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Final Report  
on  
THE DESIGN AND IMPLEMENTATION OF A  
REVOLVING DRUG FUND IN DOMINICA  
A PRICOR Study,  
VOLUME I

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## Executive Summary

The purpose of this PRICOR study was to design and implement the "best" Revolving Drug Fund for Dominica -- an RDF whose intended benefits were an increase in the volume of drugs and supplies available to health districts and facilities, and at the same time a decrease in the financial burden on the Government, first by having consumers share in the cost of pharmaceuticals and second by enabling bulk purchases at lower unit costs. It was also expected that the RDF would promote cost consciousness in drug usage among consumers. These changes would serve to extend Primary Health Care services in Dominica.

While simple in concept, RDFs have proven quite difficult to set up and operate in practice. They require a degree of managerial rigor, in both their design and implementation, that is frequently lacking in the public sector, and many attempts to introduce them into government-run supply systems have failed.

Dominica's goal was to design and implement a Revolving Drug Fund which would succeed. The Ministry of Health and Management Sciences for Health, working together, felt that the application of operations research techniques would assist them in reaching that goal -- systematically identifying and analyzing the operational problems that needed to be addressed, formalizing the logical thought process to address those problems, and eventually overcoming them, designing solutions that would then be tested and refined. It was felt that such an approach would result ultimately in an RDF system which would be feasible, would work in the Dominican context, effective, would attain the objectives that had been set out for it, and efficient, would attain those objectives at lowest cost.

It was hoped that an additional purpose of the study would be to share Dominica's experience with other countries in the Eastern Caribbean and beyond who were interested in developing revolving drug funds. An increasing number of countries are expressing interest in revolving funds, but the experiences to date which they might draw on for guidance have been far from systematic. Careful documentation of the operational issues that arose in Dominica, under what circumstances they arose and how they interacted, and how they were successfully resolved might be useful to any country or program embarking on a similar endeavor.

Early in this study the Ministry of Health decided to implement the revolving fund in two phases, postponing consumer cost sharing until the second. In the preliminary Phase I model it was the health districts and facilities who would purchase the drugs and supplies, reimbursing the revolving drug fund through their budgetary allocations.

The objectives of the Phase I RDF were specified as follows:

- to increase the availability of drugs and medical supplies to health districts and facilities
- to decrease the unit costs paid for drugs and supplies
- to increase cost consciousness on the part of the users (who were defined in Phase I as health districts and facilities)

Additional objectives of the Phase II RDF, which would incorporate drug sales, were:

- to have consumers finance a portion of the purchase cost of drugs and supplies
- to increase cost consciousness on the part of patients.

The study followed, in broad outline, the three-step process of the PRICOR approach: (1) systematic analysis of the operational problem; (2) application of the most appropriate analytical methods to identify the best solution(s) to that problem; and (3) validation of the solution(s). Yet, there were not three distinct and separable steps in this study. The initial RDF Systems Analysis produced eight components, each of which required problem analysis, solution development, and solution validation. And within each component, individual operational issues were identified. The study components and some of the major operational issues that arose are listed below:

1. FINANCE
  - capitalization requirements
  - methodology for billing districts
  - % markup over drug/supply costs
  - pricing policies (Phase II)
2. MIS/ACCOUNTING SYSTEM
  - degree of financial control desired
  - forms and procedures required
  - ability to maintain
3. SELECTION
  - RDF scope -- what items to include in system
4. PROCUREMENT
  - procedures -- periodic or perpetual ordering
  - what suppliers
  - order quantities
5. WAREHOUSE/INVENTORY MANAGEMENT
  - safety stock levels
  - monitoring of expiry dates

6. DISTRIBUTION  
scheduling of issues to districts  
backordering/returns/exchanges from districts  
course-of-therapy prepackaging (Phase II)
7. ORGANIZATIONAL DEVELOPMENT  
authority/responsibility for RDF management  
what staff required  
what training required
8. INFORMATION, EDUCATION, COMMUNICATION/PUBLIC ATTITUDES  
how to gain public support  
identification of indigents (Phase II)

Throughout the study, developments within individual operational issues were occurring continually and simultaneously in all components. The operations research as applied in this study was fluid and ongoing, and very much an iterative process.

### Results

The Phase I RDF was actually established in November 1983 with the \$500,000 loan made available from Social Security, and it became fully functional in February 1984 when the design of the Management Information/Accounting System was completed and was implemented.

From the start, the Phase I RDF model proved to be feasible: The mechanics of the model as designed worked in the Dominican context. Over the course of the study the design and implementation of this RDF proved to be, at least to some degree, effective in attaining the objectives that were set out for it. The initial capitalization of the RDF enabled CMS to undertake major procurements with a view toward long-term planning. Supplies were cleared much more promptly from the port, as it was a much simpler procedure to write an RDF check than to process a payment through the Treasury.

These factors resulted in the building up of stocks at CMS; by December 1985 the value of drugs and medical supplies held in inventory was 57.6% higher than in July 1983 (although this reflects price inflation as well as a 25.3% longer inventory list). And with improved materials management systems, these stocks were better maintained. While stockouts of specific items continued to be a problem throughout the study period -- due to difficulties in estimating the lead times of new suppliers -- CMS was much more successful in making drugs and supplies available to health districts and facilities. Issues of all items increased 27.7% overall (holding average unit costs constant) between FY83-84 and FY84-85; of first-line drugs, those used for primary health care delivery at the district level, 22%; and of antibiotics, 59%.

The tight financial and materials accounting system created a new cost consciousness among staff at CMS, as they were more

aware for the first time of the value of each item held in inventory. A major effort was launched to locate lower-cost but high quality new suppliers, primarily of generics. By July 1984 researchers were able to report in a presentation to the Prime Minister and her Cabinet unit cost reductions for some items of up to six-fold. Since that time, units costs for additional items have dropped, and many of them for high expenditure items where the impact was greatest. Offsetting to some extent these remarkable successes, however, is the fact that emergency purchases continue to be required. These are nearly always from high-cost nearby distributors at much higher prices, raising the purchased item's average unit cost once again. Nevertheless, the trend is in a positive direction.

These cost reductions have not resulted in overall savings to the Government, however. With the simultaneous efforts to increase the quantities of drugs and supplies provided to health outlets, overall spending has in fact increased.

The changing supplier profile also indicates a long-term change. Increasing proportions of total drug and supply purchases are coming from non-profit generic distributors, 24.2% of all purchases in the first half of 1985-86 as compared to 16.2% in 1983-84. As good relationships are developed and maintained with these suppliers it will be a natural development for CMS to do more business with them.

Implementation of the Phase I RDF has also resulted in the first glimmers of cost consciousness on the part of the users. When districts began to receive "costed" packing slips enclosed with their monthly shipments and were sent price lists from CMS for first-line drugs, a number of the doctors were prompted to ask when patients were going to begin to be charged for drugs. In a survey undertaken in the third year of the project, all of the doctors and pharmacists who responded and two of three nurses who responded stated that they were more aware of the monetary value of drugs and supplies.

The degree to which these changes have been efficient is somewhat harder to assert with confidence. Efficiency has to do with the achievement of objectives without wasting resources, attaining greater outputs with constant inputs or the same outputs with fewer inputs. In this study the outputs in terms of objectives have been achieved with increased inputs -- both financial and human. Without a "control" supply system to compare to, only observation and informed judgment are available to comment on the RDF's achievement of its objectives with relative efficiency.

Within individual components, while much progress has been made toward attaining objectives there is room for increased efficiency. The inventory list still includes many items which have not been purchased or used in Dominica since this study began, which slows down information processing; procurements take longer to process than seems necessary; there are still

overstocks at CMS; both RDF payments and reimbursements take longer than expected. While RDF capital has been largely conserved, there have been a few significant losses due to misunderstandings about appropriate RDF expenditures among financial officials within the Ministry. Perhaps most importantly, maintenance of the RDF accounting system has required the efforts of an additional staff member.

Although there has been discernible progress toward increased availability of supplies, reduced unit costs, and increased cost consciousness under the Phase I RDF, it has not been without setbacks. Early achievements in individual components or even in addressing individual operational issues were often dramatic, e.g., in reducing unit costs paid for drugs or in clearing supplies from the port. But the RDF is a dynamic system, with interactive components; these developments were influenced by developments in other components, or a lack of developments due to attention focused elsewhere. The composite result -- the sum of results in all components and operational issues -- while showing a positive trend, has been less dramatic.

At the end of the study, the Phase II RDF has not yet been implemented although some Phase II operational issues in some components have been addressed. District physicians and pharmacists are monitoring the value of their usage of drugs and supplies as against their budgetary allocations, and they are beginning to monitor usage by patients and thus to manage their inventories. They are also beginning to discuss the value of drugs with patients. These are prerequisites to a successful RDF with drug sales.

### Conclusions and Recommendations

Among the factors that facilitated the relatively rapid progress in Dominica were a strong, high-level commitment to establishing a revolving drug fund and substantial experience to draw upon for guidance. A viable RDF model was available at the start of the project -- a model which had been implemented in a number of countries with varying degrees of success. The potential of an RDF, as well as its pitfalls, were known. The Minister of Health, the Health Services Coordinator, and other senior officials in the Ministry were strongly in support of introducing an RDF to Dominica. The Supplies Management Officer and staff at CMS who would be operationally responsible for implementing the new systems and procedures were a highly capable and motivated group.

One factor which was perhaps the major facilitating factor in Dominica's success was the Ministry's decision to implement the RDF in two phases. This was not part of the original workplan; it was a decision which sprung from largely political considerations, but it allowed the Ministry as well as researchers to focus on central level managerial systems for both financial and materials management and development and implementation of the MIS/Accounting System; the latter has

provided information on RDF progress, guiding further RDF development and supporting research efforts. The systems developments efforts that are required to introduce consumer charges for drugs seem, in retrospect, nearly unattainable without these central level management systems in place. This may be one of the clearest and simplest, yet most important findings from this study.

A number of factors have been identified as critical to the implementation of an effective and efficient Phase I RDF.

1. Coordinated leadership and management -- Authority and responsibility for RDF assets should be vested in either a single person or a committee which meets regularly to review financial reports and address operational problems and take managerial decisions.
2. Adequate staff -- Initial design of the RDF, and in particular of the MIS/Accounting System, requires the inputs of an expert accountant. (In Dominica the services of a finance and accounting consultant were available through the PRICOR project.) Ongoing RDF maintenance requires all the staff normally required at CMS to maintain the supply system, plus an RDF accountant to maintain the MIS and accounting system which provides information for RDF management. To ensure the continuity and reliability of the supply system, all staff should be permanent rather than temporary.
3. Adequate capitalization -- The level of capitalization required is the product of the monthly usage rate and the length of the pipeline. If accurate data are not available at the outset, the information system should be designed to collect the necessary data for continually monitoring both usage and pipeline length, in order to continually refine the capitalization estimate and make the necessary adjustments. If usage is higher than expected, or there is evidence of increasing or unmet demand, or if any segment of the pipeline is longer than expected, these issues must be addressed and resolved. Adequate funds for capitalization must be available if the RDF is to succeed.
4. Assurance of RDF reimbursement -- Because all issues from the RDF must be reimbursed in order for the fund to revolve, two variables are important -- issues and reimbursements -- and must be kept in equilibrium. This means that if issues are to increase, as is happening in Dominica, additional funds must be made available to reimburse the RDF.

It should not be overlooked that these factors emerged as critical from an organizational context in which the materials management functions -- selection, procurement, inventory management, and distribution -- were already in place and operating satisfactorily.

Nor should it be overlooked that Dominica's progress was achieved with substantial inputs of time and technical assistance made available through this PRICOR study.

At the end of this study, researchers encourage the Ministry of Health to continue to plan for Phase II. One of the major findings has been that the Government's budgetary allocation for drugs and medical supplies continues to leave a significant proportion of consumer demand unmet. Yet, results of the December 1985 district survey give strong support to the hypothesis that patients in Dominica will be willing to pay for drugs if the charges are introduced through a well-planned educational and promotional campaign. The survey results suggest further that paying for drugs will, in fact, improve patient compliance, thereby extending the RDF's influence on rational decision-making to the user level.

Researchers believe that, as the Eastern Caribbean Regional Pharmaceuticals Management Project gets underway, Dominica's experiences in attempting to rationalize her drug supply system will facilitate both her own transition and her contribution to any new regionalized systems. As some procedures begin to be taken care of at the Regional level under the Eastern Caribbean Drug Service -- most likely supplier selection, purchase order tracking, and supplier performance monitoring -- Dominica will be able to redirect CMS staff efforts toward improved estimation of drug needs, maintenance of the MIS/accounting system, more reliable procurement and inventory management procedures, and planning for Phase II.

## I. BACKGROUND

Dominica is the third largest, after Jamaica and Trinidad, of the islands in the English-speaking Caribbean, with a land area of about 300 square miles. The northernmost of the Windward Islands, it is situated between the French islands of Guadeloupe to the north and Martinique to the south. The volcanically formed island is dominated by a range of forest-clad mountains from north to south, with three peaks reaching heights of over 4,000 feet. Easterly trade winds rising over this chain of mountains give rise to variable but generally heavy rainfall with annual amounts in excess of 300 inches in some locations. Dense tropical hardwood forests cover more than fifty percent of the island; flat agricultural land is scarce. The population, estimated at 78,501 in 1984, is distributed primarily along the coast.

Dominica gained independence from the British in 1978, and has a parliamentary form of Government. Its present Government, led by Miss Mary Eugenia Charles of the Dominica Freedom Party, has a reputation for honesty, integrity, and hard work. Economically, Dominica is the least developed of the countries in the Eastern Caribbean. Subsistence agriculture predominates, and significant unemployment and underemployment persist. Per capita gross national product is estimated at less than US\$500 (1983) and is heavily dependent upon bananas, which account for 60% of all exports and utilize 60% of all arable land. The country's transportation infrastructure is poorly developed.

Recent economic developments have been to a large extent influenced by the passing of two severe hurricanes within a span of twelve months. In August 1979 Hurricane David paralyzed all economic activity, completely destroying the banana crop, seriously affecting all other crops, disrupting communication, and damaging economic and social infrastructure as well as commercial and manufacturing enterprises. Rehabilitation works had commenced and banana exports had resumed when Dominica was struck by Hurricane Allen in August 1980, causing further setbacks.

### Health Statistics

Against this dismal economic background, Dominica has been surprisingly successful in delivering health services to its population. Birth and death registration is believed to be virtually complete. In 1983 the recorded death rate was only 5.5 per thousand population, and the infant mortality rate had dropped to 13.9 per thousand live births from 28.1 ten years before. Yet the crude birth rate has remained nearly constant at around 22 per thousand since 1975, and teenage pregnancies are reported to be too frequent.

Dominica's mortality and morbidity profiles are characterized by a blend of health problems traditionally associated with both developed and developing countries. The principal causes of

FIGURE 1

TEN PRINCIPAL CAUSES OF DEATH (1984)

RANK	CAUSE OF DEATH	NO. OF DEATHS	DEATH RATE PER 100,000
1.	HEART DISEASE (HYPERTENSIVE DISEASE)	119 (53)	151.65 (61.5)
2.	MALIGNANT NEOPLASMS	72	91.7
3.	CEREBROVASCULAR DISEASE	35	44.6
4.	CERTAIN CONDITIONS ORIGINATING IN THE PERINATAL PERIOD	31	37.7
5.	OTHER DISEASES OF THE RESPIRATORY SYSTEM	23	29.3
6.	DIABETES MELLITUS	19	23.9
7.	PNEUMONIA	12	15.1
8.	TRANSPORT ACCIDENTS	9	11.3
9.	TUBERCULOSIS	7	8.8
10.	ATHEROSCLEROSIS	5	6.3

FIVE PRINCIPAL CAUSES OF DEATH (1984)

IN CHILDREN UNDER 5 YEARS BY AGE GROUP

CAUSE OF DEATH	0 - 27 DAYS		28 DAYS - 11 MONTHS		1 - 4 YEARS	
	NO. OF DEATHS	DEATH RATE PER 1000	NO. OF DEATHS	DEATH RATE PER 1000	NO. OF DEATHS	DEATH RATE PER 100,000
1. CERTAIN CONDITIONS ORIGINATING IN THE PERINATAL PERIOD	30	17.4	1	0.6	0	-
2. CONGENITAL ANOMALIES	4	2.3	2	1.2	0	-
3. INTESTINAL INFECTIOUS DISEASES	0	-	2	1.2	0	-
4. HEART DISEASES	0	-	1	0.6	1	15.5
5. MENINGITIS	1	0.6	0	-	0	-

FROM 1984 ANNUAL REPORT OF THE CHIEF MEDICAL OFFICER,  
MINISTRY OF HEALTH, DOMINICA

death are shown in Figure 1. Morbidity data are less complete; leading causes of hospitalization (1984), however, are hypertension, diabetes mellitus, alcohol-related problems, cerebrovascular disease, and heart failure. Major communicable diseases are measles, influenza, gastroenteritis, typhoid, and viral hepatitis.\* The incidence of typhoid was estimated in 1981 to be approximately 75 per 100,000, one of the highest in the world. Helminth infestation rates among children under ten were estimated at greater than 90%; over 50% of all young children were estimated to suffer some degree of malnutrition.\*\* Lack of sanitary facilities is considered a major shortcoming. Less than 2/3 of all households have excreta disposal facilities, and 58% report disposing of household garbage by open dumping; only 2/3 of all households are considered to have easy access to potable water.\*\*\*

### Health Services Delivery System

Partly in response to the devastation of Hurricanes David and Allen, the Ministry of Health in Dominica has given increased attention and achieved notable progress in its expansion of Primary Health Care. The Ministry's five-year National Health Plan (1982 through 1987), prepared in 1982, describes a Primary Health Care Strategy including the following components: extension of health services coverage and environmental improvement, community organization and participation, intersectoral cooperation, development of appropriate technology and operational research, the establishment of a national system for financing the health sector, the development of appropriate human resources and the availability of critical supplies and equipment, and the development of organized Health and Family Life Education Programs.

One key feature of this strategy has been a major decentralization of the health care system. Seven Health Districts have been created, each one headed by a resident District Medical Officer. The District Medical Officer is professionally and administratively in charge of all regular health services within the District and supervises the District health team.

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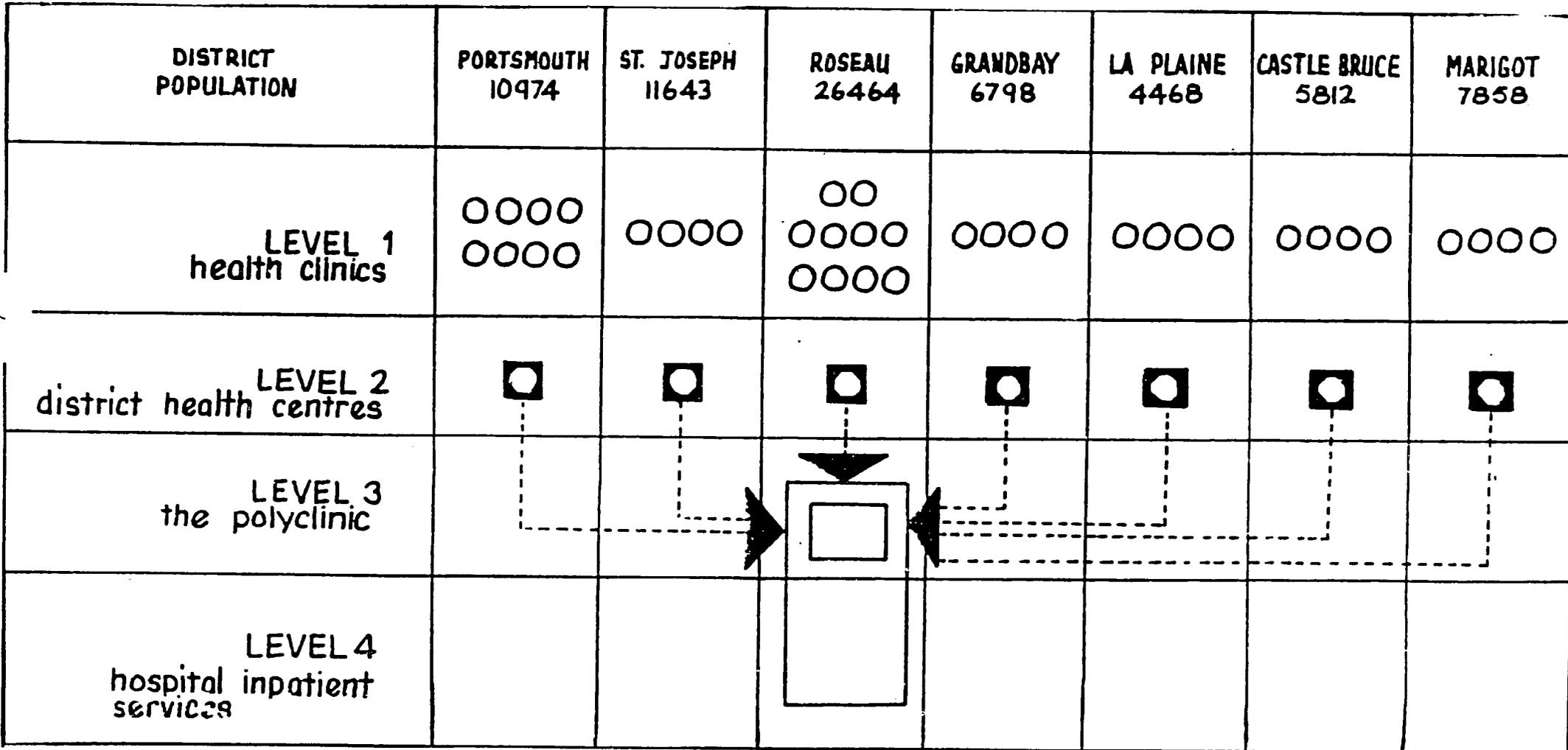
\*From 1984 Annual Report of the Chief Medical Officer, Ministry of Health, Dominica

\*\*From Control of Typhoid and Diarrhoeal Diseases in Dominica by Dr. Branko Cojetanovic, Pan American Health Organization.

\*\*\*From a Report on a Community Based Survey on Health Services Utilization and Coverage, prepared for PAHO and presented at the Ninth Meeting of the Conference of Ministers Responsible for Health, by Dr. Carissa Etienne, July 1984.

Figure 2

The Health Services Delivery System



From 1984 Annual Report of the Chief Medical Officer, Ministry of Health, Dominica

Dominica's health system has four levels, as shown in Figure 2. At the first level, Type 1 Primary Health Care Units provide basic services to villages as small as 600 in population. These PHCU's are staffed by community health nurses who have two years of training in the delivery of primary health care services; they are usually housed in one- or two-room wooden structures located in the community being served. The next level of care is provided by seven District Health Centres, one per health district, providing primary health care services to a population of 2,000 to 3,000, while providing a higher level of service to the total population in the district, usually 6,000 to 8,000 people. These health-centers are staffed by the District Medical Officer, a Family Nurse Practitioner, a Health Visitor, an Environmental Health Officer, a Staff Nurse-Midwife, a Community Health Nurse, a Pharmacist, a Dental Auxiliary, often an Assistant Laboratory-Radiographic Technician, and a Driver.

A Level Three Polyclinic as a referral point for District Health Centres has been proposed but not yet established. The fourth level of care is delivered by the Princess Margaret Hospital. With approximately 180 beds, it is the only major inpatient facility in the country and provides a broad range of specialized services including full diagnostic laboratory and radiological services. (Strictly limited in-patient services are available primarily for emergency cases at two District Health Centres in Portsmouth and Marigot.)

While a great deal of attention has been given to development of this health delivery system and to the training of health workers, its full effectiveness has been constrained by an inadequate system for the distribution of pharmaceuticals and medical supplies. In 1982 the drug supply system was plagued by frequent stockouts of essential items in Central Medical Stores as well as in peripheral health facilities.

### Health Financing

The financial resources available for health have remained fairly stable since 1972 as a proportion of total Government expenditure (see Figure 3). At 13-14%, they are fairly high relative to most developing countries. Nevertheless, in 1982 the Ministry of Health was experiencing serious financial difficulties. With less than 15% of the health sector budget allocated to drugs and other supplies, these items were in chronically short supply reducing the potential impact of the health services delivery system; further, the Government owed over EC\$400,000 to pharmaceutical suppliers, endangering reliable supplier relationships for the future.

Recognizing that the percentage of the recurrent budget allocated to health was not likely to increase, the Five-Year National Health Plan, 1982 - 1987, stated that the health sector would give "priority attention to better internal financial management, greater efficiency in operations, cost-sharing, and internal reallocations as a means of improving their resources situation."

FIGURE 3

RECURRENT BUDGET FOR HEALTH AND MEDICAL CARE  
1972-1986  
(E.C.\$)

YEAR	TOTAL GOVERNMENT	HEALTH AND MEDICAL	HEALTH AND MEDICAL AS % OF TOTAL GOV'T
1972	15,117,315	2,237,590	14.8
1973	16,354,436	2,490,840	15.2
1974	17,812,320	2,367,140	13.3
1975	20,122,679	2,875,820	14.3
1976	25,576,180	3,337,380	13.0
1977	36,005,170	3,229,690	9.0
1978	34,281,550	4,302,330	12.5
1979	44,146,134	6,556,374	14.9
1980/81	58,221,660	7,120,660	12.2**
1981/82	58,353,560	7,769,930	12.2
1982/83*	60,711,350	9,110,050	15.0
1983/84*	72,573,220	9,793,150	13.5
1984/85*	75,877,770	10,227,050	13.5
1985/86*	82,711,060	13,029,770***	15.8***

\*Recurrent Budget Estimates

\*\*Average for the period 13.5%

\*\*\*For 1985/86, Estimate includes Water and Fire Service

From Five-Year National Health Plan, 1982-1987, and Government Estimates for 1983/84, 1984/85, and 1985/86.

A USAID-financed Financial Study of the Health Care System on Dominica, undertaken in 1982, predicted that the new Primary Health Care Strategy would increase the demand for health services and, in particular, for pharmaceuticals, exacerbating the Government's financial difficulties, unless new initiatives were explored. This study noted that several countries with financial problems similar to Dominica's have set up revolving drug funds (RDFs). In national-level RDFs, money is set aside at the national level for the purchase of drugs, these drugs are sold to user facilities, and the funds recovered from sales are used for further national-level procurements.

Health center or community-level RDFs, where money collected from patients for drugs consumed is used for the purchase of resupplies for that health center or community, have sprung up on their own in countries around the world. In these individual initiative programs, the resupplies are often purchased through the private sector, often in rural areas where they are available only at very high prices. What was suggested for Dominica was a number of health district and health facility RDFs which would intersect with the national RDF; that is, the user facilities would purchase their resupplies through the national-level program. A similar system has existed since 1981 through the AGAPCO pharmaceutical procurement agency in Haiti.

The 1982 Financial Study found that, while patients were not yet paying for health services through Government facilities in Dominica, they were spending nearly as much as the Government for drugs and doctors' fees through the private sector. This suggested that they would be willing and able to contribute towards health services in the public sector.

The study described the benefits that could be achieved through a revolving drug fund:

- An RDF would reduce or eliminate the need for annual allocations from the "General Fund" for the purchase of drugs. Funding for this component of the primary health care system would be assured, by definition, as long as the Fund operated successfully.
- Sufficiently capitalized, the RDF would permit the planned procurement of relatively large quantities, reducing both the prices paid for drugs and shipping costs.
- The frequency and length of stockouts would be reduced.
- The rate of increase in the consumption of drugs should be reduced. Doctors tend to overprescribe and patients tend to overconsume when drugs are free.
- If patients paid for drugs, they would be likely to make a greater effort to use them properly. They would attach more importance to drugs if they paid for them.

- The information on drug consumption generated by the management information system supporting the revolving fund would be very useful for future planning.

Following this study, the Ministry of Health decided to establish a revolving drug fund to bring financial accountability to the drug supply system and at the same time to increase the supply of pharmaceuticals available for health service delivery.

## II. STUDY PURPOSE

The decision taken by the Ministry of Health to implement a national-level Revolving Drug Fund was not the outcome of this operations research study, but rather the starting place. It was expected that an RDF, if adequately capitalized, would result in an increase in the volume of drugs and supplies available to health districts and facilities, and at the same time a decrease in the financial burden on the Government, first by having consumers share in the cost of pharmaceuticals, and second by enabling bulk purchases at lower unit costs. It was also expected that the RDF would promote cost consciousness in drug usage among consumers. These changes would serve to extend Primary Health Care services in Dominica.

While simple in concept, RDFs have proven quite difficult to set up and operate in practice. They require a degree of managerial rigor, in both their design and implementation, that is frequently lacking in the public sector. In fact, the principles on which RDFs are based, requiring careful financial planning and strict accounting of both funds and inventories, are much more familiar to the private sector, as is demonstrated by the number of flourishing private pharmacies around the world which are essentially small-scale revolving funds operating at a profit.

Most attempts to introduce revolving funds into government-run supply systems have failed, due to one or more of the following problems:

- unanticipated price increases and/or inflation, that effectively reduce the Fund's working capital;
- slow decision-making, which increases the pipeline length and thus the need for working capital;
- inadequate attention to the development of a rigorous but cost-effective management information and accounting system;
- under-estimation of operating costs, which leads to under-pricing and insufficient revenues;
- failure to recover losses due to subsidized sales through either surcharges on other sales or from annual allocations from the General Fund;
- losses due to breakage, expiration, water damage, and theft.

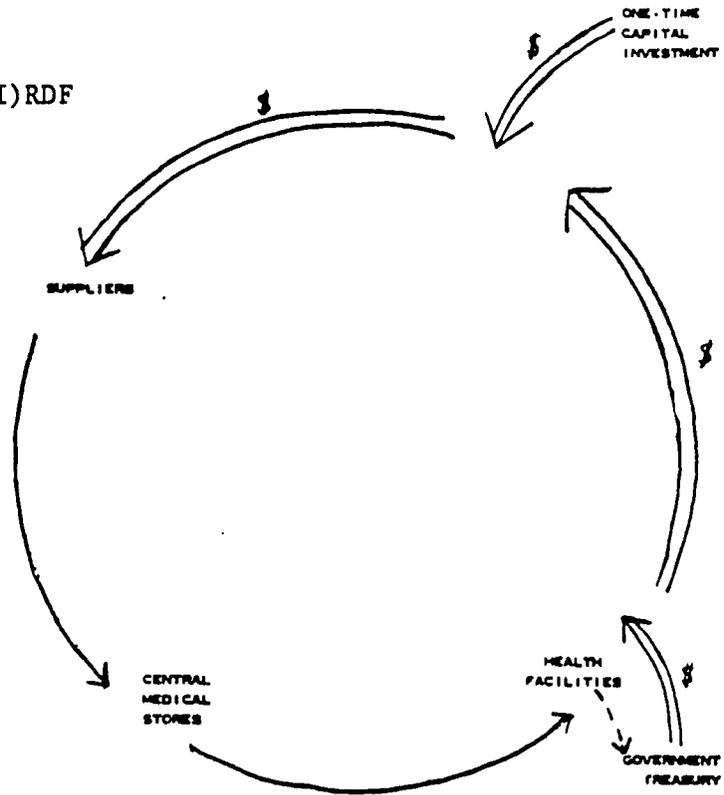
These problems all result in a gradual decapitalization of the Fund, to the point that it ceases to revolve. All are management problems which, as they are better understood, should be able to be avoided.\*

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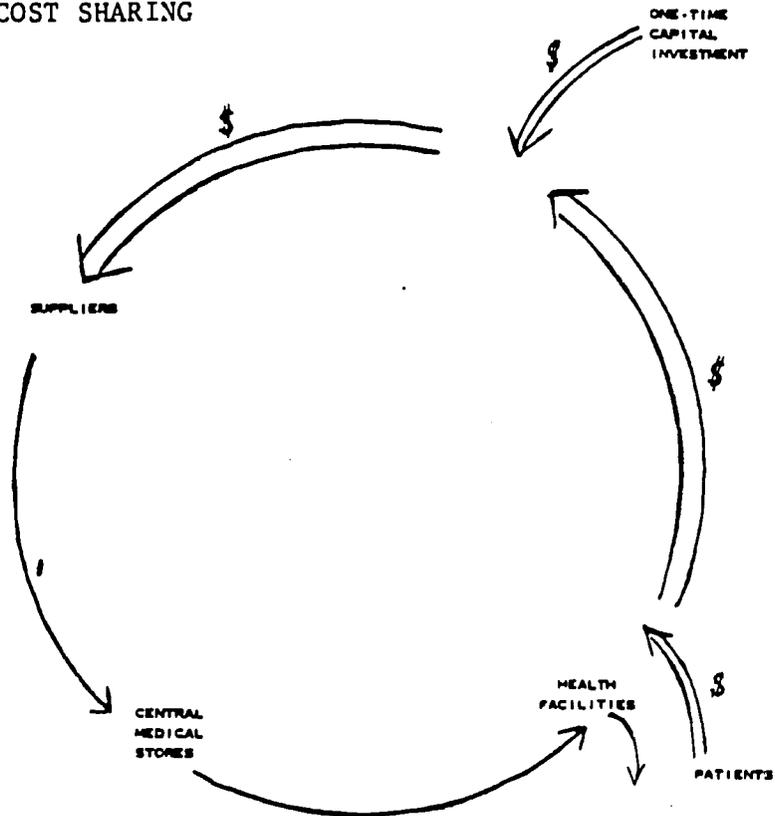
\*For more detailed discussion see "Revolving Drug Funds: Conducting Business in the Private Sector" by P. N. Cross, M. A. Huff, J. D. Quick, and J. A. Bates, Management Sciences for Health, in Social Science and Medicine, Vol. 22, No. 3, 1986.

FIGURE 4

PRELIMINARY (PHASE I) RDF



RDF WITH CONSUMER COST SHARING (PHASE II)



—————> FLOW OF GOODS  
=====> FLOW OF FUNDS  
-----> INFORMATION

Dominica's goal was to design and implement a Revolving Drug Fund which would succeed. The Ministry of Health and Management Sciences for Health, working together, felt that the application of operations research techniques would assist them in reaching that goal -- systematically identifying and analyzing the operational problems that needed to be addressed, formalizing the logical thought process to address those problems, and eventually overcoming them, designing solutions that would then be tested and refined. It was felt that such an approach would result ultimately in the "best" RDF system for Dominica -- one that would be feasible, would work in the Dominican context, effective, that would attain the objectives that had been set out for it, and efficient, that would attain those objectives at lowest cost.

It was hoped that an additional purpose of the study would be to share Dominica's experience with other countries in the Eastern Caribbean and beyond who were interested in developing revolving drug funds. An increasing number of countries are expressing interest in revolving funds, but the experiences to date which they might draw on for guidance have been far from systematic. Careful documentation of the operational issues that arose in Dominica, under what circumstances they arose and how they interacted, and how they were successfully resolved might be useful to any country or program embarking on a similar endeavor.

Just as this operations research study was getting underway, the Government of Dominica took a decision which forced a reformulation of the study's timeline. This decision, reached at the highest levels of the Government, was to postpone for an indefinite period the introduction of drug charges in public sector health facilities. Elections were less than two years away and were already influencing decision-making. It was felt that introduction of consumer charges was too high a political risk.

The researchers took this opportunity not to change the study's objectives but to rethink the timeline for the design and implementation of a revolving drug fund with consumer cost-sharing. Recognizing that a great deal of systems development work was required before drug sales could be initiated, and that the information currently available on the past functioning of the supply system was weak, it was decided that a preliminary period for management and information systems development work would be very useful.

This led to a new conceptualization of the RDF in two phases (see Figure 4): In the preliminary Phase I model, drugs and supplies would be distributed to health districts and facilities who would purchase these drugs and supplies using their budgetary allocations, thus reimbursing the revolving fund. In effect, there would be one buyer -- the Government. During this period all central-level systems for financial and materials management would be designed and implemented. With these

systems functioning effectively, only minor modifications would be required for Phase II, when patients themselves would be required to pay for the drugs they consumed.

The objectives of the Phase I RDF were specified as follows:

- to increase the availability of drugs and medical supplies to health districts and facilities;
- to decrease the unit costs paid for drugs and supplies;
- to increase cost consciousness on the part of the users (defined in Phase I as health districts and facilities).

Additional objectives in Phase II were:

- to have consumers finance a portion of the purchase cost of drugs and supplies;
- to increase cost consciousness on the part of patients.

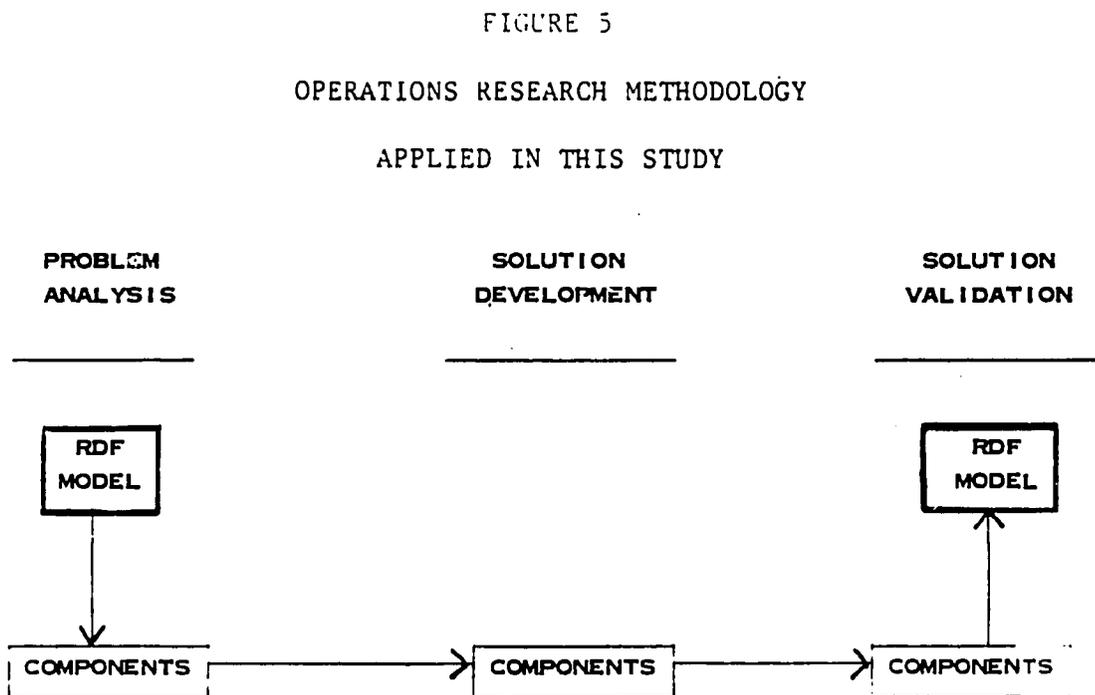
Although Dominica's Freedom Party was reelected in 1985, the decision to go forward with the introduction of consumer charges for pharmaceuticals had not yet been taken by the end of this study, in April 1986. Hence, research efforts throughout the three years of this study period have focused primarily on getting the Phase I RDF underway.

### III. METHODOLOGY

This study followed, in broad outline, the three-step process of the PRICOR approach:

- (1) Systematic Analysis of the Operational Problem;
- (2) Application of the Most Appropriate Analytical Methods to identify the Best Solution(s) to that Problem; and
- (3) Validation of the Solution(s).

Yet, these were not three distinct and separable steps in this study. The initial RDF Systems Analysis produced eight components, each of which required problem analysis, solution development, and solution validation. Together, the solutions developed and tested for these components or submodels would produce the solution for the overall RDF model. The broad framework of this methodology is shown in Figure 5 below:



The detailed methodology followed in this study is more complex than shown, however. Within each component, individual operational issues were identified and each of these needed to be addressed and solved, often using the three-step approach. Hence, a number of operational issues were being addressed simultaneously in this study, the operational issues nested within the eight components which in turn were nested within the larger operational problem -- how to design and implement the best RDF for Dominica.

A further complexity in methodology was introduced with the decision to implement the RDF in two phases -- in Phase I, with health districts and facilities "purchasing" drugs and medical supplies from Central Medical Stores, using the funds provided in their budget allocations, and during a later Phase II, with the patients themselves becoming the clients, reimbursing the Fund through payments for drugs and medical supplies consumed.

With this decision, a transitional RDF model was introduced. While it would be different in significant ways from the originally envisaged model, the basic framework would be the same. Both models would incorporate elements of all eight project components or submodels; some operational issues within these eight components would be common to both, but others would be unique to either the Phase I or the Phase II model.

The revised methodology incorporating this phased approach is shown in Figure 6. The problem analysis step still produced the eight RDF components. Analysis of each of these components produced operational issues that would need to be addressed for development and validation of the Phase I model, and other issues that would need to be addressed for the Phase II model.

Although many of the Phase II issues were chronologically the first to be identified in this study, when an RDF with consumer cost-sharing was still the goal, the change in workplan shifted the research focus to the resolution of Phase I issues. These issues, concerned with development of central-level management systems, received the major emphasis throughout the study period. But before the solutions to all these operational issues were fully developed and validated, some issues began to arise in anticipation of the ultimate Phase II model.\* Thus, both Phase I and Phase II issues were addressed, but at the end of the study were at vastly different stages of development and resolution.

