

Re: RFP AID/NEB-00038 - Portugal

"Report on Development of an Integrated Management Information System in the Areas of Ambulatory Services, Hospital Discharges, and Finance for the Ministry of Social Assurance and Public Health, Government of Portugal, 15 January 1982"

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Report on Development of an
Integrated Management Information System
in the Areas of Ambulatory Services,
Hospital Discharges, and Finance
for the
Ministry of Social Assurance and Public Health
Government of Portugal

submitted to:

The United States Agency for International Development
Lisbon, Portugal

by

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EXECUTIVE SUMMARY

This report presents the analysis and recommendations of a team of consultants requested by the Secretary of State for Health to assist in the development of an integrated Management Information System (MIS) for health. A team of five people was provided in the following areas:

- Health Planning/Epidemiologist to provide overall coordination and assist in development of ambulatory service and hospital discharge information.
- Hospital administrator to develop a framework for productivity analysis of hospitals and allocation of resources accordingly.
- Financial Analyst to assist in assessing controllable vs. non-controllable costs and simplification of reports.
- Systems Analyst to assist in preparation of a field test of the MIS in 1982.
- Senior Programmer to assist SIS in the functional analysis for data processing.

In the areas of ambulatory service and hospital discharge information, a unified form was developed to be used by all the major health service divisions (DGH, DGS, and SMS) for each category. A comprehensive but simple list of outputs and reports was developed using a process of consultations with managers, doctors, and nurses at all levels in a variety of districts to insure that the MIS meets the needs of the users. Detailed plans were developed for a six month field test in Santarem beginning in June, 1982. A series of recommendations are offered to assist the Department of Health complete the Functional Analysis and prepare for data processing. The strategy for MIS development presented here is within the resource capabilities of the DOH. The major constraint to effective implementation of the MIS will be the degree to which the major divisions and departments can coordinate activities, organize resources, and work together to achieve the desired objectives.

In the area of hospital productivity, a model is proposed that designates a "unit of service" for each hospital cost center. This could be a patient day for nursing units, a kilogram of laundry, or adjusted laboratory examinations. Cost Center Managers, hospital administrators, and analysts in the Departamento de Gestão Financeira can then analyze resources required per unit of service (e.g., number of non-physician hours/patient day) as a method of controlling costs. Annual budgets can then be approved pending productivity improvements, which can then be monitored over time. This system will give managers at all levels more information and more control to improve productivity and decrease costs.

In the area of financial analysis, the impact of investment decisions on controllable costs was examined, real costs were projected into the future net of inflation, and the rates of growth of various hospitals were compared. It was found that the cost/bed in hospitals did not bear much relationship to size of hospital or the complexity of care. Costs for central hospitals have risen net of inflation by 5.9% per year; district hospitals are rising by 10.9% per year. By 1985, if no new hospital beds are constructed, costs for all hospitals will rise 45.2% above inflation. If all projected hospital beds are built by 1985, operating expenses will rise by 80.6% above inflation from current costs. The recommendation is made to include this type of analysis in budget allocations, and to extend it to cover ambulatory systems.

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II. HEALTH SERVICES INFORMATION

A. Introduction

During previous consultancies the relative lack of information in the area of ambulatory services and hospital discharge information has been noted. The absence of information about patient characteristics such as age, sex, and location; diagnosis; types of services; and operations performed has seriously hindered the capability of the health service system to respond to the true needs of the Portuguese people. In addition information in these areas is vital for controlling spiralling costs.

Historically, the major health services within the Ministry of Health have developed their own individual information systems, none of which are linked to each other to provide a coherent view of the types of services being provided. To remedy this situation the Secretary of Health instituted a policy to develop an integrated information system that will use a common system for all the major services. Accordingly the Secretary published a Despacho in September, 1981, that established a Policy Making Group empowered to make the decisions necessary to implement this integrated system. The Policy Making Group is under the leadership of the Secretary of Health and comprises the Directors of all the major Divisions involved, including SIS, GEPS, Direcção Geral dos Hospitais (DGH), Direcção Geral de Saúde (DGS), and Serviço Médico-Sociais (SMS). The same Despacho also established an interdisciplinary Technical Group under the general coordination of GEPS, with representatives from each of the major organizations to make appropriate investigations and plans necessary for this integrated system, and to make recommendations to the policy level group for implementation.

During previous visits to Portugal the need for a unified information collection instrument was identified in the areas of Ambulatory Health Services and Hospital Discharges. A functional analysis of the needs of various services at each level was started in January of 1981, and the needs for information for management purposes was identified. Throughout 1981, a series of meetings with planners, administrators, doctors, nurses, and other involved staff at the central, district, and local institutional levels were held with the Technical Group to gather a wide variety of input into the design of the MIS. After these consultations, a list of desired outputs was drawn up in conjunction with all the major divisions in the Ministry, and from this list two forms were developed: a Ficha do Contacto em Ambulatorio, designed to collect information on outpatient contacts; and a Ficha do Internamento,* designed to collect information on hospital discharges. Various specifications for this type of system have been discussed, and the technical working group decided that in order to gain further experience a field test was needed in one district. Members of the Technical Group also visited the United States during the month of October to review various health information systems in operation, to prepare for this field test.

* A suggestion has been made that the term "Ficha da Alta" may reflect more accurately the source of the information.

After a review of all the districts in Portugal the possible sites for the field test were narrowed down to three - Leiria, Evora, Santarem. Each one of these districts was visited by the Technical Group to assess them for their feasibility as a site in the field test as well as to gain input from administrators, doctors and nurses into the design of the system. Santarem was eventually selected for implementation of the field test because of various factors:

- 1) proximity to Lisbon;
- 2) the capability of the district level management;
- 3) the desire of the district to participate in the field test;
- 4) representative cross-section of hospitals, SMS Postos, and Health Centers willing to participate; and
- 5) sufficient volume of patient contacts and hospital discharges to provide an adequate test of the system.

This consultancy focused on assessing the needs of the proposed MIS and developing the specifications for implementation of the field test in Santarem sometime in 1982.

B. Scope of Work

The overall goal was to assist the Technical Group complete the planning needed for implementation of the field test in Santarem. The specific objectives were to:

- 1) further define the outputs described and their format;
- 2) refine the Ficha de Contacto em Ambulatorio and Ficha de Internamento;
- 3) review the results of consultations with managers and representatives of other organizations;
- 4) revise operational plans and manuals;
- 5) develop training plans.

