. Furthermore, the revenue from the community participation and financing was sufficient for approximately 200 million cruzerios worth of sewage disposal system construction. In total, the extensions of the water supply system and the sewage system amounted to approximately $18 million over the period under evaluation.

The source for these funds for expansion is explained by the excess of receipts over expenditures. Under the management of the FSESP system, the community participation is adequate to ensure that all systems are "in the black" as well as providing additional funds for extensions of the systems.

C. Conclusions

The conclusions of the reviews of world and Brazilian literature and experience are embodied in the review sections. The conclusions presented here are from the diarrheal disease morbidity study, the financing costs and community attributes survey and the BID report analysis.

Conclusions from the Diarrheal Morbidity Study

Although the sample size does not provide statistical significance, the reduction in diarrhea incidence and costs was striking and is supported by the lower rates in the two villages already having a good water supply in 1980.

Survey of Financing, Costs, and Community Attributes

Consideration of community financing of water supplies is often limited to the community's contribution in labor, materials or money to construction. In point of fact, this is probably the least important part of community financing of water supplies. Regular payment of water bills by members of the community, which covers the costs of maintenance and operation of the system, and in some cases, amortization of the debt for construction costs, are by far the most important elements of community financing of water supplies.

Whether or not a community can finance the system depends as much on the method and efficiency of billing and collection as on the wealth of the community and the cost of water. The Servicos Autonomos de Agua e Esgoto (SAAE), as set up by SESP, have a uniform system for setting water rates and collecting the water revenues. Over the past 40 years, Fundacao SESP has developed a system of rate-setting and collection that has withstood the test of time. While many other water supply systems in Brazil are having major problems in remaining financially solvent, most SESP systems are expanding.

Rate-setting is one of the important elements in insuring fair community participation in financing of water supplies. The rates obviously must cover the costs of maintenance and operation. Since great economies of scale exist in supplying water to large consumers, most water supply systems in the world set rates that reflect these economies of scale. That is, the small users pay a higher rate per cubic meter than the large users. In the SESP system of rate-setting, a system of "social justice" is used. It reverses the economic dictate of lower rates for larger customers and gives the lowest rates to the minimum users (less than 15 cubic meters per month). The next lowest rate is to the smallest category of user by either metered or estimated use and the highest rates go to the commercial users of water. For details, see the previous section on charge schedule.

The need for community financing of construction of a water supply presents a major initial barrier to its installation. Most communities, particularly in rural areas of developing countries, do not have access to the capital needed to build even a simple water supply system. However, if the cost of construction and interest could be amortized over the lifetime of the water supply, the charges would represent only a small burden for community financing. Revolving funds in which the capital costs are returned to provide capital for new systems in other localities has proven helpful to communities to overcome the initial barrier of community financing of construction costs.

The explanatory variables, except extent of the distribution system, do not really explain much of the variations in percent connections. Obviously, some factors, perhaps unmeasurable ones, account for the remainder of the variation unexplained by the logically expected variables of wealth of the community, average costs of water, minimum costs of water, percent of the population in the

low socio-economic strata, etc. There is value in learning that the world does not follow our neat, academic models.

The history of the 91 water supplies financed for FSESP by the BID show the viability of the concept of communities' ability to repay construction loans. The cost of this construction program was $27 million of which $15 million was BID loan at three percent. Three-fourths of the construction was in small communities. The original 91 water supplies serve a population of 1.2 million people.

Table V-1 shows the construction cost per capita and population served by region in 1972. The average household water payments in 1972 were only four percent of a minimum salary. Of these payments, only 22 percent were for debt payment and interest, and, as the systems expanded, the percent of debt repayment decreased.

We have observed that the wealth of the community occasionally has some effect on the coverage of the water supply; that the additive effect of the cost of water has an effect in some states, but not in others; but that, in general, the major factors in securing high rates of coverage are not so much in the wealth of the community or in the cost of water, but rather in the mechanisms of payment, possibly the aggressiveness of promotion of water supplies, and certainly on the ease with which the water supply network can be spread to all streets of the city.

The task for planners and design engineers is to develop a system that will provide water of adequate quality at a lower price than the cost of individual households' efforts to get water from existing sources. There is considerable discussion in Fundacao SESP at this time about the concept of "adequate" quality being different for different localities. Appropriate design of low maintenance,

Table V-1

BID/FSESP WATER SUPPLIES

Region	No. of Supplies	Pop. (000)	Cost/Cap (U.S.$)
North	8	185	14
Northeast	33	597	17
Southeast	26	431	12
South	23	367	25
Central West	1	11	24

low upkeep systems is as important for the viability of water supply systems as is the method of community financing; only systems that can be maintained inexpensively will meet the communities' needs.