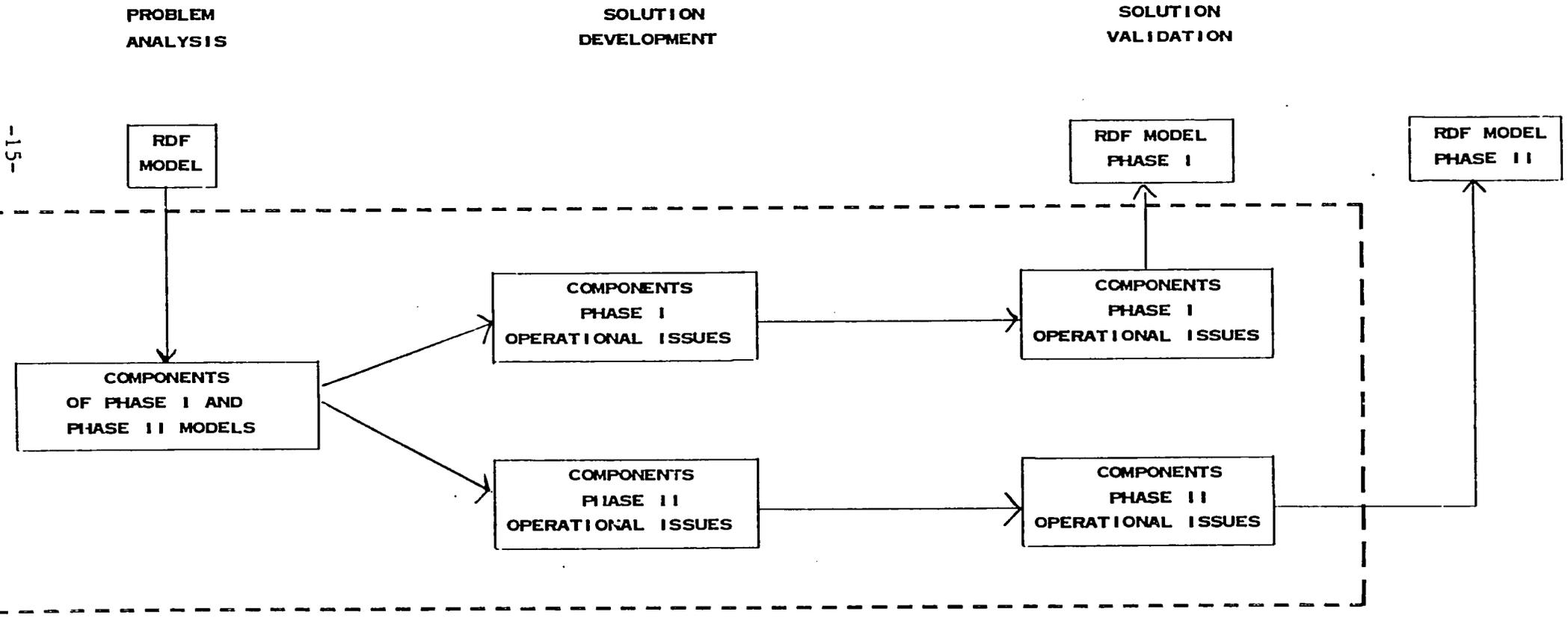
The introduction of an RDF, as drastic a change as it is for a public drug supply system and as politically significant, has produced a complex array of operational problems and issues. While some were identified early, others continued to emerge throughout the life of the study. Operations research activities have included continual identification of new issues and the careful documentation of the stages of development within each, including decision variables that were involved and how they were addressed. Developments in the analysis and resolution of issues in all components were overlapping in time and had crossover implications. The solution that was developed for one operational problem often determined what other

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\*Any issues that had to do with the development of systems and procedures requiring new decision-making at the district level were defined as Phase II operational issues.

FIGURE 6

REVISED METHODOLOGY  
INCORPORATING PHASED APPROACH



-15-

[ ] SHOWS STEPS WHICH, FOR CLARITY, ARE DISCUSSED BY COMPONENT

problems and issues arose and influenced in turn their resolution. As "solutions" in each component were monitored and refined, and became submodels within the larger RDF model, operations research techniques were used to assess the feasibility, effectiveness, and efficiency of the solution as a workable component of the larger model.

The operations research applied in this study was very much an iterative process. Developments were occurring continually and simultaneously at multiple levels -- within each component and even within Phase I and Phase II operational issues for each component. In no case were the dividing lines between steps of the operations research process clean and distinct; rather, they were blurred and overlapping. This research is complete only in the sense that the PRICOR study period has ended. The issues are not fully resolved; in reality, the research is ongoing. This final report is simply a photograph of Dominica's RDF, as of March 1986, and a detailed description of the process that led the Ministry to this point.

For clarity and to facilitate an understanding of this process by outside readers, the researchers have decided to present these three years' experience not chronologically -- the dozens of operational issues that were being addressed essentially simultaneously would make that unwieldy -- but within a logical framework that would be more useful. Since the framework itself changed over the life of the study, as components and operational issues alike became more focalized and better defined, it is the final framework adopted by the researchers that is used in this report to present study findings. This is the "historical model," incorporating the lessons that have been learned, organizing the issues with the assistance of hindsight.

The findings of this study are presented in the following pages, beginning with an RDF Systems Analysis (Section III.A.) which produced the eight components, and then with a detailed discussion of each of the eight components in turn (Section III.B.1.-III.B.8.). The presentation of each component begins with a discussion of why it was felt to be an important component or submodel of the RDF model, and how operations research techniques were used in development of that submodel over the life of the study. The operational issues that were identified in that component are then presented although they were not all identified at the outset of the study. Then each operational issue is addressed in turn, following loosely the three operations research steps in each case, but only as a guide; the three steps are not separated with subheadings. For some issues, the emphasis was on solution development; for others, solution validation.

It is the summary result of all operational issues within all components that determines the status of both the Phase I and Phase II "solutions" and the degree to which the RDF model in place at the end of the study is feasible, effective, and efficient, and what its impact is on primary health care service delivery.

A. RDF Systems Analysis

A preliminary model for the Revolving Drug Fund in Dominica was known at the start of this study (see Phase II model in Figure 4), and was the basis upon which the Ministry had decided to move forward with RDF development. The Ministry had decided to use operations research to define and develop that model within the organizational and situational setting in Dominica, and to implement it. The study actually began with an analysis of this model, and an analysis of the current drug and supply system in order to identify their common elements and the gaps between them in an effort to segment the RDF model into smaller, more manageable components.

The initial analysis of the pre-existing drug and supply system showed it to be managing the system's material assets (see Figure 7). Central Medical Stores was in communication with the Ministry of Health with regard to the list of items that needed to be procured. CMS then made direct contact with the suppliers who provided the drugs and medical supplies, but who were paid ultimately by the Government Treasury. CMS held the supplies in its warehouse and managed their distribution to health districts and facilities, from which, in turn, they were distributed to nurses and ultimately to patients. There were communication

FIGURE 7

PRE-EXISTING MINISTRY OF HEALTH  
DRUG SUPPLY SYSTEM

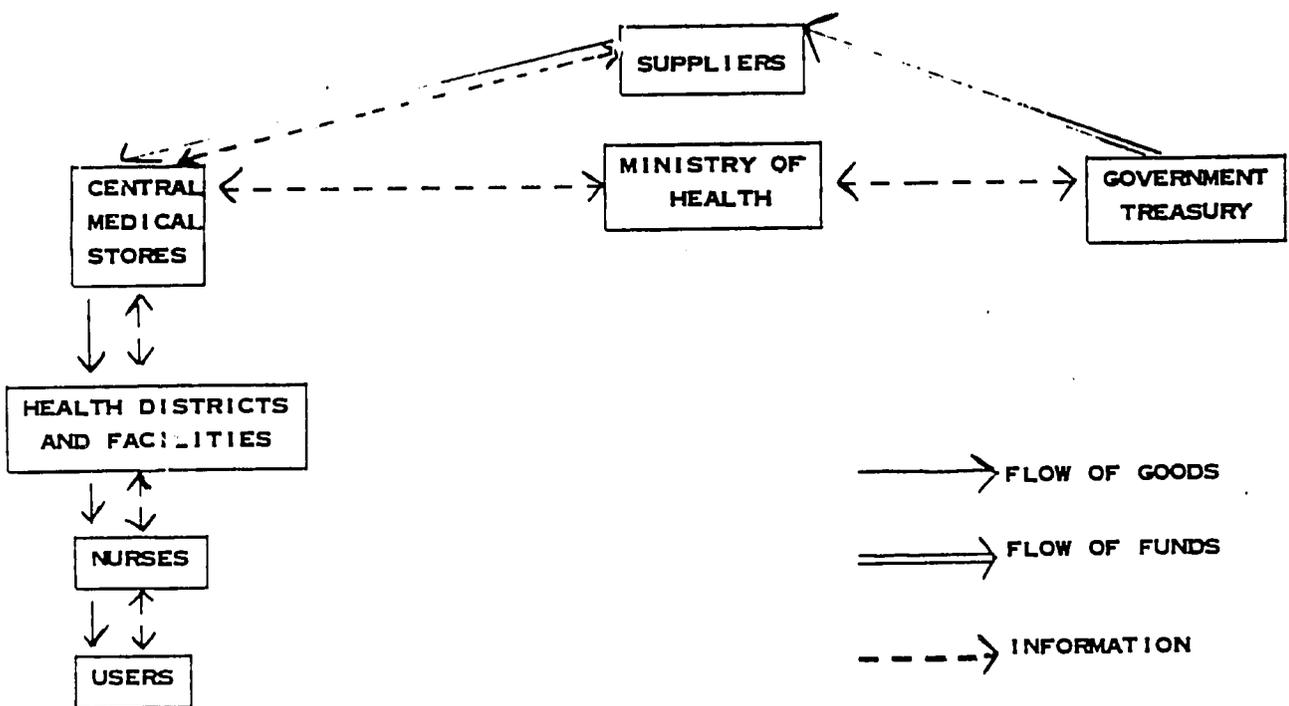
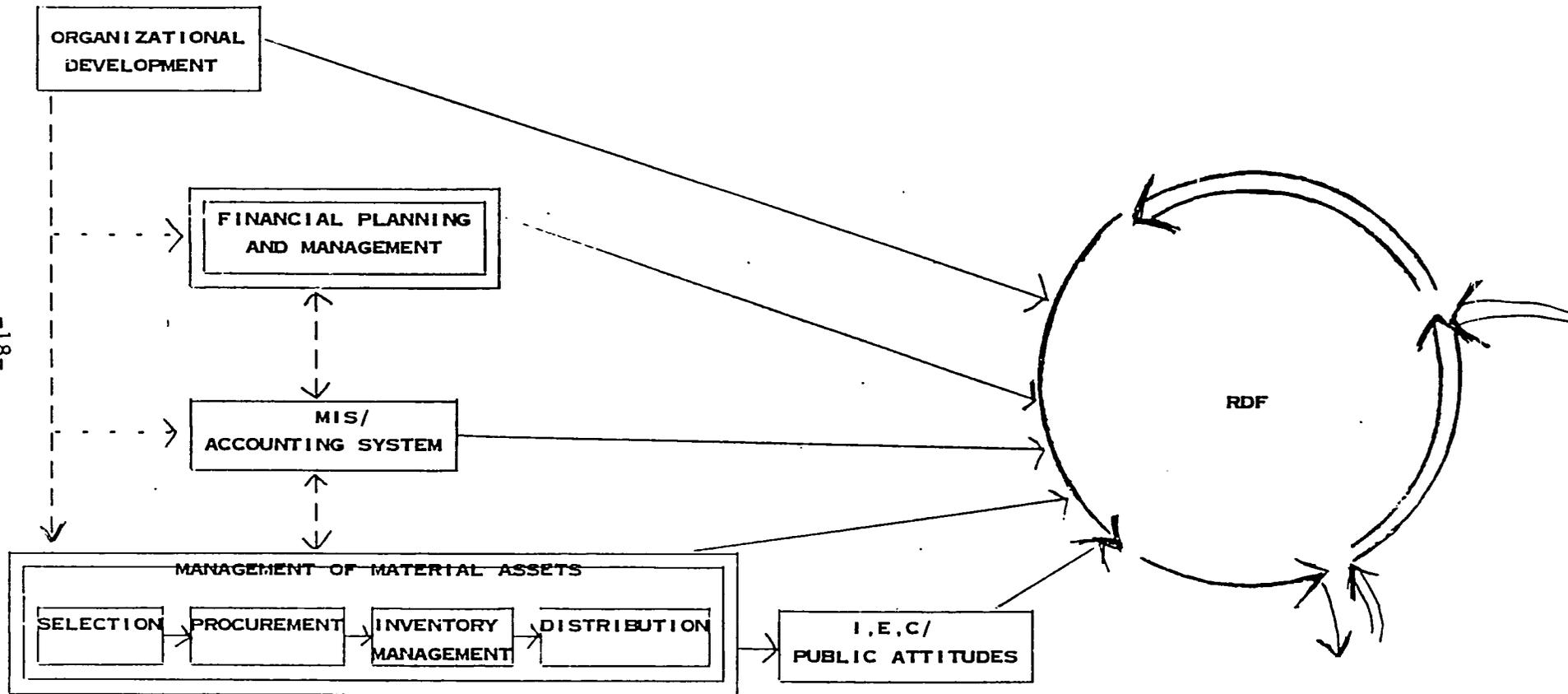


FIGURE 8

MODEL OF THE RDF SYSTEM COMPONENTS



links by means of various forms and procedures between each of these elements. The current supply system, therefore, was performing the functions of selection, procurement, warehouse and inventory management, and distribution, all of which were coordinated by a management information system.

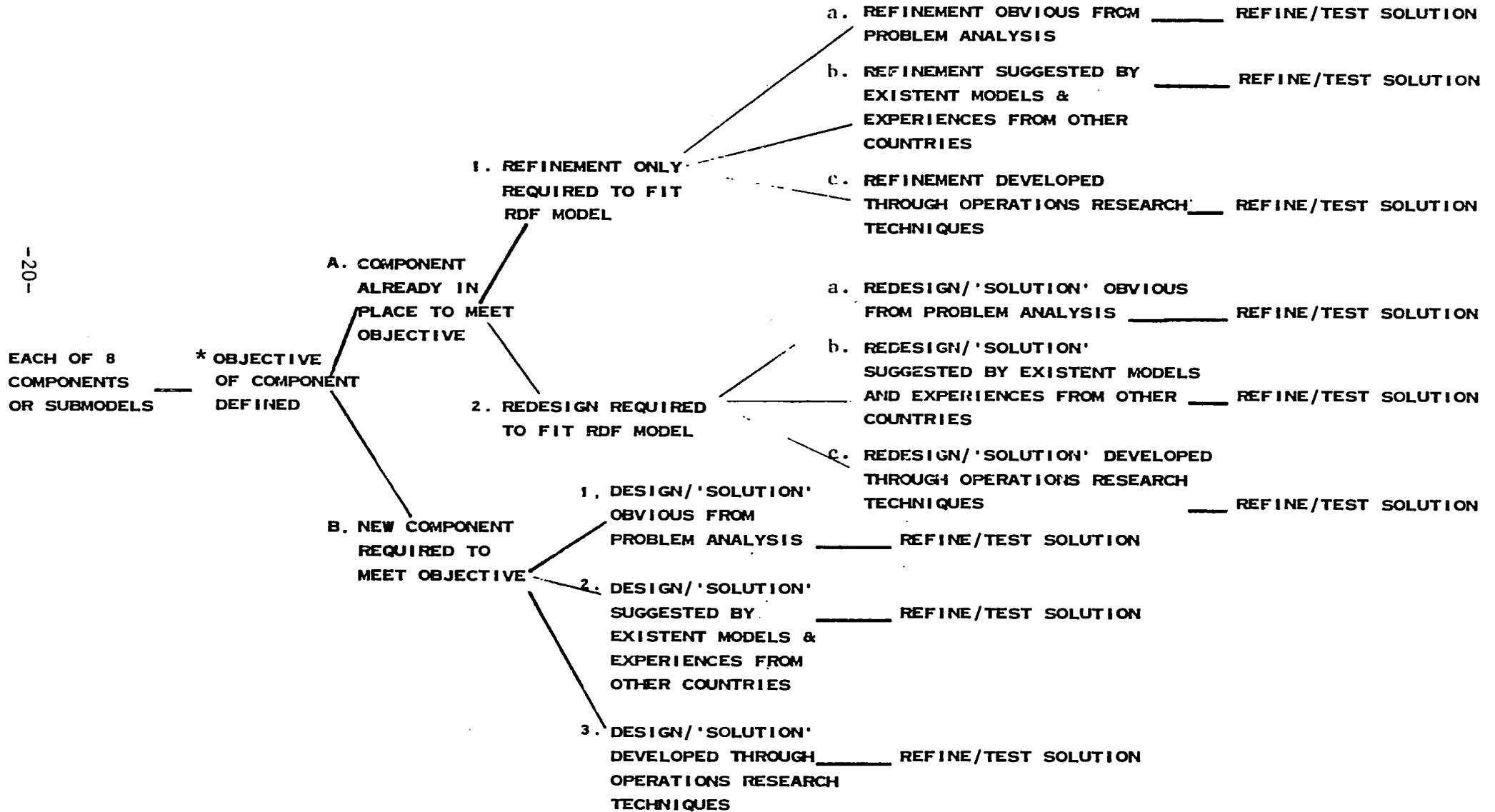
Past experiences with revolving drug funds -- both personal experiences of the researchers and experiences that have been documented in the literature -- suggested that all these elements would be required for the Revolving Fund, but would not be sufficient. The RDF's ability to help the Ministry of Health reach its goals would depend not only on the management of material assets and on an effective management information system, but would require also careful financial planning and management as well as attention to environmental factors, both organizational and public. This analysis resulted in the identification of eight components that would be required for the design and implementation of an RDF system. (See Figure 8.)

List of Components	Elements of Pre-existing Supply System	New Components Required for RDF
1. Finance		X
2. Management Information/Accounting System	X	
3. Selection	X	
4. Procurement	X	
5. Warehouse/Inventory Management	X	
6. Distribution	X	
7. Organizational Development		X
8. Information, Education, Communication/Public Attitudes		X

As each component would result, ultimately, in a submodel to contribute to and support the overall RDF model, the operations research within each component began with the definition of an objective for that component. (See \* in Figure 9.) For those components already existing, operations research techniques would be employed to make the submodels work better -- be more effective and efficient. In some cases, the submodels required only slight refinement (pathway A.1.), in other cases, redesign (pathway A.2.). The refinement or redesign would arise naturally from the problem analysis step, would be suggested by existing models and experiences from other countries, or would be developed over the course of the study through the use of OR techniques. Progress toward the development of a "known ideal model" would be closely monitored and documented.

FIGURE 9

OPERATIONS RESEARCH METHODOLOGIES APPLIED IN THIS STUDY



contribute at best only marginal improvements. Procurement, inventory management, and distribution systems were already at a functional level (feasible and to some degree effective).

Organizational development was considered a peripheral issue. It was defined early on to include administrative relationships as well as staffing and training. Although this component was considered important, it is only in retrospect that it is viewed as a critical issue. (This is discussed in detail in Section B.7. and in the Results and Conclusions sections.) The IEC/Public Attitudes component, although important, was considered a later issue and thus lower priority for attention beyond simply raising the issues.

These considerations led to the development of the Revised Workplan and the decision to focus attention first on Finance and the Management Information/Accounting System. Once Finance and MIS "solutions" were underway, and the Phase I RDF was deemed feasible, then attention would turn to developments in other components to make the RDF effective and efficient.

## B. Component Studies

### 1. Finance

Finance was considered a major component in this study because it involves a set of issues which characterize and in fact define the concept of a revolving drug fund. The assets of which a revolving fund is composed exist in two forms, liquid funds and inventory, which constantly shift and change, with funds being converted into inventory as drugs and supplies are purchased, and inventory converted back into cash as users pay for the drugs and supplies they consume. The model is much like a continually well stocked private pharmacy, but unlike a private pharmacy a revolving drug fund is a nonprofit venture: the total value of the liquid and material assets remains essentially the same. Sales prices are set only high enough to cover some predetermined percentage of purchase costs.

Smooth functioning of a revolving fund on this model requires careful planning of financial issues: assurance that Fund assets will be sufficient to cover the desired level of activity of the drug and supply system, and that appropriate levels of cash and inventory will be available when needed.

Such careful attention to financial issues was not an element of the pre-existing drug and supply system in Dominica. Purchase orders for drugs and medical/surgical supplies were prepared at Central Medical Stores and sent to the Ministry of Health for approval and processing. Supplies were received at CMS and invoices paid through the Ministry of Health Accounts Officer, but there was little coordination between the two; the coordination that did take place was of an administrative rather than a management nature. The CMS Storekeeper did not know the total value of his purchases, or whether he stayed within his budget. If there were cash flow problems within the Treasury or if administrative processes were slow, suppliers waited to be paid. The Storekeeper had no control over this but suffered the consequences in terms of delayed receipts and continually eroding supplier performance. The additional costs to the system -- to the Ministry of Health and to the Government as a whole -- were the higher purchase costs charged by the suppliers that the Storekeeper was forced to use, the nearby distributors who would provide small quantities on short notice. Inefficient payment tracking systems meant that on occasion some bills were paid twice.

Although the new Primary Health Care Strategy did incorporate some decentralization of decision making, it did not extend to the management of supplies in any meaningful sense. Health districts and facilities had budgets for drugs and supplies in the Annual Estimates, but since they were not informed of either their allocations or the value of the supplies they used each month, these budgets were effectively meaningless for financial management or control. With no tracking of the value of drug usage by each health facility, the central Ministry had no way



With the July 1983 decision to design and implement first a Phase I RDF in which reimbursements would be made by health district and facility budgets rather than by consumer payments, the priority operational questions that were posed to decision makers changed somewhat. Capitalization was still a critical issue, but since the Phase I RDF extended only to the districts and facilities as users rather than to the patients themselves, it would be estimated differently. Instead of establishing pricing policies at the outset, decision-makers were faced with questions about how the reimbursement mechanism would work and whether the district budgets were adequate.

As the study evolved, additional operational issues related to the two major variables of capitalization and reimbursement arose and were addressed. The tree diagram in Figure 11 shows all of the issues that were addressed and their interrelationships. By the end of the study these issues were at various stages of analysis and resolution. The issues are discussed in turn below in a sequence corresponding to relational logic rather than to the chronological sequence in which they were recognized.

#### a. Capitalization requirements

Designing and implementing a revolving drug fund requires at the start a capital investment -- an initial filling up of the supply pipeline so that it will be capable of sustaining a continuous supply, with recurrent inputs to replenish the stocks that have been used, or to compensate for losses or for system growth. Inadequate capitalization results in a situation where supplies are not consistently available at all outlets, or where funds are not available to purchase replenishment stocks. Assessing the capital requirements as accurately as possible is, therefore, one of the most critical issues in planning for a successful RDF.

A model is available for estimating the development expenditure necessary to capitalize a revolving fund (from Managing Drug Supply, MSH, 1981):

$$\text{Required Capitalization} = \frac{\text{pipeline length}}{\text{rate of consumption}} \times \text{rate of consumption}$$

The rate of consumption is simply the value of usage for a given time period. The length of the pipeline is the time required for one complete cycle of the revolving fund. Estimating it requires a detailed understanding of the route followed by the drugs and supplies from supplier to user and the corresponding flow of funds from user back to supplier. A graphical depiction of the RDF Pipeline for Dominica is shown in Figure 12. The amount of time spent by supplies or money at each stage in the RDF cycle must be estimated; the total time spent in all stages, then, is the length of the pipeline. The principal stages are described as follows:

Figure 11  
OPERATIONAL ISSUES WITHIN THE FINANCE COMPONENT

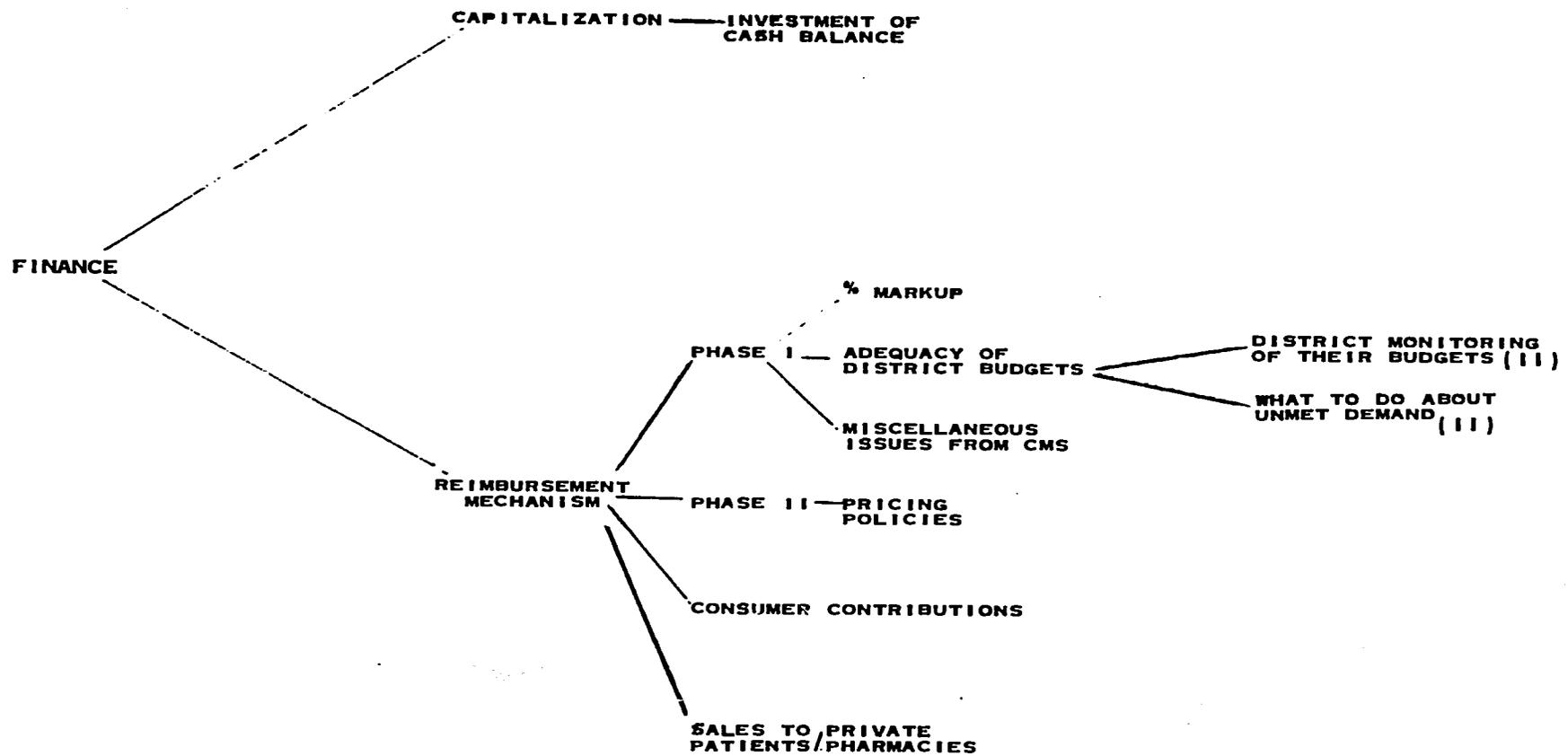
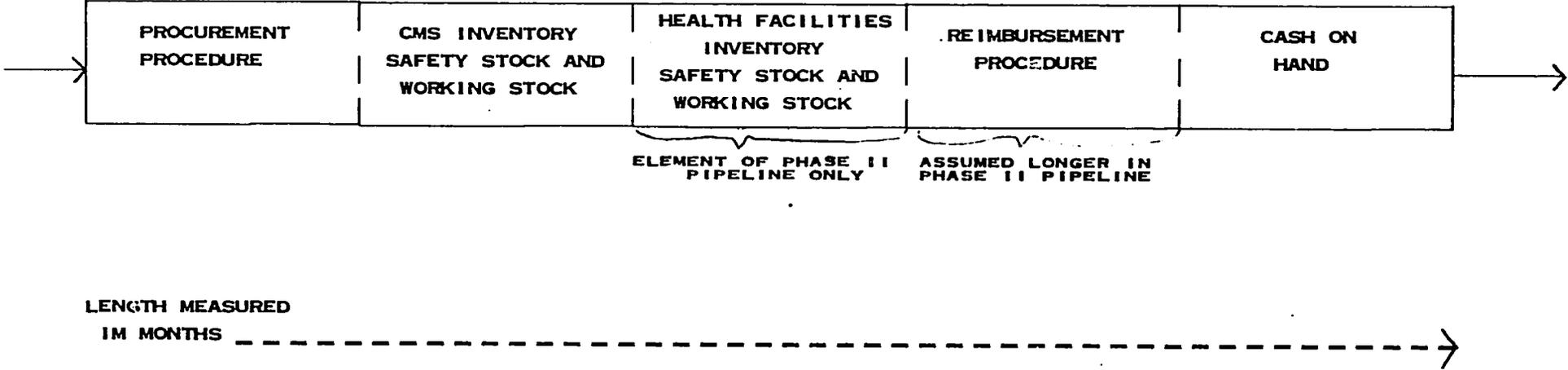


Figure 12

RDF PIPELINE  
FOR DOMINICA



Procurement Procedure -- The length of time between the time at which funds are obligated for drug purchase and the receipt of the drugs at Central Medical Stores.

CMS Inventory -- The length of time that drugs spend in inventory at CMS. It is convenient to divide inventories into safety stocks and working stocks. Safety stocks are used to insure against uncertainties in supply and demand. Although there is no set rule for establishing the size of the safety stocks, they should be estimated in advance in terms of numbers of months of consumption. Average working stocks are equal to one-half of the regular procurement volume and are also expressed in months of consumption.

Health Facilities Inventory -- The same drugs that are held for a time in CMS inventory are also held in inventory at the health facilities before they are distributed to users. Both safety stocks and working stocks at this level should also be estimated and expressed in numbers of months of consumption. (This stage is an element of the Phase II pipeline only. In Phase I when the health districts and facilities themselves are viewed as the users, the drugs and supplies are outside the system once they leave Central Medical Stores.)

Reimbursement Procedure -- The length of time between which the supplies are issued to the user and the payments for those supplies are deposited back into the revolving fund. In Phase I it is essentially the time required to inform the Treasury of district or facility usage and for the Treasury to issue a check. In Phase II it is the time that may elapse from the time that the patient pays for a drug at a health facility, until that payment is passed back to the central level and deposited in the RDF account. This Phase II reimbursement procedure is assumed to be longer.

Cash on Hand -- Safety stock in monetary form which is held at the bank and available to pay suppliers promptly. It should also be measured in number of months of drug usage.

Because capitalization requirements often represent a significant financial investment for a system, and finding a source of funds for this investment can be a challenge, it is important that these requirements be estimated as carefully as possible. However, these estimates are needed at the start of a new system or the expansion of an existing system; this is often a time when good information for making estimates on the procurement procedure time and optimal safety stock and working stock levels and the reimbursement turnaround time are simply not available. First estimates are often very crude ones, but they are increasingly refined as more and better information becomes available.

Dominica was in the fortunate position of having capitalization funds available through a loan from the Social Security fund.

One million EC dollars was said to be available, and six months into the project an initial installment of EC\$500,000 was provided, establishing the RDF. The question facing the Ministry of Health, then, was not what the precise capitalization requirements were, but whether the initial 500,000 from Social Security would be adequate. Operations research techniques were used to assist the Ministry in answering this question. The following constraints were identified at the start:

- The stockouts which would occur in health facilities if the RDF were not adequately capitalized would be politically damaging to the Government.
- Suppliers who were not paid promptly -- if the cash balance of the Fund were not high enough -- might be less inclined in the future to offer favorable terms.
- Optimal capitalization requirements were unknown because a) accurate estimates of monthly consumption were not known, and b) the information was not yet available to estimate the length of the pipeline with certainty.
- Other funding sources were not known to be available. Although the World Health Organization was thought to be a potential donor at one point, there had been no recent communication.
- The Ministry felt that if additional funding were desired from Social Security, it might take two to three months to obtain the funds after a request was made and, further, that this offer of additional funds might not be good forever.

These constraints were reviewed in a meeting between senior Ministry officials and project researchers, and led to the consensus that the additional \$500,000 should be requested. The Minister asked the researchers to prepare a rationale for the best that he could take to the Cabinet.

Researchers undertook a cash flow analysis based on the following assumption -- that the ready cash on hand in the Fund given time period was probably the most easily accessible indicator of adequate capitalization. This cash flow analysis used the best estimates that were available about payments from the Fund for drug purchases, the rate of usage by health districts and facilities, and reimbursements for that usage to the Fund by the Treasury. This analysis showed the cash balance falling to \$127,355 by the end of fiscal year 1983-84, the year of RDF operation. (See Figure 13. The detailed memo was prepared for the Minister on 8 February 1984 is included in Annex 3.) Using existing budget allocations for drugs and medical supplies, this represented approximately two months' worth of consumption. With the risks inherent in the

Figure 13

CASH FLOW ANALYSIS  
FEBRUARY 1984

	YTD	FEB	MARCH	APRIL	MAY	JUNE	TOTAL
CASH BOM		363,644	310,913	263,225	216,737	171,447	
Add: Reimbursement for Issues	328,340	50,240	62,415	70,750	79,084	87,418	678,247
Less: Payments to Suppliers	478,430	100,806	107,752	114,6967	121,642	128,588	
Bank Charges		1,663	1,778	1,892	2,007	2,122	
Miscellaneous Expenses		500	575	650	725	800	
<b>CASH EOM</b>		<b>310,915</b>	<b>263,225</b>	<b>216,737</b>	<b>171,447</b>	<b>127,355</b>	
INVENTORY BOM		567,365	616,158	664,952	713,745	762,539	
INVENTORY IN (received from suppliers)		100,806	107,752	114,696	121,642	128,588	573,484
INVENTORY OUT (issued to facilities)		52,013	58,958	65,903	72,848	79,795	645,000
INVENTORY EOM	567,365	616,158	664,952	713,745	762,539	811,332	
TOTAL FUND BALANCE (CASH & INVENTORY)		927,073	928,177	930,482	933,986	938,687	
$\bar{X} = 54080$							
CUMULATIVE ISSUES	378,580	440,995	511,745	590,829	678,247	774,000	774,000
ISSUES FOR THE MONTH		62,415	70,750	79,084	87,418	95,753	
COST OF ISSUES	315,483	52,013	58,958	65,903	72,840	79,795	645,000

pipeline estimation methodologies that were followed -- e.g. the need for additional procurements to replenish district inventories, delays in reimbursements from the Treasury, the potential that expired goods would be identified which would need to be destroyed, and the potential need for emergency procurements of essential items -- it was felt that this cash balance was precariously low.

By July 1984, a year into the study, this additional capitalization had not yet been requested from Social Security. Cash balance in the Fund was at an acceptable level, but it was noted that significant stockouts still existed at Central Medical Stores. Researchers carried out a second cash flow analysis, this one based on slightly better estimates of required procurements and drug usage. (This analysis was also facilitated by the arrival of the CMS microcomputer. See Figure 14.) The analysis led researchers to suggest that an additional EC\$200,000 be requested from Social Security. (See memo of 8 August 1984 in Annex 3 for details.)

The RDF had made funds more readily available for procurement and thus facilitated the planning of long-term needs. One result was that inventories at CMS were being built up and

Figure 14

CENTRAL MEDICAL STORES CASH FLOW ESTIMATES FOR FY 1984-85

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
CASH RECEIPTS FROM TREASURY	0	129000	64500	64500	64500	64500	64500	64500	64500	64500	64500	64500	774000
CASH PAYMENTS TO SUPPLIERS	0	70706	142587	146192	152647	82326	84208	15962	17403	17698	18894	25159	770791
CMS OPERATING EXPENSES	1500	5700	5700	5700	5700	5700	5700	5700	5700	5700	5700	5700	64200
NET CASH FLOW	-1500	52594	-83787	-87392	-93847	-23526	-25408	-42858	41397	41102	39906	33641	-63991
CASH BALANCE	399159	451753	367967	280575	186728	163202	137794	186632	222029	263131	303037	336678	
INVENTORY PURCHASES	2515	70706	142587	146192	152647	82326	84208	15962	17403	17698	18894	25159	776296
INVENTORY ISSUES	0	107500	53750	53750	53750	53750	53750	53750	53750	53750	53750	53750	645000
INVENTORY BALANCE	594884	558090	646926	739368	838265	866841	897299	557511	823164	787112	752256	723665	

supplies were more available to be distributed to districts. If district consumption increased, capitalization requirements would increase accordingly (as consumption is one of the key variables in the equation for calculating capitalization requirements).

By December 1984, the additional funds had still not been requested from Social Security. However, the cash balance in the Fund remained in a strong position. Nonetheless, concerns were growing about the need for increased capitalization. Since the rate of consumption was one of the two key variables in determining capitalization requirements (the other being pipeline length), researchers analyzed the current rates of issues of drugs and supplies to health districts and facilities and found that they were 28.5% higher than the previous year's rate. They felt that this was due primarily to the fact that CMS had embarked on an ambitious procurement program and was better able to provide requested items. Nevertheless, all stockouts had not yet been eliminated. Many purchase orders had already been placed to remedy this situation, and shipments of drugs and supplies were continually being received. It was expected that as more supplies became available, consumption by user facilities would increase further.

Additional factors were identified which might lead to consumption increases.

- The opening of new health facilities throughout the country.
- The procurement and supply by CMS of a broader range of items than currently handled. This was already beginning to happen in the case of some small supplies. The stocking of many more items had been mentioned as a possibility.
- Potential supplying of outlets in the private sector. This idea had been raised by the Prime Minister as a possibility for the future.

Researchers presented these factors as important issues for policy consideration within the Ministry. The issues and their implications for capitalization requirements were detailed in a memo which is included in Annex 3.

In the months that followed, additional capitalization funds were not received and the cash balance fell to a very low level. At the same time, consumption increases had become a reality. At the end of fiscal year 1984-85 the value of issues of supplies to health facilities was 34.5% higher than the previous year's. At the same time, further supplies, both for the hospital and for expanding dental programs, were being added to CMS inventory which promised to raise the value of its issues further.

The other key variable in determining capitalization

requirements, as noted above, was pipeline length. The segments of the Phase I RDF supply pipeline had been identified as follows:

- procurement procedure
- CMS safety stock and working stock
- reimbursement procedure
- cash on hand

These segments had not been estimated precisely; it did not seem necessary since the Social Security money appeared sufficient at the outset, and, furthermore, good information was simply not available on which to base estimates. But toward the end of the study, when the initial capitalization seemed more and more inadequate, researchers devoted more attention to reviewing the pipeline.

In considering the procurement procedure segment, researchers had not considered either the time that was involved in preparing purchase orders within CMS, once the decision to reorder had been made, or the time involved in sending purchase orders to the Ministry to be approved, which was found to add an additional week to the procurement procedure. Estimates of CMS safety stock and working stock had been made in the first year of the study -- for purposes of planning the procurement schedule -- and had not been changed. These issues are discussed in the Procurement Section.

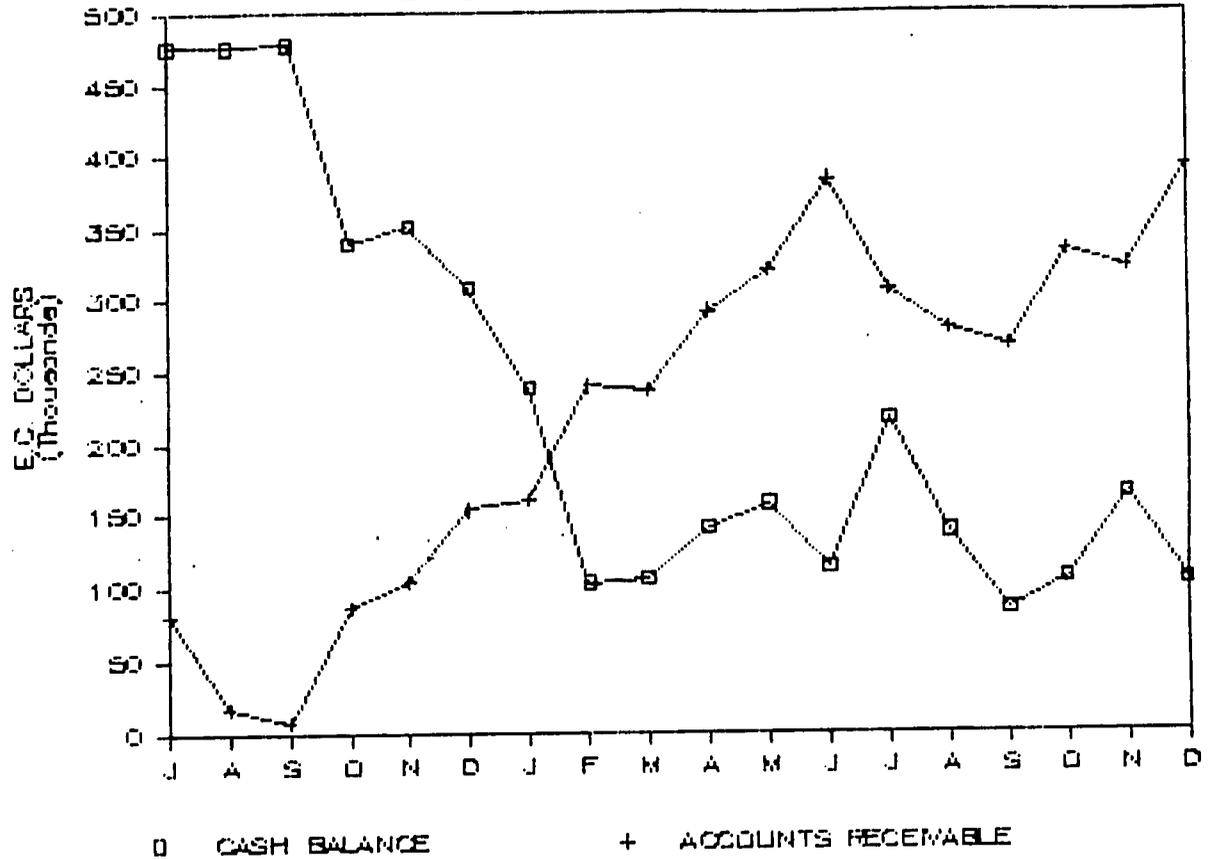
The most unexpected finding, however, was the length of the reimbursement segment of the pipeline. The cash-flow analyses had assumed that the Treasury would reimburse the Fund for health district and facility usage within one month of the time that it was billed by CMS. The CMS staff felt, however, that this process was taking more than one month, but without data, it was not a credible argument for increased capitalization funds. Researchers assisted the staff in collecting the necessary data; by recording the dates which were written or stamped on documents at each step in the process, the total reimbursement leadtime was calculated and found to be nearly 2 months. (This is discussed further in this section under "Reimbursement Mechanism.")