The Technical Group and consultants made several trips to Santarem where meetings were held with various personnel within the district from all types of health service facilities to gain their input and commitment to the field test. In addition, substantial time was spent with members of the Technical Working Group and with staff from SIS to prepare for implementation of the field test. The analysis that follows is based on this experience.

C. Ambulatory Health Information

1. Ficha de Contacto em Ambulatorio

Interestingly enough, after a year of consultations with managers and supervisors throughout the health systems, the desired outputs have changed very little. There appears to be a common agreement on what is the basic minimum information needed to improve management of the health services. A list of all the agreed upon outputs is included and discussed in detail in the section on data processing. The latest edition of the Ficha de Contacto em Ambulatorio, which is derived from the outputs, is included as Figure 1 for review. Experience with the various groups to which this system has been presented indicates that most people have some difficulty understanding the MIS as an abstract concept. However, as the Ficha is explained, it serves as a concrete focus for discussion on the utility of each piece of information and how it will fit into the overall management structure in the Ministry.

Two major problems need to be resolved in the design of this Ficha. One is the patient identification number. Discussion of this item is included in Section III on Data Processing. A second problem is the list of pre-coded diagnoses designed to capture, as far as possible, the majority of diagnoses that will be seen throughout the health system. Little information exists within the Ministry on the types of ambulatory morbidity now being treated. Some small one day surveys were done in a few SMS posts to identify the most common diagnoses. These mini-surveys should be expanded to include other health service facilities, and for longer periods of time.

However, it is possible that the Technical Group may ultimately have to arbitrarily select a list of diagnoses based on the "best guess" of health practitioners in the field. As long as enough space is left in the "other" category to write in all problems or diagnoses that are not pre-coded, it will be possible to analyze the results of the field test and revise the list. Remember, this list should include "problems" as well as "diagnosis." The practitioner may only know that the patient has abdominal pain, but not know the diagnosis. In this case, the provider of services will record the problem as "abdominal pain." It is important that health professionals understand this distinction.

The "actos" section is still not clearly defined. If common agreement cannot be reached on the utility of this information, it should be dropped from the ficha.

As presently designed, the Ficha appears adequate to meet the objectives of the field test in Santarem. After this, the Ficha should then be revised based on an analysis of the results.

2. Communication

Adequate communication at all levels is vital to the success of this project. The Technical Group needs to refine its presentation of the MIS project. A descriptive document that could be widely circulated would greatly facilitate this process. As a minimum, the document should include:

- a. the goals and objectives of the MIS;
- b. the basic principles of MIS development;
 - simplicity
 - needs at each level
 - growth over time
- c. the process of development of this project;
 - historical perspective
 - MOH commitment
 - authority and lines of communication, including the various groups involved
 - the outputs defined to date
 - explanation of Ficha
 - implementation plans
- d. the mechanisms for improving the system, including solicitation of input.

Beginning in January, 1982, meetings with interested groups should be scheduled to present and discuss this document. As a minimum, the following groups need to be addressed:

- a. Policy-Making Group
- b. Decision-makers and Managers from each of the involved divisions of the MOH (DGS, SMS, DGH, Gestão Financeira, SIS, Recursos Humanos)
- c. Consultant Group, which should, at a minimum, include representatives from the following groups:
 - Medical associations of Portugal (Ordens Médicos);

- Nursing syndicates (Sindicatos da Enfermagem);
- The National School of Public Health;
- The National Institute of Public Health;
- Important health service units within the country, especially those who have some sort of experience in this type of information system;
- The Faculty of Medicine.

d. People involved in the field test in Santarem. This group will need more extensive training in preparation for the field test.

The major goals of these meetings are to:

- a. increase the knowledge of key people within the health sector about the needs of an integrated MIS for health;
- b. influence attitudes towards positive acceptance and support of the project;
- c. improve the input into the design of the MIS to better insure that it meets the needs of all the major users.

It is worthwhile repeating that the overriding objective is to simplify the outputs to the minimum amount for which consensus can be achieved. This insures that the MIS will start as simple as possible, and then can grow over time as the needs increase. It is not possible to develop a complex system like this using a small group working in isolation. Communication, both vertically (up and down within each division) and horizontally (between divisions), is crucial to the success of this project. Some of these meetings can occur concurrently with implementation of the field test. However, the meeting with the Policy-Making Group has the highest priority and this should be done as soon as possible, before implementation of the field test.

3. Functional Analysis

A good deal of work has already been completed on the functional analysis needed to design the integrated MIS for health. The Technical Group has produced and analyzed the information in the following areas:

- a. a complete description of the health system in Portugal
- b. summaries of the major causes of morbidity and mortality identified by source of information

- c. a complete description of the current health information systems within the major service units (DGS, DGH, SMS)
- d. a description of the current analytical framework for health, including the reports that are generated and their frequency
- e. a description of the management needs of each level for information to improve functions
- f. a list of desired outputs, by level and frequency (see Section III)
- g. a proposed model of the Ficha as the basic input instrument for information collection
- h. plans for field testing the MIS in one district

However, this is only the first stage of the analysis needed to begin implementation. A second stage of detail needs to be developed, such as:

- What forms will this replace in each division?
- What will be the specific responsibilities of individuals within each service institution?
- How will this system fit into current patient files?
- What additional steps are needed for data processing (see following section)?

This next level of detail requires substantial input and staff time from SIS, and all parties must agree on the functional analysis. As the intensity of this work increases, more staff time will be needed from the Technical Group. As the project moves from planning into implementation, more time will be required to complete all the required tasks successfully.

If an experienced field-worker (i.e., one who has worked on data collection, training, data processing, etc.) could be found, we recommend that such a person become a full-time member of the group, to carry through on all the important details of implementing the field test.

D. Hospital Discharge Information

A common information collection instrument was designed to be used in all hospitals for all hospital discharges, called the Ficha do Internamento (or Alta). This Ficha will abstract data from the patient

chart after discharge and will be forwarded to SIS for information processing. It is important to stress this process, since it is different from the Ficha do Contacto em Ambulatorio. The Ambulatory ficha is filled out at the time the service is provided, and parts of it are filled out directly by the provider. Even if ambulatory patient charts are not complete, the information on the Ficha should still be valid. However, the discharge data will be abstracted by a medical records technician or clerk from the patient chart after discharge, and thus requires more accurate records. Incidentally, implementation of an information system like this demands a higher level of capacity from the medical records staff. This, in turn, may require some additional training for some key people within each hospital, which may ultimately lead (as it did in the U.S.) to a new job classification - the Medical Records Technician.