As Engineer Fraylon Moitta says:

> "We should then not be surprised, when results from our analysis don't exactly fit what we have expected. .....apart from its checking value and its use as a tool for pointing out areas where change and further research are needed, plain economic analysis, in our case, is not a good substitute for experience, good judgment and common sense."(3)

and as a measure of the application of the results of this PRICOR study, Engineer Moitta writes:

> "I am working now with a committee which is evaluating and revising PLANASA's (the new national scheme to develop water systems) political, financial and operational schemes, since PLANASA is having serious problems to survive, after 14 years of relative success.
>
> "Its theoretical economic model is not realistic any more and we are trying to define new ways and means for financing it, including subsidies and (more appropriate) standards
>
> "In order to have basic data to support our analysis, we are surveying the State Water Supply Agencies, using the same approach we used in our (PRICOR) project and, for that matter, we are getting somewhat similar results."(3)

References

1. J. David Grynfogiel and Joany Resende Castro de Andrade, Um Programa de Abastecimento de Agua Para Pequenas Comunidades Parcialmente Financiado Pelo BID--a Experiencia Brasileira (A program of water supply systems for small communities partially financed by the Inter-American Bank. The Brazilian Experience, XIII Congresso, Inter-Americano de Engenharia Sanitaria Assuncao Paraguai 20-26 August, 1972, Fundacao SESP, Rio de Janeiro, Brasil.

2. J. David Grynfogiel, Avaliacao do Programa das Pequenas Comunidades--FSESP/IBD (Evaluation of a program of small communities), XI CONGRESSO, Brasileiro de Engenharia Sanitaria e Ambiental Fortaleza Ceara 20-25 September, 1981, Fundacao SESP, Rio de Janeiro, Brasil.

3. Personal communication, Engineer Fraylan Moitta.

VI. ADMINISTRATION

A. Personnel

Engineer Froylan Moitta, Chief of the Research Unit of the Environmental Sanitation Division was the Project Director for Fundacao SESP. Engineer Moitta has had extensive experience in Brazil and served as a WHO staff member in Afghanistan and Sri Lanka. He was in charge of the financing of water supplies portion of the study, as well as being overall Project Director. He was assisted by Engineers Pedro Gondim and Luiz Maria Camacho Leal in the analysis of the study. Engineers David and Zadir provided consultation on project planning and interpretation. Dra. Ermingarda, Director of Research and Planning, provided the information on the effect of water supplies on incidence of diarrheal disease.

Dr. Corinha Fischer, Special Assistant to the President of Fundacao SESP, was in charge of the visitadora portion of the study. Dr. Jacques N. Manceau, Director of Biostatistics for Fundacao SESP (former President of Fundacao SESP), assisted in the development of the data analysis of the work of the visitadora and served as consultant in other aspects of the project. Mr. Mario Reyes, Chief of Data Processing, and Ms. Maria de Concecão provided the basic information on the work of the visitadora for further analysis. Mr. Modesto of the Statistics Section provided population estimates for coverage areas of the visitadora health posts. Drs. Plenio and Zilda of the Training Unit provided information on the costs and type of training for the visitadora. Ms. Ercy Guerra of the Nursing Unit and Dr. Fernando Gomez, the Regional Director, of Rio Grande de Norte; Dr. Nicodemus, Director of Local Health Services; and Engineer Euripides of Minas Gerais assisted

in field visits in those states. Dr. Aldo Villas Boas, the President of FSESP, provided encouragement and overall guidance to the project.

At Johns Hopkins, Dr. Timothy Baker served as Project Director. Dr. Alan Sorkin wrote the review of the literature for the community financing of water supply part of the projects. Drs. Robert Parker, Doris Storms, David Salkever, and Kaz Kawata consulted in the early stages of the project and gave assistance in the review of parts of the final write up. Dr. Mary E. Young, consultant to the World Bank, assisted Dr. Baker in the write up of the history of SESP while she was a resident at Hopkins in International Health. Ms. Lani Rice carried out analysis of the service data from the L-1 visitadora units, made a field visit to the SESP office in Rio, and wrote the descriptive section of the visitadora part of the project. Ms. Susan Burger and Moiara Ruehsen carried out further analysis of the visitadora program with special emphasis on immunizations.

B. Financing

PRICOR allocated $77,779 plus a supplemental $6,510 for the project. Of the total $84,289, $32,370 was obligated to Fundacao SESP on a fixed price contract basis. The final payment was delayed until the delivery of the project specified from Fundacao SEPS. The delay of the final product delivery from SESP also delayed the final report preparation and delivery to PRICOR. The approximate total cost of the project was $110,000. The additional cost was made up by personal time volunteered by Dr. Baker, Ms. Rice, work study time provided by Ms. Burger, and time of SESP personnel paid for from the SESP operating budget. In addition, most computer time was provided by the student and faculty introductory accounts at Johns Hopkins and by Fundacao SESP in Rio.