This finding was further strengthened by the trend in monthly figures for RDF Accounts Receivable, the amount owed to the Fund by the Treasury. This amount, which should be stable in a stable system, increased nearly 5-fold between July 1984 and December 1985. This is the same period in which the cash balance fell, emphasizing the relationship between these two variables. (See Figure 15.)

With the length of the pipeline significantly longer in some segments than originally assumed, there is evidence that capitalization must be increased immediately if the Fund is to survive. At the same time, the researchers suggest that

Figure 15

### TRENDS IN RDF CASH BALANCE & A/R BETWEEN JULY 1984 & DECEMBER 1985



pipeline analyses be continued using the methodologies that have been outlined, as more and better data become available, in order to approach more closely a realistic estimate for capitalization requirements.

b. Investment of cash balance

Recognizing that the cash balance in the RDF needed to represent at least several months of consumption at any one time, the question was arose whether it was feasible to invest that cash balance so that it could earn interest. This question was first raised by researchers when the accounting system was set up in February 1984, and the Financial Secretary expressed interest. In July and August 1984 the researchers investigated the possibilities of investing this money through local banks in Dominica, and undertook an informal cost benefit analysis of doing so.

A survey of the local banks in Roseau found that the best possibility was through fixed Certificates of Deposit earning 5% interest. The benefit, then, at this interest rate, was the possibility of incrementally increasing the assets of the Fund. The costs were nil, as long as the cash balance was sufficient to allow some necessary portion of it to remain liquid. This would require vigilant monitoring of the Fund's cash balance. Without such monitoring, the cost of investing in a Certificate of Deposit was the lost liquidity of funds, which would result in further costs to the RDF system. As suppliers would no longer be paid promptly, their costs might naturally rise and thus the volume of drugs and supplies that could be purchased might be lower.

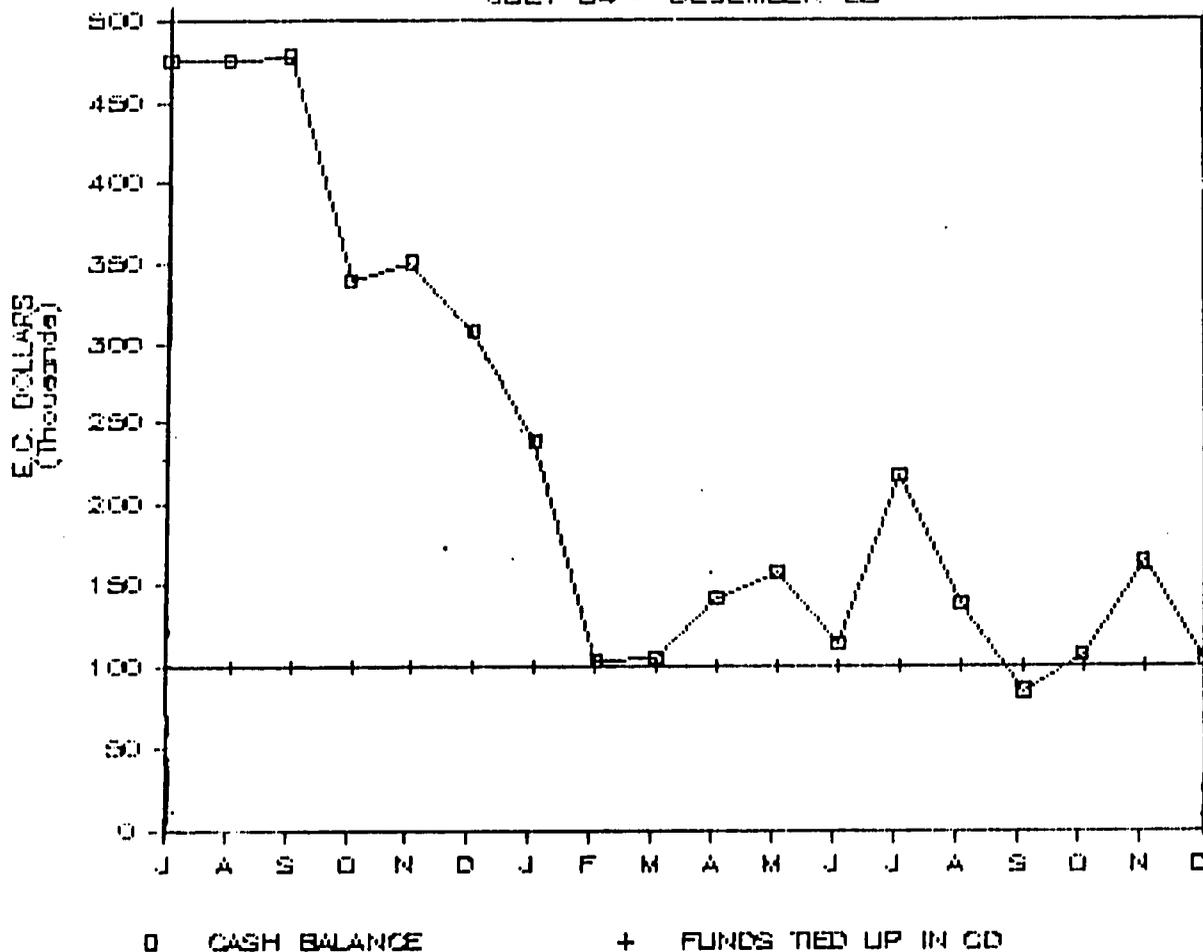
After approximately eighteen months since funds were invested in a Certificate of Deposit, it is the view of the researchers that the costs of this investment have outweighed the benefits. This may be due, in part, to a lack of understanding of the real costs and benefits by the financial authorities within the Ministry. Interest that has accrued has been considered "extra" income, rather than RDF assets. It has been used for expenditures that were not planned for in the original RDF financial planning. It was used for the purchase of a filing cabinet and for repairs to the CMS computer. Because one of the potential benefits of a healthy cash balance in the Fund might be to reduce the percentage markup charged to districts and health facilities, thus freeing up more of their budget allocations for drug and supply purchases, the consequence of losing that money to the Fund is, in effect, reducing the volume of supplies that districts and health facilities might otherwise purchase.

Another cost is the lost liquidity that was anticipated. As shown in Figure 16, the cash balance in the Fund fell to a very low level after January, 1985, and only once in the next twelve months was over the EC\$200,000 level. Given that EC\$100,000

Figure 16

### EFFECT OF CD ON RDF LIQUIDITY

JULY '84 - DECEMBER '85

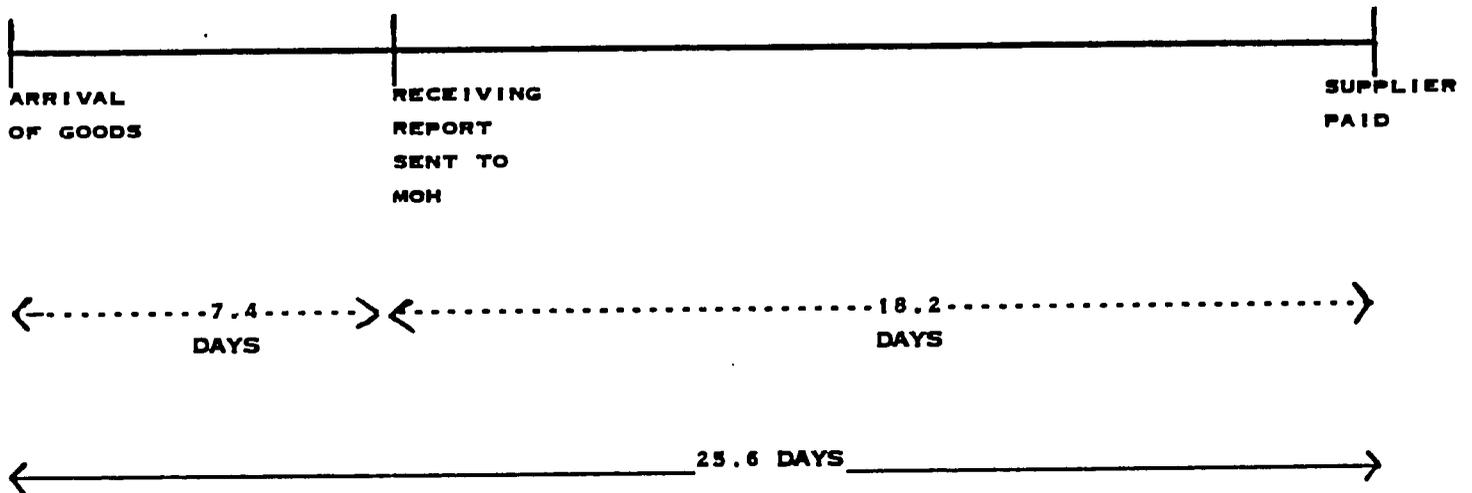


(plus accrued interest) was tied up in the Certificate of Deposit, a liquid cash balance of significantly less than \$100,000 was the norm throughout 1985. In September it fell effectively below zero. It was only slightly higher in November 1985, when financial authorities within the Ministry renewed the C.D. for another 3 months!

A study of the payment process turnaround time undertaken in the summer of 1985 showed that the processing of payments to suppliers was taking on average 25 days after the supplies had been received, as shown in the Figure 17. Of this 25 days, 7 days ensued between receipt of the goods and Ministry of Health approval for payment; 18 days ensued between approval and the issuing of an RDF check. Whether the delay is due to insufficient funds or simply administrative delay is not known with certainty. However, with cash balances at such low levels, one might conjecture that the cash balance made prompt payments difficult.

Figure 17

LEADTIME FOR SUPPLIER PAYMENTS



The loss of this liquidity is a loss of one of the major benefits, if not the major benefit, of a revolving drug fund. Cost benefit analysis at the end of this study suggests that the Certificate of Deposit should be liquidated until a further date.

### c. Reimbursement mechanism

The primary identifying characteristic of a revolving drug fund is that all disbursements from the fund are eventually reimbursed. This characteristic is so key that the feasibility, effectiveness, and efficiency of the reimbursement process is a good indicator of RDF success.

In the original RDF model envisaged for Dominica, it was expected that users would be charged for the drugs and supplies they consumed. The proceeds from these drug "sales" would be returned to the Revolving Fund and would be used to purchase replacement stocks which would in turn be sold. The decision to implement a preliminary Phase I model anticipated a different reimbursement mechanism which was defined by the Ministry of Health. In Phase I, the buyers would be health districts and facilities who would pay for the supplies they consumed through their budgetary allocations. In effect, there was one buyer in Phase I -- the Government.

Policy discussions between Ministry officials and researchers led to the decision that districts and facilities would be charged for the drugs and supplies they consumed at the purchase price of those supplies, with a markup to cover other charges related to the procurement cost. (Estimation of the markup is discussed in a later section.) A methodology needed to be developed for calculating the purchase price of individual items, given that the items already held in inventory had been purchased a year or more earlier. (The method that was developed for costing is discussed in the MIS/Accounting System component.)

Development of the MIS/accounting system also led to the development of the exact procedure for billing the districts. The district's requisition (SIV) was to be "costed" and a copy forwarded to the Ministry of Health and then on to the Treasury for a debiting of that district's budget allocation and issuance of a check to the RDF for reimbursement.

The reimbursement mechanism has shown itself to be feasible since startup. It has not always been effective, however, in maintaining the cash balance of the Fund. The Financial Year End Reports of both FY83-84 and FY84-85 and the Mid-Year Report for 85-86 all showed large sums of money tied up in Accounts Receivable (See Figure 18), suggesting that reimbursements were delayed, and at the end of the study the Fund was experiencing serious cash flow problems as was discussed in earlier sections. (Selected financial data are included in Annex 4).

Figure 18

## CENTRAL MEDICAL STORES

COMPARATIVE BALANCE SHEET FOR THE 6 MONTHS ENDED 12/31/85

	F/Y 1983-84	F/Y 1984-85	JULY-DEC 1985-86
Cash	400,659	133,925	104,320
Accts Receivable	384,167	385,985	391,885
Inventory	592,369	716,731	798,548
-----	-----	-----	-----
Total Assets	1,377,195	1,236,641	1,294,753
	=====	=====	=====
Accts Payable	3,223	117,214	106,811
Treasury Payable	349,467	-	
Long Term Debt	500,000	500,000	500,000
Ret. Earnings, Prior Yrs.	-	55,974	150,894
Ret. Earnings, Current Yr.	55,974	94,922	68,517
Capital	468,531	468,531	468,531
-----	-----	-----	-----
Total Liab. & Capital	1,377,195	1,236,641	1,294,753
	=====	=====	=====

## CENTRAL MEDICAL STORES

COMPARATIVE INCOME STATEMENT FOR THE 6 MONTHS ENDED 12/31/85

	F/Y 1983-84	F/Y 1984-85	JULY-DEC 1985-86
Revenue	672,922	905,728	429,666
Cost of Goods	560,768	754,773	358,055
-----	-----	-----	-----
Gross Margin	112,154	150,955	71,611
Rent & Tgate Fees	3,191	1,649	624
Local Transport	1,645	3,497	169
Bank Charges & Govt. Levy	12,147	13,894	5,067
Casual Labor	2,400	2,592	600
Freight	10,127	5,525	5,908
Inventory Writeoff	2,442	2,004	0
Exchange Loss	22,423	30,354	4,287
Misc Expense	8,311	37,221	12,352
-----	-----	-----	-----
Total Oper. Expense	62,686	96,736	29,006
Misc. Income	6,505	38,187	23,333
Interest Income	-	2,516	2,579
-----	-----	-----	-----
Net Income	55,973	94,922	68,517
	=====	=====	=====

This finding prompted a detailed analysis of the reimbursement segment of the pipeline. Researchers traced all district and facility requisition forms (SIVs) for FY 84-85 through the system -- documenting the dates they were received at CMS, supplies were issued from CMS, SIVs were sent to the Ministry of Health Accounts Office, sent to the Treasury, approved for payment by the Treasury, and reimbursement checks were deposited. This analysis showed that SIVs spent approximately 13 days in the Ministry of Health Accounts Office before being sent to the Treasury, and 46 in the Treasury (41.5 of these days after approval) before the RDF was reimbursed (see Figure 19).

Further investigation into this long turnaround time at the Treasury led to several important findings. One reason for the delay at the year was that some fiscal and facility budgets had been exhausted for the year. The questions of the potential inadequacy of district budgets and rising consumer demand are important ones facing the Ministry and are discussed as separate operational issues later in this section. Another reason for the delayed reimbursements is the presence of an external factor that was not previously identified. The Treasury makes limited allocations each month to each Ministry. Claims that are received late in the month when the Ministry's allocation for that month is already exhausted will not be processed until the following month. The RDF is not exempt from this rule. Some Ministry of Health officials felt that the RDF should be exempt, but there has been no change in the policy.

The length of the reimbursement segment of the pipeline has a direct effect on the capitalization requirements of the Fund, as noted in the discussion on capitalization. And capitalization, through its effect on the RDF cash balance, influences the effectiveness and efficiency of the RDF.

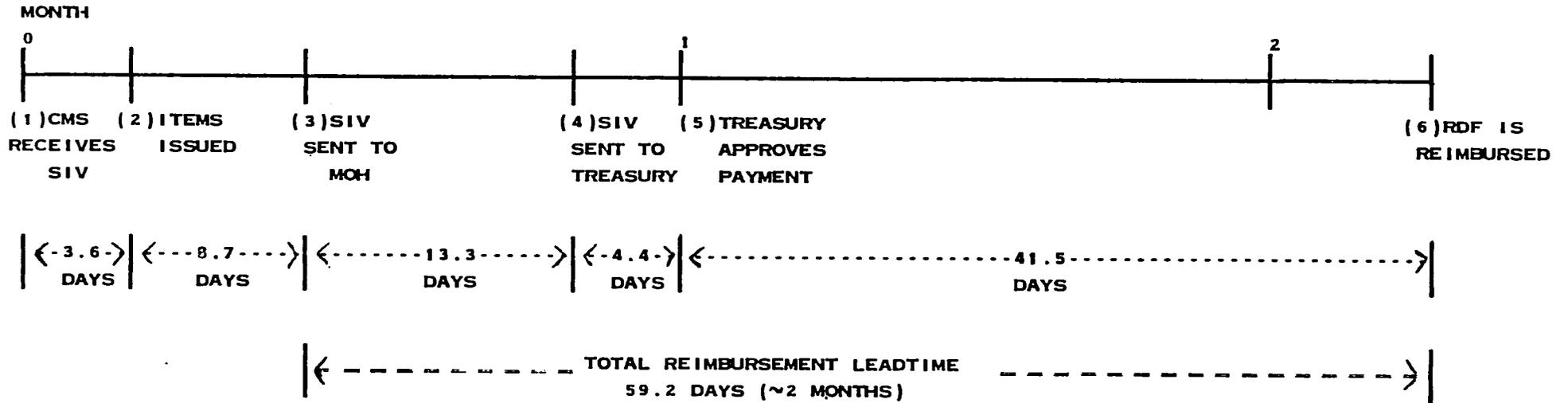
A very serious problem afflicting the Fund is the apparent lack of understanding among some Ministry officials that all disbursements from the Fund must be reimbursed in order for the Fund to continue to revolve. Several disbursements have been made -- for a filing cabinet for the Ministry of Health Accounts Office, repairs to the CMS computer, and more recently, a salary payment to a temporary laborer at CMS -- for which reimbursements are not anticipated. Disbursements such as these, unless they are planned for in developing the financial parameters of the RDF, will surely lead to its decapitalization.

#### d. Percent markup to be charged to districts

When the parameters for the preliminary Phase I RDF were established in July, 1983, it was agreed that there should be a markup on drug costs charged to the districts when the RDF got underway. The scope and size of this markup was discussed in detail between Ministry officials and researchers in January and February 1984, when the accounting system was being designed. It was generally felt that the objective of the markup would be

Figure 19

DOMINICA REVOLVING DRUG FUND (PHASE I)  
PIPELINE ANALYSIS -- REIMBURSEMENT SEGMENT



to cover handling costs at the port (rent and tailgate fees), local transportation (from port to warehouse), local casual labor, bank charges and commissions, net losses on the exchange rate, occasional losses from expiry or obsolescence, inflation, and occasional unusual expenses such as freight charges paid for donated items (as happened in January). The Ministry decided that the markup would not attempt to cover either personnel costs or the purchase of a truck (which had originally been considered).

Determination of the exact percentage to be charged was unscientific because the pre-existing information system had not collected information on handling costs and bank charges in a way that made it accessible. Analysis was simply not possible. The Dominican freelance accountant who had been employed in the fall of 1983 to draft the RDF accounting system (which was not accepted) had proposed in his report a markup of 15%. In January, researchers and MOH officials together questioned whether that would be adequate. The alternative proposal was 20%. In discussions, the following arguments were put forth:

- It was not possible to know whether 15% or 20% was more realistic.
- The new management information/accounting system would provide that information; thus, whatever percent was chosen now could be changed at a later date.
- It would be more difficult politically to raise the percent markup than to lower it.

For these reasons, it was decided to begin the RDF with a markup to districts of 20%. It was decided that this 20% would be added to the total cost of goods issued each month to each facility and would be noted at the bottom of the SIV. The exact procedure is detailed in the RDF Accounting System Procedures Manual (included in Annex 1).

Financial analyses of the RDF carried out at the end of fiscal years 1983-84 and 1984-85 showed that the 20% markup was more than adequate. The amount spent on handling costs, bank charges, etc. ("Total Operating Expenses" in Figure 18) was 11.2% of the amount paid to suppliers ("Cost of Goods") in 1983-84, 12.8% in 1984-85, and 8.1% in the first half of 1985-86. Furthermore, in August 1985 the Government lifted the bank drafts and site drafts that had been charged in the past. If payments to suppliers in fiscal year 85-86 continue at the same rate as in the previous year, this new action should result in a savings to the RDF of approximately EC\$13,000. Since there is no reason to expect any of the operating expenses to increase further, the Government may wish to decrease the percentage markup, perhaps first to 15%, and to continue to monitor it.

#### e. Adequacy of district budgets

Since district and facility budgets are the source of reimbursement to the Phase I RDF, and since reimbursement is the key to its survival, the operational question of whether these budgets were adequate arose as soon as the RDF model was designed.

A preliminary question that needed to be answered was what the sizes of the district budgets actually were, and what they were intended to cover. In the 1983-84 Estimates, the line item 03, "Supplies and Materials," did not distinguish between drugs, medical supplies, administrative supplies, and food for inpatients. Researchers undertook an analysis to determine the value of drugs and medical supplies consumed in the previous year by each health district and facility, in order to give an idea of what proportion of the 03 line item should be appropriately allocated to drugs and supplies. With the help of Central Medical Stores staff, usage figures for each item in inventory were extracted from the Kardex file. The total shipments received and the total issues to each district or facility for each of the approximately 600 items in stock were recorded. The total issues then were multiplied by the unit cost of each item which had been determined by the costing study carried out earlier (and described in the MIS Section), to get the total value of each item distributed to each district or facility.

These data, which are presented in Figure 20, show that nearly all districts spent more than their 03 allocation on drugs and medical supplies alone, when the 03 allocation was completely used the previous year for other supplies before any accounting for drug supplies was done. The data also show the great variation among districts in the per capita allocation they received. These findings were shared with Ministry officials as they were approaching decisions on other operational issues associated with the revolving fund. The Ministry Accounts Officer used this information to split the 03 allocation for each district and facility into two parts -- one part for drugs and medical supplies, and another part for "other supplies."

Once the MIS/Accounting System for the Revolving Fund was set up, it was a routine task to monitor district and facility usage and to compare it to their budgetary allocations. In FY 83-84 all health districts and facilities together spent 85.75% of their allocations and in FY 84-85 115.87%. (These data are included in Annex 4.) The great increase in usage in 83-84 and 84-85 was due primarily to the increased ability of CMS to provide drugs and medical supplies; during that period great efforts had been made to reduce stockouts at CMS and to build up inventories. These are global figures, however. There was enormous variation among the districts with regard to how greatly they exceeded their budgets. The allocations themselves varied, as noted earlier, as they were based on little or no data from the past. This brought into question the validity of

Figure 20

VALUE OF 1982-83 REQUISITIONS FROM CMS COMPARED TO 1982/83 BUDGETARY VOTE  
FOR O3, MATERIALS AND MEDICAL SUPPLIES

<u>FACILITY</u>	<u>VOTE 82/83</u>	<u>VOTE 83/84</u>	<u>REQUISITIONS</u> <u>1/6/82 - 31/5/83</u>	<u>POPULATION</u> <u>SERVED</u>	<u>PER PERSON</u> <u>EXPENDITURE</u> <u>(DRUGS &amp; MEDICAL SUPPLIES)</u>
3350 Policy Formulation & Administration	0	0			
3351 Health Administration	0	0			
3352 Operation of CMS	\$ 50	\$ 50	\$ 31,257.31 (compounding) 3,420.35 (losses)		
3353 Primary Health Care Services	40,000	44,000	4,550.22 (disaster boxes)		
3354 Roseau Health District	5,000	5,000	49,007.62	30,163	1.62
3355 Portsmouth Health District	50,000	50,000	47,262.61	10,980	4.30
3356 Marigot Health District	42,000	42,000	42,457.81	8,703	4.88
3357 Grand Bay Health District	10,000	10,000	21,797.14	7,081	3.08
3358 La Plaine Health District	5,000	5,000	18,064.42	4,407	4.10
3359 Castle Bruce Health District	5,000	5,000	15,719.13	4,987	3.15
3360 St. Joseph Health District	8,000	8,000	22,794.63	7,718	2.95
3361 Princess Margaret Hospital	1,190,000	1,190,000	249,049.86	74,039	3.36
3362 St. Luke's Hospital	40,000	40,000	27,282.07		
3363 Tarreau Home	10,000	10,000	911.89		
3364 Laboratory Services	70,000	37,000	19,291.18		
3365 Dental Services	80,000	40,000	13,701.28		
<b>TOTAL</b>	<b>\$1,555,050</b>		<b>\$566,567.52</b>		

Not included: \$226.08 to Government Printery  
Fort fees, etc. (estimated at 5%)  
Purchases handled separately by Roseau Health Center

Total value of supplies procured during 12-month period: \$703,276.65  
Estimated value of supplies waiting at Customs: \$153,287.01

budget allocations as control tools, which will be of concern when and if they begin to be used as such.

The budgets were not used to limit issues in 1984-85 for several reasons. The main reason, perhaps, was that budget management and control was not facilitated by the way Government systems and procedures were set up. Budgets were monitored only in retrospect, when corrective action could no longer be taken to avert overruns. Aside from this fact, however, the Ministry was eager to demonstrate the impact of the new Revolving Drug Fund on increasing the availability of pharmaceuticals and medical supplies in health districts. Limiting issues to districts and facilities according to their budgetary allocations was not encouraged.

Nonetheless, by the end of the fiscal year the Treasury was experiencing difficulties in reimbursing the Revolving Fund, just as it had had difficulties in paying suppliers in the past. Discussions between researchers and Ministry officials nearly two years before had recognized this possibility. What would happen if a district exceeded its budget allocation before the end of the fiscal year? Three major options had been identified:

- (1) CMS could refuse to issue any further supplies to that district. The result would be that the service level in that district would decline and available drugs would remain in CMS, expiring. Not a favorable option.
- (2) CMS could continue to issue supplies and not charge the district. The result would be that the RDF would begin to decapitalize. Not a viable option.
- (3) A district which had exhausted its budget could get a supplemental allocation from either the Ministry of Health budget, the Treasury, or some external source.

By the end of FY 84-85 the first alternative was no longer an option. The supplies had already been issued. Although supplemental allocations were sought to pay for the previous year's excess consumption, the Fund had not yet been completely reimbursed by the end of this study.

The trend for districts and facilities as a whole to consume beyond their allocations was continuing into FY 85-86: By the end of December, when 50% of the year had passed, 58.32% of the budgetary allocations had been used. Yet some stockouts still remained at CMS, and districts were not being supplied with all the items they requisitioned. Consumption could be expected to increase even further as stocks were increased at CMS.

By the end of this study, it seemed obvious that current budgetary allocations were not adequate to meet demand, nor were they functioning as control mechanisms for limiting usage. The information system that had been designed for the RDF was fully

capable of and already was providing information on budget monitoring. SIVs from districts were being costed, the value of each shipment totalled, and this total subtracted from the district's budgetary allocation in records kept at CMS. Further, a procedure for districts to monitor their own budgets was designed and was in use in most districts, as will be discussed below. What was missing was the management decision which would restrict shipments beyond what could be paid for.

At the end of the study, it was not clear whether or at what level the Government would choose to limit the consumption of drugs and medical supplies through MOH facilities. When consumption was not limited, the Ministry of Health came closer to meeting demand, but this posed serious financial repercussions for the Government Treasury and potentially for the RDF, if it were not reimbursed. What level of demand could the Government sustain? If the Government decided, on the other hand, to limit issues, several issues in addition to the obvious political ramifications should be considered:

- The allocations among districts should be reviewed and adjusted to make them as realistic as possible, considering such issues as the population base and the variation among health facilities available in different districts.
- The 03 allocation should be formally separated in Treasury records into the two components which have been informally recognized and used during the past two fiscal years: drugs and medical/surgical supplies, with which the RDF was concerned, and other supplies. Without this separation, the careful accounting systems that were in place under the RDF were considerably less valid as a budget control mechanism for both the Ministry of Health and the Treasury.
- Finally, any significant reduction in issues would very likely lead to an overstock situation at Central Medical Stores. Any expiration or obsolescence of stock would be a loss to the Fund.

District and facility budgets were not the only mechanism with which to reimburse the Fund. They were simply the mechanism that was devised for the preliminary Phase I RDF. The Government may wish to consider consumer cost sharing in Phase II as an option not to replace budgetary allocations but to supplement them. This is discussed in a later section.

#### f. Monitoring of district budgets (II)

The RDF model adopted for Phase I stipulated that districts would begin to monitor their drug usage against their budgets. Some mechanism of monitoring or control is inherent in the RDF concept -- in order to assure that expenditures will be

reimbursed and the RDF will remain solvent. If the Phase I model were the ultimate RDF envisioned for Dominica, this control mechanism could justifiably be exercised at the central level: CMS would have the responsibility for controlling issues. Because the Phase II RDF anticipated a decentralization of management control with the districts themselves ultimately responsible for collecting revenue from drugs sold, however, the concept of beginning to involve the districts in controlling their drug usage seemed appropriate for Phase I as a transitional model. District monitoring of their budgets was viewed in this study as a Phase II operational issue, one of the earliest to be addressed.

Although the "costing" of drug and supply issues had begun in July 1983, it was not until the MIS/accounting system was implemented in February 1984 that this became a regular process. Then districts and facilities began to receive costed packing slips with their monthly shipments informing them of the value of their monthly supplies. But because they had not been informed of their budgetary allocations for drugs and supplies at the beginning of that fiscal year, this information was meaningless to them.

In July 1984 at the start of the new fiscal year, researchers suggested a procedure to assist districts in monitoring their drug usage. It required, however, a decision from the Ministry Accounts Officer as to how the O3 budget allocation for each district was to be split between drugs and medical supplies and other supplies. This split was decided in August, and in October CMS set up Budget Control Books and distributed them to the districts. Opening balances for each component of the O3 line item were recorded in the books by CMS Staff. Districts were instructed to subtract the value of each drug shipment received, or each "other" expenditure, to maintain current balances. To assist districts in making cost conscious decisions about their drug usage, CMS also distributed price lists for first line drugs. These two activities provoked the interest of some district officers who asked Ministry officials when patients were going to begin to be charged for drugs.

The problem remained, however, that the Treasury did not recognize the O3 split; in Treasury records, O3 remained one line item. The limit that was set on spending for drugs and medical supplies was therefore somewhat artificial.

In FY 84-85 health districts and facilities requisitioned and were shipped drugs and supplies valued at 15% higher than their budgetary allocations. The districts did not exercise control in their requisitioning, but neither did CMS in its issues, as was discussed in the previous section. The Financial Secretary agreed to formally split the O3 allocation within the Treasury record keeping system -- to provide a structure at least, within which control could be exercised -- by the end of the study it was not clear whether this had occurred.

Midway through FY 85-86, researchers visited all districts to observe whether the Budget Control Books that had been implemented over a year earlier were present and up to date and to survey the district doctors and pharmacists as to their usefulness. The Budget Control Books were present in five of the seven districts but were up to date in only two. When questioned, doctors in two districts and pharmacists in three said that they were useful, but there were complaints from others that they took too much time to maintain or that districts still did not have accurate budget figures. (The complete survey instrument and data are included in Annex 5.)

Budget monitoring at the district level was not yet working, at the end of the study, although the mechanism as designed was mathematically simple and in that sense, feasible. Why was it not effective? The researchers conclude that budget monitoring at the district level will not work until the districts have some reason to believe that the central level takes it seriously. This will require a formal splitting of the 03 line item, if it has not already occurred, an attempt to make budgetary allocations realistic, and a shared commitment to stay within them.

g. What to do about unmet demand (II)

As discussed in the two previous sections, the district budgets for drugs and supplies were not adequate to meet current levels of demand, nor were they functioning as controls to limit usage. Consumption in FY 84-85 was at a rate 15% higher than the budget allocations, and was continuing at a similar rate in FY 85-86. With stockouts still occurring at CMS and requisitions still not being filled completely, the level of real demand was even higher. And it is still growing as more and more health facilities are opening and more and more different supplies are available and distributed through CMS.

The operations research undertaken in the past three years in Dominica has helped to elucidate this problem and to identify the set of options available to the Ministry of Health in addressing it. The researchers suggest that there are three major options:

- (1) Do not meet the demand for drugs and supplies through the Ministry's health delivery system.
- (2) Meet the demand, and pay for it through increased budgetary allocations or supplemental allocations.
- (3) Meet the demand, not by further funding from the Government, but by consumers sharing in the cost.

Although these options were evident from the start of the study, sufficient data were not available to adequately compare and analyze them. By the end of the study, data were available on

the value of usage over the past three years and the extent to which that demand remained unmet; other data existed simply in the form of experience with the Phase I RDF.

Researchers suggest that these three options offer different costs and benefits to the Ministry of Health:

Option (1) involves a recognition that Government resources for drugs and medical supplies are limited. In fact, current levels of distribution to health districts and facilities (which are running 15% above current budgetary allocations) would have to be reduced. This alone would have its cost, since CMS has built up its stocks over the past three years and some items, if not distributed, would expire. More important perhaps is the effect this decision would have on public perceptions of the Government's willingness and ability to meet the needs of its people.

Option (2) would allow issues of drugs and supplies to increase, as they have been doing, but it would require an increased expenditure from the Government. The data already available would suggest that budgetary allocations should be increased 15% immediately. Since some stockouts still exist and thus some already-expressed demand is as yet unmet, and because more types of supplies are being distributed through CMS, a further increase of 10-15% is not unlikely. Any sustained increase in usage would require, in addition, a proportional increase in capitalization. This option would require continual close monitoring of trends in drug and supply usage, in order to forecast the RDF's financial requirements.

But how realistic is Option (2)? The budget overrun of FY 84-85 was still not fully reimbursed to the RDF midway through the next fiscal year. In February, 1986 the Government was experiencing very serious cashflow problems which put civil servant salaries at risk. If the Government, as the only source of reimbursement to the RDF, was not able to make these reimbursements on a timely basis, the RDF would collapse.

Through Option (3), the Government would not bear the sole responsibility for reimbursing the Fund; consumers would also participate by paying for drugs and/or services. The demand would be set, therefore, not by the Government's ability to finance virtually unlimited usage, but by the consumer's willingness to pay.

In discussions researchers had with various Ministry staff members at the outset of this study, there was notable sentiment that the public would accept charges. Patients in some districts were already making contributions for services at their health clinics -- contributions that were being used locally for maintenance of the clinics. One official felt that people were becoming more conscious of their health, and that if services were free, they were felt to be not as good.

In January, 1984 fees for service were reintroduced at Princess

Margaret Hospital and were the subject of a Sunday morning "Dialogue" radio program. Of the listeners who called in to comment, most were supportive of the fees, one noting that there was no such thing as free health services; the public ultimately pays, either through taxes or through fees.

In the December 1985 survey undertaken by PRICOR researchers, district doctors, pharmacists, and nurses were asked if they thought patients would be willing to pay a small fee for drugs through Ministry of Health facilities. Of the five pharmacists, three doctors, and four nurses who responded, all but one said yes. Several noted that education and motivation would be required. Several also commented that fees would promote more cost conscious or better use of drugs. These responses are shown in Figure 21; the complete survey instrument is included in Annex 5.

In fact, many people in Dominica are already paying substantial amounts for health care through the private sector. A PAHO and USAID funded survey undertaken in 1983 found that 55% of people who were ill during a given period sought formal health care, and of those, 18% did so from a private practitioner. The average total cost of health care per episode of illness was EC\$8.00 (approximately US\$3.00) in Dominica, ranging from an average cost of EC\$39.00 (US\$14.50) when the care was sought from a private practitioner and under EC\$1.00 (US\$0.40) when sought from a Ministry of Health facility. On average, drugs represented the highest proportion of that expenditure, averaging EC\$3.99 (US\$1.49) per episode of illness.\*

To get a rough idea of what levels of prices people were paying for drugs when they bought those drugs from the private sector, researchers did an informal survey of the prices charged at two private pharmacies in Roseau. When asked, the pharmacist and/or salesperson at Jolly's Pharmacy and City Drug Store willingly gave the prices they charged for individual units of several commonly used drugs in Dominica. As shown in Figure 22, these prices were found to be from 2 to 13 times as high as the unit costs paid by CMS. Evidently, the public willingly pays these prices, as demonstrated by the success of the pharmacies. On each of several visits the researchers made to each shop, the shop was filled with several people.

Why do people patronize private pharmacies when the same drugs are much less expensive (in fact, currently "free") in public sector health facilities? As has been found in many countries and was also true in Dominica at the start of this study, supply systems that attempt to provide drugs free of charge are often

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\*From a Report on a Community Based Survey on Health Services Utilization and Coverage, prepared for PAHO and presented at the Ninth Meeting of the Conference of Ministers Responsible for Health, by Dr. Carissa Etienne, July 1984.

Figure 21

	ROSEAU	ST. JOSEPH	PORTSMOUTH	MARIGOT	GRAND BAY	LA PLAINE	CASTLE BRUCE
<b>DISTRICT SURVEY FOR PHARMACISTS</b>							
Do you think patients would be willing to pay a small fee for drugs? Comments	Most people would prefer free drugs, but with educ. some could pay per prescription	Maybe, some likely willing to pay contribution	Yes, as a contribution	Yes, contribution	With much education		
Would this change the amount of drugs they consume?	Yes, use more since cost is involved	Yes, drugs which are left unused would be taken since cost involved. Patients need education on this.	Yes, they would use more	No difference	They would take all drugs which are prescribed	Yes	
Would this be good or bad?	Good	Good	Good	Good	Good	Good, it would alleviate cost in a small way.	Good to subsidize budget.
<b>DISTRICT SURVEY FOR DOCTORS</b>							
Do you think patients would be willing to pay a small fee for drugs?			There could be a prescription cost (e.g., \$1/prescr.)		Yes, maybe if introduced now and proper educ. carried		No
Would this change the amount of drugs you prescribe? Why or why not?			No	No Prescribe according to needs of patient	Yes/no	No	No Prescribe what patients need.
<b>DISTRICT SURVEY FOR NURSES</b>							
Do you think patients would be willing to pay a small fee for drugs? Yes or no, comments		Some would, if educated, others would refuse	Yes, for those who could afford it, but not the entire cost of drugs		If it is made a policy of the hospital fees, they will pay		With much motivation and education I think they should be willing to pay
If no, would they be willing to pay for some drugs if essential drugs (like aspirin and antibiotics) were free? comments.		I think so	With some education, some would				
Would this change the amount of drugs you give out?		Depends on stipulated cost	No		Yes/no, depends on patients' needs and ability to pay stipulated amounts		No, give according to patient's needs

Figure 22

## COMPARISON OF CMS AND PRIVATE SECTOR PRICES

	CMS unit cost as of 12/85 (EC\$)	Jolly's Pharmacy unit price as of 3/86 (EC\$)	City Drug Store unit price as of 3/85 (EC\$)	ratio avg. private pharm price to CMS unit cost
<u>Analgesics</u>				
Acetylsalicylic Acid, 300 mg.tab.	.0047	.08	.05	13.83
Paracetamol, 500 mg.tab.	.0163	.10	.08	5.52
<u>Antibiotics</u>				
Ampicillin, 250 mg.cap.	.0882	.35	.50	4.88
Penicillin V Potassium, 250 mg.tab.	.0305	.25		8.20
Procaine Penicillin, 3-4 mu inj.	.8400	5.90		7.02
Tetracycline, 250 mg.cap.	.0280	.20	.20	7.14
<u>Anti-diabetic agents</u>				
Chlorpropamide, 250 mg.tab.	.0803	.15		1.87
Metformin, 500 mg.tab.	.0802	.30		3.74
<u>Amoebicides</u>				
Metronidazole, 200 mg.tab.	.0213	.15	.25	9.39
<u>Cardiovascular drugs</u>				
Methyldopa, 250 mg.tab.	.0839	.25		2.98
Propranolol, 40 mg.tab.	.0283	.10		3.53
<u>Tranquilizers</u>				
Diazepam, 5 mg.tab.	.0071	.10	.08	12.68

out of stock. There is also the perception that Government-supplied "free" drugs are of poor quality.

It is through the management efficiencies achieved under the Phase I RDF that researchers hoped to alter those variables in Dominica. Once people are assured that drugs will be available in the public sector and that they are of high quality, researchers assume that it is not unrealistic to expect that they will be willing to pay reasonable fees for those drugs.

The practicalities of introducing charges through the public sector health delivery system involve a number of complex operational issues. There is substantial sentiment within the Ministry of Health that some drugs and some patients should be exempted from fees, and in particular that there must be a mechanism for identifying indigents. Concern has been expressed by the Financial Secretary that the administrative cost of handling fees might exceed revenues. The experience of introducing fees at the hospital no doubt holds valuable lessons that should be explored. It was hoped that these issues could be addressed through this operations research study, but attention has been focused throughout this study on Phase I issues.

Ultimately, the Ministry's decision as to which of the three options to implement in responding to unmet demand will be determined by its own assessment of political, economic, and other realities.

#### h. Miscellaneous issues from CMS

Another operational issue related to reimbursements to the Phase I RDF had to do with insuring that all supplies distributed through CMS be paid for. Prior to the establishment of the RDF when, as noted earlier, there was no accounting of the value of the inventory, supplies were given out of individual doctors who came to CMS requesting them, and to various government-supported offices and programs, for example, to schools, the fire station, the Red Cross, the Dominica Infirmary, and the Dominica Football Association; even the Government Printery obtained its spirits and cotton from CMS for cleaning its equipment! This was noted during the first analysis of drug and supply issues carried out by researchers in July, 1983. All of these facilities, however, did not have budgetary allocations for drugs and supplies.