More attention was paid in this visit than in previous visits to the hospital discharge information. A list of outputs is included in Section III and the latest version of the Ficha is included here as Figure 2. This list appears a bit complex for the initial field test, and it should be examined carefully to see which ones could be dropped. For example, fetal deaths and deaths by time period after operation have questionable management value. Of greater interest are the outputs related to productivity (No. of discharges and operations); patient characteristics (age, sex, location); and diagnosis, especially average length of stay per diagnosis. This will allow effective comparisons between hospitals. Remember, it is much better to start out simply and add on outputs after the system is working than to overload the system initially. This list of outputs could be reduced by 1/3 and still be extremely valuable.

Nevertheless, the feeling of the Technical Group and Consultants is that given the resources that currently exist in Portugal, implementation of this component of the information system should be possible in the near future. The Technical Group also felt that this should be coordinated with the Ambulatory Fichas in Santarem so that institutions will get experience with using both components of the MIS. Again the feeling is that the Ficha do Internamento as currently designed is appropriate for use in the field test with some changes to meet data processing requirements. Since none of the outputs relate to laboratory or X-ray services, these should be dropped from the Ficha. They can be added later if desired.

Many of the comments presented above in respect to communication and the process of the functional analyses apply equally here. Hospital discharge information should not be looked on as a separate entity, but rather as a major component of the integrated MIS in health.

E. Cultural History of Management in Portugal

There is one aspect of this MIS project that is critically important but does not fit into any defined category. This involves the cultural

history of management in Portugal and, after five visits to Portugal in the past year, it is becoming increasingly apparent that this may prove to be a major obstacle to successful implementation of this project in the future.

As part of this project, the Working Group and Consultants have had the opportunity to interact with a wide variety of health sector personnel at all levels, both public and private. The concept of improved management decisions through rational use of information is enthusiastically accepted by almost all we meet. However, a second, almost equally strong feeling emerges -- a deep skepticism that it will ever work.

In both private and public conversations our contacts have consistently voiced the opinion that, historically, decisions have usually been made on an emotional basis, or through a system of political allegiance and favors, rather than on a "rational" or "scientific" basis. Proponents of this view point out, for example, that Portugal has no university program to graduate Master's in Management, or state how difficult it is to achieve effective communication and coordination between divisions within the MOH. Each division has developed historically as an independent unit, and, although the official policy stresses integrated services and management support systems, integration has been most difficult to achieve in actual practice. Coordination and organizational linkages remain major problems that inhibit progress within the health sector.

The integrated MIS for health is intended to overcome some of these problems, yet it could easily fall prey to the same problems it hopes to solve. This is a very complex and ambitious project for the Ministry, one that requires skill, dedication, and hard work. Information is power, and development of an integrated MIS requires trade-offs and negotiations. Thus, support is required from the highest levels to insure effective coordination and cooperation among all the divisions.

An interesting example that illustrates this point clearly was discovered during our present consultation. As discussed in previous sections, the Technical Working Group is composed of representatives of each of the major divisions of the DOH, including SMS and SIS. During the past year, the Group has conducted numerous consultations at all levels and within a variety of districts to gather a wide range of input into the MIS. Yet we discovered that SIS and SMS posto No. 6 in Lisboa were developing an identical project at the same time. The two SIS technicians involved in this local information project were unaware of the larger MIS project and all the planning that has gone into it. The SMS representative on the Working Group was unaware that Posto No. 6 was doing similar work. Thus, efforts were duplicated and scarce resources dissipated that could have been more effectively used in a coordinated fashion. Of additional concern is the feeling by some program managers that now that this work has been done with SMS Posto No. 6, the results there can be applied to a national system, thus bypassing the consultative process so important to long-term success of an integrated MIS.

During our work here, we have encountered numerous instances where effective implementation of an improved management system was hampered by an inability to cooperate effectively. A key issue here is who controls information? What are the proper roles of GEPS, SIS, Gestão Financeiro, and the other divisions? Although each of the major divisions involved have publicly stated their willingness to cooperate we have found this difficult to do in actual practice. As this project moves from planning to implementation of the field test, more staff time and resources will be required, and a mutually supportive interdependence must be developed between the Technical Group and SIS. During our visit here, a great deal of negotiation took place between the two entities to establish appropriate roles and commit resources. This can be a positive process if it clarifies the situation and leads to concrete actions towards implementation. It will be a negative process that can, in effect, stop or slow down implementation if the issues of control and resource allocation are not resolved. At present, these issues seem to be the major obstacles to successful completion of this project.

F. Implementation Plan

Our feeling is that little more will be gained from endless rounds of planning an integrated MIS for health. Rather, the DOH should move as quickly as possible to implement the field test in Santarem in order to gain valuable experience. It is difficult for planners and managers at all levels who have had little or no experience with an MIS to design one from scratch. Therefore, the implementation plan presented here was developed by the Technical Group to support the field test, analyze the results, and make plans for the next stage. This process should take a year.

ACÇÕES	1981		1982												Obs.		
	NOV	DEZ	JAN	FEV	MAR	ABR	MAI	JUN	JUL	AGO	SET	OUT	NOV	DEZ			
	.Elaboração definitiva dos projectos de fichas e definição de out-puts: -Ficha de ambulatório (lista de diagnósticos e revisão da ficha existente) -Ficha de internamento																
.Apreciação da ficha e definição de out-puts com: -Grupo de consultores -Grupo local -Grupo político																	
.Planeamento do trabalho com o Grupo Local																	
.Livro de normas e instruções																	
.Teste das fichas (preenchimento a nível local)																	
.Impressão das fichas																	
.Preparação de codificadores de morbilidade																	
.Preparação de registadores																	
.Preparação de gestores																	
.Plano de trabalho com o SIS: -Estágio nos EUA -Análise funcional -Análise orgânica -Package select -Curso de formação (curso, aplicação e instalação do package) -Validation Programming -Teste																	
.Vinda de consultores Dr.Hartman																	
.Implementação da experiência operacional -Colheita da informação -Tratamento da informação																	
.Avaliação da experiência e proposta de desenvolvimento do projecto																	

G. Recommendations

1. Continue planning for implementation of the field test in Santarem by June, 1982. Suggested steps are:

a. Outputs - Do not add any new outputs. Work with the current list of outputs with a view towards simplifying them. Define each one by level and frequency of report as presented in the appendices.

b. Fichas - Simplify the fichas to correspond to the outputs. Drop any variables on the Fichas that do not directly correspond to any listed output. Define the list of Problems/Diagnoses.

c. Functional Analysis - The Technical Group should work closely with SIS to complete the Functional Analysis (see next section). The Group must consult representatives from Santarem who will be involved in the field test, in order to complete this analysis.

d. Training - Refine the instructions for filling out the form to meet the needs of the simplified outputs. Expand the instructions into an operations manual for two levels - registrars of informations and users of reports. Develop detailed plans for training these two groups of people.

2. Improve communication about this project and coordination of activities within the DOH. As a minimum, this should include:

a. Preparation of a document describing the need for an MIS, the goals and objectives, basic principles of an MIS, and the development of this project.

b. Meeting with the Policy-Making Group to establish a unified and coordinated policy about this project and establishing clearly defined roles.

c. Meetings with consultant groups to obtain input and support for this project.

3. Link development of this component of the MIS with the financial management systems being developed by the Division of Gestaõ Financiera (see sections IV and V).

Diagnostic and service information should be linked with productivity and cost information to allow grouping of institutions according to "case-mix," or types of problems treated, to assist in the allocation of resources and control of costs.

4. Provide management training at all levels - Local, District and Central.

It is clear that organizational linkages and coordination are major constraints to effective program implementation. Management implies the organization of resources to achieve desired objectives. Therefore, short courses should be developed in the following areas:

- program planning and evaluation.
- use of information in decision-making
- management by objectives
- team building and leadership
- supervision and feedback of information

Plans are currently being developed for these types of courses in two areas - within the District of Santarem for program managers in preparation for the field test, and the Escola Nacional de Saude Publica has requested technical assistance from USAID in some of these areas. The experience gained from these courses should be used to develop a series of workshops and seminars on management at the Central and District levels. The implementation and utilization of an integrated MIS on a national level will take 5-10 years, so that a phased plan for training people to make effective use of it should begin now.

5. Provide technical assistance for implementation of these recommendations.

a. Department of Health - This project is a complex and ambitious task that requires a lot of coordination and dedication. This can be best accomplished by assigning one (or more) full-time technicians to work under the supervision of the Technical Working Group to provide continuity and follow-through on all the complex tasks required. Given the importance of this project to the DOH, one full-time person will have a very positive cost-benefit ratio (i.e., the benefit will far outweigh the cost).

b. USAID

1) Health Services Information

a) Health Planner/Epidemiologist - 4-6 weeks over next 12 months

- MD/MPH in health planning or epidemiology.
- Substantial experience, both in the U.S. and in other countries, in design and implementation of management information systems in health.
- Language capability in Portuguese at the technical level.

b) Systems Analyst - 6-8 weeks over next 12 months

- M.S. or M.B.A. in statistics, managements, econometrics, or computer technology.
- Experience in design of systems for collecting and processing large data bases in health systems.
- Language capability in Portuguese, Spanish or French.
- Knowledge of computer technology and languages.

These are minimum requirements for the field test. If sufficient resources exist, the DOH would benefit from 6 months of continuous technical assistance from a systems analyst to correspond to an increased input from the DOH. Further technical assistance will be required in the second year after the field test.

2. Management Training

a) Health Planner/Epidemiologist - 6-8 weeks over next several years.

Qualifications as described.

b) Training Specialist - 8-12 weeks over next several years.

- M.Ed. or M.P.H. in Health Education
- minimum 5 years experience in training in public health programs in countries other than the U.S.
- a sub-specialty in management training, with demonstrated competence in the management areas noted above.
- language capability in Portuguese or Spanish.

III. DATA PROCESSING

A. Introduction

This section of the report addresses the multitude of activities involved in the collection, processing and analysis of data which will be used in the Management Information System (MIS). We discuss activities which must take place in order to implement the field test in Santarem. We also point out pivotal decisions which affect the MIS's capacity to expand, so that it can treat more data and cope with more complex analysis in the future.

The activities discussed here will have a great impact upon the work of the Sistema de Informática em Saúde (SIS). SIS has the responsibility for processing the raw data to produce the computer printouts, and SIS's technicians know better than anyone else about the time-consuming and expensive problems which can be caused by poorly designed systems and dirty data. Thus the next stage of the Functional Analysis must be produced by the Technical Group with extensive input both from SIS, concerning the many aspects of data processing, and from the health services (DGS, DGH and SMS) which will be supplying the data and are requesting the outputs.

For this reason, two consultants (Systems Analyst and Programmer) worked with both the Technical Group coordinated by GEPS, and systems analysts from SIS.

The discussion and recommendations presented below will help clarify some complex issues and provide a basis for further development of the MIS. After reviewing the scope of work, we define technical terms, then discuss a summary diagram of the proposed MIS. This is followed by a detailed review of the outputs for both ambulatory services and hospital discharges. Technical notes on these outputs are attached in Appendix I and II respectively. The variables needed to produce these outputs are listed, and implications for coding and intermediate files are raised. The latest version of the ficha is discussed in light of all these constraints. Programming requirements for producing the outputs are addressed; the advantages and disadvantages of using a statistical package are raised, with criteria for selecting a package which can meet the needs of the MIS. Some considerations regarding future expansion of the system are offered. Finally, the major recommendations for collecting, processing and analyzing data are summarized.

B. Scope of Work

Technical assistance in planning for the collection, processing and analysis of data for the MIS was provided by a systems analyst and a computer programmer, who worked closely with both the Technical Group and SIS. The scope of work included:

- Assist the Technical Group with finalizing plans for the outputs of the MIS in preparation for the field test in Santarem.
- Identify constraints imposed by automated processing of data, and suggest ways of operating within these constraints (e.g., layout of fichas and of reports; appropriate codes; necessary intermediate data files)
- Assess resources (equipment, personnel) available, and recommend strategies for processing the data with these resources.