This was the subject of a memo to the Minister of Health in January 1984, at the time that the MIS/accounting system was being designed. By August 1984, the Dominica Infirmary was paying directly for the items it requisitioned and CMS was no longer making issues of inventory items to other facilities.

i. Pricing policies (II)

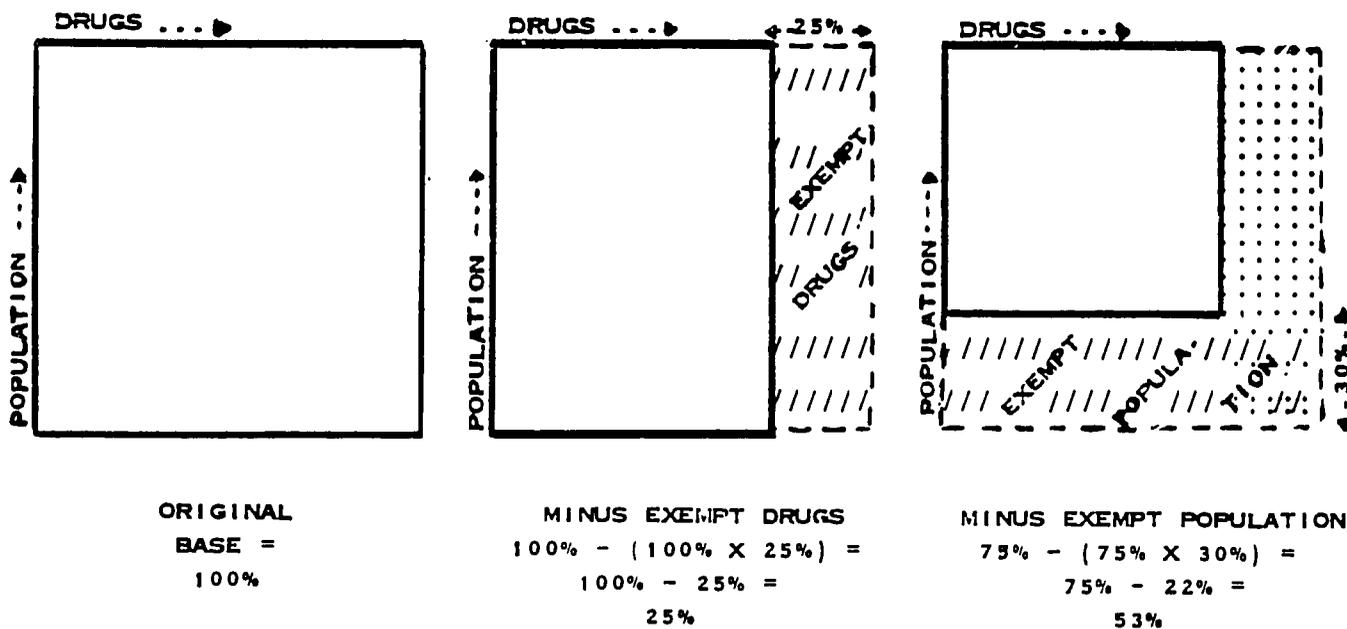
The determination of pricing policies is an operational issue in the design and implementation of a RDF that incorporates consumer cost sharing. This issue was addressed during the first visit of PRICOR researchers to Dominica in May 1983, before the decision had been taken to postpone consumer cost sharing until a second phase.

Two major decision variables were identified in the development of a pricing policy: What cost or what percentage of cost did the Government want to recover through sales, and what combination of subsidies and surcharges would allow the Government to achieve this goal?

Early discussions with Ministry officials led to the preliminary decision that the pricing policy adopted should aim to recover the direct cost of drug purchases as well as costs directly associated with the purchase, handling, and sale of the drugs (for example, freight, insurance, tailgate fees, bank fees, customs storage, packaging). The pricing policy should also consider both inflation and potential losses.

The Ministry expressed interest at this early stage in exempting indigents, those under 15 and those over 65 years of age, as well as certain drugs of vital public health interest or those required to treat prevalent chronic diseases, such as diabetes and hypertension. Researchers prepared a Discussion Paper in May 1983 (included in Annex 3) to show the shrinking effect on the revenue base of multiple exemptions for both major segments of the population and a number of widely used drugs. The revenue base depends on that proportion of the population which is not exempt from purchasing those drugs which have not been exempted from the sales program. (See Figure 23.)

Figure 23



To evaluate the real impact of selected subsidies or exemptions which had been proposed, the Ministry needed data on the consumption of drugs and supplies by specific population groups, as well as the value of overall usage of specific drugs. Researchers assisted the Ministry of Health in designing a questionnaire to collect some of this information.

In June and July 1983, the Ministry of Health distributed its questionnaire to several health centers that were considered representative of Dominica. The first portion of the single page form was to be completed by the attending physician and the second was to be completed by the dispenser. Patient information was solicited in the following categories:

By physician:

- Age
- Sex
- Drugs prescribed, by name, dosage form, quantity prescribed, and quantity required for complete course-of-therapy; up to five drugs could be listed.
- Reason for prescribing (preventive, treat symptoms, non-life threatening illness, life threatening illness, pregnancy-related).
- Ability to pay (within four given price ranges).

By dispenser:

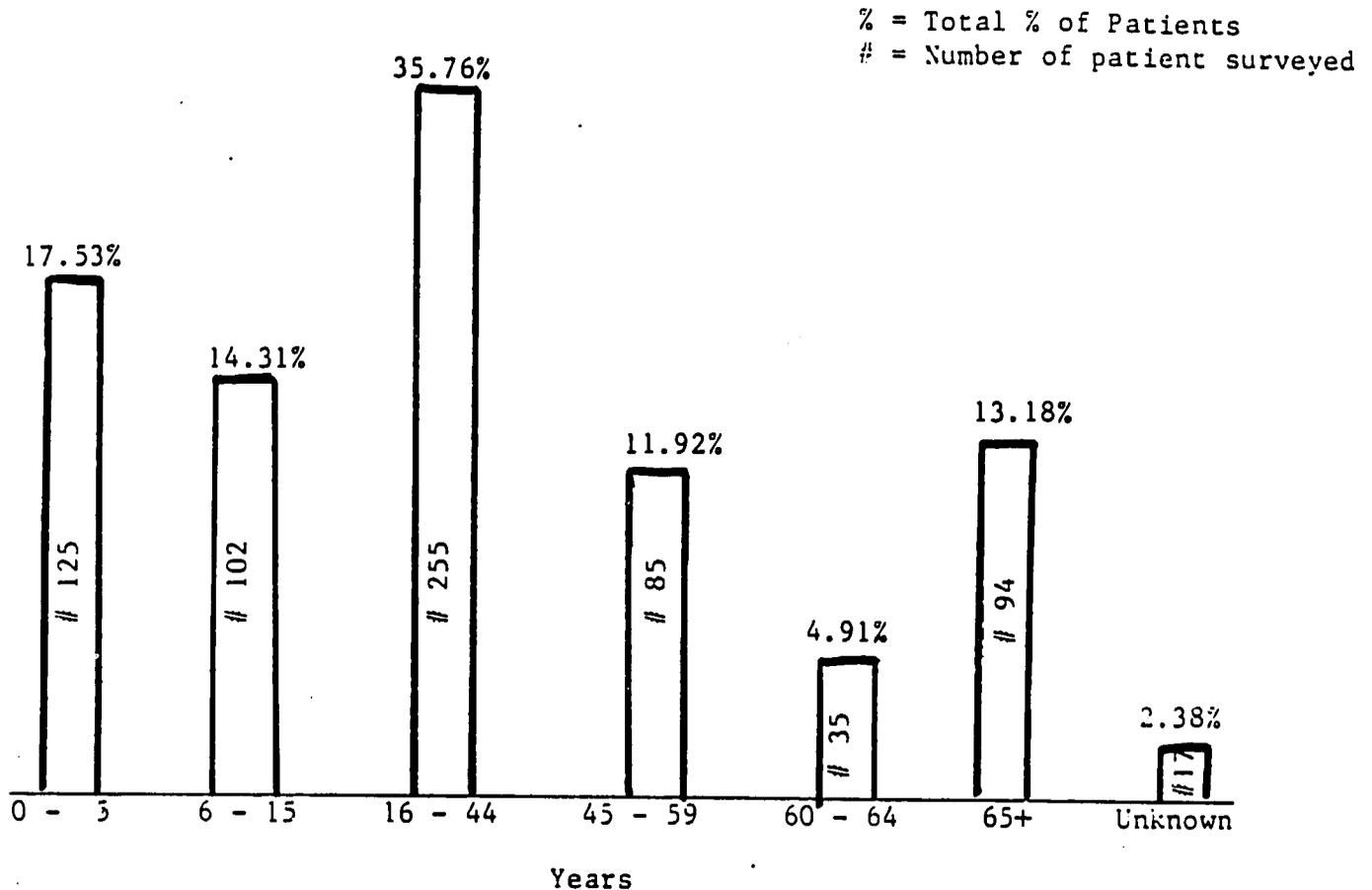
- Dispenser's ability to provide or substitute for each of the drugs listed.

The Ministry received 713 completed questionnaires, a number roughly equivalent to 1% of the population of Dominica. Researchers considered analyzing these data by computer, but the form had not been designed with data entry in mind. There were problems with other aspects of the form design and with the level of instruction and background information given to some participating physicians and dispensers, with the result that much of the information was difficult to analyze. Nonetheless, much of the information on the 713 questionnaires was hand-tallied, providing useful information on the age and sex of patients. Figure 24 shows the age distribution of patients that were surveyed. These data show that if patients over 65 and under 15 were exempt from payment, over 45% of the patient population would be exempt; the group over 65 and under 5 represented 30.7% of the patient population. More than 65% of the patients represented in the survey were female.

Other results do not provide useful statistical information due to questionnaire design and the illegibility of responses; the experience will no doubt be useful in designing a followup questionnaire that provides quantifiable results.

Figure 24

## AGE DISTRIBUTION OF PATIENTS SURVEYED



With the decision to postpone Phase II and thus postpone pricing decisions, research attention was focused away from further analysis in this area. Detailed information on the types and quantities of drugs and supplies issued from CMS, however, is readily accessible from the computerized information base that has been developed and is being maintained at CMS; this information is available to the Ministry to assist in the formulation of pricing policy when needed.

j. Consumer contributions

At the time the decision was made in July 1983 to postpone the introduction of charges for drugs, researchers raised the idea with Ministry officials of placing voluntary donation boxes at health center pharmacies and posting or displaying in some way the cost of drugs supplied. This has been done in other countries, not so much to serve as a source of revenue, as to begin to communicate to the public that the Government was providing the public something of value in the drugs and supplies it distributed. Although this suggestion aroused interest among Ministry officials, it was never implemented. CMS did distribute price lists to district pharmacists for their use in requisitioning, but these lists were never posted in any of the districts.

#### k. Sales to private patients/pharmacies

The question of CMS potentially selling drugs and supplies to private patients as a source of revenue was raised informally in July 1983, but was not seriously considered at that time by Ministry officials. In July, 1984, in a meeting between PRICOR researchers and the Prime Minister and her Cabinet, the Prime Minister expressed interest in expanding the role of Central Medical Stores to include procurement for the private sector. At the request of the Minister of Health researchers prepared a memo outlining some of the issues that would be involved in expanding CMS responsibility to that extent. Researchers suggested that the following activities would need to be undertaken:

- A review of Barbados' and other experiences.
- A survey of private sector interest, collection of their drug lists, and estimation of their annual needs.
- Determination of prices that would be charged to the private sector.
- An increase in the capitalization of the CMS pipeline by an amount proportionate to the value of the annual procurement increase.

The following issues were raised for Ministry consideration:

- What would be the source of funds for the increased capitalization requirements?
- Would procurements for the private sector be limited to formulary items? To what extent would this new system imply regulation of the private sector -- on imports? on selling price?
- The system would increase space requirements and the workload for CMS and would stress current management systems.

There was no further discussion of this idea, as the attention of Ministry officials and researchers was devoted to other more pressing issues through the end of the study period.

#### Testing of Finance submodel

At the end of the study the Finance submodel of the Phase I RDF appeared to be feasible. It was not as effective as it should have been, however, in supporting RDF goals. With inadequate liquidity to allow prompt payments to suppliers, one of the major benefits of the RDF is not being realized. Continuing problems of inadequate capitalization, delayed reimbursements,

and district budgets which are insufficient to meet demand are threatening the effectiveness of the RDF as a whole.

Several Phase II operational issues were addressed, but require much more attention before consumer charges for drugs can be introduced.

## 2. Management Information and Accounting System

A management information and accounting system was identified as a critical component of the RDF model to coordinate management of both financial and material assets. As noted in the Finance section, these assets are held in a delicate equilibrium in a revolving drug fund. A shortage of either funds or inventory at any time can pose serious problems for the RDF's effectiveness and efficiency. An MIS is required to coordinate all phases of the procurement and distribution cycles necessary for any supply system; the RDF MIS requires, in addition, a tracking of assets throughout the system in order to control these assets and to ensure the conservation of capital in the Fund.

An MIS was already present within the drug supply system in Dominica. Forms and records were kept on purchase orders, stock held in inventory, and issues to health districts and facilities. It was an MIS that had evolved over time and provided the necessary information to keep the system functioning, though not necessarily very effectively. The information system did not incorporate any tracking of the value of the supplies as they moved through the system. As part of and to support the RDF model, a revised MIS and accounting system was needed to monitor and control all phases of the procurement and distribution cycles -- to provide information on which to base management decisions and to ensure the conservation of the RDF's assets. The objective was to make the MIS more effective and efficient in meeting the needs of the new revolving fund.

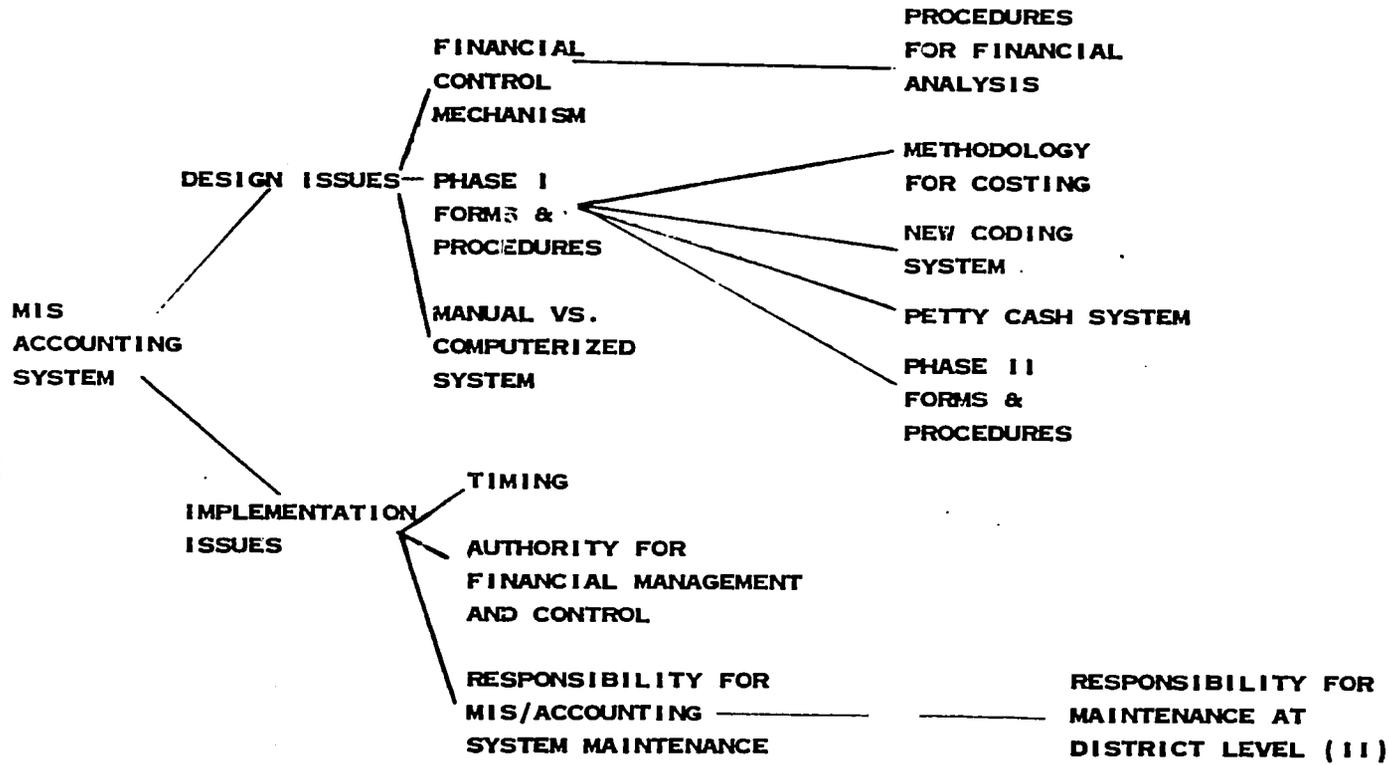
Experiences from other countries suggested that issues of both design and implementation of the MIS/accounting system would be critical to its success. Although a number of operational issues arose during the course of this study, they tended to be issues related to one of these two variables as shown in the tree diagram in Figure 25. Operations research was used in the MIS component to assist the Ministry in refining the design of the MIS accounting system and in addressing the problems and issues that arose in its implementation.

The decision to introduce a Phase I RDF as a preliminary model was made early enough to facilitate the MIS design and implementation process. Just as the development of the financial subsystem and the materials management subsystems (selection, procurement, inventory management, and distribution) could be focused on making central-level systems feasible, effective, and efficient, the initial MIS design focused on central-level systems as well. It was anticipated that only minor modifications would be needed to incorporate the management information that would be required for Phase II.

The first drafting of the MIS/accounting system -- undertaken by a Dominican freelance accountant in the fall of 1983 -- produced a design which was considered too complicated in some aspects and incomplete in others. MSH researchers assisted the Ministry

Figure 25

OPERATIONAL ISSUES WITHIN THE MIS COMPONENT



in reviewing the pros and cons of this first draft with a view toward the Ministry's overall system goals and objectives, and in redesigning an MIS/accounting system which was subsequently implemented in February 1984.

MIS design issues are discussed in Sections 2a. - 2h. below and implementation issues in Sections 2i. - 2l.

a. Financial control mechanism

One of the major objectives identified for the MIS/accounting system that would be developed for the Phase I RDF was to monitor and control the material and financial assets of the Fund, conserving the capital and preventing leakages. One of the first decision variables that was recognized, therefore, had to do with the degree of financial control that should be built into the system.

As early as July 1983, when the decision was made to implement a preliminary RDF, a consensus was emerging within the Government that, given the financial constraints under which the Ministry was operating, there needed to be "careful accounting" to assure that the funds spent on drugs and medical supplies were "not wasted." The freelance accountant hired by the Ministry in the fall produced a draft MIS/accounting system which built in a number of controls by requiring multiple signatures at different stages in the supply process. The Ministry reviewed the proposed system and also sought the advice of the PRICOR researchers, finally concluding that this system was overly complicated.

The researchers set out to assist the Government in reviewing its goals and objectives and in designing a system to meet them. There was renewed urgency as the initial funds for capitalization were made available in November 1983, and the Government was eager to avoid losses. The Prime Minister herself made the following comment:

"The accounting system must be in place; otherwise, we're all talking nonsense, you know."

From their experiences with revolving drug funds in other countries, MSH researchers suggested to the Government two main design alternatives for the degree of financial control that could be built into the accounting system: a single-entry accounting system which would provide minimal control but would be easier to maintain, and a double-entry system providing greater control but requiring greater efforts to maintain. These two options were compared in discussions between researchers and Government officials using a qualitative cost-effectiveness analysis.

A double-entry accounting system requires the keeping of parallel records on both cash and inventory; it incorporates multiple control points, providing a good audit trail and the

ability to catch mistakes. A single-entry system does not require parallel records. While it is much simpler to design and to maintain, it is much less effective in catching mistakes and thus in controlling assets. Ministry officials felt that ease of maintenance of the system was certainly a desirable characteristic, particularly given the already heavy demands on Ministry of Health staff and the constraints on hiring additional staff. Nonetheless, this factor did not weigh in as heavily as the need for tight controls. The Prime Minister, the Minister of Health, and the Financial Secretary had all expressed the urgency for an MIS/accounting system which would, above all, conserve the capital of the revolving fund. It was thus decided to design a double-entry accounting system.

There was some discussion about the monitoring and control of the actual use of supplies once they were received at the district or health facility level. It was felt, however, that this was a secondary priority in the Phase I RDF.

By the end of the study, it was concluded that the double-entry system had been very effective in controlling the Fund's assets over the two and a half years since it had been implemented. Maintenance of the system, however, had stressed the capabilities of current Ministry staff. This is discussed further in Sections B.2.d., and in Section B.7., Organizational Development.

#### b. Procedures for financial analysis

Financial analysis of a revolving drug fund is required on a periodic basis to determine whether conservation of assets is actually being achieved. This is usually done on an annual basis. MSH researchers assisted the Government in developing procedures for the preparation of annual closings. The first fiscal-year-end financial analysis was carried out in July, 1984, through a collaborative effort of MSH researchers, the PRICOR-supported Research Assistant, and CMS staff, using the opportunity to demonstrate the purpose and process for carrying out a financial analysis. At the same time, a July financial report was prepared to be used as a model for subsequent monthly reports.

A second fiscal-year-end financial analysis was carried out in July, 1985, and through that process the procedures for both monthly and annual analyses were refined. These have since been included in the Procedures Manual for the RDF Accounting System included in Annex 1.

#### c. Phase I forms and procedures

The other major objective of the MIS/accounting system, aside from financial control, is to monitor all aspects of the procurement and distribution cycles of the supply process in order to provide information to assist with management decision-making. As noted earlier, a management information

system was already in place in Dominica which provided some information; most of it was never used for management decisions, however. Some refinements in the system were required to make whatever information might be useful more accessible. Other refinements were needed to collect additional information which management of the revolving drug fund would require.

The type of information that would be required was dictated by the design parameters of the Phase I RDF. The financial assets of the Fund would be held independent from the Treasury and would be used to purchase the drugs and medical supplies that would be warehoused at and distributed by Central Medical Stores. Health districts and facilities with budgetary allocations for drugs and supplies would requisition and be issued supplies according to needs. The cost of these issues would be calculated at CMS and a markup added to cover bank charges and handling costs, as well as losses from expiration of goods, currency conversions, and inflation. Health districts and facilities would be charged for their drug usage via their budgetary allocations, and the Treasury would reimburse the Fund these amounts. The Fund would thus be replenished to allow for further drug purchases.

The transactions that needed to be recorded would include the placement of orders, payments to suppliers from the RDF, receipts of shipments at Central Medical Stores, issues to health districts and facilities, and reimbursements to the RDF from the Treasury. Additional transactions would be required for Phase II, but it was decided to design them later.

Researchers began with a thorough study of the pre-existing information system -- what documents were used, the flow of documents, and the Ministry of Health organizational chart including various responsibilities and relationships. This analysis was carried out through interviews with the CMS Storekeeper and other staff and through observation and review of the forms and records which were kept at CMS, in the Ministry Accounts Office, and in the Treasury. Treasury records were found to be well-organized and well referenced in Dominica compared to some in other countries. Researchers encouraged the Government to build new systems on the existent base to the extent possible, with the recognition that too many changes would slow down RDF implementation unnecessarily.

Once the Phase I RDF parameters had been decided and the drug supply system and MIS elements already in place identified, developments of the necessary ledgers, forms, and files followed. These were detailed in the preliminary Procedures Manual for the Phase I RDF Accounting System, which is included in Annex 1.

Only three new forms were introduced at this stage: a Receiving Report, a Destruction of Inventory Form, and a checklist to be maintained by districts to monitor their budgets. Several memo formats were also designed. It was recognized from the start

that there would be adjustments and refinements to this system. In particular, several of the forms which had not been changed would be reconsidered when the time came to reprint them or when new needs were identified.

By the next visit of MSH researchers in May 1984, four months after the new MIS/accounting system had been implemented, both CMS staff and the Ministry Accounts Officer seemed satisfied with the design. Copies of the Procedures Manual had also been made available to the Government Audit Department who reviewed it and seemed satisfied. The new Supplies Management Officer and the Accounts Officer had noted comments, suggested changes, or problems in the procedures as written, most of them minor. Other minor changes were suggested in some of the forms.

In the months that followed, the Supplies Management Officer continued to identify other minor changes which would make the design more responsive to her managerial needs. This process of continually refining the system continued throughout the life of the study. Often, the need to reprint certain forms or ledgers was used as an opportunity to introduce new refinements.

The Accounts Officer expressed more concerns about the design of the system. Many of the procedures that had been suggested for the filing of various documents and later for the maintenance of various ledgers did not seem to her to be useful, but her frame of reference was the Government accounting systems and procedures she was accustomed to using -- quite different in requirements from an RDF. This posed a problem for maintenance of the system which is discussed further in Section B.2.k. and in Section B.7, Organizational Development.

#### d. Methodology for costing

One operational issue which was central to the design of the MIS/accounting system was the method that would be used for tracking supplies through the system. They needed to be "costed" or valued in some way -- translated into financial terms in order to facilitate many of the management decisions that the RDF would require. Costing would facilitate estimation of the total value of inventory at any point in time, comparison of unit values under different procurement methods, comparison of usage rates over time and at different facilities, and the setting of sales prices.

The first decision variable was the unit of distribution which would be costed. Would it be a tablet or a bottle of tablets, for example? A review of RDF system requirements confirmed quickly that the smallest unit that would be used in any transaction was the unit that needed to be costed. Before the decision had been made to implement the preliminary Phase I RDF, MSH researchers encouraged the Government to consider prepackaging drugs into courses-of-therapy. Standard courses-of-therapy, "COTs," would be agreed upon by doctors and pharmacists at the start; the drugs would be issued from CMS in COTs and distributed to patients in COTs. Each COT would have

its own value. Experiences in other countries have suggested that adoption of this unit of distribution simplifies administrative procedures enormously and also promotes rational prescribing, dispensing, and patient compliance. With a decision to postpone Phase II, however, the Government chose not to implement this system.

The smallest unit of distribution for a Phase I RDF, which encompassed only transactions between suppliers and CMS, and between CMS and districts, was or might have been the bottle of tablets or the box of vials; but the anticipation of Phase II, which would encompass the individual patient as the user, suggested that the unit that should be tracked was the individual tablet or vial itself.

### Initial Costing

MSH researchers assisted the staff of CMS in the design of a methodology to determine the "per unit cost" of all drugs and supplies held in stock. This information had never been aggregated, though it was retrievable from CMS files. The costing process was begun in May, 1983 and completed in July, 1983. For simplicity, it was decided to use the most recent purchase price for each item and to use the currency conversion rates which were in effect on May 4, 1983, when the process was started. The source documents for this analysis were the Bin Cards on which was recorded the most recent receipt of each item and the invoices which were filed by number within each calendar year. The procedure to be followed was established as follows:

1. From the Bin Card for each item, identify the most recent shipment received.
2. Look up the relevant invoice, using the invoice number which is recorded on the Bin Card.
3. Verify on the invoice the drug name, dosage form, CMS code, and quantity ordered.
4. Check whether the invoice is written in FOB (Free-On-Board) or CIF (Cost-Insurance-Freight) prices.
5. Convert prices to EC dollars -- both the total price for that item and the per unit price (noting the unit that is used, e.g., tablet) -- and enter these on the Bin Card on the right-hand column set aside for this. Note whether the price is FOB or CIF.
6. If the price is not CIF, record the breakdown of costs (all in EC dollars) on a separate form.

Because of different billing procedures followed by suppliers, it was not possible to calculate FOB prices for all drugs and supplies; some were available only as CIF. However, the study allowed researchers to compare FOB and CIF prices and to

establish that, on average, CIF prices were greater than FOB by a factor of 1.084. FOB prices were then increased by that factor to make costs comparable.

### Changes in Unit Cost

It was noted that unit costs frequently vary from one shipment to the next, particularly given the efforts already underway at the start of this study to try to locate lower cost suppliers. Researchers assisted the Ministry in identifying two alternatives for handling new unit costs: Using the FIFO -- first in, first out -- system, charging for the older drugs the previous unit cost and for the newly received drugs the new unit cost; or figuring a new average unit cost for a drug or supply each time a shipment is received, by figuring the total value of inventory (previous quantity at previous unit cost, plus new quantity at new unit cost) and dividing it by the new total number of units. These two alternatives were discussed between Ministry officials and researchers, and the following comments were noted:

- The financial implications for the Ministry were essentially identical under the two methods.
- The FIFO method would raise both ethical and administrative problems regarding distribution of the lower cost (but same quality) units. Which district or districts should benefit from the lower cost units? How would it be handled if there were an order for 100 units and only 20 units remained of a previous shipment, requiring a segmented order? The administrative burden could become complex.
- Distinguishing between older and newer shipments of the same product, which would be required in order to employ the FIFO method, would be difficult and would require additional storage space.
- The average unit cost method would require the calculation of a new cost at the time each new shipment was received, though not a difficult calculation, and once completed the filling of orders and the costing of issue tickets (SIVs) could be done by a less trained person.

The average unit cost method was agreed upon as the more equitable and administratively simpler method.

The methodology developed for calculating new average unit costs at the time of each shipment worked well throughout the period of this study; a worksheet designed to assist in this calculation was included in the RDF Accounting System Procedures Manual.

Design of the MIS/accounting system raised questions about the

costing of raw materials used by the Compounding Section, and of finished products produced by the Compounding Section; the costing of disaster boxes which included a standard set of items; and the costing of supplies which were donated to the Ministry of Health. Procedures for these exceptional circumstances were developed through consultation with CMS staff, and outlined in the Procedures Manual.

e. New coding system

From the start of the study the coding system that had been used at CMS to identify the different items held in inventory was already posing problems. It was a sequential coding system, organized by form of presentation of an item, e.g., tablet or injection, whose logic was destroyed when a new item was added to inventory.

Researchers assisted the Ministry in assessing the implications of a changeover to a new coding system. It was recognized that while a new system would be ultimately required, the introduction of any additional change might shift attention away from the issues which were felt to be more central to making the RDF operational, and, furthermore, that the new Eastern Caribbean Regional Pharmaceuticals Management Project might require adoption of a new regional system at a later date. For these reasons, adoption of a new coding system was delayed for at least the first year.

By August, 1984 CMS was running out of Kardex cards and needed to reprint them. It was decided to create two columns on the new cards for codes, as it was felt that even after the new codes were adopted, the old codes would still be needed for some time to trace earlier documents.

CMS ordered new Kardex cards early in 1985 and developed and introduced its own new CMS coding system in June. The new system is more flexible with each category of drugs and supplies now beginning with the number 1, new items can easily be added. Although there were no major changes in the general classification of drugs and supplies, several items were reclassified.

By the end of the study, the Eastern Caribbean Regional Pharmaceuticals Management Project was just getting underway, and there had been no formal effort as yet to encourage the countries of the Region to adopt a uniform coding system.

f. Petty cash system

One operational issue that was recognized at the time of the first financial closing in July, 1984, was the fact that no petty cash was held at CMS. When petty cash was needed to pay small fees related to the clearing of supplies from the port, for example, the Ministry Accounts Officer arranged that the Ministry's own petty cash be used. The RDF was then billed periodically.

CMS staff felt that this system was not in the best interests of the RDF. It meant that information on the financial status of the Fund was never quite up to date. Furthermore, there could easily be errors, as the Ministry's accounting system was less detailed than the RDF system.

There were periodic discussions over the next year between the Supplies Management Officer and the Accounts Officer with regard to this issue; a petty cash system was finally set up at CMS.

#### g. Phase II forms and procedures

By the time the MIS/accounting system was actually designed, the decision had already been made to delay consumer cost sharing. A Phase I RDF required very few forms and procedures to be implemented at the district level, the main exception being the Requisition/Issue Voucher (also called the Stores Issue Voucher or SIV) which originated in the districts and which was already in use.

MSH researchers suggested that any new procedures which required management decision making at the district level be considered Phase II issues, and encouraged that they be considered a secondary priority at the start for several reasons: (1) because they had little immediate impact on the cost accounting the Prime Minister was interested in, (2) because in order to take hold any new procedures would need to be accompanied by staff training and supervision, and (3) because the proposed central level systems and procedures were already a major task.

Some Phase II forms and procedures did begin to be introduced during the period of this study:

#### Budget Monitoring

The preliminary Procedures Manual for the Phase I RDF included a Checklist for districts to use to monitor their drug usage against their budgets. The checklist was not introduced in FY 83-84, however, because districts had not been informed of their budgetary allocations, and it was felt that the Checklist would not be meaningful. Early in FY 84-85, researchers assisted the Supplies Management Officer in the design of a Budget Control Book for districts, which would assist them to monitor expenditures in both categories of the 03 line item.

In the district survey undertaken by researchers in December, 1985, it was found that these Budget Control Books were not being kept up to date in most districts. This finding and some of the potential reasons were discussed in more detail in the Finance Section.

#### Inventory Management

When this study was begun there were no formal procedures in place at the district level for inventory management. The

methods that district doctors and pharmacists used to decide the quantities of individual items to requisition from CMS were in most cases ad hoc. The result was frequent stockouts at the district level and frequent emergency requisitions in the middle of the month, or, at the other extreme, overstock situations.

There was interest among both Ministry staff and researchers to introduce methods as early as it was feasible, to assist the districts in managing their inventories. In May, 1984, approximately four months after the introduction of the Phase I MIS/accounting system, researchers began to assist the Ministry in exploring alternatives. The idea of a Bin Card for district pharmacies was discussed informally with several pharmacists. Most felt that it would work, but one concern that was expressed was whether, or how often, the pharmacists would have time to update them. It was suggested that a pharmacist could keep a daily tally of what was dispensed on a preprinted list of the first-line drugs, and subtract these totals from the balances on his Bin Cards at the end of each day or each week.

MSH researchers discussed the possibility of trying out this or a similar system in a district with one of the better trained pharmacists before introducing it throughout the country. This would provide an opportunity to find and correct problems in the system, and might also produce a district level advocate which would be very useful. By August, 1984 CMS staff felt that they would rather introduce Bin Cards in all the districts at once.

By December, 1984 a new Bin Card for district level use had been designed and printed on card stock, and had been distributed. The Chief Pharmacist was making visits to the districts to assist pharmacists in using the Bin Cards to monitor monthly usage and to use that information to estimate more accurately the quantities of items they needed each month from CMS.

In the survey undertaken by researchers in December, 1985, six of the seven district pharmacists reported that the Bin Cards were useful. (Survey results are included in Annex 5.)

#### Management of Fees Collected

The operational issue of what type of record-keeping at the district level would facilitate the management of drug sales was discussed among Ministry officials and researchers early in this study, and quickly became a secondary priority as attention was focused on the establishment of central level systems and procedures.

One alternative that was discussed was the use of a prescription slip which, if used in duplicate, could serve as a record of sales for health center staff and as a receipt for the patient. The advantages perceived by Ministry officials of introducing a prescription slip -- not currently used in Government facilities -- were that (a) information on what was actually prescribed would be available for the first time, (b) information could be

easily sorted, and (c) if prenumbered, the prescription slip would facilitate security. Disadvantages were: (a) the difficulty that would be posed for the physician in cases when more than one drug was prescribed, (b) the problem that would be posed in the cases of refills when there was not normally a new prescription slip, (c) that sorting would require a special box, and (d) that bits of paper could easily be lost.

There was no further discussion of the issue of the management of fees at the district level during the period of this study. It is suggested, however, that Ministry officials would be advised to analyze the fee collection experience at Princess Margaret Hospital in designing whatever mechanism is ultimately used for drug sales.

#### h. Manual versus computerized system

At the time that the RDF was set up there were very few microcomputers in use in Dominica and no staff associated with Central Medical Stores had had any training in computers. For these reasons the idea of designing an MIS/accounting system which would be computerized from the start was never seriously considered. Of greater interest was use of a microcomputer for research purposes.

A microcomputer was made available to this project in July, 1984. It was installed at Central Medical Stores and was immediately useful in enabling more effective manipulation of data available from manual records. It never became an integral or required element of the MIS/accounting system.

Initial applications of the computer in support of the revolving drug fund were designed in three main categories: (1) ongoing analyses for improved decision making, (2) development and dissemination of information on various supply system activities to Ministry officials and to District Medical Officers and pharmacists, and (3) support of various elements of the RDF accounting system, in particular preparation of periodic financial statements.

By December, 1984, the computer was being used regularly and successfully by both the PRICOR Research Assistant and the Chief Pharmacist. Applications in all three categories were being used:

- (1) Analyses to improve decision making. Printouts of the inventory list with computer assisted calculations of reorder levels and reorder quantities were being used as a guideline for the placement of purchase orders.
- (2) Printouts for information and/or dissemination. Price lists of first-line drugs, lists of non-Formulary items still in stock, and lists of overstocked sutures had been sent out to districts.

- (3) Support for elements of the accounting system. The Research Assistant was keeping all sub-ledgers on the computer, making entries from source documents, as a check against his manual system. He was also making entries for monthly financial closings.

The preliminary Procures Manual for the Phase I RDF Accounting System was put on computer, using its word-processing capability, to facilitate revision and updating.

MSH researchers made heavy use of the computer during certain periods, the finance consultant carrying out annual financial closings, and other researchers performing analyses involving price history data, stock levels, the value of issues, and the procurement and reimbursement segments of the pipeline.

Use of the computer was interrupted when the computer broke down in August, 1985, soon after the finance consultant had completed his closing. It was repaired several months later when service facilities were located on a nearby island.

#### i. Timing of implementation

The Prime Minister had first mandated that a strict cost accounting system within CMS go into effect before the capitalization funds to initiate the RDF would be made available. The determination of unit costs for all items held in inventory had begun in May, 1983, and the costing of SIVs began in July, 1983. The preliminary accounting system that was developed between August and October by the Dominican freelance accountant was found to be inadequate, however, and was not implemented.

MSH researchers returned in December to make plans for revising the accounting system and for implementing it as soon as possible. The Ministry was feeling some urgency to get the system into place as the initial capitalization for the RDF had been provided in November and drugs were continuing to be procured and issued. The MIS/accounting system was designed and implemented in February, 1984. It was decided to open all required ledgers as of July 1, 1983, however, so that a full fiscal year's data would be available for analysis. The value of inventory as of July 1st, 1983, was determined by the following formula:

$$\begin{array}{l} \text{Value of} \\ \text{inventory} \\ \text{(as of 7/1/83)} \end{array} = \begin{array}{l} \text{Value of inventory} \\ \text{as of 1/31/84} \\ \text{(obtained by} \\ \text{physical} \\ \text{inventory)} \end{array} + \begin{array}{l} \text{Value of issues} \\ \text{since 7/1/83} \end{array} - \begin{array}{l} \text{Value of} \\ \text{Purchases} \\ \text{since} \\ \text{7/1/83} \end{array}$$

Entries for all transactions between July 1, 1983, and January 31, 1984, were entered in the subledgers, and Ministry staff continued to maintain the records from that point.

j. Authority for financial management and control

This issue was not recognized as an important operational problem until well into this operations research study. When the MIS/accounting system was first designed, it was assumed that the Ministry Accounts Officer would be involved and that she would be responsible for approving purchase orders, as she had done in the past, and for signing RDF checks, thus approving expenditures from the revolving fund. As her supervisor, the Permanent Secretary would be the ultimate authority for financial management and control. This was confirmed in discussions with the Minister.

As the study evolved, the question of where financial authority and responsibility should lie came to be identified as a major operational issue by researchers. It was felt at first that separation of the management responsibility for financial assets from the responsibility for material assets (which were managed by the Supplies Management Officer) was cumbersome at best and did not promote coordinated or efficient management. The PRICOR-funded Research Assistant, supervised for different activities by both the Accounts Officer and the Supplies Management Officer, was often caught between different perspectives and different priorities about what kinds of information were needed to manage the RDF.

Over time, it appeared that the financial authorities were making decisions which were not entirely in keeping with the original goals of the RDF, as they had been agreed in early planning meetings between Ministry officials and researchers. Expenditures were made from RDF funds for a filing cabinet for the Accounts Officer, for repairs to the CMS computer, and for a temporary employee at CMS -- expenditures which were not planned for in those early discussions.

This issue is presented briefly here because its lack of resolution contributed to problems with regard to the implementation of the MIS/accounting system; it is discussed more broadly in Section B.7, Organizational Development.

k. Responsibility for MIS/accounting system maintenance

When the MIS/accounting system was first set up, it was assumed that those portions of the information system that were involved with aspects of the supply process would be maintained by CMS staff, and the accounting system by the Ministry Accounts Officer. Those responsibilities were decided as a function of four variables as shown below:

Maintenance of MIS/accounts = f (system design, availability of staff, other responsibilities of staff, training).

At the first financial closing in July, 1984, however, MSH researchers found an unacceptably high error rate in the accounting books that had been maintained by the Ministry Accounts Officer. There were many simple transcription and calculation errors. More distressing, however, was the frequent failure to properly follow the detailed procedures specified in the Procedures Manual for the Revolving Drug Fund Accounting System. For example, the numbers of the source documents (e.g. SIV#) were rarely recorded in the various subledgers, greatly increasing the difficulty in tracing and correcting other errors.

Researchers concluded that it may have been a mistake to have asked the Ministry Accounts Officer to undertake the additional responsibility for the RDF accounts, given her other responsibilities, some of which understandably deserved priority attention. They pushed forward to hire a Research Assistant for the PRICOR study, who would assist in maintaining the RDF accounting books. From the start, this was considered a temporary solution. He was hired, oriented, and trained by MSH researchers and almost immediately took over virtually all responsibility for the accounts, in addition to carrying out various research analyses. It was easily a full-time job.