A considerable amount of time was spent in trying to ascertain where the MIS stood in SIS's overall workplan; one systems analyst (also a member of the Technical Group) was available to work on the MIS, and extensive discussions were held with the Director of SIS. Although we were invited to contact other analysts and programmers on an ad hoc basis, no others had been assigned to this project, apart from the member of the Technical Group. SIS's staff were involved in other activities. Thus apart from assessing the capacity of the hardware, and some discussions with SIS's inhouse programmers and technical personnel working under contract (from IBM and SEMAP), the consultants' work was confined to the Technical Group and activities related to the Functional Analysis of the MIS. The limited contact with SIS's programming staff will not significantly hinder progress on the MIS, as long as SIS acts on the recommendation to install a suitable statistical package (see J. Programming, below).

C. Definition of Terms

Many of the terms defined below may sound familiar, but they have precise technical connotations. We found that these terms were being used inconsistently, probably because none of the members of the Technical Group nor the systems analysts in SIS with whom we worked had extensive experience with computer-sized information systems. In order to avoid confusion and misunderstandings arising from imprecise usage, we have included these definitions, which describe what we are referring to in the rest of Section III. We begin with the simplest element in the system, and progress through terms which use these elements in progressively complex combinations.

1. Data - information

Examples: diagnostic code; sex; date of birth

2. Raw data - information in the form in which it is written on the ficha, and as it is typed onto the floppy disc, which is an exact copy of the ficha's data. Raw data sometimes has to be treated (i.e., converted into another form, or used in a calculation to create a new variable) before it can be analyzed.

Example: date of birth and date of service are used to find patient's age.

3. Data entry - changing the data into "machine readable" form; that is, transforming data written on the paper ficha into a medium which can be deciphered electronically, by the computer. In the MIS, data are entered by typing information, from the ficha, into a machine which stores the data on a floppy disc.

Other types of data entry are keypunching the data onto cards, which can be read mechanically by card-sorting equipment, or electronically by a card reader which transmits the data to the computer; and direct entry of data on a terminal like a TV screen (CRT) which sends the data to an interim data file.

4. Variable - a set or class of data which consists of mutually exclusive categories. To illustrate the application of mutually exclusive, consider the data_items which describe a specific patient's characteristics:

38 years old, male, resident in Coimbra

These data items can be referred to in a way which applies to all patients, irrespective of the specific values for each individual, using the variables

age sex locality

For each service recorded on the ficha, we have to distinguish whether a data item is a specific value of a variable, or whether it has to be subdivided into more variables. The discussion of "primeira consulta" in E. Outputs provides an example of this distinction.

5. Codes - numeric representation of categories within a variable. Codes can represent words:

<u>Variable</u>	<u>Codes</u>
sex	male = 1
	female = 2

Codes can also be used to summarize continuous data into specified classifications:

<u>Variable</u>	<u>Codes</u>
age group	less than 1 year = 1
	1 - 4.99 years = 2
	5 - 14.99 years = 3
	15 - 44.99 years = 4
	45 - 64.99 years = 5
	65 + = 6

6. Character - space for containing one letter or numeral or symbol (+, *, etc.). Thus the floppy disc has space for 128 characters per record. In this sense, character is an exact parallel to "column" on a computer card.

(Note that "character" also has specific connotations regarding internal representation; it is used in this sense in Figure 5 to indicate that the variable Patient ID is in alphanumeric form on the data file.)

7. Data Element or Field - The space for one item of data. A field may be one character, as with sex, or it may take six characters, as with entidade.

NOTE: Data element is not synonymous with either "variable" or "code", because

- one variable can appear several times (e.g., prestador); each time it appears, it is counted as a separate data element.
- one variable can be subdivided into several different codes (e.g., entidade); the length of the field (number of characters) then depends upon the analysis being performed. If the report was by facility, the relevant data element would be six characters; if it was by type of facility, the relevant field would be one character.

The file layout included in I. Fichas (Figure 5) illustrates how to manage these cases.

8. Format - has two senses, both based upon the technical programming use (i.e., READ and WRITE statements):

a. the format of a data element indicates how the programmer should instruct the computer to read the data element. Thus format specifies

- length of field
- internal representation (in machine-readable form)
 - alpha or numeric or alphanumeric
 - if numeric, real or integer.

b. the format of outputs refers to the layout (mapas) in which the results of a computer program are printed out.

9. Record - all the information which refers to one observation.

For ambulatory care, a record is one patient contact.

For hospital discharges, a record is one in-patient who left the hospital (discharged, died, or decided to leave without medical permission).

For both ambulatory and hospital care, the set of information on one observation is written on a ficha, so a record contains all the information from a particular ficha.

Note that one record may contain data on more than one diagnosis or procedure; see the discussion of Multiple-Response Variables in E.2 - Hospital Discharge Outputs.

10. Record length - the number of characters which contain all the data for one observation.

11. Record layout or File layout - contains the list of data elements on each record, the format (length, alpha/numeric) of each data element, and a description of each field, including codes and references to dictionaries of codes (see 12 below).

A sample record layout is included in I. Fichas, Figure 5.

12. Dictionary - for each variable which has more categories than can easily be contained on the record layout, there must be a dictionary which describes what the numeric code means. For example, the ICDA would be the dictionary for diagnostic codes. Dictionaries are discussed further in G. Codes and H. Intermediate Files.

13. Data File - a collection of records (e.g., concatenated from the floppy discs), all in identical file layout. The file is read into the computer when the analysis program is run.

14. Concatenation - combining a collection of records (e.g., from several floppy discs) or data files (e.g. from several districts), to make a larger, single continuous data file.

15. Intermediate Input Files - files which contain information from other sources, needed to calculate the outputs (for example, number of beds, by service, by hospital). Intermediate files are discussed in Section H, below.

16. Package - a collection of general programs which perform various calculations on data, and print the results.

17. Program - the specific instructions written by the programmer, specifying what calculations the computer will do on the input files, and what results will be printed out.

18. Output - to programmers, this means the results of the program; output can be on paper, disc or tape.

19. Report - a particular table, cross tabulation, frequency distribution or listing, produced by the program.

- a cross tabulation shows the number of cases* in each cell created by specifying the variables to be included. For example, here is a cross tabulation of ambulatory contacts:

registration status by sex by type of consultation

TYPE OF CONSULTATION	REGISTRATION STATUS	NEW			ESTABLISHED			TOTAL		
	SEX	Male	Female	Total	Male	Female	Total	Male	Female	Total
	1. Clinica Geral		X	X	X	X	X	X	X	X
2. Saúde Materna		X	X	X	X	X	X	X	X	X
3. Saúde Infantil		X	X	X	X	X	X	X	X	X
4. Plan. Familiar		X	X	X	X	X	X	X	X	X
5. Especialidades		X	X	X	X	X	X	X	X	X
6. Outro		X	X	X	X	X	X	X	X	X
Total		X	X	X	X	X	X	X	X	X

Each "X" represents a cell, i.e. a unique combination of the various categories for the three variables specified in this crosstabulation. (The three cells in boxes should always have zero observations.) There are $3 \times 3 \times 7 = 63$ cells in this crosstabulation, which makes it difficult to absorb. Leaving sex out of the specification would reduce the number of cells to 21.

- a frequency distribution shows the number of cases in each category (for each value of the codes) for one variable. An example would be number of ambulatory contacts, by type of consultation. This report would be identical to the column of numbers at the extreme right of the crosstabulation example shown above.

* NOTE: Number of cases is usually the same as number of observations, but not always. For example, more than one procedure and more than one provider can be recorded within one observation (contact or discharge).

Packages usually calculate the percentage as well as the absolute frequency and total, and many provide the option of displaying the data in a histogram.

- a listing prints all the cases which fulfil criteria specified by the program. For example, one report could print the patient identification number, the entidade code and the provider code(s) for all observations in which the diagnosis was one of the notifiable communicable diseases. The listing might look like this:

<u>Patient ID</u>	<u>Entidade</u>	<u>Provider 1</u>	<u>Provider 2</u>	<u>Diagnosis</u>
XXXXXXXXXX	XX XXX X	XX XXXXX X	XX XXXXX X	XXX

20. Functional Analysis and Organic Analysis. The distinction between the contents of these two analyses is not clear-cut; for example, SIS staff said that sometimes codes were described and defined in the Functional Analysis and sometimes in the Organic Analysis, depending on whether the codes already existed or were created for the project in question. Broadly speaking, it seems that Functional Analysis includes a description of the present system of collecting and processing data, and of the proposed system; the Organic Analysis covers more technical aspects of processing the data including programming specifications, sequence of running programs, construction of variables, etc.

It is earnestly hoped that the technical staff at SIS will assist with translating these definitions to make sure that the appropriate Portuguese terminology is used. These terms should then be used consistently by all staff involved in the MIS. The remainder of Section III on data processing will use the terms as they have been described above.

D. Summary of the MIS Flow of Information

An outline of the proposed flow of information was included in an earlier report (MSH, April 7, 1981, page 14). An expanded diagram is shown below in Figure 3; it summarizes the regular activities of recording and processing data, who does each task, where the activity takes place, and the medium (paper, floppy disc, tape) on which the data are recorded. The question marks indicate items that have not yet been settled. Each activity is discussed below.

1. Record health service data.

The precise list of items which will be recorded depends upon the variables needed to generate the specified outputs. Most of the data are recorded by a registration clerk; the physician would supply the diagnosis, and the provider (doctor or nurse) would record what procedures (actos) were carried out.

FIGURE 3

SUMMARY DIAGRAM OF DATA COLLECTION AND PROCESSING FOR THE MIS

<u>ACTIVITY</u>	<u>STAFF</u>	<u>LOCATION</u>	<u>DATA MEDIUM</u>
1. Record information about - place & date of contact - patient (ID, birthdate, sex, etc.) - type of consultation - provider - diagnosis - procedures - referrals - etc.	Registration Clerk " or Medical Assistant Provider " or Medical Assistant	Health facility	Ficha
2. Coding of diagnoses, procedures, etc.	Clerical	Facility? or Coding Center? (e.g. District Health Office)	"
3. Quality control (check ficha for completeness & coding)	"	"	"
4. Movement of fichas - dispatching to data processing center - recording documents received at data processing center	"	" SIS Data Entry Post? or SIS Regional Center	"
5. Data entry and verification	Data Entry Operator	"	Floppy Disc
6. Concatenation	Programmer, Computer Operator	SIS Regional Center	Magnetic tape
7. Run programs	"	"	"
8. Distribute printout	Clerical	"	Paper

For ambulatory services, the Ficha de Contacto em Ambulatorio would be filled out when the contact took place. The most frequent diagnoses will be identified and precoded before the ficha is printed, so that a relatively small proportion of diagnoses will be written in by hand in the "other" category. If nurses provide services (e.g., counselling or family planning) these would be recorded also, as long as the patient saw a physician during the visit.

For data on patients discharged from hospital, the data are already recorded on the ficha clinica during the patient's stay in hospital. Clerical staff or a "medical records technician" would abstract the relevant items from the ficha clinica onto the Ficha de Alta after discharge.

2. Coding

Diagnoses written in by hand will be transformed into three-digit numeric codes using the International Classification of Diseases (WHO), 9th Edition. Surgical operations also need to be coded for patients discharged from hospital; the same source of codes can be used. Coding can be done quite effectively and reliably by clerical staff with one or two days' training and continued supervision. Some large hospitals already have experience with codes; the volume of discharge fichas from hospitals which treat a simpler mix of cases and provide fewer services may indicate that it would be inefficient to train coding staff at each facility. For ambulatory services, coding could be done at the facility or at a coding center (e.g. the District Health Office); the cost of code books and the need for consistent coding and supervision makes the coding center an attractive option. These factors also emphasize the desirability of identifying 25 to 40 most frequent ambulatory diagnoses and preprinting their codes on the ficha, to minimize the need for manual coding. The Functional Analysis should examine the various alternatives for coding these items.

3. Quality Control

The fichas must be checked for completeness, legibility and accuracy before they go to data entry. Quality control should be done in a location which permits easy access to the health facility and coding center, so that problems can be resolved and errors corrected quickly. It may be appropriate to have some quality control at the facility, and some where coding takes place. Quality control is a clerical function with supervisory responsibilities.

4. Movement of Documents

The fichas will be dispatched to the data processing center regularly (weekly or monthly). The number of fichas dispatched should be recorded and compared with those received at the data processing center; the proposed sequential number printed on the ficha would greatly facilitate this aspect of document control (see below, I. Fichas).