Although the accuracy of the accounts improved, there were still a troublesome number of errors, probably due to the relative inexperience and substantial workload of the Research Assistant; the financial closing on July 1985 again required a substantial effort from the MSH finance consultant.

Toward the end of the study, it became obvious that successful maintenance of the accounts and thus viability of the RDF concept required an accounts officer who could give it priority attention. Researchers had a number of discussions with Ministry Officials, urging them to hire the Research Assistant as a full-time member of CMS staff. By the end of the study, he had not been hired. The only other person who was trained to maintain the accounts (the junior clerk at CMS) could not be freed from her other tasks, and the accounting books almost immediately began to lapse, putting the RDF at risk.

It is the strongly held view of the researchers that responsibility for maintenance of each aspect of the MIS/accounting system for an RDF be clearly assigned, and that maintenance of the accounts, even for a system as small as Dominica's, is a full-time job and requires supervision and training. Without adequate trained staff, maintenance of the accounts is neither feasible, effective, nor efficient.

This issue is discussed further in the Section B.7. on Organizational Development.

1. Responsibility for maintenance of MIS/accounting system at the district level (II)

Just as at the central level, successful performance of responsibilities at the district level are a function of the same four variables:

- . maintenance of district MIS/accounts = f (system design, availability of staff, other responsibilities of staff, training)

Naturally, a constraint to the resolution of this operational issue is that fewer alternatives are available at the district level. The only district level MIS elements that were introduced during the period of this study were Bin Cards and Budget Control Books. Both were assigned to pharmacists, the only staff members currently present in district pharmacies.

As the district MIS is expanded and more tasks are identified, researchers encourage Ministry officials to consider carefully each of the four variables before responsibilities are assigned.

Testing of MIS/accounting system submodel

The Phase I MIS/accounting system was designed to allow easy access to information which would facilitate decision-making in all phases of the drug supply system and management of the RDF. With substantial inputs from outside researchers and the PRICOR funded Research Assistant in Dominica, the system has been feasible and somewhat effective, and will become more effective as staff gain experience; due to the necessity of those extra investments, however, it has certainly not been efficient. With staff inputs limited to MOH and CMS staff currently available, researchers must question whether the MIS/accounting system will ever be feasible. This is one of the study's more important findings and poses a significant operational problem for the Ministry.

Only a few Phase II elements have been added as yet to the MIS/accounting system. Researchers conclude that the outlook for Phase II is not good until the Phase I system is more stable.

### 3. Selection

Selection was considered a key element of the materials management component of the RDF. It is involved in defining the scope of the RDF. Dominica's pre-existing supply system was a system that encompassed pharmaceuticals and medical and surgical supplies that were stored at CMS and used by public sector health facilities. As the RDF was being planned, a key operational issue was whether the RDF should include all those items, or just pharmaceuticals, or all the items currently managed by CMS and more. Because each inventory item has a monetary value, this decision would affect all financial parameters of the Fund, most importantly the capitalization requirements. All planning and management decisions in other components of the RDF model would be based on the selection decisions that were taken.

Operations research was used in this component to document the decision process that was used to address this key operational issue. Other operational issues that were addressed were development and introduction of the Dominica formulary, and reorganization of the inventory list.

#### a. What items to include in the RDF

There was almost an infinite array of possible options with regard to defining the scope of the RDF. The line had to be drawn somewhere in order for detailed financial planning to begin, but could be drawn almost anywhere. Would all the items currently procured, stored, and distributed by CMS be included, or fewer, or more? Researchers surveyed the current inventory before conferring with Ministry officials.

The administratively simplest option was to include all items that were in the current supply system. Many CMS procedures were already in place encompassing these items. Furthermore, drugs and medical and surgical supplies were included in the same 03 line item in the Government's budget. So also were non-medical supplies for health facilities, e.g., stationery supplies, light bulbs, and even food for the hospital, but management of these purchases was different, and it was felt to be unwieldy to include them in the RDF. The only further possible constraint that was identified was the amount of funds that would be required for initial capitalization, which would increase incrementally as the value of monthly issues from CMS increased. However, the necessary funds seemed to be available through the loan from Social Security, so this constraint was dismissed.

It was agreed to begin the RDF with all drugs and supplies on CMS's current and active inventory list -- a total of 454 drugs and 193 supplies. (An additional 120 items remained on the list the first year; these were out of stock items which were no longer being purchased.) A copy of the inventory list (as of June 1985) is included in Annex 6.

This decision meant that only CMS inventory items were to be purchased with RDF funds, and the RDF was to be reimbursed for all usage of these items. During the "validation" phase of this decision, which extended throughout the study period, a number of minor abnormalities arose which had to be addressed. In the first few months, some stationery supplies not within the RDF scope had been purchased with monies from the Fund. An additional questionable payment was for rent and tailgate fees amounting to EC\$1500 for the release from Customs of dental equipment, equipment which was not part of the inventory at CMS, and thus not included in the RDF. These deviations indicated that there was not clear agreement or understanding about the scope of the RDF. They were discussed, and adjusting entries were made in the accounts. Several months later, when the suggestion was made from within the Ministry to purchase a calculator with Fund monies, the Supplies Management Officer succeeded in preventing it.

Unfortunately, however, a full two years after the RDF had been set up, Ministry officials approved several more expenditures which were not part of the original plan. Such expenditures, if not repaid, would contribute to decapitalization of the Fund. Researchers assisted the Supplies Management Officer in bringing this issue to the attention of the Minister and the Health Services Coordinator, but by the end of the study it had not been resolved.

Over the life of the study, a number of adjustments were made to the inventory list, usually with the goal of facilitating and streamlining materials management and accounting procedures. Some items were dropped from the list, particularly non-Formulary drugs and other items that were no longer purchased or issued; the number of "never-used" items dropped from 120 to 81 by December 1985. Nonetheless, 89 types of catgut remain on the list when only a few are used regularly! Researchers strongly encourage further reductions in the list, which will contribute further to management efficiencies.

There was discussion about adding other items to the list, family planning supplies, for example, which had not been included at the start because they were donated items and were stocked at and distributed by Roseau Health Centre rather than CMS. It was felt that if the RDF began to pay for them, or if they were moved to CMS, they should be brought into inventory and included in the RDF. By the end of the study they had been added to the RDF inventory list along with a significant number of new surgical supplies and dental supplies.

The further suggestion was made that CMS take over the ordering and stocking of supplies like sheets and towels which were used in health facilities, but it was felt that there was not adequate space at CMS to handle them. With the new extension to CMS completed in the late spring of 1985, space will no longer be a major constraint.

MSH researchers had prepared a memo for the Ministry in December, 1984 (included in Annex 3), outlining the implications of an expanded inventory list for staff workload and for capitalization requirements. The concerns expressed were increasingly valid at the end of the study when the inventory list was 25.3% longer and the value of inventory 57.6% greater than at the start. (See Figure 26.)

FIGURE 26  
CHANGES IN CMS INVENTORY LIST  
OVER LIFE OF STUDY

	JUNE 1983	JUNE 1984	JUNE 1985	DECEMBER 1985	% CHANGE
# OF DRUGS	454	454	455	508	+11.9%
# OF MEDICAL/ SURGICAL SUPPLIES	193	193	258	303	+57.0%
TOTAL # OF INVENTORY ITEMS	647	647	712	811	+25.3%
TOTAL VALUE OF INVENTORY (EC\$)	537,379.00	594,143.00	840,605.00	847,169.00	+57.6%

b. Development and Introduction of the Dominica Formulary

The Ministry of Health in Dominica was involved in the process of finalizing a National Drug Formulary at the time this study began. It was an activity independent of this study. A Drug Committee had been formed -- consisting of central Ministry officials and representatives from all the districts -- which met on a periodic basis to reach decisions on which pharmaceuticals and which dosage forms should be included in the Formulary. Dominica was assisted in this process by PAHO, who advised them on technical details and specifically the adoption of a standard coding system, with the expectation that Dominica's Formulary might be a good model for other Caribbean islands. Both "Caribbean drug codes" as used by the Barbados Drug Service, and therapeutic category codes were incorporated, as were level of use availability specification codes. All content decisions were made by February 1984, and the first printing of the Formulary was available in May. A more formal bound edition, prepared with PAHO's support, was available in July 1984. A year later, the first formal revision was underway but had not been completed by the end of this study.

When the Formulary was first available and had been distributed to prescribers throughout the country, CMS began to restrict its ordering to "primarily" Formulary items. The computerized

Figure 27

NO.	NEW C.M.S. CODE	OLD C.M.S. CODE	FORMULARY CODE	AVAIL. SPEC.	THERAP CODE	GENERIC NAME	STRENGTH OR SIZE	UNIT OF ISSUE	AV.UNIT COST 6/84	AV. UNIT COST 6/85	
781	TAB	115	000115	C4691	F	36:88	diagnostic, proteinuria test	50's	tab	13.7200	5.6993
782	TAB	116	000116	C3701	F	36:26	diagnostic, blood glucose	25's	tab	21.0500	15.0150
783	TAB	117	000117	C0511	H	08:38	clofazimine	100 mg	tab		
784	TAB	118	000118	C2441	H	56:04	magnesium trisilicate	250 mg	tab	0.0060	0.0118
785	TAB	119	000119	C6344	H	08:16	isoniazid/thiacetazone	100/50 mg	tab	0.0083	0.0083
786	TAB	120	000120	C	F	28:18	haloperidol	5 mg	tab	0.0400	0.0986
787	TAB	121	000121	CN	F	40:12	calcium lactate	300mg	tab	0.0065	0.0065
788	TAB	122	000122	C6061	N	28:08	penicillamine	250 mg	tab	0.8900	0.3669
789	TAB	123	000123	C	N	10:00	cyclophosphamide	25 mg	tab	0.8400	0.8400
790	TAB	124	000124	C1181	H	24:08	metoprolol tartrate	50 mg	tab	0.4500	0.4491
791	TAB	125	000125	C1462	S	28:12	carbamazepine	200 mg	tab	0.4800	0.2117
792	TAB	126	000126	C2671	S	68:04	fludrocortisone acetate	100 mcg	tab	0.1400	0.1400
793	TAB	127	000127	C0042	F	08:08	bephenium hydroxynaphthoate	500 mg	tab	0.0520	0.0520
794	TAB	128	000128	C6351	F	20:04	ferrous sulphate	200 mg	tab	0.0030	0.0231
795	TAB	129	000129	C3491	H	88:08	pyridoxine	50 mg	tab		0.0907
796	TAB	130	000130	C1932	F	36:88	diagnostic, ketonuria test	50's	bott	7.7120	7.7120
797	TAB	131	000131	C0501	F	08:36	nitrofurantoin	50 mg	tab	0.0080	0.0073
798	TAB	133	000133	C1162	F	24:08	hydrallazine	50 mg	tab		0.0411
799	TAB	134	000134	C1693	F	28:18	thioridazine Hcl	50 mg	tab		0.1114
800	TAB	135	000135	C1694	F	28:18	thioridazine Hcl	100 mg	tab		0.2215
801	TAB	136	000136	C1644	F	28:18	haloperidol	1.5mg	tab		0.2296
802	TAB	138	000138	C2011	F	40:12	potassium chloride	500mg	tab		0.0971
803	VAC	1	000621	C6481	F	80:12	vaccine,BCG (dried)	M.D	vial	0.2100	4.4583
804	VAC	2	000622	C6891	F	80:12	vaccine,diphtheria (toxoid)	M.D	vial	1.1950	1.1950
805	VAC	3	000623	C3721	F	80:12	vaccine,diphtheria/tetanus(toxnioid)	M.D	vial	0.9100	0.7449
806	VAC	4	000624	C3731	F	80:12	vaccine,diphtheria,pertussin/tetatanus	M.D	vial	0.7060	0.9144
807	VAC	5	000625	C3111	F	80:12	vaccine,measles, live,attenuated	M.D	vial	0.9000	0.9204
808	VAC	6	000626	C4611	F	80:12	vaccine,poliomyelitis,oral	50 doses	vial	2.9300	2.9300
809	VAC	7	000627	C3101	F	80:12	vaccine,tetanus(toxoid)7.5ml	M.D	vial	4.5900	5.7000
810	VAC	8	000628	C3713	F	30:04	serum,diphtheria antitoxin	40000 IU/ml	vial	28.5500	28.5500
811	VAC	9	000629	C3093	F	80:04	serum,tetanus antitoxin	1500 U	vial	0.0000	
812	VAC	10	000630	C3094	F	80:04	serum,tetanus antitoxin,5 ml	10000 U	vial	5.5600	5.5600
813	VAC	11	000631	C3092	F	80:04	serum,tetanus antitoxin,10 ml	50000 U	vial	18.0300	18.0300
814	VAC	12	000632	C	F	68:22	insulin soluble (beef)	100 U/ml	vial	12.7700	26.6201
815	VAC	13	000633	C2872	F	68:22	insulin(rapid)regular,MC(10ml)	100 U/ml	vial	12.2050	14.2819
816	VAC	14	000634	C2923	F	68:22	insulin(lente),zinc susp(10ml)	beef100U/ml	vial	14.2600	14.2600
817	VAC	15	000635	C2922	F	68:22	insulin(lente),zinc susp(10ml)	pork100U/ml	vial	12.8700	34.6123
818	VAC	16	000636	C3777	F	36:84	tuberculin (PPD)	10 U/ml	vial	2.7100	2.7100
819	VAC	17	000637	C3778	F	36:84	tuberculin (PPD)	100 U/ml	vial	2.7100	2.7100
820	VAC	18	000638	C3779	F	36:84	tuberculin (PPD)	1000U/ml	vial	2.7100	3.4275
821	VAC	19	000639	C4611	F	80:12	vaccine,poliomyelitis,oral	20 doses	vial	1.1700	1.3024
822	VAC	20	000640	C4611	F	80:12	vaccine,poliomyelitis,oral	10 doses	vial	1.1800	1.0433
823	VAC	21	000641	C	F	80:12	Evans special diluent		vial	8.3800	8.3800
824	VAC	22	000642	C2861	F	68:22	insulin,isophane (NPH)	100 U/ml	vial	16.9800	16.9806
825	VAC	23	000643	C	F	80:12	vaccine,diphtheria/tetanus(paed)d	M.D	vial	0.9100	2.8314

inventory list was amended with the Formulary codes -- Caribbean drug codes, therapeutic category codes, and availability specification codes. (See Figure 27 for a sample printout showing these codes.) This permitted computer sorting by these categories, facilitating any number of management analyses.

A computer-generated price list of Formulary items was sent out to districts, as well as a list of non-Formulary items still currently in stock. When non-Formulary items were used up, CMS did not reorder them, and when these items were requisitioned by districts, the CMS Storekeeper wrote "non-Formulary item" on the issue voucher. The 28 non-Formulary drugs that were on the inventory list in FY 1983-84 had been reduced to six in FY 1984-85 and to zero by December 1985. By reducing the number of drugs on the inventory list, the Formulary development process greatly supported management efficiencies and the RDF itself.

At the end of the study, researchers carried out a survey of district-level pharmacists, doctors, and nurses. In this survey all seven district medical officers reported having a copy of the Dominica Formulary, and five gave specific examples of ways in which they found it useful. (The complete survey results addressing this and other issues are included in Annex 5.)

c. Reorganization of the inventory list

The RDF inventory list consisted of all pharmaceuticals and medical and surgical supplies procured by and stored at CMS, as noted in an earlier section. Basic to any standardization of materials management systems and procedures within CMS and throughout the supply system was a standard, consistent, and reasonable organization of this list.

The pre-existing list was organized by form of presentation of the item, as follows:

- TAB - tablets
- ANT - antibiotics
- INJ - injections
- LOS - A - liquids, ointments, salves (internal use)
- LOS - B - liquids, ointments, salves (external use)
- POW - powders
- DD - dangerous drugs
- VAC - vaccines, serums
- IVS - IV solutions
- SUT - catgut
- SYR - syringes, needles
- SUR - surgicals (appliances)
- COT - surgical dressings
- SUN - sundries

Within these categories, items were ordered alphabetically and then numbered; a specific number of slots were left open within each category to anticipate new items, but the entire list was ordered and numbered in a single numerical sequence. Items were stored physically in this same order on CMS shelves.

In December 1984, as changes in procedures in major finance and materials management systems were stabilizing, an MSH consultant and the Supplies Management Officer discussed together a possible reorganization of the inventory list. The CMS coding system was no longer adequate, as the numbering system had broken down with the addition of new items. A reorganization would have most influence on the Kardex system and, as it was time to reprint Kardex cards, the issue had become more critical. There would also be possible implications for SIVs if the decision were taken, as had been discussed, to preprint them with the items used at the district level, and possibly for the arrangement of shelf storage.

A number of options were identified: The new Formulary, for example, offered Caribbean drug codes and therapeutic categories as possible systems for organization. The Supplies Management Officer expressed interest in waiting for the new Eastern Caribbean Regional Pharmaceuticals Management Project to get underway in order to avoid the need for two separate transitions. In June 1985, however, new Kardex cards were introduced, and the SMO decided to use the occasion to make an intermediate change in the CMS codes. The drug and supply categories were left the same, but it was decided to begin each category with 1, so that no matter how many items might be added, the categories would not overlap one another. To facilitate research and management analyses using documents carrying the old codes, both old and new CMS codes for each item were kept on the computer lists. (See Figure 27.)

By the end of the study, the Eastern Caribbean Regional Pharmaceuticals Management Project was just getting underway. Whether this project will encourage adoption of a regionally standardized coding system, and what that system might be, are as yet unknown. Any further reorganization will pose another operational problem for Dominica in making the transition.

#### Testing of Selection submodel

At the end of the study, the Selection submodel was a feasible and reasonably effective component of the RDF model, although continued disbursements from the Fund for non-RDF items made it less than optimally effective in limiting the scope of the RDF. Inefficiencies continued with a number of "never-used" items on the inventory list, and with some confusion about what coding system would be ultimately adopted, but both of these issues were being addressed.

#### 4. Procurement

Procurement was considered an important component of the RDF system model, as it is a key element of effective and efficient materials management. And the management of the Fund's material assets -- the drugs and medical supplies -- determines whether and at what cost they are available to meet the health needs of the population. In order for the Fund to continue to revolve on a smooth and reliable basis, drugs and medical supplies need to be procured on a regular schedule.

A procurement system was pre-existing in Dominica at the time the Government decided to institute a revolving drug fund. The original Storekeeper, who had had approximately forty years' experience at Central Medical Stores (and who retired soon after this study got underway), had developed a set of fairly consistent procurement procedures. He placed annual orders, usually in July or August, from a fixed set of approximately 37 well-known firms. He was acquainted with these firms through either their listings in CARICOM's "Pooled Procurement Summary of Quotations," price lists he received by mail, or visits from company representatives. He selected suppliers for individual items by comparing prices, but commented to researchers that he didn't buy from any company that required a Letter of Credit, even if its price was the lowest. He mentioned having problems with quality, and for that reason preferred brand-name items. While these procedures proved themselves somewhat "effective" in making supplies available in the system, they were sub-optimal as attested to by the shortages within Central Medical Stores and by the frequency of -- and in fact reliance on -- emergency shipments from high-cost distributors in Barbados.

The objective of operations research in this component was to refine the existing procurement system to make it more effective and efficient in supporting the larger RDF system. An effective and efficient procurement system would accomplish the following objectives (Managing Drug Supply, MSH, 1981):

- assure prompt and dependable delivery of drugs;
- acquire needed supplies as inexpensively as possible;
- obtain supplies which meet reasonable quality standards;
- accommodate increased demand during epidemics and other emergencies;
- distribute the workload as evenly as possible throughout the year.

A review of the weaknesses and inefficiencies of Dominica's procurement system suggested that major efforts needed to be directed toward improving the reliability of supply and decreasing unit costs paid. Over the period of the study, operations research has assisted in identifying mechanisms for making the necessary changes in procurement practices, in managing those changes, and in documenting the results.

The operational issues that were addressed could be presented in a number of frameworks, as they are all related and interacting. They are presented here in a structure that follows the major procurement themes in Managing Drug Supply and felt most logical to the researchers.

- What purchasing model to follow
- Obtaining better purchase prices
- Supplier contracts
- Port clearing

a. What purchasing model to follow

The purchasing model that was in use before this study began had been annual purchasing. For a number of reasons including the unavailability of accurate annual consumption data and the difficulty in obtaining the necessary funds from the Treasury when needed, this system resulted in frequent shortages of essential items which in turn required small emergency orders from expensive distributors who could provide supplies promptly.

Increasing attention was being given to remedying this situation during the first year of this study. While researchers were focusing their primary efforts on finance and MIS issues, they did assist the staff of Central Medical Stores in calculating consumption figures for each individual item over the past twelve months in order to estimate needs for the future. Once the RDF had been set up, offering much greater liquidity for drug purchase, the Chief Pharmacist was placing large orders for the first time with new generic suppliers.

By May 1984 most of these new large orders had been received, and CMS was well stocked. Attention then turned to the planning of future procurements so that stock levels, and thus service levels, would be maintained. The operational issue that arose was what would be the most appropriate purchasing model for Dominica.

Well-known inventory management principles suggested two alternative purchasing schedules -- periodic and perpetual. Under periodic purchasing, stock levels are reviewed and orders are placed on a periodic basis, often every three months or six months. The quantities ordered depend on how much of each item is needed up to a predetermined maximum inventory level. Under perpetual purchasing, the inventory level of each item is reviewed at least weekly, and whenever the stock level falls below a predetermined point -- the reorder level -- an order for a standard quantity is initiated. Both systems have advantages and disadvantages, and the choice in a given circumstance depends on a number of factors which are described in detail in Managing Drug Supply.

Briefly, under the periodic system, there is the risk that stock levels can fall to dangerously low levels, particularly when consumption data are weak or consumption patterns are changing.

Furthermore, periodic purchasing creates an uneven workload situation, as the staff responsible for placing orders are very busy at some times and have very little to do at other times. The perpetual system which, in theory, is more precise and more efficient, relies on a good information system with inventory records accurate and up to date.

The researchers used simple heuristic techniques to suggest the most reasonable system for Dominica. Given the staff available at CMS, the quality of the information system, and the probability that consumption patterns would change as supplies became more available, they suggested a modified optional replenishment system. Specified reorder levels for each item would be checked at pre-determined reorder intervals; but in addition minimum stock levels would be set as a secondary control point, to be monitored between the formal review periods.

The newly acquired microcomputer in July 1984 was a big help in calculating monthly consumption figures which were needed for establishing minimum stock and reorder levels for each item. (Stock levels are best defined in terms of numbers of months of consumption.) Every inventory item was entered into the computer, as well as its beginning and ending stock level and receipts over the past fiscal year, in order to determine its average monthly usage for that year. Researchers suggested that reorder levels be set at six months (assuming two months' safety stock and four months' lead time for resupply), and that each time an order was placed six months' worth be ordered. It was suggested that the reorder level for each item be recorded on the Kardex. At the end of each month the reorder level should be compared to the current balance for each item and a list developed of the items that needed to be reordered. These reorder level and reorder quantity decisions were made without accurate and complete data on either consumption or lead times, but were based on past experiences with supply systems in other countries. It was suggested that monthly consumption figures, and thus reorder levels, be recalculated every three months, and that supplier lead times be monitored.

The first systematic plan for a major procurement was made in August 1984, once the complete inventory list was on computer. Current stock levels were converted into months of consumption, and the list was sorted by the number of months of consumption on hand: it ranged from zero to well over two hundred (or well over ten years' worth of stock on hand)! Items with six months on hand were at their reorder level and needed an order to be placed for six months' worth. Those with five months on hand needed six months plus one month, or seven months' worth to be ordered, and so on. The quantities to be ordered and the value of each (using the current average unit cost) was easily calculated by computer, and indicated the need for an immediate order of 300 items out of a total of 763, for a total value of EC\$491,000! (See sample printout of Reorder file in Figure 28.)

Figure 28

FEORDER LEVELS AS OF 30 JUNE 1984

NO.	FORM	CODE	GENERIC NAME	STRENGTH	FORM	UNIT COST	STOCK ON RECEIPTS			USSEE	MONTHLY CONSUMP	MONTHS ON HAND	TOTAL COST	MONTHS IN STOCK	MOS. TO ORDER	QNTY TO ORDER	COST OF ORDER
							1/78	9/84	30-6/84								
76	000075	paracetamol	500 mg	tab	0.0110	55000	83000	13000	12000	19200	0.9	1120.00	7.5	12.1	23100	2547.00	
474	000038	tuberculin (PPD)	U/ml	vac	2.7100	0	50	10	40	10	1.0	108.40	5.0	12.0	115	311.11	
232	000275	water pro injection	20 ml	inj	0.2100	2100	0	200	1900	190	1.1	393.00	12.0	11.9	2270	476.70	
474	000547	diphtheria tetanus(pediatric)		vac	0.9100	250	0	24	226	23	1.1	245.66	12.0	11.9	270	345.52	
497	000124	ignocaine hcl	12 plain	inj	0.5135	729	21	74	676	69	1.1	374.12	12.0	11.9	805	413.26	
103	000127	cytosphosphamide	25 mg	tab	0.8400	2000	0	200	1800	180	1.1	1680.00	12.0	11.7	2100	1197.00	
239	000502	chlorhexidine gluconate	5 i	los.b	132.0500	2	5	1	2	1	1.1	264.10	6.0	11.9	11	1412.72	
257	000412	diphenhydramine expect.	0.25 l	los.a	24.0900	48	0	5	43	4	1.2	1155.44	12.0	11.8	51	2255.67	
151	000229	penicillin V	250 mg	tab	0.0400	21000	36000	7000	50000	6700	1.1	2040.00	16.0	11.6	71000	2840.00	
124	000227	rispericin	300 mg	cap	0.4900	7400	5000	1700	11100	1110	1.1	5451.00	12.0	11.9	12120	6427.70	
75	000079	phenobarbitone	30 mg	tab	0.0079	10500	50000	15000	75000	8400	1.2	10005.00	10.5	11.9	94200	25000.00	
52	000052	hydralazine	25 mg	tab	0.0079	20000	50000	12000	100000	10000	1.2	1580.00	12.0	11.9	121700	5700.15	
306	000462	lassar s paste	500 g	los.b	3.4581	9	17	0	0	2	1.2	31.12	12.0	11.7	0	93.03	
84	000084	potassium chloride	500 mg	tab	0.0270	6500	50500	6500	49500	4950	1.1	1755.00	12.0	11.7	57950	1561.95	
572	000855	gloves disposable	large	sur	0.1400	2000	20000	2600	19400	1740	1.2	278.00	12.0	11.7	22620	3160.80	
47	000047	ferrous sulphate	300 mg	tab	0.0140	0	30000	30000	25000	26400	1.4	3560.00	12.0	11.6	20200	4700.80	
259	000414	ferric ascorbic citrate mix.	1 l	los.a	3.5119	0	13	0	10	2	1.4	45.65	5.5	11.6	25	69.82	
122	000122	penicillamine	250 mg	cap	0.8900	800	0	100	700	70	1.4	627.00	12.0	11.6	610	700.50	
550	000771	M316 (mersill)	4/0	sut	28.4500	24	0	0	21	2	1.4	597.45	12.0	11.6	29	691.34	
252	000407	chloral hydrate mix	1 l	los.a	3.3964	0	4	0.5	3.5	0	1.4	11.89	12.0	11.6	4	13.75	
311	000465	salicylic acid unq. 2%	1 g	los.b	0.0086	2000	11500	2000	11500	1200	1.4	17.20	10.0	11.6	15950	127.40	
184	000322	ergometrine	500 mcg/ml	inj	1.3700	2745	0	350	2395	240	1.4	3231.15	12.0	11.5	2764	2780.00	
631	001265	umbilical catheter		sur	1.0170	0	190	90	100	50	1.5	193.20	2.0	11.5	600	711.75	
727	000485	hydrogen peroxide ear drops	1 ml	los.b	0.0026	900	240	150	990	99	1.5	23.57	12.0	11.5	1127	21.96	
26	000026	chloropropamide	250 mg	tab	0.0260	18000	83000	18000	83000	11067	1.6	2150.00	7.0	11.4	125857	3271.53	
194	000332	iron dextran	50 mg/5 ml	inj	0.3630	1130	0	160	970	97	1.6	352.11	12.0	11.4	1301	392.66	
232	000369	parentrovide IM		inj	2.8600	336	0	48	288	29	1.7	623.68	12.0	11.3	320	923.50	
720	000491	acridiavine lotion	1 l	los.b	0.3155	9	33	6	36	4	1.7	10.71	12.0	11.3	91	12.87	
615	000870	urine bags		sur	0.0250	0	200	100	100	60	1.7	2.50	2.0	11.3	250	6.25	
623	001957	stercocel 3-way		sur	1.2720	0	200	100	100	60	1.7	127.20	2.0	11.3	600	763.46	
168	000305	benztropine mesylate (2 ml)	1 mg/ml	inj	13.4400	736	0	45	282	25	1.7	790.68	12.0	11.2	710	431.98	
682	000802	bandage hose, gauz.	10 cm x 5 m	rot	0.7500	0	7524	1159	6385	606	1.7	9766.75	11.5	11.2	7520	5641.79	
719	000490	eusol/parafin lotion	1 l	los.b	3.4040	1	19	3	17	2	1.7	57.87	12.0	11.2	19	65.02	
653	000808	needle mental long	27g	svr	0.2300	13000	200	2000	11200	1120	1.9	2966.00	12.0	11.2	12550	2898.60	
58	000068	metronidazole	200 mg	tab	0.0170	51250	30000	12500	69750	6975	1.8	1168.75	12.0	11.2	76975	1700.69	
271	000768	xylocaine + epinephrine .2%		inj	0.7300	6000	6200	2200	12000	1200	1.8	6780.00	12.0	11.2	12000	9780.00	
726	000500	calamine lotion	1 l	los.b	2.8351	9	42	8	43	4	1.9	121.91	12.0	11.1	40	175.80	
73	000073	nitrofurantoin	100 mg	tab	0.0110	9500	0	1500	8000	800	1.9	83.00	12.0	11.1	9900	97.90	
520	000741	M482 (plain)	27g	sut	25.3000	38	0	6	32	0	1.9	956.60	12.0	11.1	30	900.63	
717	000474	zinc undecanoate oint	1 g	los.b	0.0137	100	12500	2000	10600	1060	1.9	145.22	12.0	11.1	11780	161.79	
728	000520	ethyl salicylate lipisent 25%	1 l	los.b	16.2112	0	6	1	5	1	1.9	91.06	12.0	11.0	6	89.16	
760	001533	boric eye lotion	1 l	los.b	0.2881	0	3	0.5	2.5	0	2.0	0.72	12.0	11.0	0	0.79	
283	000439	B.I. expect. mix.	1 l	los.a	3.5635	3	26	6	27	3	2.1	91.96	9.5	10.9	0	113.21	
131	000131	nitrofurantoin	50 mg	tab	0.0080	0	6000	2500	3500	1200	2.1	28.00	7.5	10.9	13000	104.80	
53	000067	metformine	500 mg	tab	0.0970	35500	36000	14000	57500	6571	2.1	5577.50	10.5	10.9	71429	6928.57	
317	000478	chloramphenicol eye unq.		los.b	0.3700	288	200	86	402	40	2.1	146.74	12.0	10.9	637	161.54	
51	000051	glyceryl trinitrate	500 mg	tab	0.0450	5500	0	1000	4500	450	2.1	202.50	12.0	10.8	4850	210.25	
715	000471	zinc oxide oint	1 g	los.b	0.0057	7000	20500	5000	22500	2250	2.2	128.25	12.0	10.8	24250	138.23	
217	000354	promethazine	25 mg/ml	inj	1.0500	815	0	150	665	67	2.2	696.25	12.0	10.7	715	750.23	
750	000600	ephedrine nasal drops	1 ml	los.b	0.0012	0	3800	700	3100	310	2.3	3.72	12.0	10.7	3330	4.00	
334	000514	ethylchloride spray		los.b	8.1400	115	100	40	175	18	2.3	1424.50	12.0	10.7	180	1526.25	
116	000116	dextrostix	25 s	strip	21.0500	70	96	31	135	14	2.3	2841.75	12.0	10.7	145	3041.77	
510	000770	W442 (chronic)	0	sut	25.3000	48	0	9	39	4	2.3	956.70	12.0	10.7	40	1055.01	

By the next visit of MSH researchers, many purchase orders had been placed to remedy the shortages that had been identified. The Supplies Management Officer and Chief Pharmacist reported that the computer analysis had been useful mostly as a guideline, but that reorder levels and reorder quantities had been adjusted for individual items based on experience and professional judgment about expected consumption. The computer analysis had been based on past consumption rates, which in many cases would have been significantly higher if stocks had been available. Other computer runs were done, and some changes made in monthly consumption figures for some items and thus in reorder levels.

Regrettably, this procurement system was not kept up. Up-to-date stock level information was not introduced into the computer on a quarterly basis, as required for a quarterly recalculation of monthly consumption figures. The Chief Pharmacist who had assumed the major responsibility for placing orders was on leave in January 1985 and then became preoccupied with setting up more elaborate computer files. Meanwhile, few purchase orders were placed until late spring, and the stockout rate remained unacceptably high -- 25.4% of all items and 20.4% of all first-line drugs (i.e. for primary health care at the district level) by June 1985 -- substantially higher than the year before!

With a Research Associate present in Dominica in the summer of 1985, detailed data on the lead times of various suppliers were collected. The intent was that these figures could be added to the computer file and used to calculate more precise reorder levels (safety stock + lead time) for different items depending on their suppliers. Lead times ranged from 1.0 - 8.6 months, with an average of 2.9 months. (See Figures 29 and 30.)

A further study found, however, that the length of time between the posting of a purchase order to a supplier and receipt of the shipment was not a complete measure of lead time. Data were collected on the length of time between the initial preparation of the purchase order at CMS and the time it was posted. They showed that purchase orders spent an average of 4.1 days at the Ministry of Health waiting to be approved and signed by the Permanent Secretary, and an average of 2.2 days between the time they were approved and the time they were returned to CMS for posting. It was concluded that this processing time must also be considered when calculating lead times in order to determine when orders should be initiated. Hence, as long as purchase orders need to be approved by the Permanent Secretary, lead times should be revised upwards by 6.3 days, or approximately one week.

Although the necessary systems and procedures are available and accessible to staff at Central Medical Stores, they will be of no use in improving the procurement system unless they are followed. By the end of this study there were still too many stockouts, signifying that the modified optional replenishment

Figure 29

DOMINICA REVOLVING DRUG FUND  
PIPELINE ANALYSIS -- PROCUREMENT SEGMENT

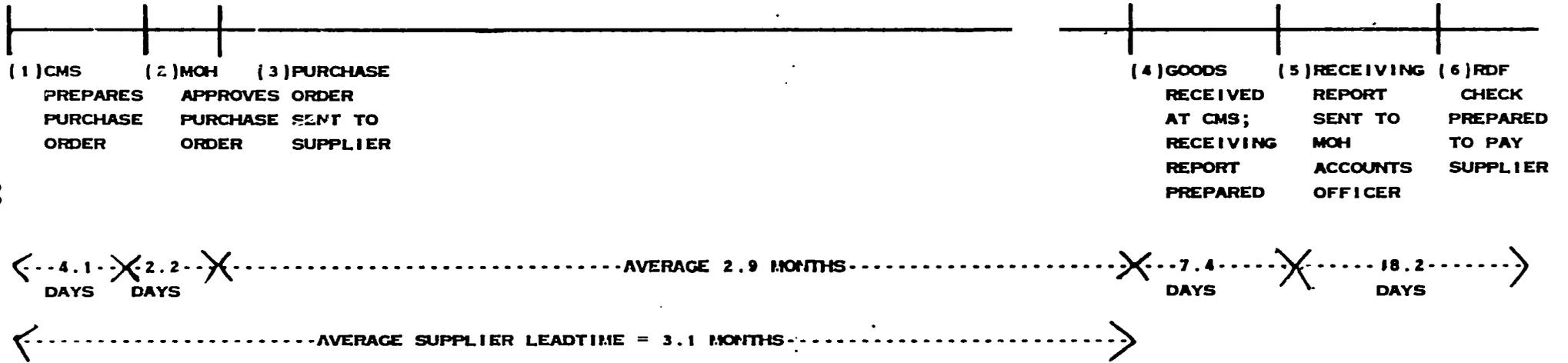


Figure 30

## AVERAGE LEADTIME BY SUPPLIER

SUPPLIER	# OF P.O.s FOR YEAR	AVE LEAD- TIME-DAYS	AVE LEAD- TIME-MONTHS
AMERICAN HOSPITAL	1	130	4.3
AN-MED	3	106	3.5
AS BRYDEN	6	96	3.2
BAXTER TRAVENOL	1	166	5.5
BURROUGHS WELLCOME	1	52	1.7
CARONI	1	79	2.6
COLLINS	9	57	1.9
CPM	6	90	3.0
DOWNS SURGICAL	1	31	1.0
DR. ETZOL	1	34	1.1
ECHO	3	90	3.0
ETHICON	1	51	1.7
FENCOURT	2	138	4.6
GEDDES GRANT	3	49	1.6
HALEWOOD	3	97	3.2
IMPAS	4	89	3.0
KNIGHTS	1	150	5.0
MCCARTHY SURGICAL	1	74	2.5
MILES LAB	1	59	2.0
MISSION PHARMA	3	87	2.9
MUSSONS	1	258	8.6
NOVOPHARM	1	49	1.6
PARKE DAVIS	2	103	3.4
PERIE MEDICAL	4	54	1.8
PHARMACY SALES	2	76	2.5
PHARMANOVA	1	84	2.8
PROSALES	1	62	2.1
ROBINSON	1	99	3.1
SMITH & NEPHEW	3	71	2.4
SQUIBB	3	105	3.5
STOKES & BYNOE	1	38	1.3
SURGIKOS	2	117	3.9
WALLACE	1	122	4.1

procurement system that had been selected as the most appropriate model for Dominica was still ineffective in maintaining an uninterrupted supply. (See Section B.5. on Warehouse/Inventory Management for a more detailed discussion of stockouts.)

b. Obtaining better purchase prices

The goal of obtaining pharmaceutical and medical supplies at lower cost was stated as an early objective of this study -- as one means of decreasing the financial burden on the Government. It became a more focal issue once the Government had decided to postpone consumer cost-sharing. With the Government still financing 100% of the drugs and supplies that were to be provided to patients, greater emphasis was placed on realizing some savings through more efficient procurement. This objective was stated repeatedly by the Minister of Health and the Health Services Coordinator.

Well aware of the frequent small orders and high prices paid for drugs and supplies, Government officials expressed particular interest from the start in obtaining better purchase prices. It was felt that that could be achieved by making efforts to buy in bulk -- the liquidity provided by the revolving drug fund would facilitate that -- and to move to lower cost by high quality generic suppliers. In fact, the Minister and Health Services Coordinator returned from a trip to the World Health Assembly in Geneva in May 1983 with the names of several new suppliers to try -- specifically, IMPAS and Mission Pharma.

The researchers assisted in July 1983 with the costing of all items held in inventory in order to establish baseline data on the unit costs that were being paid for drugs and supplies. (Costing was required for implementation of the MIS/Accounting System; the procedure that was followed is described in that section.) An initial study was undertaken to analyze potential cost savings through selection of lower priced suppliers. Following broad guidelines for ABC Analysis as discussed in Managing Drug Supply (MSH, 1981), the amount spent annually on each item (of tablets and antibiotics) was calculated by multiplying estimated annual consumption, from Kardex data, by unit cost for each item. The items were then ordered in decreasing order of total cost. Then, for each item for which more than EC\$1,000 was spent, researchers investigated other supply sources, mainly by comparing catalogues, to find one that provided that item at a lower unit price. That supplier's unit price was used to calculate an alternative lower total cost for that item.

Preliminary results (included in the Technical Progress Report for July/August 1983 in Annex 3) showed a potential 26.4% savings available for tablets, and 33% for antibiotics. These results were discussed in detail with the Health Services

Coordinator and with the Supplies Management Officer, and gave increased impetus to the search for lower cost supply sources.

Several bulk orders, primarily for high expenditure items from this preliminary study, were placed with the new generic suppliers in the months that followed. By July 1984 researchers were able to report to the Prime Minister that these procurements had contributed a savings of about EC\$43,500 or about 6% of the value of the previous year's procurements. About EC\$37,000, or most of that savings, was attributable to about 15 items which were some of the highest expenditure items held in inventory. Unit costs on individual items had been reduced in some cases up to six-fold. (The July 1983 presentation made to the Prime Minister and her Cabinet is included in Annex 2.)

It was noted that the newly acquired computer would make ABC Analyses very easy to perform. The sample printout shown in Figure 31 is the first page of an ABC computer sort, prepared in July 1984, showing the highest expenditure items for the previous fiscal year; the items for which a lower cost supplier had been identified are checked.

Also in July 1984, a supply registry system was set up in Central Medical Stores, with a card for each item, on which would be recorded historical information on past and all future purchases from different suppliers and their unit costs.

In July 1985, another ABC Analysis was carried out to identify the highest expenditure items in FY84-85. Detailed price histories were traced and analyzed for the A-class highest expenditure items, i.e., the top 39 items that made up 50% of the value of consumption. For these items, prices that had been paid between January 1984, when the first shipments from nonprofit generic suppliers were being received, and July 1985, were compared.

Of the 39 highest expenditure items:

- 17 items (44%) showed price differences of one and a half times or more;
- 13 items (33%) showed price differences of two times or more;
- 8 items (20%) showed differences of three times or more;
- 6 items (15%) showed differences of five times or more;
- 2 items (5%) showed fluctuations of ten times or more.