5. Data Entry and Verification

Data entry involves typing or key-punching the hand-written information from the ficha onto a medium which is machine-readable. SIS has recently changed its equipment so that it is no longer restricted to using computer cards with 80 characters (columns) per card; now, data can be typed onto floppy discs. Each unit of observation (or record) can have up to 128 columns on the floppy discs before identifying information (e.g., patient identification number) has to be repeated. This equipment can also be used to do some verification that the correct data have been typed into each field. For example, the machine can be programmed to accept only numeric data in certain fields, or only alphabetic data, and the acceptable ranges of data can be programmed in advance. Some illustrations of range-checking are that anything typed in the field containing the variable "Sex" must be either 1 or 2; dates can also be checked for reasonableness (e.g., "Month" must be between 1 and 12), if not for accuracy. If check digits are used on identifying numbers, this equipment can verify check digits in Modulus 10, which will catch about 95 percent of incorrectly recorded identifiers. The equipment would have to be programmed to verify check digits based on other algorithms (e.g., Modulus 23). Note that this equipment cannot perform logical checks between different fields; an example of this kind of verification is that if sex is male, then type of consultation cannot be Saúde Materna. Once the verification program is operating, the data entry staff simply respond to the machine's messages that the data just typed in are unacceptable. The procedures for resolving problems discovered during data entry must be specified in the Functional Analysis.

Two Honeywell Bull floppy disc machines are scheduled to be delivered to Santarem District early in 1982, as part of SIS's nation-wide strategy to prevent bottlenecks in the regional centers' data entry departments. Note that this equipment is not yet functioning, and operators have not yet been trained. (Each machine can support two operators working simultaneously.)

6. Concatenation

After the data have been typed onto floppy discs, the records (contacts or discharges) have to be combined into one data file before the computer program which generates the outputs can be run. The data are moved from the floppy discs onto magnetic tape by a utility program, which can also be used to create a record structure which is more suitable for computer analysis. A brief example will demonstrate the elegance of this application.

- On the ficha, dates are recorded in the way we write them on checks, letters, etc. - day, month, year (DDMMAA)
- Patient's age changes continuously, so we record date-of-birth and date-of-service.

From these two dates, the patient's age can be calculated in an infinitesimal fraction of a second by the computer.

- The way the machine does this calculation is to subtract date-of-birth from date-of-service, so these two dates have to be transformed into year, month, day (AAMMDD)*
- It is far more efficient to do these transformations once, in the utility program which moves data from the floppy disc to magnetic tape, than to move the data around in memory (the space used by the computer to execute the program) every time an age must be calculated.

Further verification (e.g., consistency checks between fields on key variables) can take place in the utility program, and any errors found can be corrected before the data file is constructed.

Concatenation of floppy disc records must take place where SIS has an IBM 4331 in operation.

7. Run programs

The computer programs which generate the printouts containing the outputs are run on the data file, at SIS's regional center. Various other input files will be needed to permit the specified outputs to be calculated. The identification of these input files should take place during the Functional Analysis; the need for such

* If the analysis program (e.g., the statistical package) does not have a ready-made date routine, age calculations can be further simplified by dividing the numbers produced by the AAMMDD transformation by 10,000, and truncating the result of the subtraction. For example, date-of-birth is 10th March 1951 and date-of-service is 1st December 1981.

$$\begin{aligned}
 \text{Date-of-Service minus Date-of-Birth} &= 81.1201 - 51.0310 \\
 &= 30.0891 \\
 \text{Age, at Date-of-Service, in completed years} &= 30
 \end{aligned}$$

If the service had taken place on 9th March 1981, age would have been 29.9999, which would have been correctly truncated to 29.

extra data files can be minimized if SIS systems analysts are thoroughly involved at the early stages of variable identification, specification of outputs, and ficha design. An example of such intermediate files is a dictionary which links postal code to district/concelho/freguesia code; this issue of geographic identifiers is discussed below in G. Codes.

Note that in a national MIS, all programs which generate statistics for the whole country must be run in one place at one time. This implies that data from two of SIS's regional centers would have to be transferred to the third in order to produce national-level aggregations. Since the field-test is confined to one district, this process will not take place. However, before the MIS is expanded, further analysis should be performed to investigate the possible ways of combining data from the three regions, and to stipulate the protocols for aggregating these data into national reports.

8. Distribute printout

The pages of printout have to be separated, and the relevant outputs dispatched to the managers and administrators who are designated to receive them.

This summary description of how the MIS will operate barely touches upon the series of activities now under way to implement a field test. For example, the "start-up" issue of training staff to fill out the ficha is missing from the diagram. The Functional Analysis should include discussion of such issues, many of which the Technical Group is already working on, as shown by the time line in Section II. The Functional Analysis should also identify variations in the flow of information. For example, data on both ambulatory services and hospital discharges are filled out at the facility, but at different times in relation to when the services were provided. Special protocols to cover home visits and school services must be developed; the staff performing each task have different titles in different services and facilities. It is useful to treat these as variations upon the central flow, rather than as fundamental differences, so that the overall unity of the system's concept is retained.

Unresolved items and details such as those mentioned in the preceding paragraph should be addressed in the Functional Analysis (what information flows and how it flows, both now and in the proposed MIS) and the Organic Analysis, which specifies data files, the sequence of processing, the precise construction of variables, and treatment of raw data to transform it into the reports specified by the users.

The diagram does emphasize that the MIS is a continuum which begins with the patient giving information about himself to the clerical and medical staff, and which comes to rest when the computer

printouts containing the processed data (or outputs) are distributed. The reports are used by local managers and staff in the facilities to improve services and delivery of patient care, and by district and central managers for evaluation, decisions about resource needs, planning, etc. If the results in the regular reports indicate extraordinary circumstances, the data can be processed further, in response to the managers' requests for more specific analysis of noteworthy information.

E. Outputs (Reports)

The Technical Group has been developing specifications for cross-tabulations, frequency distributions and listings that SIS will produce from the raw data. The list of reports on ambulatory services that was suggested in April 1981 has changed very little after discussions with a wide variety of professionals at all levels of the health services. This list has been expanded to show specific information needed by SIS, and revised to reflect discussions during the last six months. During November, a preliminary list of reports on hospital discharges was developed. Some recommendations were made in Section II, suggesting that the complexity of these outputs be reduced. In the following pages we give the latest version of specifications for ambulatory data (Table 1) and hospital discharge data (Table 2). The Notes to these tables are attached as Appendix I and II respectively; they go into considerable detail in order to record the reasoning behind decisions which have been made after many months of discussion, and to focus attention on items which must be settled very soon, so that the field test can proceed.