Most of the price differentials were attributed to changes in supplier, only a few to favorable exchange rates.

While these findings are impressive, they are counterbalanced by the continuing need for emergency shipments at higher prices. The first time each new supplier was used, its lead time had to be estimated, and it was not uncommon for CMS supplies to reach dangerously low levels or even to be stocked out before the new shipments arrived. To respond to these situations, CMS was

Figure 31

CONSUMPTION FY 83-84 ABC ANALYSIS

(run 2/27/84)

DOM. NO.	FORM CODE	GENERIC NAME	STRENGTH	FORM	UNIT COST	STOCK ON 1/7/83	RECEIPTS 83/84	STOCK ON 30/6/84	USAGE 83/84	TOTAL COST	MONTHS IN STOCK
138	000207	erythromycin estolate	125 mg/5ml	susp	34.3870	40	75	42	73	2510.25	12.0
336	000528	jeyes fluid (zotal)		los.b	19.3400	343	0	215	128	2475.52	12.0
543	000764	M773 (chronic)	1	sut	28.4500	260	9	184	85	2418.25	12.0
681	000901	bandage cotton		cot	0.5700	110	7200	3072	4238	2415.66	11.0
152	000221	penicillin V	125 mg/5ml	susp	1.8100	1363	0	58	1305	2362.05	12.0
533	000754	M666 (silk)	3/6	sut	17.4800	222	0	90	132	2307.36	12.0
647	000802	syringes disposable	10 cc	syr	0.6000	3839	0	0	3839	2303.40	6.0
146	✓000215	benzathine penicillin	2.4 MU	inj	0.6800	2377	2628	1626	3379	2297.72	12.0
191	000329	hydrocortisone	100 mg/amp	inj	2.3500	2170	0	1200	970	2279.50	12.0
539	000760	M758 (chronic)	0	sut	26.8500	128	2	46	84	2255.40	12.0
651	000806	needle disposable	23g	syr	0.0910	28148	42000	45500	24648	2242.97	12.0
26	✓000026	chlorpropamide	250 mg	tab	0.0260	18000	83000	18000	83000	2158.00	9.0
544	000765	M775 (silk)	2/6	sut	19.1200	263	0	154	109	2084.08	12.0
689	000909	bandage elastocrepe	7.5 cm x 4.5 m	cot	3.2600	0	960	322	638	2079.88	11.0
695	000915	zinc oxide plaster (paragon)	5 cm x 5 m	cot	3.3900	0	864	260	604	2047.56	11.0
141	000210	streptomycin	1 g	inj	0.3500	48860	100	43120	5840	2044.00	12.0
289	000445	tedral elixir		los.a	16.7900	91	140	110	121	2031.59	12.0
93	✓000093	propranolol	40 mg	tab	0.0200	12850	187000	98500	101350	2027.00	10.5
702	000922	op-tulle (paraffin)	10 cm x 10 cm	cot	3.9800	756	0	249	507	2017.86	12.0
151	✓000220	penicillin V	250 mg	tab	0.0400	21000	36000	7000	50000	2000.00	10.0
648	000803	syringes disposable	20 cc	syr	1.1800	2650	0	1000	1650	1947.00	12.0
541	000762	M763 (chronic)	2	sut	29.0600	164	0	98	66	1917.96	12.0
650	000805	needle disposable	25g	syr	0.1200	37375	325	21750	15950	1914.00	12.0
471	000635	insulin zinc monotard (pork)		vac	12.8700	385	100	259	146	1879.02	12.0
144	✓000213	ampicillin	500 mg	inj	0.5630	2070	1400	250	3220	1812.86	12.0
286	000442	salbutamol elixir		los.a	11.7400	58	100	4	154	1807.96	12.0
142	✓000211	tetracycline Hcl	250 mg	cap	0.0280	35400	14000	114500	63400	1775.20	9.0
688	000908	bandage elastocrepe asst.		cot	2.5000	74	771	268	677	1692.50	12.0
273	000428	re-hydration salts		los.a	0.1300	1675	2700	17750	12925	1680.25	12.0
157	000226	griseofulvin	500 mg	tab	0.2200	39000	0	31500	7500	1650.00	12.0
135	000204	chloraamphenicol	1 g	inj	0.7000	189	150	102	237	1587.90	11.0
105	✓000105	co-trimoxazole	480 mg	tab	0.0510	17000	14000	1000	30000	1530.00	10.5
690	000910	bandage elastocrepe	15 cm x 4.5 m	cot	6.3300	0	240	0	240	1519.20	10.0
123	000123	cyclophosphamide	25 mg	tab	0.8400	2000	0	200	1800	1512.00	12.0
672	000826	syringe tuberculin disposable	1 cc	syr	0.2670	0	16000	10470	5530	1476.51	11.5
181	000319	dioxhydrate	50 mg/ml	inj	6.5300	105	120	1	224	1462.72	10.0
316	000477	nystatin cream		los.b	4.3400	127	400	192	335	1453.90	12.0
334	000514	ethylchloride spray		los.b	8.1400	115	100	40	175	1424.50	12.0
540	000761	M762 (chronic)	1	sut	28.4500	118	1	69	50	1422.50	12.0
225	✓000362	thiopentone sodium	1 g/vial	inj	1.0800	940	1500	1150	1290	1393.20	12.0
173	000311	chlorpromazine	50 mg/ml	inj	0.3700	6230	898	3450	3678	1360.86	12.0
84	000084	potassium chloride	600 mg	tab	0.0270	5500	50500	6500	49500	1336.50	12.0
76	✓000076	paracetamol	500 mg	tab	0.0110	55000	83000	18000	120000	1320.00	7.5
74	000074	norethisterone	5 mg	tab	0.5400	3000	0	600	2400	1296.00	12.0
158	000227	nystatin	.5 MU	tab	0.1920	6800	5000	5100	6700	1286.40	12.0
343	000536	framygen eye drops		los.b	9.1000	144	0	3	141	1283.10	12.0
49	000049	furosemide	40 mg	tab	0.0130	97250	6000	5000	98250	1277.25	12.0
103	000103	stilboestrol	500 mcg	tab	0.1300	23000	0	13200	9800	1274.00	12.0
3	✓000003	acetylsalicylic acid	300 mg	tab	0.0060	207500	100000	101500	206000	1236.00	12.0
8	000008	amtryptiline	25 mg	tab	0.0270	93000	0	48000	45000	1215.00	12.0
148	000217	cloxacillin	250 mg	cap	0.1030	6300	6450	1000	11750	1210.25	12.0
145	✓000214	ampicillin	125 mg/5ml	susp	1.6200	6	2721	1993	734	1189.08	9.0
275	000431	multivitamin syrup + iron		los.a	45.2500	42	0	16	26	1176.50	12.0

forced to place emergency orders for small quantities with the familiar and dependable but very expensive suppliers nearby. These trends continued toward the end of the study. Figure 32 shows the relative proportions of total purchases from each of four categories of suppliers for FY83-84, FY84-85, and the first half of FY85-86. While there was a steady increase in the relative share of purchases from non-profit generic distributors (e.g. ECHO, IMPAS, Mission Pharma), and purchases from manufacturers had dropped by fully half, the share from for-profit distributors (most notably a few located on Barbados) had grown to nearly 50% of all purchases by December 1985! (Detailed data on receipts from all suppliers between July 1983 and December 1985 are included in Annex 4.)

Figure 32

	<u>FY83-84</u>	<u>FY84-85</u>	<u>FY85-86</u>
A	16.22%	19.17%	24.20%
B	15.04%	11.21%	7.17%
C	46.75%	24.87%	22.56%
D	22.00%	44.75%	46.07%

KEY: A - Nonprofit/Generic/Distributor  
 B - Forprofit/Generic/Manufacturer  
 C - Forprofit/Brandname/Manufacturer  
 D - Forprofit/Generic & Brandname Distributor

This trend -- of significant advances accompanied by frequent setbacks -- is equally evident in the changing average value of receipts between July 1984 and December 1985. These data suggest a slight but definite trend, in spite of the intermittent lapses, toward bulk orders. (See Figure 33.)

On the last visit of MSH researchers to Dominica in March 1985, a brief analysis was undertaken to determine whether the overall trend -- given the large orders from non-profit generic suppliers and the continuing emergency orders -- was toward lower purchase prices. Researchers costed a "market basket" of drugs and supplies (determined by eliminating any items with missing data points from the CMS inventory list) using CMS average unit costs at six different time periods. When a 4% inflation rate was assumed, the cost of this market basket of goods was EC\$12,000 lower in December 1985 than in June 1984. (See Figure 34.)

Researchers conclude that this progress is very promising. As consumption rates stabilize, and as better data become available on supplier lead times, more reliable procurement planning will be possible. The need for emergency shipments should continue

Figure 33

# TREND IN AVERAGE VALUE OF RECEIPTS

JULY '84 - DECEMBER '85

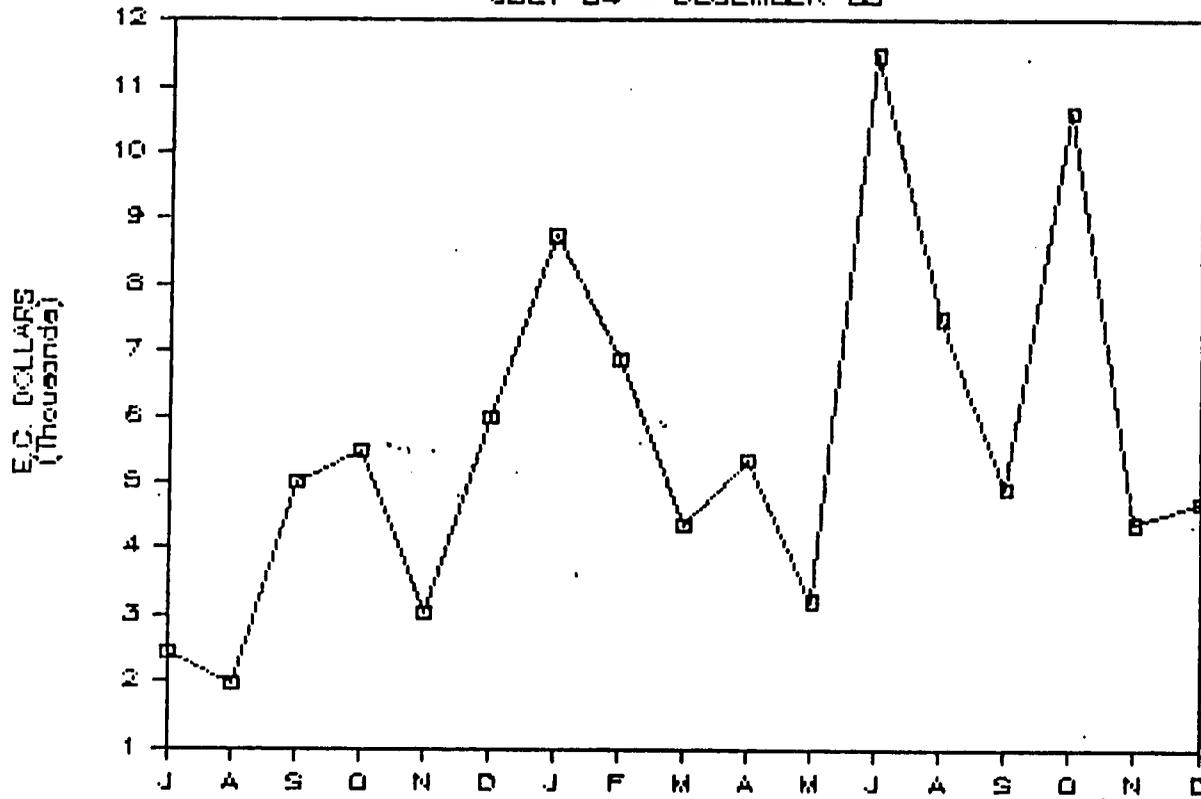
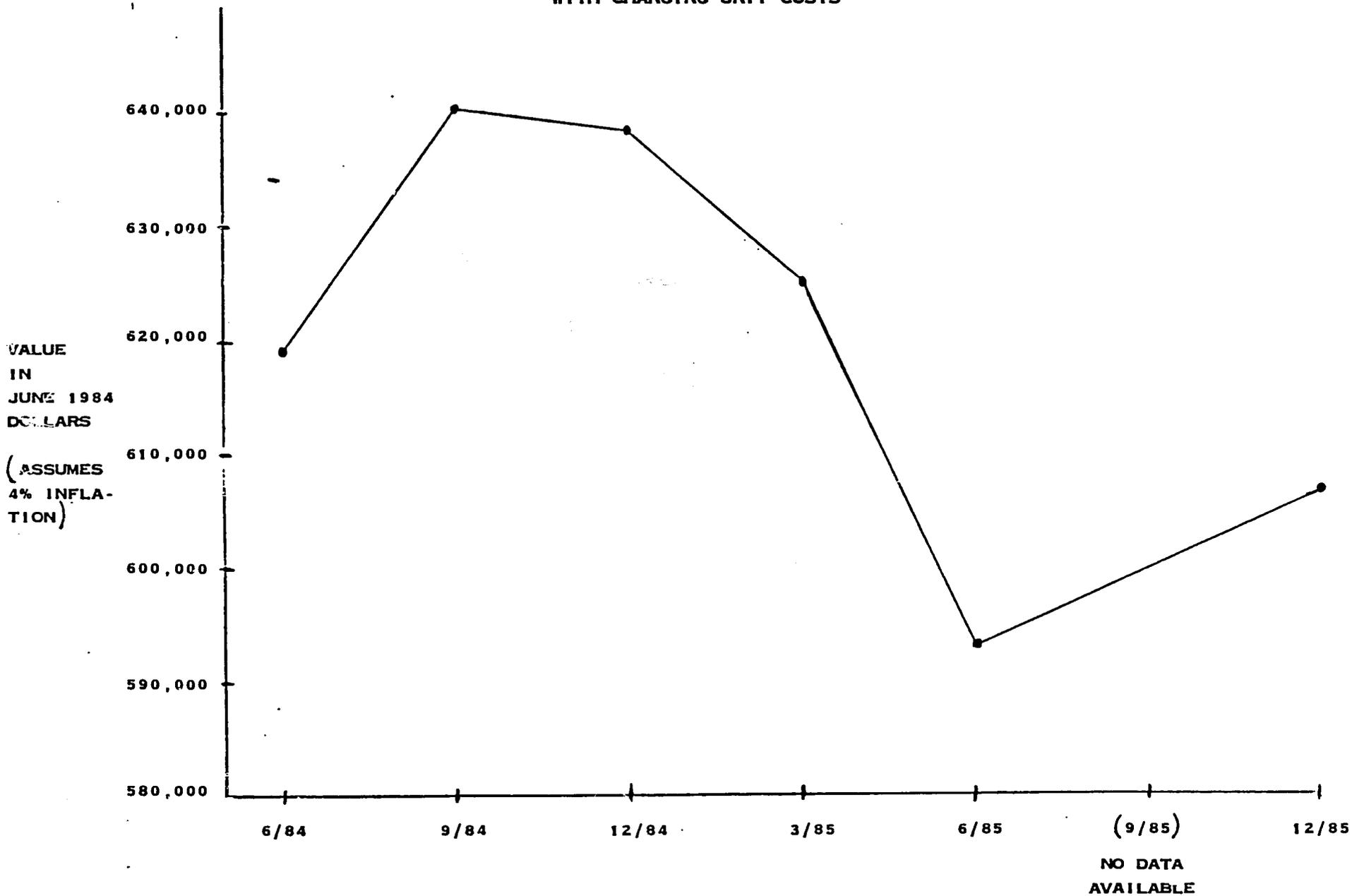


FIGURE 34

CHANGING VALUE OF "MARKET BASKET" OF DRUGS/SUPPLIES  
WITH CHANGING UNIT COSTS



to decrease, and unit cost savings achieved through the non-profit generic suppliers should have an increasing impact.

#### c. Supplier contracts

The efforts to improve procurement planning and to locate lower cost suppliers prompted greater interest among Ministry officials and particularly the Supplies Management Officer in assuring the quality of products purchased. CMS had occasionally received damaged or expired goods but had not always been confident in its rights to return them. (In another instance, due to an error that had been made on a purchase order, ten times the desired quantity of streptomycin had been received and not returned; this ultimately was a significant financial loss for the revolving fund.)

In mid-1984, once the major RDF systems -- Finance and MIS/Accounting System -- were set up and functioning satisfactorily, attention turned to this matter. Researchers suggested that more detailed procurement specifications be printed on purchase orders, e.g., specification of expiry date, packaging, notification of delivery, and guarantees of quality. A set of sample contract terms, based on those used by the Barbados Drug Service, were prepared which could be adapted for Dominica and submitted to suppliers with purchase orders. (These sample contract terms are included in Annex 3.) The Supplies Management Officer picked up another sample purchase order which included contract terms on a trip to the United States, one used by a U.S. hospital. However, by the end of the study, contract terms were still not being specified in Dominica's drug orders.

#### d. Port-clearing

In the drug supply system that existed before the Government decided to implement an RDF, drugs and medical supplies arrived at the port and often spent up to eight weeks there before being cleared. In fact, in July 1983, drugs and supplies valued at EC\$153,287 were being held at the port; this represented 19% of the value of all payments for drugs and medical supplies in the previous fiscal year. These problems were due to administrative delays and often cash flow problems within the Treasury; money was simply not available to pay suppliers promptly, and thus supplies were not released. The fact that suppliers were requiring payment before goods were released was probably due to Dominica's poor track record in making prompt payments. The Ministry was caught in an unfortunate cycle. The consequences of this were not only unavailability of supplies that were planned for and needed, but also increased storage fees at the port, and reduced shelf life of drugs once they were received, as they were nearer their expiry dates. At the same time, suppliers who were paid late became less and less willing to offer favorable terms in the future.

One expectation of the RDF was that there would always be sufficient funds in liquid form to pay suppliers and clear supplies promptly. Over the period of this study, data were collected to determine whether, in fact, this was happening.

The value of rent fees charged at the port was considered one good indicator of rapid port-clearing; the longer supplies were held at the port, the higher the rent fees. Because rent was lumped with handling fees (called tailgate fees) in the port's billing and record-keeping system, researchers looked at the value of rent and tailgate fees over the life of the study. While they averaged EC\$616 per month in FY82-83 before the Fund was set up, they dropped to EC\$266 per month in FY83-84, to EC\$137 per month in FY84-85, and EC\$104 per month in the first six months of FY85-86! This indicates remarkable improvements in the effectiveness and efficiency of port clearing.

Nonetheless, as discussed in Section III.B.1. on Finance, the Fund's cash balance was very low toward the end of FY84-85 and throughout the first half of FY85-86. With EC\$100,000 tied up in a Certificate of Deposit, it was not uncommon for the liquid cash balance to be nearly zero. This, naturally, has delayed supplier payments, and, for those suppliers requiring payment before goods are released, it has delayed port clearing as well.

Delays experienced in clearing supplies from the port are a reversion to pre-RDF problems. If the RDF is not providing sufficient liquidity for prompt payments, one of its most important benefits is not being realized. This is a problem that the Ministry must address as soon as possible.

#### Testing of Procurement submodel

At the end of the study, researchers believe that the Procurement submodel is feasible, and also somewhat effective and efficient in supporting RDF goals. The modified optional replenishment purchasing model has not yet proved itself to be workable in the Dominica context, but remarkable progress has been made in moving toward bulk orders from non-profit generic distributors and in expediting port clearing. Continuing problems have to do with the difficulty in accurately estimating order quantities, due to the unreliability of past consumption figures for forecasting demand, the unavailability, until recently, of accurate supplier lead time data, the failure to establish contract terms with suppliers, and a low cash balance in the RDF, delaying supplier payments.

Resolution of these problems will require continuing focused attention from Ministry officials. Until the Procurement submodel is more consistently effective in making supplies available, researchers believe that it is unrealistic that a Phase II RDF incorporating drug charges will be acceptable to consumers.

## 5. Warehouse/Inventory Management

Warehouse and inventory management is an important element of the materials management in a revolving drug fund. In order for a constant and reliable supply of goods to be available, they must be not only procured but also stored properly and must flow through the system smoothly reaching users before they are expired. In an ideal warehouse and inventory management system, materials are stored in a well organized manner in the warehouse and remain on the shelves for a consistent period of time, as safety stock and then as working stock, and finally are distributed.

In the pre-existing drug supply system in Dominica, the system of warehouse and inventory management was functioning, but not as effectively and efficiently as it might have been. The warehouse was badly in need of repair, shelves were overcrowded and somewhat disorganized, the first-in-first-out (FIFO) system was not strictly observed, there were stockouts of some items and overstocks of others, and there were more than a few expired items. One objective of this study was to develop procedures which would make this system more effective and efficient, and, if possible, to define optimal minimum and maximum stock levels for CMS.

This was not one of the study components that received priority attention; however, once the major systems of Finance, MIS, and then Procurement were underway, attention naturally turned to warehouse and inventory management issues. The new cost accounting procedures underscored the importance of careful materials accounting and of stock rotation, with greater attention to expiry dates. The Government took new interest in the physical conditions of CMS and undertook major repairs in the spring of 1984. Broken louver windows were replaced, dropped ceilings were put in, an air conditioner was installed in the room with antibiotics, all interior walls were painted, and new divider walls were constructed to close off and separate office space. In addition, an extension to CMS was planned. (This extension was finally completed in the late spring of 1985.)

Researchers assisted the Ministry in making improvements in warehouse and inventory management procedures, first at the central level, and later within the pharmacies of peripheral facilities and district health centers.

The major operational issues that were addressed during this study and which are discussed in the following pages are as follows:

- Implementing the use of Bin Cards
- Decreasing stockouts
- Decreasing overstocks
- Stock rotation and the management of expiry dates
- Introducing inventory management procedures at the district level

a. Implementing the use of Bin Cards

When researchers first visited Central Medical Stores in May and again in July 1983, Bin Cards were being maintained but at the desk of the current Storekeeper and not on the shelves. The Storekeeper, however, was well aware of appropriate warehouse management practice, and by January 1984 the Bin Cards had been placed on the shelves and were up to date. Researchers conclude that the increased attention to the supply system as a whole was a motivating factor. The Bin Cards have remained on the shelves and have been well maintained throughout the period of this study.

b. Decreasing stockouts

One of the most important measures of the effectiveness of a drug and supply distribution system is its ability to maintain stock levels to meet demand. Conversely, the frequency or rate of stockouts is a measure of ineffectiveness of the supply system. As early as the first visit of MSH researchers to Dominica in May 1983, the Minister of Health mentioned that decreasing stockouts and thus improving service delivery was very important to the Government. This was especially significant since the Government would be facing elections within two years, and the provision of health services would be an important issue.

Researchers proposed that the stockout rate was dependent on two variables, as follows:

Stockouts = f(order not placed; order placed but not received)

The latter can be due to a miscalculation of supplier lead times or to delays in port-clearing; both of these are procurement issues and were discussed in the Procurement section.

The failure to place an order, however, while inextricably intertwined with procurement practices, is not wholly a procurement issue. In a perpetual or modified optional replenishment procurement system (see Procurement Section), it is the inventory management practices which determine whether low stock levels are identified and which trigger reorders.

Bin Cards were on the shelves of Central Medical Stores by January 1984 to assist in the identification of low stock levels and impending stockouts, but no procedure existed for reporting low stock levels, or for placing new orders. In July 1984 researchers suggested a preliminary model for inventory management based on conventional inventory management principles and experiences in other countries. It was suggested that safety stock levels be set at two months' usage within CMS, and reorder levels set at six months. (This was discussed in greater detail in the Procurement Section.) It was suggested, and the Supplies Management Officer agreed, that both the

Warehouseman, as he was placing items on or taking items off the shelves, and the Clerk, as she was making entries in the Kardex, would watch the reorder level and report the items that needed to be reordered. But this procedure was never fully implemented.

Researchers had estimated the stockout rate at CMS at approximately 30% when they set up the RDF accounting system in January/February 1984. There were stockouts of paracetamol, tetracycline, methyldopa, chlorpropamide, and catheters, and aspirin and ampicillin were in low supply. But by June 1984, following receipt of the first large orders placed with non-profit generic suppliers in Europe, the stockout rate was measured at 10.8% of all items, 10.4% of all drugs, and 8.6% of all "first-line drugs," those drugs used primarily for primary health care delivery at the district level -- for a 90% service level. In the 18 months that followed, however, stockouts within CMS increased dramatically, as shown in Figure 35 -- to over 25% of first-line drugs! This was the period during which improved procurement and inventory management procedures needed to be not only initiated, but also maintained, and they were not.

Figure 35

STOCKOUT RATES AT CMS

	12/31/83	6/30/84	6/30/85	12/31/85
% of all drugs/supplies out-of-stock	30%	10.8%	25.4%	23.8%
% of all drugs out-of-stock	30%	10.4%	24.6%	25.6%
% of all first-line drugs out-of-stock	30%	8.6%	20.4%	25.2%

Over a six month period in FY84-85, researchers undertook a study to compare what districts and health facilities requisitioned from CMS to what they actually received, as a measure of CMS service level. As shown in Figure 36, CMS was providing 74.7% of what these facilities were requisitioning. While this is undoubtedly a crude measure, since facilities continued to requisition items they had not received the previous month, it emphasizes that CMS performance was much less than optimal. In fact, this figure corresponds as expected to the stockout rate of 25.4% found at CMS.

Figure 36

## COMPARISON OF REQUISITIONS AND ISSUES

MONTH	TOTAL VALUE OF REQUISITIONS (EC\$)	TOTAL VALUE OF ISSUES (EC\$)	ISSUES AS % OF REQUISITIONS
December, 1984	84,340	55,100	65.3%
January, 1985	135,564	95,063	70.1%
February, 1985	103,098	80,671	78.2%
March, 1985	87,167	68,330	78.4%
April, 1985	121,016	96,245	79.5%
May, 1985	112,686	85,288	75.7%
	-----	-----	----
TOTAL 6 mos	643,871	480,697	74.7%

Researchers conclude that continuing stockouts are due to inefficiencies in both procurement and inventory management practices as efforts were focused elsewhere. Nonetheless, this is a major threat to the RDF system in Dominica. Reducing stockouts must be the focus of immediate attention by CMS staff if the supply system and the RDF is to be effective in making supplies available.

Once the system is effective, greater efficiencies in inventory management might be achieved by setting safety stock levels more optimally, balancing the cost of maintaining safety stocks against the risk of stockouts. Differential safety stock levels might be set for different items, e.g., higher levels for very essential items (according to the VEN classification as discussed in Managing Drug Supply, MSH, 1981) and lower levels for less essential items for which stockouts would be less critical.

### c. Decreasing overstocks

The occurrence of overstocks in a supply system is not necessarily an indication of an ineffective system -- since needed supplies may be available -- but of an inefficient system -- because funds are tied up unnecessarily. Early in this study a number of overstocks were noted in CMS: Over 89 types of sutures were being held in inventory, many of which were never requisitioned, 105,000 disposable needles which the Storekeeper estimated as at least 3 years' supply, 60,000 units of streptomycin ordered by mistake when 6,000 were required, and a stock of 50-dose vials of polio vaccine when the Island-Wide Immunization program used only 20-dose vials. These are only a few examples.

A computer sort of the inventory list on 30 June, 1984 showed that 254 items out of a total of 647 on the inventory list, or 39.3% of all items, were overstocked. (An overstock was defined as over 8 months' supply, using the inventory management principles that researchers had proposed.)

Researchers discussed with the Supplies Management Officer methods for decreasing the level of overstocks within the system. Improved procurement planning would avoid further overstocks in the future. And current overstocks might be reduced by informing physicians of overstocked supplies. The Supplies Management Officer prepared a memo for distribution to physicians regarding the types of sutures that were held in stock and urging them to requisition them and use them if possible. It is not known whether there was any response.

These problems were not given priority attention since it was felt that they were secondary to issues of supply effectiveness.

d. Stock rotation and the management of expiry dates

On their first tour through CMS, MSH researchers noted that supplies were not stored in a first-in-first-out (FIFO) manner, that newer supplies were sometimes located on shelves in front of, often hiding, older supplies, and that the older supplies were in many cases expired.

With the implementation of the new cost accounting system in February 1984, CMS staff began to recognize the importance of stock rotation and using drugs before they expired, so that they would not be written off as a financial loss. At that time the FIFO system was announced as standard procedure, and although FIFO should go a long way toward avoiding expired drugs, expiry has continued to be a problem. During the physical inventory taken in July 1985 it was discovered that at least seven drugs had been issued during the past year after they had expired.

At the end of the study the Supplies Management Officer was investigating various systems for monitoring expiry dates. Given the urgency of other operational issues more critically involved with keeping the RDF intact, this was not given priority attention by researchers.

e. Introducing inventory management procedures at the district level (II)

On their first tour through CMS, MSH researchers visited a number of district-level pharmacies on their first visit to Dominica in May 1983, and noted that they suffered from a lack of shelving and adequate storage space, and had no established procedures for inventory management. With the decision to postpone consumer cost sharing and to implement first a transitional Phase I RDF, however, researchers made the

Figure 37

OBSERVATION VISITS

QUESTION:	ROSEAU	ST. JOSEPH	PORTSMOUTH	MARIGOT	GRAND BAY	LA PLAINE	CASTLE BRUCE
Are bin Cards present?	Yes	Yes	Yes	Yes	Yes	At homes of pharmacists	Yes
Are they up to date?	No	Yes	No	Yes	Yes	--	Yes

DISTRICT SURVEY FOR PHARMACISTS

Are you keeping bin cards?	No	Yes	Yes	Stopped in Sept; but new pharm. took stock and is maintaining them			
Are they useful or not?	If kept well it should be useful for stock control	Yes	Yes	--	Yes	Yes	Very useful
Why, or why not		can process requisition quicker	able to get stock levels	--	--	stock balance and usage	Able to determine quantity to order; know what stock levels are

conscious decision that attention to inventory management at the central level should precede efforts at the district level, simply because once supplies reached the district level they were outside the Phase I RDF.

Nonetheless, a year later in August 1984, complaints from the Matron's Storeroom at Princess Margaret Hospital (PMH), with regard to their difficulties in getting needed supplies from CMS, indicated that inventory management procedures were needed there. A seminar was held with PMH nurses to explain the RDF system, following which two staff members from CMS went to the Matron's Storeroom to set up Bin Cards.

The Supplies Management Officer and Chief Pharmacist expressed interest in introducing Bin Cards in all district and facility pharmacies. Although researchers were still focusing their primary attention on central-level systems, the Chief Pharmacist went ahead. He designed new Bin Cards for district facilities and introduced them in October 1984. (This is discussed in more detail in the MIS Section.) There was intermittent follow-up over the next year, but by December 1985, five of seven district pharmacists reported when asked that they found the Bin Cards useful. Their responses are shown in Figure 37. The complete survey that was carried out with district physicians, doctors, and nurses is included in Annex 5.

#### Testing of Warehouse/Inventory Management submodel

At the end of the study period, researchers conclude that there is no evidence to suggest that the Warehouse/Inventory Management submodel was infeasible. It was not as effective as it could have been, however, in making supplies available to health districts and facilities, as exemplified by the continuing high rate of stockouts. Reorder levels and safety stock levels were not being respected. Continuing problems with overstocks and expired items suggest that it was not efficient. Warehouse and inventory management procedures were much more ad hoc than systematic.

These central level problems must be resolved before inventory management in peripheral facilities (Phase II) can be expected to be effective or efficient.

## 6. Distribution

Distribution is an important element of the materials management component of a revolving drug fund. It involves the outflow of material supplies from the system, specifically the movement of drugs and supplies from Central Medical Stores to the users. Its counterpart in the RDF is the flow of funds back into the system. In order for the RDF to function effectively and efficiently, not only must the funds be managed well, but also the inventory must be procured, stored, and distributed according to systematic procedures.

Drugs and supplies were being distributed to 11 user facilities in a single-tiered distribution system even before the RDF was set up, but there were weaknesses in the system. Requisitions from all facilities were received at CMS on approximately the 25th of each month (following a procedure established by CMS), and the filling of these requisitions took the better part of the next month. Some facilities waited three days for their supplies, others nearly three weeks. Shipments were usually picked up by someone from the facility who came into town; if the shipment was not ready, he waited, if the shipment was ready but no one was there to pick it up, the supplies waited. Given this somewhat unsatisfactory system, emergency requisitions and issues were very common.

Although models of effective and efficient distribution systems were available to researchers, and the decision variables known, it was not evident what the values of those variables should be to produce the optimal model for Dominica. Operations research techniques were used to develop that model and to monitor the development and testing process.

The operational issues that arose and were addressed during this study included the following:

- Unit of distribution
- Scheduling of distribution
- Backordering procedures and communication with districts
- Returns/exchanges from districts (II)

### a. Unit of distribution

One of the first operational decisions to be made in the reorganization of any supply system is the unit in which supplies will be distributed throughout the system. This is also the unit in which all transactions will be recorded, in order to bring consistency and integrity into the information system and reduce the chance for error. In a drug supply system the unit might be either tablets or bottles of 1000 tablets, for example, or vials or boxes of 100 vials. The choice of unit depends on a number of factors, but whatever alternative is chosen must become convention throughout the system.

In Dominica a major constraint was the Government's original intent to introduce consumer charges for drugs. Drugs are usually distributed to patients through public-sector facilities in courses-of-therapy (COTs), a set number of tablets or a single injection, for example, rather than single tablets. This suggested, through a simple heuristic approach, that drugs should be traced through the system as either courses-of-therapy or as the smallest possible unit, i.e., tablets, as the lowest common denominator. The decision was made to "cost" drugs according to the smallest unit; this issue was discussed more fully in the MIS Section.

In the first months of the study, when the Ministry's intent was to move directly toward institutionalizing consumer cost sharing, the researchers assisted the Ministry in evaluating the potential costs and benefits of COT packaging. They prepared a discussion paper on this issue, which is included in Annex 3. The benefits, adapted from Managing Drug Supply (MSH 1981), were outlined as follows:

- Safer, easier, and faster distribution of drugs with less room for error. This frees the dispenser from routine counting chores and permits more time for communication with the patient. This is particularly important at lower levels of the health system.
- Easier and more accurate record-keeping, with better control over drug supplies and funds. This is particularly important at lower levels of the health system.
- Greatly facilitated storage and distribution, by minimizing the amount of bulk stock tied up in peripheral health centers.
- Less deterioration of drugs due to adverse environmental conditions. Prepackaged drugs may remain unchanged for up to two years, while bulk drugs may deteriorate earlier due to high heat and humidity, once the bulk container has been opened.
- More accurate and efficient prescribing by all health workers, as they have available the exact amount of drugs needed for a course of therapy. Less writing is required from lower level health workers.
- Increased likelihood that patients will take the drugs as prescribed for the proper period of time, and decreased tendency by health personnel to prescribe only partial therapeutic doses when drugs are in short supply.

MSH researchers felt from experiences in other countries that course-of-therapy prepackaging was virtually essential in revolving drug fund programs to sufficiently simplify the accounting process. They arranged for several Ministry officials to visit an MSH project in Haiti where an RDF and COT packaging operation were in operation. Although interested, the Dominican

officials were concerned about the costs of setting up a COT operation and the recurrent labor costs of maintaining it. MSH researchers had begun to research the costs of alternative methods of COT packaging when the Government decided to postpone drug sales, making this decision a less critical issue. Although Ministry officials continued to be interested in considering COT packaging as the unit of distribution and the unit of costing under a drug sales program, it was given no further attention during the study period.

#### b. Scheduling of distribution

The receipt of requisitions at CMS from all user facilities at the same time each month produced a situation which was sub-optimal for these facilities, and, it was hypothesized, contributed to the high number of emergency orders, and was inefficient for CMS due to the uneven workload that resulted. The Chief Pharmacist had introduced a staggered schedule for requisitions to the Compounding Section (which continued to receive separate requisitions throughout the study period). This concept was appealing to the new Supplies Management Officer, who took over early in 1984, but it did not receive attention until the Phase I RDF's central-level Finance and MIS systems were in place.

In May 1984 the Supplies Management Officer began to give serious attention to this issue. She felt that staggering requisitions from the various user facilities would not only even out the workload over the month but would also decrease the turnaround time for filling orders. It was felt, too, that it was realistic to establish a schedule for a known number of requisitions -- two per month from the Princess Margaret Hospital Pharmacy, and one per month from all other facilities, for a total (including separate requisitions to the Compounding Section) of 22 routine requisitions per month. With fewer stockouts at CMS, it was expected that routine requisitions would be filled to districts' greater satisfaction, and the number of "emergency" requisitions would thus decrease.

By August 1984 the Supplies Management Officer had devised a staggered schedule for requisitions from and issues to the various facilities. Each facility was given a specific date for submitting its requisition and a date two days later when it could expect its shipment. All requisitions were scheduled for the first three weeks of the month, leaving the fourth week open. MSH researchers expressed concern that this system might be tighter and stricter than was optimally efficient, but the SMO decided to go ahead with implementing it.

A year later, the staggered schedule seemed to be working relatively well; however, it was not accepted enthusiastically by all members of CMS staff. Its main effect on staff was that they were occupied with the same routine of filling orders throughout the month in order to keep to the schedule; they had very little flexibility to batch tasks, for example, which resulted in a

Figure 38

NUMBERS OF SIV'S BY MONTH

	ROSEAU	PORTSMOUTH	MARIGOT	GRAND BAY	LA PLAINE	CASLTE BRUCE	ST. JOSEPH	PMH	APU	LAB	DENTAL	DISTRICT TOTAL AVG./MONTH	AVG NO. PER MONTH
<b>1983-84</b>													
JULY	4	3	4	2	2	2	2	2	7	1	3	2	32
AUGUST	5	7	3	3	3	2	1	4	13	3	2	1	44
SEPTEMBER	3	4	2	2	2	1	2	4	7	1	1	1	28
OCTOBER	7	3	3	3	3	3	2	3	11	3	2	1	41
NOVEMBER	3	5	2	3	1	4	3	3	12	1	2	1	37
DECEMBER	3	3	3	2	2	2	1	2	9	3	1	1	30
JANUARY	3	6	1	3	2	3	3	3	12	2	1	1	37
FEBRUARY	3	5	2	2	2	2	3	2	11	2	4	4	40
MARCH	2	5	2	3	5	1	3	3	9	3	2	1	36
APRIL	3	4	3	2	3	5	3	3	6	2	1	2	34
MAY	4	3	2	4	2	5	4	4	7	2	1	1	34
JUNE	2	5	3	3	4	2	3	3	7	2			31
<b>TOTAL</b>	<b>42</b>	<b>53</b>	<b>30</b>	<b>32</b>	<b>29</b>	<b>31</b>	<b>36</b>	<b>111</b>	<b>25</b>	<b>19</b>	<b>16</b>	<b>424</b>	<b>35</b>
<b>1984-85</b>													
JULY	5	2	2	4	3	3	3	3	11	1	1	2	37
AUGUST	4	4	3	5	2	2	3	3	3	2	3	1	34
SEPTEMBER	3	4	3	2	2	4	3	3	6	1	2	1	31
OCTOBER	4	2	2	3	2	2	4	4	8	1	1	2	31
NOVEMBER	4	3	3	2	2	5	4	4	8	1	0	1	33
DECEMBER	3	2	2	3	2	0	2	2	8	1	1	2	26
JANUARY	2	3	3	2	4	4	2	2	13	2	1	2	38
FEBRUARY	3	5	4	3	3	2	2	2	6	1	1	2	32
MARCH	2	3	4	3	2	4	2	2	4	1	1	2	28
APRIL	6	5	2	5	6	5	5	5	10	2	1	1	48
MAY	4	4	3	3	4	2	4	4	12	2	1	2	41
JUNE	3	3	5	2	4	4	3	3	4	4	1	1	34
<b>TOTAL</b>	<b>43</b>	<b>40</b>	<b>36</b>	<b>37</b>	<b>36</b>	<b>37</b>	<b>37</b>	<b>95</b>	<b>19</b>	<b>14</b>	<b>19</b>	<b>413</b>	<b>34</b>
<b>1985-86</b>													
JULY	3	2	2	2	2	3	2	2	6	2	1	1	26
AUGUST	3	2	2	4	1	3	3	3	8	2	1	1	30
SEPTEMBER	4	2	4	2	2	5	4	4	8	1	1	0	33
OCTOBER	3	5	5	3	4	3	4	4	12	3	2	2	46
NOVEMBER	4	2	4	4	3	2	3	3	9	1	2	1	35
DECEMBER	3	3	4	4	3	4	3	3	9	1	1	0	35
<b>TOTAL</b>	<b>20</b>	<b>16</b>	<b>21</b>	<b>19</b>	<b>15</b>	<b>20</b>	<b>19</b>	<b>52</b>	<b>10</b>	<b>8</b>	<b>5</b>	<b>205</b>	<b>34</b>

non-creative and boring routine. One storekeeper (a position which turned over five times during the period of this study) was particularly lax and was frequently several days late in preparing shipments promised to the districts.

Researchers had set up a system for monitoring the number of SIVs per month, in order to test this system's effectiveness in reducing the number of emergency orders. They found that the number of requisitions per month (about 35 per month in FY83-84) was reduced only slightly after the distribution schedule was introduced. (See Figure 38.) Researchers conclude that this is due to weaknesses in inventory management practices at the district level. Pharmacists do not plan their drug needs in a systematic way. With inventory management still a problem at CMS -- continuing stockouts and emergency orders placed with nearby distributors -- in spite of all the assistance and support that has been available to CMS staff, it is not surprising that inventory management practices at the district level are still imperfect.

Hence, the major effects of this distribution schedule were felt at the CMS level, not within the districts, and the effects within CMS seemed to be not entirely positive. Researchers suggest that the schedule should be reviewed for more positive effects within CMS, and at the same time district pharmacists should be supported in improving their inventory management procedures.

#### c. Backordering procedures and communication with districts

As districts and health facilities were being urged to submit only one requisition per month to CMS and to try to reduce non-routine or emergency requisitions, they began to expect a better level of service from CMS. They complained of stockouts at CMS, of receiving nearly expired products at times, and of not being notified when shipments arrived of items that had been out of stock.

By August 1984, nearly a year after the Phase I RDF had been set up, complaints of poor service from CMS, particularly by nurses at the Princess Margaret Hospital, were reaching the highest levels of the Ministry. This prompted the Minister himself to call a meeting with the Supplies Management Officer during a visit by MSH researchers where he stressed the need for improved communication with all districts and facilities. Providing information with regard to the supplies on hand at CMS -- their expiry dates, overstocks, and price differences -- would allow districts to share in the goals of improved stock management in the new system. Researchers suggested that when CMS was out of stock of a requested item the Storekeeper should propose substitutes to the district and should backorder the item, keeping track to deliver that item to the appropriate district when it was received.

By the end of the project, however, there was still no back order system and no system for proposing substitute items when CMS was out of stock. Until such systems are devised and implemented, the distribution system will not be as effective as it should be in providing service to health facilities.

#### d. Returns/Exchanges from Districts (II)

Once the new cost accounting system had been implemented and districts were being asked to limit their drug and supply requisitions to within their budgetary allocations, they began to express interest in being able to return unneeded or expired Supplies to CMS for credit or to exchange them. The original accounting system did not specify procedures for returns or exchanges; it was felt that this was a refinement which should await a later stage in the new RDF system.

As time wore on, however, districts became more and more insistent that they had a right to return unneeded items and certainly to not accept items that were nearing their expiry dates. The Supplies Management Officer was concerned that the institution of a credit note system would result in careless ordering by districts and careless inventory management, if there were no penalties. Without such a system, however, districts were resorting to swapping supplies with the hospital and with each other. By August 1985, however, after the Phase I RDF had been in operation for nearly two years, the SMO agreed and the MSH finance consultant amended the RDF accounting procedures with the development of a credit note system. The credit note would allow districts to return surplus and expired goods within certain limitations. A district's budget would be increased by the value of the items that it returned.

By the end of the study, however, there was no evidence in the financial records to suggest that the credit note procedure was being followed. Since it is the districts who would initiate any returns or exchanges, researchers hypothesize that they may not have been informed of the new procedure or not encouraged to take advantage of it. The system has been designed but not implemented, and it is therefore impossible to determine to what extent it will be feasible, effective, and efficient.

#### Testing of Distribution submodel

At the end of the study, the Distribution submodel was reasonably effective in getting supplies out to users, but could have been even more effective if a procedure for backordering supplies had been implemented. Inefficiencies in the system were demonstrated by suboptimal use of staff time, the continuing frequency of emergency requisitions from districts, and the fact that the credit system to allow districts to return or exchange supplies was not working.

## 7. Organizational Development

During the problem analysis phase of this study, researchers identified the organizational environment as a critical component in the design and implementation of the RDF system. While not a core element of the RDF model as such -- as were the financial management and materials management subsystems -- the organizational environment in which the RDF would operate was seen as critical to its success. Operations research would assist in this component in creating the organizational context in which the RDF would operate effectively and efficiently.

Figure 39 shows the organizational structure of the supply system in Dominica which has existed in essentially the same form since before the RDF was implemented. (The only notable change has been the creation of the position of Supplies Management Officer which occurred at about the same time that the Ministry made its decision to implement a revolving fund; prior to that time the Storekeeper was the senior officer within Central Medical Stores.)

A review of this organizational framework and previous experiences with revolving drug funds suggested a number of operational issues: Where would the RDF be administratively situated within the Ministry of Health? Who would be responsible for the RDF? What staff would be involved? Since these issues arose uniquely because of the new RDF system, organizational development was considered by researchers to be a new component. Operations research would assist in drawing attention to these issues and developing solutions. Previous experience did not offer ideal solutions; in fact, ideal solutions to these issues probably do not exist, as they depend heavily on the complex and interrelated factors of the environment in which the supply system operates. Not only would operations research assist in developing the best solution for Dominica, but also in confirming the importance of organizational development issues and in developing them and describing them as carefully as possible in the hopes that this would be of assistance to other countries.

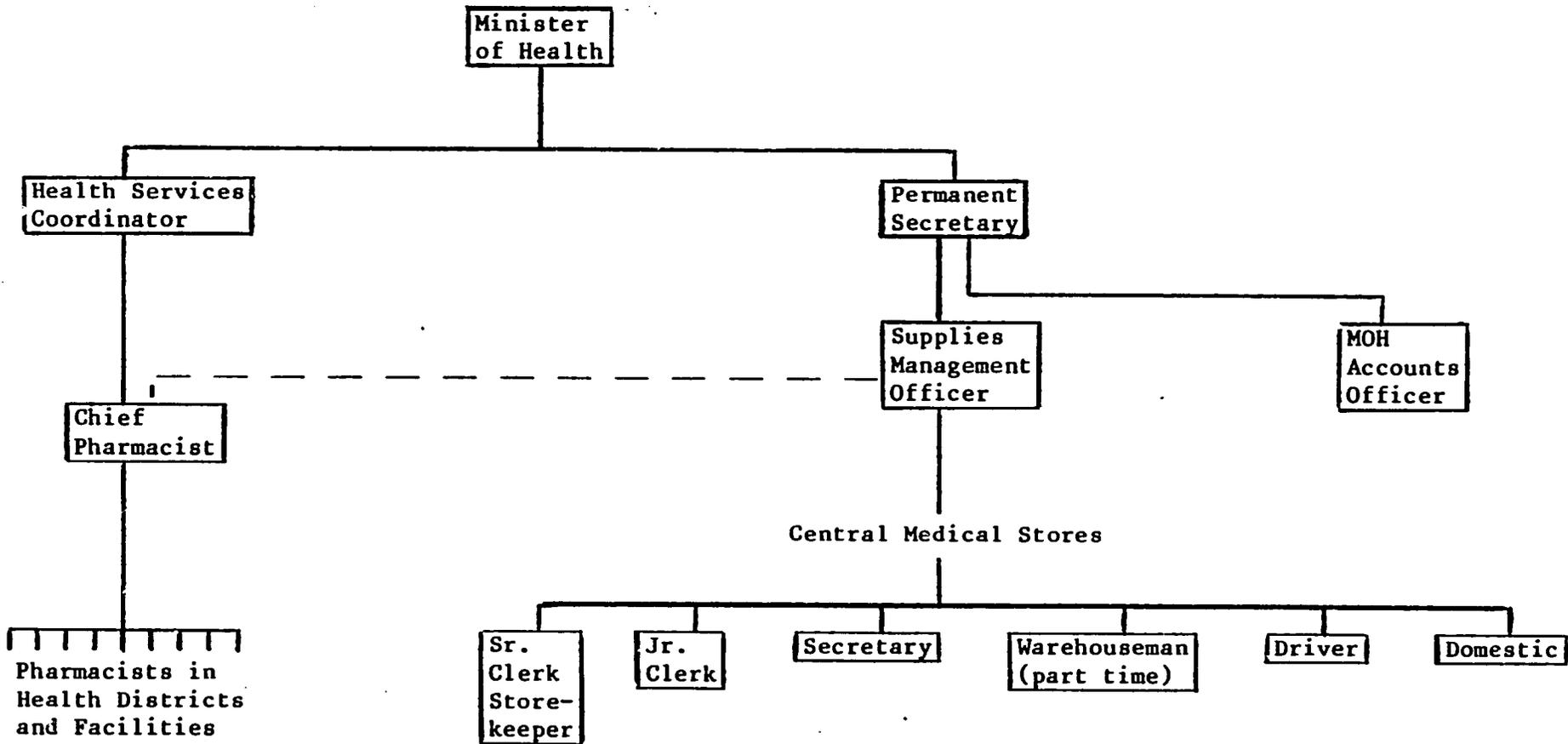
The operational issues in Organizational Development that arose in this study are presented in the following format:

- Management responsibility for the RDF
- Authority/responsibility for RDF assets
- Gaining support/collaboration of Audit Department
- Staffing required
- Training required
- Additional staffing/training required for Phase II

These operational issues, documented in the following pages, represent three years of experience and evolution. At the end of the study the researchers conclude that these issues are even more critical than they were considered at the outset. One of the major findings of this study may well be that these issues

Figure 39

ORGANIZATIONAL CHART  
OF  
DOMINICA'S DRUG SUPPLY SYSTEM



merited more explicit attention and resolution in the early stages of RDF development.

a. Management responsibility for the RDF

Clearly designated responsibility within the Ministry of Health for the new tasks associated with the RDF was not identified as a significant operational issue at the start of this study. Its significance has emerged simply through experience over the past three years. At the outset it was assumed that the RDF would be integrated within the existing organizational structure of the Ministry (as shown in Figure 39); responsibility would be shared broadly. And in fact this was the reality during the development of the early policy and planning decisions.

Because the RDF was a drastically new system for procurement and distribution of drugs and medical supplies and offered the possibility for much improved health care services within MOH facilities, it drew the attention of a wide range of senior officials within the Ministry. Initial policy and planning discussions were carried out with their participation -- many of whom would not be and have never been operationally involved.

The decision that emerged -- as yet implicit -- was that the RDF would be managed jointly. The suggestion of a committee as the focus for management was raised by one Ministry official, but the structure that developed was an informal one. Researchers continued to work with two major players -- the Supplies Management Officer as the most senior official at CMS, and the Ministry's Accounts Officer. These two officials, plus the Health Services Coordinator, were the ones selected to visit Haiti to observe the RDF in operation there.

During development of the Procedures Manual for operation of the RDF and, in particular, for maintenance of the accounting system in February, 1984, researchers and Ministry officials reviewed together the additional responsibilities which the RDF would entail, and concern was expressed about the time that current staff had to take on these new responsibilities. (The Accounts Officer, who had responsibility for all Ministry accounts, was the main focus of this concern; the Supplies Management Officer was in a newly created position and was not yet overburdened with responsibilities.) The general sense from these discussions, however, was that there were no alternatives. The Financial Secretary emphasized that the Prime Minister had stated that there were to be no new posts established. Therefore, the RDF Procedures Manual that was developed was explicit about dividing responsibilities between CMS and the Ministry Accounts Office.

From the start, however, it was evident that the Accounts Officer was overwhelmed with other responsibilities, and the Supplies Management Officer became the closest operational level counterpart to MSH researchers; she became the most consistent

representative of MOH interests and the repository of accrued experience in development of the RDF. The Permanent Secretary, who as the supervisor of both the Supplies Management Officer and the Accounts Officer was the logical coordinating officer, was never operationally involved.

By the time of the first fiscal year-end financial analysis of the RDF, it was evident that the Accounts Officer had not been able to fulfill her responsibility in following the detailed procedures that had been specified in the Procedures Manual. Several weeks had to be spent by consultants tracing all accounting entries, in effect performing a 100% audit in order to be able to prepare a year-end closing and assess the performance of the Fund. The Supplies Management Officer had continued to manage the material assets of the Fund, overseeing procurement, inventory management, and distribution functions, but without ongoing and up-to-date information from the MIS/accounting system, she was unable to take optimal management decisions.

This observation suggested to Ministry officials and to researchers that better coordination between financial and materials management -- separate but related functions -- was needed for effective and efficient implementation of the RDF. Researchers proposed one alternative by which these two responsibilities would be coordinated under the Supplies Management Officer, citing the following advantages of that option:

- (1) The Supplies Management Officer already had the responsibility for managing the material assets of the Fund but was effectively precluded from making management decisions as effectively as possible without financial information.
- (2) Many of the source documents for maintaining the MIS were held by necessity at CMS. Maintaining all records at CMS would produce a small but significant reduction in the quantity of paperwork required and would save time from going back and forth between CMS and the Ministry Accounts Office.
- (3) CMS had adequate, highly motivated technical and clerical staff who could perform many of the routine accounting chores.

Political and organizational considerations prevailed, however. The Minister felt that the Accounts Officer should continue to be involved, stating clearly that CMS activity was not to be considered independent from the Ministry. It was decided that the Research Assistant hired under this study should be responsible for maintaining all records for the revolving fund -- accounting books at the central Ministry under the direction of the Accounts Officer and inventory records at CMS under the Supplies Management Officer. He would thus serve to coordinate

these two aspects of the system. The fact that the Research Assistant was a temporary employee was identified immediately as a constraint in making this a viable long-term solution.

Coordination between the financial accounting and materials management functions did improve somewhat under this arrangement, but the coordination remained at the operational level; coordination at a managerial level did not follow. The researchers can only hypothesize about the possible explanations for this.

First, the time and attention that the Supplies Management Officer and the Accounts Officer were able to give to the RDF even at a supervisory level continued to differ. The Supplies Management Officer continued to be very involved; the Accounts Officer continued to be overburdened with other responsibilities and never had the opportunity to visit CMS to understand the materials management aspects of the system. The arrival of the Research Assistant and the expansion of his responsibilities resulted in the Accounts Officer being less involved on an operational level and seemingly even less interested, although the Minister had emphasized that she should continue to supervise; perhaps she felt "demoted." Naturally, the Research Assistant, who was supposed to report to both the Accounts Officer and the Supplies Management Officer, began to identify more closely with the SMO and with CMS staff, which exacerbated the situation further. The possibilities for real coordination became more and more remote. To the extent that the Accounts Officer exercised her supervisory authority, she did so more within the parameters of usual Government accounting norms, rather than within the procedures designed for the RDF. The Cash Book is the case in point; it was simply not possible to tell at a glance the current cash balance in the Fund -- information which may not be important for normal government accounts, but which is vital to RDF management decisions.

By the end of the study the suggestion was being raised again that at least the keeping of the records be coordinated, i.e., that accounting books be maintained at CMS along with inventory records. However, by the end of the study the effective maintenance of the accounting records is itself in question with the departure of the Research Assistant. This is discussed below under Staffing.

The researchers conclude that the organizational setting within which the RDF is situated has emerged as a critical operational issue. Coordination at the managerial level is imperative if the RDF is to be effective and efficient; yet, when functions are split between different officials, all of whom have multiple responsibilities without taking on new ones, such coordination does not occur on its own.

The most effective way to achieve coordination, perhaps, is to place all responsibility, for financial and material assets, under a single person -- someone who has the time and the

interest to fulfill those responsibilities. The only person that the researchers can identify as meeting those criteria in Dominica is the Supplies Management Officer. This would mean giving her the authority to approve purchase orders and to sign RDF checks. If this is not possible under existing Government statutes, an alternative solution is the development of an RDF management committee. All responsibilities, including the signing of purchase orders and of RDF checks, would be given to that committee, and the committee would meet on a periodic basis to take decisions.

b. Authority/responsibility for RDF assets

Another related issue which was never directly addressed was who in the Ministry was ultimately responsible for the conservation of capital in the revolving fund. Just as RDF operations were separated between the Ministry Accounts Office and CMS, so also was responsibility for RDF assets. The Permanent Secretary, the Accounts Officer, and the Health Services Coordinator, with their offices in Government headquarters, were given the authority to write checks on the RDF account, but none of these officials was involved with the management of material assets.

Researchers emphasized the necessity of vesting ultimate financial control within one individual who could be unambiguously held responsible for Fund assets. The Minister stated that this responsibility fell to the Permanent Secretary. It was a decision which was never operationally effective, however. The P.S. had come to the Ministry of Health after many of the early policy meetings had taken place -- meetings in which the RDF concept was discussed at length, a unique system different from other Government accounting systems, a system which had its own parameters and its own requirements. For that reason, commitment to the RDF concept at the highest levels within the Ministry seemed on occasion to falter. Some decisions with regard to expenditures from the Fund and to CMS staffing, therefore, have not always seemed to support the original principles. Some of those decisions have constrained RDF effectiveness and efficiency.

c. Gaining support/cooperation of Audit Department

As the RDF accounting system was new to the Ministry of Health and somewhat unusual when compared to normal Government accounting procedures, Ministry officials felt that it was important to involve the Government Audit Department in its development and introduction. MSH researchers met with officials from the Audit Department during the design phase of accounting system development and provided them with a copy of the Procedures Manual when it was available.

From that time on, the Audit Department took great interest in the accounting system, visited CMS on a number of occasions, and

reviewed the Annual Reports from both FY 83-84 and FY 84-85, holding frequent meetings with researchers and the Research Assistant to pose questions about the system. They were consistently supportive.

#### d. Staffing required

The pre-existing supply system in Dominica functioned with a Chief Storekeeper, Chief Pharmacist, Clerk, Warehouseman, and Domestic at CMS, and pharmacists in the health districts and facilities. The Ministry Accounts Officer was involved solely in processing payments to suppliers. Added to that complement of staff since the decision to implement an RDF were a Supplies Management Officer who became the most senior official at CMS, a Secretary, and a Driver.

The RDF increased supply system responsibilities significantly. The major changes came about with the requirement that all receipts and issues be costed and the introduction of the MIS/accounting system which required detailed entries. Further, as receipts and issues increased overall under the RDF, so also did the workload for performance of materials management functions.

When the MIS/accounting system was first designed it was decided that the Ministry Accounts Officer would maintain the accounting books. This proved to be an unrealistic expectation, given her other tasks, and eventually the Research Assistant supported through this project took over those responsibilities. There was immediate concern expressed about this not being a viable solution for the long term, since he was a temporary employee, but no other options seemed to be available.

Researchers proposed a time analysis study in order to estimate to what extent the current staff at CMS was adequate to carry out all the tasks required under the RDF. Monthly timesheets were prepared, using the microcomputer, for each member of staff, listing as specifically as possible the tasks he or she was engaged in. (A sample is shown in Figure 40.) Each staff member was asked to record the number of hours spent each day in each task. Unfortunately, this analysis was not successful. Researchers were not present to encourage staff members to fill in their timesheets. Apparently, most staff members interpreted this assignment to be of a supervisory nature, and their compliance was very close to zero.

Observation had to suffice. By the end of the study the Research Assistant was taking almost full responsibility for maintenance of the RDF accounts. There were initial problems given his lack of formal training in accounting, but his skills improved immeasurably with experience, and by the end of FY 84-85 he was functioning very well independently. Maintenance of these accounts became very nearly a full-time job. With the rest of his time he carried out various research studies, some

Figure 40  
Sample Timesheet

NAME	ACCOUNTING			RESEARCH			OTHER EMPLOYMENT		
	Accounting Entries/ Activities	Await Signature for P.O.	Await Signature Bank check Grant	Computer Entries	Computer Research	Other Research Activities	Part Clearing	Issuing Supplies	
Monday	1 July								
Tuesday	2 July								
Wednesday	3 July								
Thursday	4 July								
Friday	5 July								
Monday	8 July								
Tuesday	9 July								
Wednesday	10 July								
Thursday	11 July								
Friday	12 July								
Monday	15 July								
Tuesday	16 July								
Wednesday	17 July								
Thursday	18 July								
Friday	19 July								
Monday	22 July								
Tuesday	23 July								
Wednesday	24 July								
Thursday	25 July								
Friday	26 July								
Monday	29 July								
Tuesday	30 July								
Wednesday	31 July								

of which the Supplies Management Officer expressed interest in continuing beyond the study period for the management information they provided.

Early in the third year of the project researchers encouraged the Ministry to begin to make plans for appointment of a senior clerk who could function as RDF Accounts Officer, preferably the currently existing Research Assistant whose skills had become so well developed. There was some indication that he would be hired.

Among other staff at CMS the workload had become heavier since the RDF was established. New tasks included more careful estimation of order quantities needed, checking of shipments as they were received, management of a greater volume of stock, maintenance of Bin Cards and the Kardex on an ongoing basis, the costing of SIVs, and detailed records at every stage of the supply process. In the first year or so of the RDF, there was a sense of high morale among the staff. Small but noticeable improvements in the physical space at CMS, facilitated by the new Supplies Management Officer, no doubt played some part in this, but in addition staff seemed excited by the RDF project and by the arrival of a Compaq computer, the Government's first microcomputer. The RDF had become quite "visible" within Dominica. It was mentioned by the Prime Minister during the Health Ministers Conference held on Dominica in July, 1984, prompting a number of visits by participants to CMS, and was the subject of a major article in the newspaper. Many staff had also had the opportunity to begin to develop computer skills.

Motivation was hard to sustain, however. The excitement about a new project always eventually dulls, particularly as the realization sinks in that the heavier workload is not temporary. The new Eastern Caribbean Regional Pharmaceuticals Management Project, which engaged staff interest at the start, was very slow to evolve. But more importantly many of the staff at CMS were not in permanent positions, creating a sense that all of their achievements had a tenuous nature about them. Some of the new "acting" staff were having problems getting paid which was not only demotivating but also resulted in their leaving their posts to try to straighten out the situation at the Ministry. The position of Storekeeper turned over five times during the life of this study. The Supplies Management Officer discussed these problems frequently with the Permanent Secretary in an attempt to build a permanent, reliable staff at CMS.

By November, 1985, there were still only three permanent positions at CMS -- the Supplies Management Officer herself, the Chief Pharmacist, and the Warehouseman, and there were no developments with regard to the appointment of the Research Assistant as RDF Accounts Officer. Researchers reviewed this situation with senior Ministry officials, emphasizing the importance of permanent staff for continued efficient operation of the supply system and maintenance of the RDF, and emphasized

that several of the temporary staff had developed valuable skills which, if lost, would be a setback for the RDF.

By the end of the study, the Ministry had decided not to hire the former Research Assistant as RDF Accounts Officer, citing the Government's inability to create new positions at that time. Unfortunately, this had not been stated definitively on any previous occasion; in fact, the researchers and other Ministry officials had been led to believe that there was a possibility he would be hired. This precluded CMS from making plans to transfer his responsibilities to the only other person on the staff who had become familiar with them (the Junior Clerk, who had taken his place when he was on sick leave). Further, there had been no progress in either making the current temporary staff members permanent (which might have been difficult under the hiring restrictions) or putting permanent employees from other departments in those positions (which should have been possible). In short, there was little recognition that the RDF was an unusual system whose viability required trained staff.

After three years of close observation within CMS, the researchers conclude that effective and efficient operation of the RDF as it is currently structured in Dominica requires the following minimum staff:

- One Supplies Management Officer
- One Senior Pharmacist
- One Senior Clerk (as RDF Accounts Officer)\*
- One Senior Clerk (as Storekeeper)
- One Junior Clerk
- One Secretary
- One Warehouseman (could be part-time, as currently)
- One Domestic (part-time)

The RDF Accounts Officer is the only entirely new position. (The other positions are also required for a non-RDF supply system, as existed before, but some have required restructuring and now encompass a heavier workload under the RDF.)

Researchers undertook a brief analysis to determine whether the savings that had been achieved under the RDF were sufficient to support the salary of a Senior Clerk (approximately EC\$15,000 per year). A "market basket" of drugs and supplies (determined by eliminating any items with missing data points from the CMS inventory list) was costed at CMS average unit costs at 6 different time periods. When a 4% inflation rate was assumed, the value of this market basket of goods declined approximately EC\$12,000 between June 1984 and December 1985. (See Figure 34 in the Procurement section.) And these savings are expected to increase as the need for high priced emergency shipments is reduced. Naturally, this does not represent "real savings," since CMS did not purchase the same but a greater volume of supplies; but it does demonstrate that the extra funds could be

used instead toward the support of an RDF Accounts Officer if the Government chose to do so.

e. Training required

Although the RDF required the introduction of a number of new systems and procedures, maintenance of the RDF's double-entry accounting system was the only task which required specialized training. The MSH finance consultant worked closely with the MOH Accounts Officer and the Supplies Management Officer in setting up the system at the start, and with the Research Assistant when he took over the accounting responsibilities. The Research Assistant then participated with the Finance Consultant in two fiscal year-end financial analyses which further developed his skills. By the end of this study he understood the system better than anyone else who was involved in Dominica and was fully capable of handling the routine tasks. Still there were occasions when his lack of formal training in accounting posed problems; he did not have the experience to know how to handle unforeseen or unusual circumstances.

From this experience the researchers conclude that an accountant with formal training is not necessarily required for the day-to-day maintenance of the accounts. The individual who will function as RDF Accounts Officer needs on-the-job training, however, and a trained accountant must be available for troubleshooting and for periodic financial analyses.

At the end of this study, the Ministry was faced with two challenges: The first was to find a mechanism for transferring the necessary skills to whomever was going to take over the responsibility for RDF accounts, since the Research Assistant was no longer employed. Perhaps the Research Assistant would be available for temporary employment to train his replacement, or perhaps the current Junior Clerk who already knew the system could take over, but she was not a permanent member of staff either, so this would be another short-term solution. The second challenge was to make arrangements for the periodic assistance of a trained accountant. Researchers found that the necessary skills were available in Dominica.

Although use of a computer is not required to maintain an RDF, it has been very useful for various analyses throughout this study, and has become an important tool for CMS as well. Some initial training was provided when the microcomputer was first introduced. By the end of the study, it was surmised that enough skills existed among the staff at CMS and throughout the Ministry to continue to use the computer and to develop new applications.

f. Additional staffing/training required for Phase II

This operational issue, although recognized, never received priority attention during this study period. However, MSH experience with a drug sales program in Haiti suggests that the collection and management of fees does require a specific and focused training effort. Whether the current staff available in district pharmacies in Dominica will be capable of assuming the new tasks that will be required will depend in part on an analysis of their other responsibilities. This issue was discussed in some detail in the MTS Section.

Testing of Organizational Development submodel

The Organizational Development submodel included a number of fairly discrete issues. Given the significance of management decision-making to the continued viability of an RDF, researchers question whether the authority and management structures currently in place are even feasible; they would suggest a reorganization and a reassignment of responsibilities to allow the RDF to function as it was designed, more independent from normal Government accounting procedures.

The staff available and the training provided to them throughout the study period were reasonably effective in supporting the RDF, but considering the project resources that were invested to maintain a critical staff member, researchers cannot conclude that the submodel, as developed, was efficient.

## 8. Information, Education, Communication/Public Attitudes

Not only are management systems and procedures and a favorable organizational context important for making an RDF successful; so also are the attitudes of the public. When patients are first charged for drugs in public sector health facilities where they have traditionally received them "free" there is bound to be initial resistance. People need to understand the reason for the change in order to accept it. Anticipation of this need led the researchers to identify public attitudes as a critical component in RDF implementation.

The operational issues that were first identified had to do with determining the willingness and ability of people to pay for drugs, designing and implementing a publicity campaign, and deciding how indigents would be identified. These were new issues; they had not been issues at all in the drug supply system that existed before consumer cost sharing was contemplated. Operations research techniques would be used to resolve these issues and to identify and resolve others that would invariably arise in designing and implementing a fee scheme.

The major significance of public attitudes was underscored by the Government's decision to postpone consumer cost sharing. This decision was due presumably to the increasing criticism of the Government's policies by opposition parties in July 1983, and the Government's desire to retain public support through the pre-election period and the election itself. Once the decision was made to implement first a Phase I RDF, the operational issues that had been identified at the start were superseded by others needing more prompt attention.

Public attitude considerations were given little attention during the first year of the study as the Phase I RDF was being designed, with only intermittent suggestions which were never acted upon to use Phase I as a means to begin to communicate the value of drugs and medical supplies to the public. But the need for cooperation from health districts and facilities complying with the new supply management procedures made gaining their support an important operational issue. The Minister himself became more and more interested in the financial and accounting aspects of the RDF scheme and the management efficiencies they provoked, and he wanted to share this experience with other top officials in the Government, specifically the Prime Minister and members of the Cabinet.

This led researchers to conclude that the support of all of these groups -- top Government officials, health systems staff, and the public -- was needed for a successful RDF. "Public Attitudes" was too narrow a definition for this component; it was renamed "IEC/Public Attitudes" to encompass the broader perspective. The operational issues that were given attention during this study, and which the researchers believe would be

important to any country or program implementing an RDF, are discussed below.

a. Gaining high-level Government support

The concept of an RDF with drug sales and the realities of introducing a Phase I RDF in Dominica benefitted from the start from strong support from the Minister of Health; the Honorable Charles Maynard. It was due to his efforts, in fact, that the RDF was contemplated and this PRICOR study initiated. He supported the study throughout, even after elections in July 1985 and his move to the Ministry of Agriculture, by meeting frequently with MSH researchers, reviewing progress, urging the cooperation of all Ministry of Health staff members, and spearheading public communication efforts. Dominica could not have been in a more fortunate position.

In May, 1984, only six months after the Phase I RDF had been set up and only three months after the MIS/accounting system was in place, the initial results of Phase I management improvements were so impressive to the Minister that he suggested the possibility of a presentation to the Cabinet. Even the Prime Minister, he said, should understand the project. He indicated that the Revolving Fund concept and the benefits of the strict cost accounting system it entailed might be of interest to other Ministries. MSH researchers were asked to make such a presentation in July, 1984. (These remarks are included in Annex 2.) Whether this led to any changes in the management systems of other Ministries is not known.

The Caribbean Health Ministers Conference was being held on Dominica the same week as the Cabinet presentation. It was attended by health ministers and other officials from the countries of the Caribbean Region as well as by representatives from donor agencies. The Prime Minister addressed the Conference, and in her remarks, described the RDF project underway. This public support was extremely valuable, not only in giving credibility to the RDF concept throughout the country and the Region, but even in motivating CMS staff in a period when the enthusiasm for the new system was waning, but much hard work was yet to be done.

Over the next year the Minister's support continued and he asked repeatedly for data demonstrating the impact of the RDF on health service delivery. This was an important campaign issue as the elections approached. The Freedom Party was reelected in July, 1985, and a new Minister of Health appointed. During the transition period the loss of the deep personal involvement of the Honorable Charles Maynard was already felt. The handling of a number of critical issues, in particular the non-appointment of the Research Assistant at CMS who had served as the RDF Accounts Officer, put the RDF in serious jeopardy. This was discussed in greater detail in the Organizational Development section.

b. Gaining the support of health system staff

During the first year of the study, and particularly after the Government decided to postpone consumer cost sharing, most efforts were being directed toward the design and implementation of central level management systems. Very little attention was given to district systems with the assumption that they were less critical for Phase I. It became obvious in May, 1984, however, that the success of the central level systems required the cooperation of the health districts and facilities to the extent that they were the users in the Phase I RDF. It was not until then that gaining the support of all staff within the health system was seen as an important operational issue.

The first signals were complaints from nurses at Princess Margaret Hospital about the service being provided by CMS. They felt that they were not getting the supplies that they needed. When these problems were investigated it was found that CMS staff were so intent on following strict accounting procedures that they were putting this ahead of service delivery, refusing to make exceptions even in life threatening situations at the hospital. For example, surgical gloves were not issued on one occasion -- even though they were out of stock in the operating theatre -- because they had not yet been brought into inventory with the preparation of a Receiving Report. During the visit of MSH Researchers, and at the urging of the Minister, the Supplies Management Officer organized a seminar which was attended by the Matron (Head Nurse), the Assistant Matron, one Departmental Sister, four Ward Sisters (out of approximately 10), the Requisitioning Officer for the Matron Storeroom, and the Assistant Hospital Administrator, but regrettably not by anyone from the PMH Pharmacy or the Accounts Clerk. It was a useful exchange of information for both sides, and the relationship and cooperation between them improved.

The Minister and the Health Services Coordinator continually expressed interest in CMS organizing a seminar for the districts. It was never held, but each district was visited on a number of occasions. The Supplies Management Officer and the Chief Pharmacist introduced Budget Control Books and Bin Cards in the district pharmacies, and distributed a Price List of first line drugs. This later prompted some pharmacists to ask if and when sales of drugs were likely to begin!

Researchers undertook a survey in December, 1985, two years after the Phase I RDF had been instituted, to determine the opinions of district-level pharmacists, doctors, and nurses about CMS service delivery under the RDF, their awareness of the monetary value of drugs and supplies, and whether they thought patients would be willing to pay for drugs. Their responses were predominantly supportive of the Phase I RDF and of the outlook for Phase II. These responses are shown in Figure 41; the complete survey is included in Annex 5.

Figure 41  
Excerpts from District Survey

DISTRICT SURVEY FOR PHARMACISTS	ROSEAU	ST. JOSEPH	PORTSMOUTH	HARIGOT	GRAND BAY	LA PLAINE	CASTLE BRUCE
3. How would you say the level of stock compares to before the RDF?		Much better	Better	Better	Improved	Better	Much improved
How often do you not have the appropriate drug?		Infrequently			Infrequently	Infrequently	Infrequently
5. Would you say you are more aware of the monetary value of drugs and supplies?		yes	yes	yes	yes	yes	yes
If yes, why				Requisition cost	Price list, costing of SIVs		Price list & SIVs
Do you refer to the price list for first-line drugs that CMJ sent? If so, when?		yes, when necessary ordering	yes			randomly	yes, to compare prices against CMS issues
Does this affect what you requisition from CMS?		Yes, order cheaper items	Yes		Yes		No
Does this affect what you dispense?			No		No		No, dispense what is prescribed
Does this affect what you say to patients?		Explain cost to patients	no		Give idea of cost of drugs	Tell of cost to make patient cost-conscious	
6. Do you think patients would be willing to pay a small fee for drugs? Comments	Most people would prefer free drugs, but with educ. some could pay per prescription	Maybe, more likely willing to pay contribution	Yes, as a contribution	Yes, contribution	With much education		
Would this change the amount of drugs they consume?	Yes, use more since cost is involved	Yes, drugs which are left unused would be taken since cost involved. Patients need education on this.	Yes, they would use more	No difference	They would take all drugs which are prescribed	Yes	
Would this be good or bad?	Good	Good	Good	Good	Good	Good, it would alleviate cost in a small way.	Good to subsidize budget.

DISTRICT SURVEY FOR DOCTORS

4. How would you say the level of stock compares to before the RDF?					Better	Better	Better
How often do you not have appropriate drug?				Rarely		Few times (may be due to fault of district)	Rarely

5. Would you say you are more aware of monetary value of drugs and supplies?		Yes	Yes	Yes	Yes	Yes
If yes, why				Requisition cost	Price list, cost on SIV	Price list
Do you refer to the price list for first-line drugs that CMS sent?		Yes, once			Yes	Yes
Does this affect what you requisition from CMS?					No	No, requisition according to usage
Does this affect what you prescribe?		Yes, I try to prescribe cheaper drug	Prescribe cheaper drug	Prescribe cheaper drug		Prescribe cheaper items
Does this affect what you say to patients?						No
6. Do you think patients would be willing to pay a small fee for drugs?			There could be a prescription cost (e.g., \$1/prescr.)		Yes, maybe if introduced now and proper educ. carried	No
Would this change the amount of drugs you prescribe? Why or why not?		No	No	Prescribe according to needs of patient	Yes/no	No
						Prescribe what patients need.

DISTRICT SURVEY FOR NURSES

1. How would you say the level of stock compares to before the RDF?	Much improved	Average, problems seen to be with Pharmacist; order patterns	Better		Much better
How often do you not have the appropriate drug?		Few times			Below average
2. Would you say you are more aware of the monetary value of drugs and supplies?		Yes	Have no idea of cost		Yes
If yes, why?		Price List, now aware of budget and how it's spent			Price List and costings of SIV
Do you refer to the price list for first-line drugs that CMS sent? If so, when?	No	Yes	Never seen price list		Rarely
Does this affect what drugs you give out?		Give the cheaper drug if there is a choice			No
Does this affect what you say to patients?					No
3. Do you think patients would be willing to pay a small fee for drugs? Yes or no, comments	Some would, if educated, other would refuse	Yes, for those who could afford it, but not the entire cost of drugs	If it is made a policy of the hospital fees, they will pay		With much motivation and education I think they should be willing to pay
If no, would they be willing to pay for some drugs if essential drugs (like aspirin and antibiotics) were free? comments.	I think so	With some education, some would			
Would this change the amount of drugs you give out?	Depends on stipulated cost	No	Yes/no, depends on patients' needs and ability to pay		No, give according to patient's needs

### c. Gaining public support

How to gain the public's acceptance and support for an RDF and drug sales scheme was one of the earliest and most critical operational issues identified by the Ministry. MSH Researchers prepared a Discussion Paper entitled "Planning for Public Acceptance" (included in Annex 3) which was the basis for early discussions of this issue. With the Government's decision to postpone consumer cost sharing, however, it became less pressing.

Public opinion, however, was still an issue of concern for the Ministry. It was noted that the level of service provided by the current drug supply system was having a negative impact on public perceptions of health services. It was hoped that management improvements in Phase I would result in increased supplies available in health districts and facilities. The suggestion was made that the Ministry might begin to post the real costs of drugs, either in lists or on drug packages, to show the public what the Government was financing. This, along with a voluntary donation box, which had been suggested to bring some additional revenue into the Ministry, could pave the way for later implementation of a Phase II RDF. There was some interest in these suggestions, but no resolution.

The Ministry opted to follow the more subtle approach of improving drug supply availability and communicating these improvements to the public. As early as February, 1984 the Minister described the RDF in a Sunday morning radio program. That same month, and on several more occasions when MSH researchers were present on the island, he arranged for the researchers to be interviewed for the radio. In May, 1984 a Letter to the Editor came out in the weekly newspaper, The New Chronicle, criticizing the drug distribution system, and accusing the Ministry of Health of not making efforts to purchase in bulk from lower cost generic suppliers. The accusation was distressing as it was unfounded. The Minister arranged for a feature article to be done soon describing the RDF and the new systems underway; it was published in August. MSH Researchers discussed with the Supplies Management Officer the idea of preparing monthly news clips for The New Chronicle about the progress being achieved for the RDF. This was never followed up.

In thinking ahead to Phase II, researchers decided to monitor the experience the Ministry was having at Princess Margaret Hospital where new fees for service had been introduced in January, 1984, for any lessons that could be gained for better planning for the introduction of drug charges. In May, 1984, researchers visited the hospital and spoke the Hospital Administrator, the Admissions Officer, a Social Welfare Officer, and the Accounts Clerk. The general feeling was that the new fee program had been quite difficult. The staff interviewed said that it seemed as though the program was introduced "all of a sudden" and many patients said they didn't know about it.

One result was that many patients resisted the fees and some simply refused to pay. When hospital officials were asked how they felt the fee program might have been more successfully introduced, they generally agreed that a more vigorous public relations effort in advance would have been helpful. When asked their ideas for a publicity campaign before any introduction of drug charges, they suggested short radio spots, in Patois, which would be repeated frequently, posters in villages and health centers, leaflets, presentations to church groups and women's groups, and even TV. They felt that the theme at the earliest stages should be what the Government was currently spending to provide drugs through its health facilities.

Indigents were exempted from paying fees at the Hospital. They were identified from a list maintained by the Welfare Department or by interview with a Social Welfare Officer at the Hospital. This was reported to be relatively satisfactory, although researchers did not have the opportunity for any follow-up after May 1984.

The Minister expressed interest, on several occasions, in undertaking a study of health utilization, what people were paying for health services, and the impact of fees on health services utilization. Results from a PAHO survey carried out in the Eastern Caribbean Region found that Dominicans were paying on average of EC\$8.00 per episode of illness, ranging from an average cost of EC\$39.00 when the care was sought from a private practitioner to under EC\$1.00 when sought from a Ministry of Health facility. On average drugs represented the highest proportion of that expenditure, averaging EC\$3.99 per episode of illness.\*

The survey of district pharmacists, doctors, and nurses carried out by MSH and Ministry researchers suggested that people would be willing to pay for drugs in public sector facilities if an information and educational campaign were carried out. (See Survey Data in Annex 5). It is the view of the researchers that a more detailed study might be useful as Dominica begins planning in earnest for Phase II. Experiences from Haiti suggest that "the 5 P's of marketing" are as relevant to a public drug sales program as they are to any other marketing effort -- product, package, price, place, and promotion. Researchers encourage the Ministry to give careful consideration to all of these operational issues as it moves toward the introduction of drug charges.

\*From a Report on a Community Based Survey on Health Services Utilization and Coverage, prepared for PAHO and presented at the Ninth Meeting of the Conference of Ministers Responsible for Health, by Dr. Carissa Etienne, July 1984.

Testing of IEC/Public Attitudes submodel

Researchers conclude that all efforts that were made in information, education, and communication were effective in increasing support for the Phase I RDF. These efforts should not only be continued but expanded as the Ministry moves toward Phase II.

### C. Solution Validation/RDF Model

As described in the introduction to the Methodology section, validation of the overall RDF model as designed and implemented in Dominica was to be determined in large part by validation of the composite solutions developed for the eight sub-models. The extent to which the RDF was feasible, effective, and efficient, and had impact on primary health care service delivery, was directly related to the feasibility, effectiveness, and efficiency of each of the sub-models.

The main methods that were used to collect and analyze data for the testing of each sub-model and of the RDF itself are summarized below:

#### FINANCE

- Cash flow analysis, using microcomputer
- Cost benefit analysis
- Fiscal-year-end financial analysis, using microcomputer
- Review of CMS, MOH, and Treasury documents for analysis of reimbursement segment of pipeline
- Comparison of Government budget figures with CMS issues data
- District survey

#### MIS/ACCOUNTING SYSTEM

- Fiscal-year-end financial analysis, using computer
- Review of CMS and RDF records
- Observation/interview
- District survey

#### SELECTION

- Observation/interview
- District survey

#### PROCUREMENT

- Stock-level analyses
- Review of CMS, MOH, and Treasury documents for analysis of procurement segment of pipeline
- Price history analyses
- Analysis of changing supplier profile

#### WAREHOUSE/INVENTORY MANAGEMENT

- Observation/interview
- Stock-level analysis
- Analysis of CMS ability to provide requisitioned supplies
- District survey

#### DISTRIBUTION

- Observation/interview

#### ORGANIZATIONAL DEVELOPMENT

- Analysis of financial records

- CMS task analysis
- Observation/interview

IEC/PUBLIC ATTITUDES

- Observation/interview
- District survey

OVERALL RDF MODEL

- Observation/interview
- Analysis of CMS issues
- Price history analyses
- District survey

#### D. Timetable

The RDF systems analysis undertaken at the outset of the study produced eight components, within each of which were identified operational issues that needed to be addressed. It was anticipated from the start that operations research would be undertaken in all of these components essentially simultaneously to work toward implementation of the Revolving Drug Fund with consumer cost sharing. The original workplan that was developed is shown in Figure 42.

With the decision to postpone consumer cost-sharing, in July 1983, and to design and implement first a Phase I RDF, the workplan changed significantly. The study period now incorporated two phases, each involving the design and implementation of a different RDF model, although there would be common elements. Each phase would require problem analysis, solution development, and solution validation. The timing of these two phases, however, could not be determined with certainty, as it would be linked to political developments in Dominica. The introduction of consumer charges, which would signal the start of Phase II, would occur only when the Government decided that the political climate was right. That uncertainty made it difficult to set dates for many of the research tasks that had been envisioned, since many were related to the introduction of drug charges, and all were interrelated. Consequently, the revised workplan set forth only the broad parameters of the study and was accompanied by a list of the operational tasks and issues that were envisioned for each of Phases I and II. (See Figure 43.)

In fact, the Government never took the decision to introduce consumer fees for drugs and Phase II was not implemented during the life of this study. Research attention throughout the study period (which had been extended to three years, from May 1983 through April 1986) was focused on the identification and resolution of Phase I operational issues.

Figure 44 shows where, specifically, among the eight components major research efforts were focused at each visit of MSH researchers. The main emphasis in Phase I was the development of central level systems and procedures. A brief summary of major developments follows:

- |            |   |
|------------|---|
| May 1983:  | <ul style="list-style-type: none"><li>● Development of financial parameters of RDF with consumer cost sharing</li><li>● Initial discussion of RDF scope (e.g., what items to include)</li></ul> |
| June 1983: | <ul style="list-style-type: none"><li>● Visit of MOH officials to MSH project in Haiti, to observe RDF</li></ul>  |

Figure 42

WORKPLAN

May, 1983

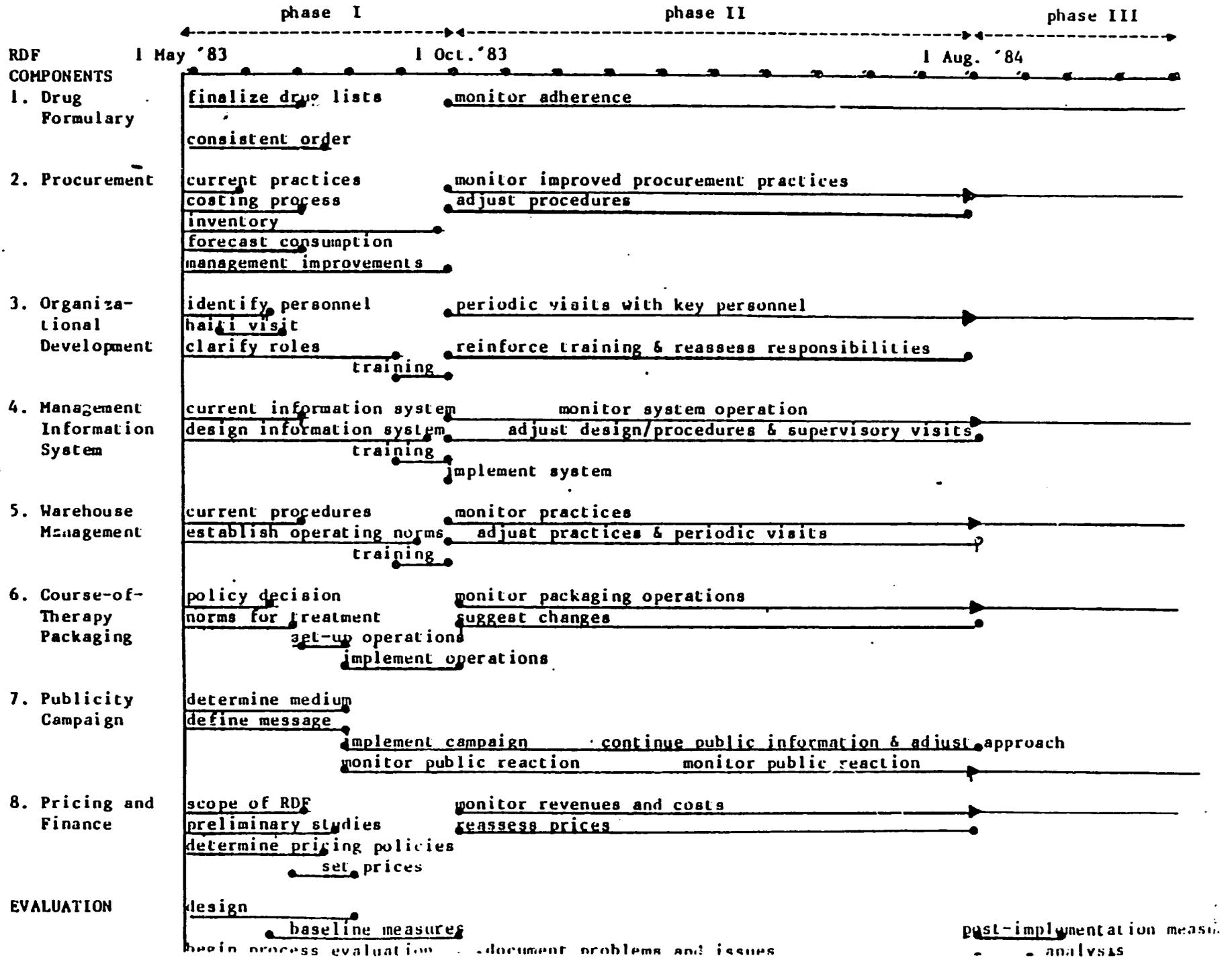


Figure 43

REVISED WORKPLAN  
(February, 1984)

RDF Components	Phase I RDF			Phase II RDF				
	Date Unspecified							
	May '83					December 1, '84		
I. Finance	Analyze	Develop	Solution	Monitor	Develop	Solution	Monitor	
II. Management Information System	Analyze	Develop	Solution	Monitor	Develop	Solution	Monitor	
III. Selection	Analyze	Develop	Solution	Monitor	Develop	Solution	Monitor	
IV. Procurement	Analyze	Develop	Solution	Monitor	Monitor			
V. Warehouse Management	Analyze	Develop	Solution	Monitor	Analyze	Develop	Solution	Monitor
VI. Distribution	Analyze	Develop	Solution	Monitor	Monitor			
VII. Organizational Development	Analyze	Develop	Solution	Monitor	Analyze	Develop	Solution	Monitor
VIII. Public Attitudes	Monitor				Analyze	Develop	Solution	Monitor

OPERATIONAL TASKS AND ISSUES

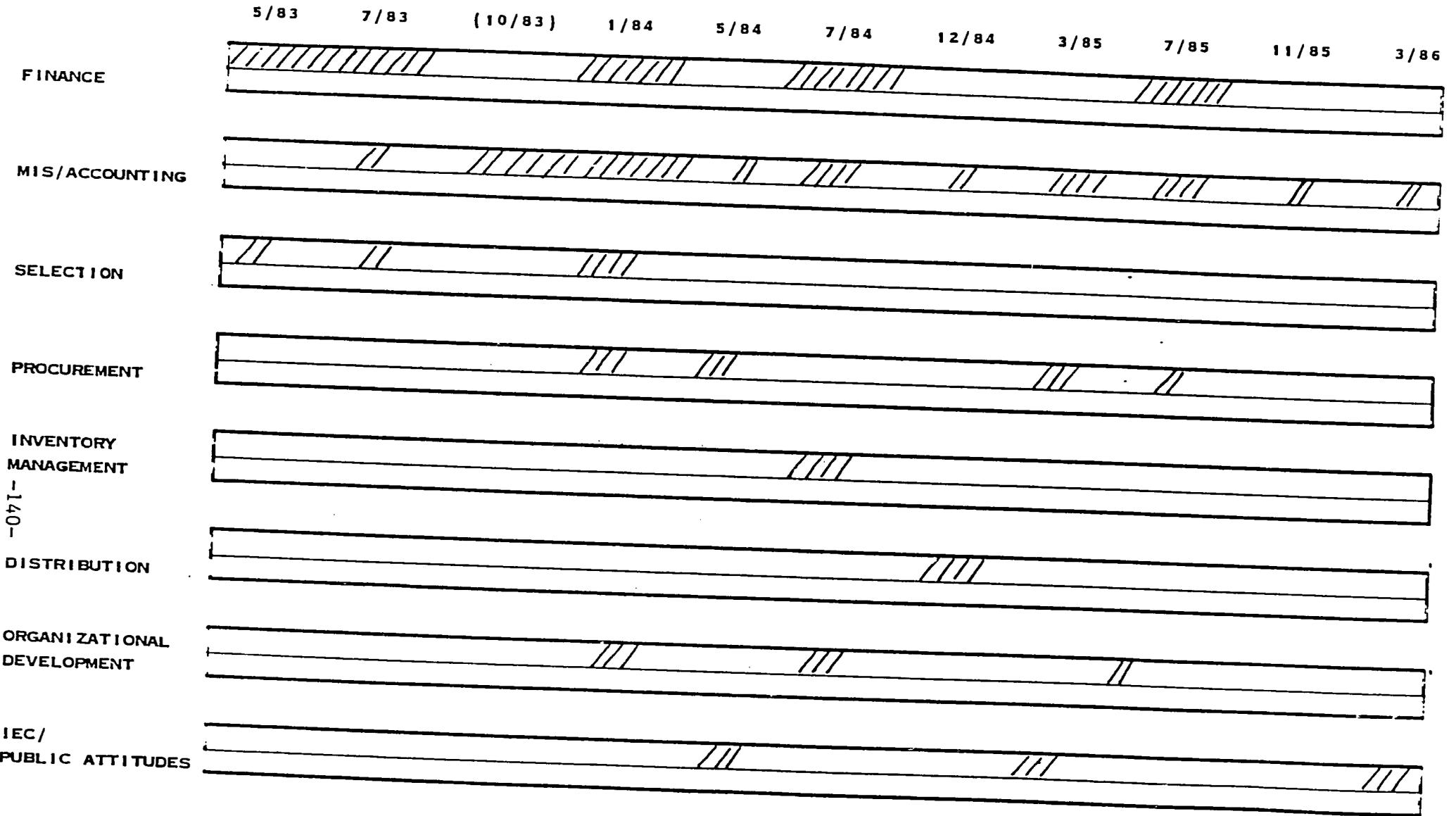
Component	Phase I	Phase II
Finance	Determine parameters of RDF Determine capitalization requirements Monitor	Determine pricing policies Set prices Monitor
MIS	Analyze current MIS Design MIS/accounting system Monitor implementation	Design/extend to district level Monitor implementation
Selection	Analyze current procedures Determine items to include in RDF Finalize drug lists Monitor	Finalize drug lists/district level Monitor/revise as appropriate
Procurement	Analyze current practices Develop management procedures Monitor	Monitor/revise as appropriate
Warehouse Management	Analyze current practices/CMS Develop management procedures/CMS Monitor	Analyze current practices/district level Develop management procedures/district level Monitor
Distribution	Analyze current practices Decision re course-of-therapy prepackaging Develop management procedures Monitor	Monitor/revise as appropriate
Organizational Development	Analyze current status Determine authority/responsibility Monitor	Analyze current status Determine authority/responsibility, district level Monitor
Public Attitudes	Monitor fee-for-service experience	Analyze current attitudes Design campaign Monitor/revise approach as appropriate

- July/August 1983:
- Government decision to postpone consumer cost sharing, and to introduce first a Phase I RDF
  - Analysis of adequacy of district budgets
  - Analysis of pre-existing MIS
  - Decision on RDF scope
  - Preliminary survey of health center patient population and drug use
- October 1983:
- Drafting of RDF accounting procedures by Dominican freelance accountant (not accepted by MOH)
- November 1983:
- RDF capitalized by EC\$500,000 loan from Social Security
- January/February 1984:
- MIS/accounting system developed and introduced, signalling actual start-up of Phase I RDF
  - Physical inventory taken at CMS
  - Analysis of existing procurement procedures
  - MOH Accounts Officer and CMS staff trained in maintenance of MIS/accounting system
- May 1984:
- MIS/accounting system reviewed and revised
  - Development of procurement schedule
  - Analysis of fee-for-service experience at Princess Margaret Hospital
- July/August 1984:
- Presentation by researchers to Prime Minister and Cabinet
  - Microcomputer purchased by Government and set up at CMS
  - First fiscal year-end Financial Analysis
  - Refinements introduced in MIS/accounting system
  - Dominica Formulary introduced
  - Analysis of stock levels
  - Research assistant hired
  - Staggered distribution schedule introduced
- December 1984:
- Research analyses continued
- March 1985:
- MIS/accounting system reviewed
  - Seminar held with PMH nurses
  - Refinement of procurement schedule, reorder levels and quantities
  - Research analyses continued

- July/August 1985:
  - Second fiscal year-end Financial Analysis
  - Refinements introduced in MIS/accounting system
  - Research analyses continued
- November 1985:
  - Research analyses continued
- December 1985:
  - District survey undertaken
- March 1986:
  - All Research analyses reviewed

Given the problems and issues that remained at the end of the study, researchers conclude that some issues deserved more attention earlier, specifically issues of RDF management and control in the Organizational Development component; other issues in Finance, Procurement, and Inventory Management needed more intensive attention than they received. This is discussed in more detail in Conclusions and Recommendations.

Figure 44  
 CHANGING OPERATIONS RESEARCH FOCUS OVER LIFE OF STUDY



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DATES INDICATE VISITS TO DOMINICA BY MSH RESEARCHERS. (EXCEPTION IS 10/83 WHICH WAS PERIOD OF MIS DEVELOPMENT BY LOCAL CONSULTANTS.)

KEY -



FOCUS OF PROJECT ATTENTION

#### IV. RESULTS

The purpose of the study was to design and implement the "best" RDF for Dominica -- an RDF whose intended benefits were an increase in the volume of drugs and supplies available to health districts and facilities, and at the same time a decrease in the financial burden on the Government, first by having consumers share in the cost of pharmaceuticals and second by enabling bulk purchases at lower unit costs. It was also expected that the RDF would promote cost consciousness in drug usage among consumers. Through this study researchers would assist the Ministry of Health with the identification of operational problems and issues and with the development and testing of solutions for these problems. It was intended that this operations research effort would assist the Ministry with the development of their RDF and that documentation of this process, both the technical content and the methodology followed, would be useful to other countries in the Eastern Caribbean and beyond who were interested in developing revolving funds.

It was felt that the operations research approach would result ultimately in the "best" RDF system for Dominica -- one that would be feasible, would work in the Dominican context, effective, that would attain the objectives that had been set out for it, and efficient, that would attain those objectives at lowest cost.

Early in the project the Ministry of Health decided to implement the Revolving Fund in two phases, postponing consumer cost sharing until the second. In the preliminary Phase I model it was the health districts and facilities who would purchase the drugs and supplies, reimbursing the Revolving Drug Fund through their budgetary allocations.

The objectives of the Phase I RDF, then, were as follows:

- to increase the availability of drugs and medical supplies to health districts and facilities
- to decrease the unit costs paid for drugs and supplies
- to increase cost consciousness on the part of the users (who were defined in Phase I as health districts and facilities)

Additional objectives in Phase II were:

- to have consumers finance a portion of the purchase cost of drugs and supplies
- to increase cost consciousness on the part of patients

Results are summarized in Figure 45.

Figure 45

RESULTS

EXPECTED OUTCOMES OF RDF

FINDINGS AT END OF STUDY

PHASE I RDF

Feasible

Effective in attaining objectives:

- Increasing availability of drugs and medical supplies.
- Lower unit costs paid for drugs and supplies.
- Increased cost-consciousness on the part of users.

Efficient (attaining objectives without wasting resources)

PHASE II RDF

Mechanics of RDF model as designed successful in Dominica.

- 23.7% more drugs and medical supplies, 22% more first-line drugs, 59% more antibiotics issued to health districts and facilities in 1984-85 than in 1983-84.
- Some unit costs reduced by as much as 6-fold.
- Overall trend toward reduced unit costs.
- Supplier relationships being developed with non-profit generic distributors.
- Some cost-consciousness expressed by district-level doctors and pharmacists (who are defined as the "users" in Phase I).
- Overall, however, districts consuming beyond their budgetary allocations.
- Many systems management procedures streamlined; some administrative procedures causing delays.
- RDF capital largely conserved -- a few exceptions identified.
- RDF functioning appears to require additional staff member -- for maintenance of MIS/accounting system.

Not yet implemented.

## Phase I RDF

The Phase I RDF was actually established in November 1983 with the \$500,000 loan made available from Social Security, and it became fully functional in February 1984 when the design of the Management Information/Accounting System was completed and was implemented.

### Feasibility

From the start, the Phase I RDF model proved to be feasible. Although there were initial difficulties in implementing some of the components or submodels as designed, the RDF as a whole quickly became viable as all staff at CMS, at the Ministry of Health, and at district health facilities became used to the system and complied with the new procedures. The mechanics of the model as designed worked in the Dominican context, and the assets of the Fund have been largely conserved, although these achievements have been made with substantial inputs from outside the Ministry -- specifically MSH researchers and the PRICOR-funded Research Assistant.

### Effectiveness

Over the course of the study the design and implementation of this RDF proved to be, at least to some degree, effective in attaining the objectives that were set out for it. The initial capitalization of the RDF enabled CMS to undertake major procurements with a view toward long-term planning. Supplies were cleared much more promptly from the port, as it was a much simpler procedure to write an RDF check than to process a payment through the Treasury.

These factors resulted in the building up of stocks at CMS; by December 1985 the value of drugs and medical supplies held in inventory was 57.6% higher than in July 1983 (although this reflects price inflation as well as a 25.3% longer inventory list). And with improved materials management systems, these stocks were better maintained. While stockouts of specific items continued to be a problem throughout the study period -- due to difficulties in estimating the lead times of new suppliers -- CMS was much more successful in making drugs and supplies available to health districts and facilities. Issues of all items increased 27.7% overall (holding average unit costs constant) between FY83-84 and FY84-85; of first-line drugs, those used for primary health care delivery at the district level, 22%; and of antibiotics, 59%.

The tight financial and materials accounting system created a new cost consciousness among staff at CMS, as they were more aware for the first time of the value of each item held in inventory. A major effort was launched to locate lower-cost but high quality new suppliers, primarily of generics. By July 1984 researchers were able to report in a presentation to the Prime Minister and her Cabinet unit cost reductions for some items of up to six-fold. Since that time, units costs for additional items have dropped, and many of them for high expenditure items where the

impact was greatest. Offsetting to some extent these remarkable successes, however, is the fact that emergency purchases continue to be required. These are nearly always from high-cost nearby distributors at much higher prices, raising the purchased item's average unit cost once again. Nevertheless, the trend is in a positive direction. When average unit costs for six successive time periods were applied to constant annual usage figures (a year's "market basket" of drugs and medical supplies), the total value of those supplies increased at below the inflation rate or decreased in real terms. As better information becomes available on monthly consumption and on supplier lead times, and as inventory management improves further, stockouts and thus emergency purchases will become less frequent; the trend in decreasing average unit costs can be expected to continue and to become more pronounced.

These cost reductions have not resulted in overall savings to the Government, however. With the simultaneous efforts to increase the quantities of drugs and supplies provided to health outlets, overall spending has in fact increased.

The changing supplier profile also indicates a long-term change. Increasing proportions of total drug and supply purchases are coming from non-profit generic distributors, 24.2% of all purchases in the first half of 1985-86 as compared to 16.2% in 1983-84. As good relationships are developed and maintained with these suppliers it will be a natural development for CMS to do more business with them.

Implementation of the Phase I RDF has also resulted in the first glimmers of cost consciousness on the part of the users. When districts began to receive "costed" packing slips enclosed with their monthly shipments and were sent price lists from CMS for first-line drugs, a number of the doctors were prompted to ask when patients were going to begin to be charged for drugs. In a survey undertaken in the third year of the project, all of the doctors and pharmacists who responded and two of three nurses who responded stated that they were more aware of the monetary value of drugs and supplies. Four of the five doctors who responded and one nurse said that they tried to prescribe a cheaper drug whenever possible; three out of seven pharmacists stated that they tried to requisition cheaper items from Central Medical Stores; three of the pharmacists also reported making an effort to explain cost to patients. In spite of these reported trends, the observed patterns of requisitioning from health districts and facilities do not seem to have changed noticeably, probably because the Ministry of Health has not yet restricted drug usage to within budgetary allocations.

### Efficiency

The degree to which these changes have been efficient is somewhat harder to assert with confidence. Efficiency has to do with the achievement of objectives without wasting resources, attaining greater outputs with constant inputs or the same outputs with

fewer inputs. In this study the outputs in terms of objectives have been achieved with increased inputs -- both financial and human. Without a "control" supply system to compare to, only observation and informed judgment are available to comment on the RDF's achievement of its objectives with relative efficiency.

Within individual components, while much progress has been made toward attaining objectives there is room for increased efficiency. The inventory list still includes many items which have not been purchased or used in Dominica since this study began, which slows down information processing; procurements take longer to process than seems necessary; there are still overstocks at CMS; both RDF payments and reimbursements take longer than expected. While RDF capital has been largely conserved, there have been a few significant losses due to misunderstandings about appropriate RDF expenditures among financial officials within the Ministry. Perhaps most importantly, maintenance of the RDF accounting system has required the efforts of an additional staff member.

### Impact

Although there has been discernible progress toward increased availability of supplies, reduced unit costs, and increased cost consciousness under the Phase I RDF, it has not been without setbacks. Early achievements in individual components or even in addressing individual operational issues were often dramatic, e.g., in reducing unit costs paid for drugs or in clearing supplies from the port. But the RDF is a dynamic system, with interactive components; these developments were influenced by developments in other components, or a lack of developments due to attention focused elsewhere. The composite result -- the sum of results in all components and operational issues -- while showing a positive trend, has been less dramatic.

In helping to make significantly more drugs and medical supplies available throughout Dominica, particularly first-line drugs to health districts in rural areas, the RDF has had significant impact on expanding primary health care service delivery. To determine whether it has influenced procurement decisions or usage patterns in any more significant way, researchers carried out a modified ABC analysis using CMS issues data from FY83-84, FY84-85, and the first half of FY85-86. (ABC analysis is described in Managing Drug Supply (MSH, 1981).

Researchers compared the highest value items for each time period (unit cost x units issued) which accounted for 25% of the total value of issues for the period. These items are shown on the following page.

FY83-84

Insulin (lente), zinc susp (F)  
 Gauze plain hospital quality  
 Fluphenazine decanoate inj. (F)  
 Lint. b.p.c.  
 Methyldopa (F)  
 Uristix (F)  
 Hydrocortisone acetate powder  
 Ampicillin (F)  
 Alcohol

FY84-85

Methyldopa (F)  
 Insulin (lente), zinc susp (F)  
 Gauze plain hospital quality  
 Insulin (rapid) regular (F)  
 Surgical blade  
 Rifampicin  
 Chlorpropamide (F)  
 Dextrose (500 ml.)  
 Vaccine, measles (F)  
 Lignocaine/adrenaline (dental) (F)  
 Fuller's earth, dosage (F)

FY85-86

Insulin (lente), zinc susp (F)  
 Methyldopa (F)  
 Gauze plain hospital quality  
 Lint. b.p.c.  
 Insulin soluble (beef) (F)  
 Chloramphenicol (F)  
 Ampicillin (F)

While many of the same items are on all the lists, and most differences among the lists are not dramatic, a few observations can be made. In all three years, many of the highest (value of) usage items addressed two of Dominica's major health problems -- cardiovascular disease and diabetes -- suggesting that drug procurement and use was already by-and-large rational when the RDF got underway. However, the third item on the list in 1983-84 was fluphenazine decanoate, an injectable tranquilizer, and sixth in 1984-85 was rifampicin, a very expensive antibiotic, usually a drug of choice only for tuberculosis. Both of these items had dropped to much lower on the list in FY85-86. In fact, in 85-86, of the five drugs on the list, two were antibiotics, one was a cardiovascular medication, and two were insulins.

These analyses do not provide conclusive evidence that the RDF has had any direct impact on usage patterns, but suggest that it has had a positive influence in bringing rationality into all aspects of the drug supply process.

Phase II RDF

At the end of this study, the Phase II RDF has not yet been implemented although some Phase II operational issues in some components have been addressed. District physicians and pharmacists are monitoring the value of their usage of drugs and supplies as against their budgetary allocations, and they are beginning to monitor usage by patients and thus to manage their inventories. They are also beginning to discuss the value of drugs with patients. These are prerequisites to a successful RDF with drug sales.

## V. CONCLUSIONS AND RECOMMENDATIONS

### A. Conclusions

By the end of the study the Phase I RDF in operation in Dominica was feasible, effective, and efficient. Early progress in the design and implementation of drastically new systems and procedures was more rapid than these researchers have seen in any other country. Yet, by the end of the study, several serious issues have emerged which threaten its sustainability. What factors have facilitated the remarkable successes in Dominica, and what constraints persist to limit them?

Working in Dominica's favor were a strong, high-level commitment to establishing a revolving drug fund and substantial experience to draw upon for guidance. A viable RDF model was available at the start of the project -- a model which had been implemented in a number of countries with varying degrees of success. The potential of an RDF, as well as its pitfalls, were known. The Minister of Health, the Health Services Coordinator, and other senior officials in the Ministry were strongly in support of introducing an RDF to Dominica. The Supplies Management Officer and staff at CMS who would be operationally responsible for implementing the new systems and procedures were a highly capable and motivated group.

One factor which was perhaps the major facilitating factor in Dominica's success was the Ministry's decision to implement the RDF in two phases. This was not part of the original workplan; it was a decision which sprung from largely political considerations, but it allowed the Ministry as well as researchers to focus on central level managerial systems for both financial and materials management and development and implementation of the MIS/Accounting System; the latter has provided information on RDF progress, guiding further RDF development and supporting research efforts. The systems developments efforts that are required to introduce consumer charges for drugs seem, in retrospect, nearly unattainable without these central level management systems in place. This may be one of the clearest and simplest, yet most important findings from this study.

Three years after the start of the project the Phase I RDF is in full swing. It no longer feels like an experiment. Yet it is still afflicted by a number of problems that limit its effectiveness and efficiency. Many of these problems emerge from operational issues that have been addressed but not squarely and definitively; they must be solved to provide the solid ground which will allow the Ministry of Health to move into Phase II with confidence.

These problems are most readily identified within the context of the RDF components:

1

## Finance

- Cash balance too low to permit prompt payments
- District budgets inadequate to cover district usage of drugs and supplies
- Reimbursements slow
- Payments to suppliers slow
- Expenditures being made which will not be reimbursed

## MIS/Accounting System

- Accounting entries not being made promptly, accurately, and completely
- System not providing management information

## Selection

- List includes many items which are never used

## Procurement

- Routine purchasing systems still not in place
- Frequent emergency purchases from high-cost distributors
- Contract terms still not specified in purchase orders

## Warehouse/Inventory Management

- Frequent stockouts at CMS
- Many items overstocked

## Distribution

- Rigidity of distribution schedule demotivating for CMS staff
- Still no procedures for backordering
- Credit note procedure not working

## Organizational Development

- No coordinated leadership for the RDF
- Responsibilities unclear
- RDF accountant (supported through this project) not hired by Ministry of Health at end of study.

An analysis of these problems leads to the observation that there are a number of recurring root causes: Authority/responsibility issues, availability of staff, inadequacy of district budgets, and capitalization. These root causes or "critical factors" are elements of three of the eight RDF components: Finance, MIS/Accounting System, and Organizational Development. While Finance and MIS were identified as priority issues in the problem analysis phase of this study, and were the focus of early project attention, organizational development was not identified as critical.

Figure 46 offers a retrospective of where the attention of both Ministry officials and researchers was focused over the life of this study, and where -- in what components -- issues which in retrospect should have been addressed were addressed inadequately or not at all. Had Ministry attention been focused differently, it is not unlikely that the Phase I RDF would be functioning more effectively and efficiently at this stage, and that the foundation for Phase II would be even more firmly laid.

In summary, at the close of this operations research study the major findings are: (1) a recognition of the validity of the phased approach in designing and implementing a revolving drug fund, (2) identification of the critical factors involved in implementing a Phase I RDF, and (3) recognition of the time frame that is required.

It is hoped that the findings of this operations research study may be of use to other countries who are interested in establishing revolving drug funds.

#### Validity of the Phased Approach

The Phase I RDF, identified and defined by the Ministry of Health in Dominica for political considerations, was found to be a very useful preliminary model or a transitional stage in RDF development. Since its design incorporated the major elements of all of the management systems required for an RDF except drug sales, introducing the Phase I model had the effect of stretching out the time line for all of the management systems development work that is required for an RDF. It allowed the necessary attention to be focused on central systems development rather than dispersed across a wider range of issues.

The Phase II RDF would not only introduce additional operational issues which are equally if not more complex to address, but also increases the stakes for system success. Once consumers are asked to pay for drugs and supplies, they have higher expectations of the system and are disillusioned if continuity of supply is not maintained.

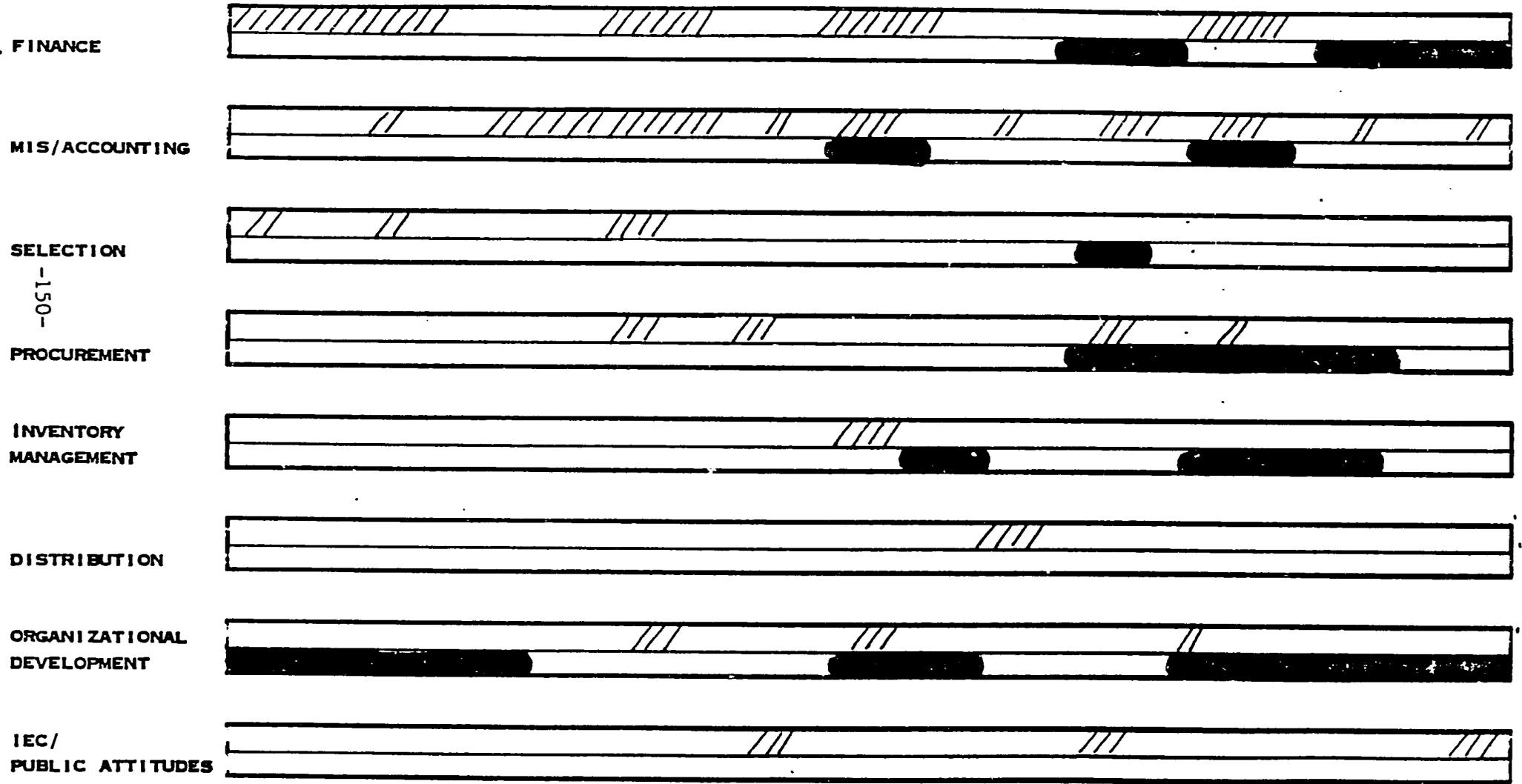
After three years of research in Dominica, where the social, environmental, and organizational factors were as favorable as they ever are anywhere to the prospects of RDF success, it is hard to imagine that an RDF with consumer cost sharing could be operational in any sense with the operational problems that remain. An effort to introduce consumer cost sharing too soon -- before central level systems were operating effectively -- would have resulted in continuing stockouts, emergency purchases, stressed systems, and, in addition, consumer disillusionment.

Researchers do not conclude that development and implementation of a Phase I model is necessarily a three-year process. A country would be advised to delay Phase II only until the operational issues that have been identified in Phase I have been addressed satisfactorily and the Phase I RDF model is operating effectively and at least to some degree efficiently.

Figure 46

CHANGING OPERATIONS RESEARCH FOCUS OVER LIFE OF STUDY  
 (including identification of areas needing increased attention)

5/83      7/83      (10/83)      1/84      5/84      7/84      12/84      3/85      7/85      11/85      3/86



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DATES INDICATE VISITS TO DOMINICA BY MSH RESEARCHERS. (EXCEPTION IS 10/83 WHICH WAS PERIOD OF MIS DEVELOPMENT BY LOCAL CONSULTANTS.)

KEY -  
 FOCUS OF PROJECT ATTENTION  
 SIGNIFICANT OPERATIONAL ISSUES ADDRESSED INADEQUATELY OR NOT AT ALL

## Critical Factors in Designing and Implementing a Phase I RDF

A review of Dominica's experience, its remarkable successes as well as the problems that have constrained these successes, leads to identification of the factors listed below as critical to the implementation of an effective and efficient Phase I RDF.

1. Coordinated leadership and management -- Authority and responsibility for RDF assets should be vested in either a single person or a committee which meets regularly to review financial reports and address operational problems and take managerial decisions.
2. Adequate staff -- Initial design of the RDF, and in particular of the MIS/Accounting System, requires the inputs of an expert accountant. (In Dominica the services of a finance and accounting consultant were available through the PRICOR project.) Ongoing RDF maintenance requires all the staff normally required at CMS to maintain the supply system plus an RDF accountant. In a system that handles 800 items supplied by 40 vendors dealing in 10 different currencies, a substantial amount of record-keeping is inevitable. The RDF accountant will maintain the accounting books and will ensure maintenance of other aspects of the MIS which provide information for RDF management; he should report to the RDF manager or RDF management committee. To ensure the continuity and reliability of the supply system, all staff should be permanent rather than temporary.
3. Adequate capitalization -- The level of capitalization required is the product of the monthly usage rate and the length of the pipeline. If accurate data are not available at the outset, the information system should be designed to collect the necessary data for continually monitoring both usage and pipeline length, in order to continually refine the capitalization estimate and make the necessary adjustments. If usage is higher than expected, or there is evidence of increasing or unmet demand, or if any segment of the pipeline is longer than expected, these issues must be addressed and resolved. Adequate funds for capitalization must be available if the RDF is to succeed.
4. Assurance of RDF reimbursement -- Because all issues from the RDF must be reimbursed in order for the fund to revolve, two variables are important -- issues and reimbursements -- and must be kept in equilibrium. This means that if issues are to increase, as is happening in Dominica, additional funds must be made available to reimburse the RDF.

It should not be overlooked that these factors emerged as critical from an organizational context in which the materials management functions -- selection, procurement, inventory

management, and distribution -- were already in place and operating satisfactorily.

Nor should it be overlooked that Dominica's progress was achieved with substantial inputs of time and technical assistance made available through this PRICOR study.

#### Time Frame and Sequencing

The length of time that is required to implement and validate the Phase I RDF model will vary from country to country. The Dominican experience has proven that it can take longer than expected even under relatively favorable circumstances, and even with the substantial outside support that Dominica received.

The "component approach" has proved a valid one for analyzing the system and addressing important operational issues, although in different countries the priorities for attention might be set differently. In Dominica the priority components were finance, MIS, and, in retrospect, organizational development. But a country where the materials management functions were not in place would not be able to put those aside at the outset; a country where information was even less readily available than it was in Dominica on past consumption or supplier prices would have to devote more time to gathering baseline data, with which to formulate early decisions.

While results can appear quickly in individual components, as happened in Dominica, these results are sustainable only if they are implemented in conjunction with developments in related components. The RDF is a complex and dynamic system, the operational issues within its components interdependent and interacting. Steady progress toward RDF effectiveness and efficiency is achieved through constant vigilance in the development of all components.

#### B. Recommendations for Dominica

At the end of the study, Dominica's Phase I RDF is afflicted by a number of critical operational problems which, if not resolved, will lead to its collapse and a return to pre-RDF circumstances in the drug supply system. Certainly if the Ministry is considering the introduction of consumer charges sometime in the near future, the Phase I RDF must be brought into equilibrium and be functioning effectively. It is an important transitional stage and, in fact, as this study's findings have suggested, almost a prerequisite to successful implementation of an RDF with drug sales.

MSH researchers suggest that the Ministry move quickly and systematically to address the ongoing operational problems that were outlined at the beginning of this section, with the following specific comments and recommendations:

- The Certificate of Deposit should be cashed immediately, and additional funds sought for further capitalization.

- A single individual (or, somewhat less desirably, a committee) should be given management responsibility for both financial and material assets of the RDF. This responsibility must include check-signing privileges.
- For sound financial management, districts must be held to their budgetary allocations for drugs and supplies or budgets must be increased. How to respond to unmet demand in the districts -- whether or not to try to meet the demand -- is an issue that will not disappear; it must be squarely addressed.
- An RDF accountant must be hired to maintain the accounting books and to prepare periodic financial statements. If this person is not a trained accountant him/herself, a trained accountant must be made available to advise as necessary. MSH researchers are aware that qualified people are available within Dominica. Arrangements must also be made for at least an annual review of the accounts.
- Efforts should be made to put permanent Government employees in CMS staff positions. The skills necessary for successfully carrying out the tasks required under an RDF are skills that require some investment -- motivation on the employee's part, which has not been possible to sustain among the temporary staff at CMS, and commitment to that staff and training on the part of the Ministry. The necessary skills are not easily transferable on short notice.

At the same time, researchers encourage the Ministry to continue to plan for Phase II. One of the major findings of this study has been that the Government's budgetary allocation for drugs and medical supplies continues to leave a significant proportion of consumer demand unmet. Yet, results of the December 1985 district survey give strong support to the hypothesis that patients in Dominica will be willing to pay for drugs if the charges are introduced through a well-planned educational and promotional campaign. The survey results suggest further that paying for drugs will, in fact, improve patient compliance, thereby extending the RDF's influence on rational decision-making to the user level.

Discussions of the eight RDF components in the Methodology Section of this report identify some of the key operational issues that will arise and must be addressed in the design and implementation of the Phase II RDF. Ministry officials are encouraged to review these issues and to address them systematically in the planning for Phase II.

Finally, researchers believe that, as the Eastern Caribbean Regional Pharmaceuticals Management Project gets underway, Dominica's experiences in attempting to rationalize her drug supply system will facilitate both her own transition and her contribution to any new regionalized systems. None of

Dominica's efforts of the past three years have been in vain; those procedures which are likely to be taken care of at the Regional level under the Eastern Caribbean Drug Service -- most likely supplier selection, purchase order tracking, and supplier performance monitoring -- will benefit from Dominica's experiences in those areas. And Dominica herself will be able to redirect CMS staff efforts toward improved estimation of drug needs, maintenance of the MIS/accounting system, more reliable procurement and inventory management procedures, and planning for Phase II. Dominica's progress will allow her to continue to lead the Region in pharmaceutical supply management.

## VI. ADMINISTRATION OF STUDY

This PRICOR study was carried out over a 35-month period from April 1983 through March 1986, supported by a total of \$215,022 in grant funds from PRICOR and managed by Management Sciences for Health.

MSH researchers made periodic visits to Dominica, approximately every 3 months, with visits averaging 3 weeks in length, during which they worked with the Ministry of Health researchers whose involvement was ongoing over the life of the study. Technical Progress Reports were prepared and submitted to PRICOR on a periodic basis and are included in full in Annex 3 of this report.

Co-Principal Investigators, from Management Sciences for Health and the Ministry of Health in Dominica, were responsible for overall supervision of all aspects of this study -- from initial design through RDF systems analysis, component analyses, data collection and analysis, ongoing monitoring and review, periodic technical progress reports, and conclusions and recommendations.

The Co-Principal Investigators were supported by frequent assistance at various points throughout the study from a number of key contributors from both MSH and the MOH. Research activities were further strengthened by the participation of two Research Associates from MSH who spent 2-3 months each in Dominica, the PRICOR-supported Research Assistant who worked full time over 21 months in Central Medical Stores, and other members of CMS staff.

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