The outputs should be reviewed by SIS with the following questions in mind:

- a) Does the terminology used in the specifications correspond to data elements appearing on the ficha? If not, what variable does the request for the report refer to? What category within a variable?
- b) Can all of the specified reports be calculated from data on the ficha? If not, what extra information must be provided? How can it be provided?
- c) How many copies of each report are needed? For whom are these copies intended? (SIS has to distribute the output.) How often is each report generated?

When these questions are answered with input from the Technical Group, the reports will correspond to what they want to see. The final list of outputs for the field test should come from the entire Technical Group, not from individual services. For example, both DGS and DGH administer hospital services, and even though the concelho hospitals are quite different from district hospitals, many of the reports needed will be the same.

TABLE 1

LIST OF OUTPUTS ON AMBULATORY CONTACTS

<u>REPORT</u>	<u>VARIABLES</u>	<u>NOTES</u>	<u>TYPE OF PROGRAM</u>	<u>RECIPIENTS</u>	<u>HOW OFTEN PRODUCED</u>
1	Number of Contacts by Provider by Facility (Entidade)	a b c	Crosstab		Monthly, Quarterly, Annually
2	Number of Contacts by Patient's Freguesia by Patient's Concellio by Facility	a d d c	Crosstab		Annually
3	Number of Contacts by Sex by Age Group by Facility	a e c	Crosstab		Monthly, Quarterly, Annually
4	Number of Contacts by "Contacto em" by Facility	a f c	Crosstab*		Monthly, Annually
5	Number of Contacts by (25) Problem/Diagnosis by Facility	a g c	Crosstab*		Monthly, Annually
6	Number of Contacts by Type of Consultation by Registration Status by Facility	a,h i j c	Crosstab		Quarterly, Annually
7	Number of Contacts by Type of Consultation by Type of Visit by Facility	a,h i k c	Crosstab		Quarterly, Annually
8	Number of Procedures by Type of Procedure by Facility	l m c	Crosstab*		Quarterly, Annually
9	Number of Patients by Type of Consultation by Facility	n i c	Crosstab		Annually
10	List of Patient IDs by Diagnosis by Facility	o p c	Listing		Upon Request

*Although these outputs are technically crosstabs, they will look like frequency distributions if data for each facility begin on a new page.

TABLE 1 (Continued)

<u>REPORT</u>	<u>VARIABLES</u>	<u>NOTES</u>	<u>TYPE OF PROGRAM</u>	<u>RECIPIENTS</u>	<u>HOW OFTEN PRODUCED</u>
11	Number of Contacts (by Facility) by Provider	a q r	Frequency distribu- tion (or Crosstab)		Quarterly? Annually
12	Number of Contacts by (25) Problem/Diagnosis by Provider	a g r	Crosstab*		Upon Request
13	Number of Contacts? Patients? by Registration Status by Provider	a,s j r	Crosstab		Quarterly? Annually
14	Number of Contacts by Type of Consultation by Type of Visit by Provider	a i k r	Crosstab		Quarterly Annually
15	Number of Procedures by Type of Procedure by Provider	l m r	Crosstab		Quarterly, Annually
16	Number of Contacts by (25) Problem/Diagnosis? by Concelho?	a t u	Crosstab*		Annually?

*Although these outputs are technically crosstabs, they will look like frequency distributions if data for each facility begin on a new page.

1. Ambulatory Contact Outputs

Table 1 shows Reports 1 to 10 by facility, Reports 11 to 15 by provider, and Report 16 by concelho. In the process of reviewing the Technical Group's previous specifications included in MSH's report of April 1981 (pages 13-15), some reports were simplified. For example, if only one consultation per ambulatory contact is recorded, then "number of consultations" becomes identical with "number of services" (see old outputs 6 and 7). Similarly, if the old outputs mean number of contacts, and not number of individual patients, then "number of patients by diagnosis" (old output 11) is a different way of specifying "number of contacts by diagnosis" which is Report 5 in Table 1. It seems as if the first output specified for localidade (i.e., number of contacts in each health service unit) would contain the same information as Report 2 in Table 1, so the former output has been dropped.

The detailed technical notes to Table 1 which are included in Appendix I discuss points such as defining variables in an unambiguous manner (e.g., "primeira consulta"), analyzing multiple-response variables, making outputs comparable with each other, and identifying sources of bias in the MIS data.

Both the Technical Group and SIS should review Table 1 after looking at the Notes in Appendix I, to make sure that the deletions have not unintentionally removed a necessary report. Any new specifications must make it clear precisely which unit of observation (e.g., patient or contact) and which variables are to be included. The outputs for the field test should then be finalized, including specification of the recipients and how often the reports are produced (see (c) above).

2. Hospital Discharge Outputs

The first draft of outputs on hospital discharges was specified by the Technical Group during November. An amended set of outputs is presented in Table 2; Reports 1-7 refer to discharges (saídos), Reports 8-12 refer to operations, Reports 13-16 are about births and deaths, Reports 17 and 18 show occupancy and turnover rates, and Reports 19 and 20 show average length of stay. Appendix II contains detailed notes on the hospital discharge outputs. Here, we raise some general issues which need to be clarified.

a. Analysis of Multiple-Response Variables

Some variables can have more than one response recorded (e.g., problem/diagnosis, operation, physician). This raises the question of whether a report containing these variables should include only one observation per discharge (i.e., the principal diagnosis, operation, etc.), or whether all recorded information should be processed.

TABLE 2

LIST OF OUTPUTS ON HOSPITAL DISCHARGES

<u>REPORT</u>	<u>VARIABLES</u>	<u>NOTES</u>	<u>TYPE OF PROGRAM</u>	<u>RECIPIENTS</u>	<u>HOW OFTEN PRODUCED</u>
1	Number of discharges by service by hospital	a b	Crosstab*		Monthly, Annually
2	Number of discharges by concelho of patient by hospital	a c	Crosstab*		Annually
3	Number of discharges by sex by age group by hospital	a d	Crosstab		Annually
4	Number of discharges by selected diagnosis by hospital	a,f,g e,f,g,h	Crosstab*		Monthly, Annually
5	Number of discharges by diagnosis by facility	a,f,i e,f,i,j j	Crosstab*		Monthly Annually
6	Number of discharges by origin of patient by hospital	a k	Crosstab*		Annually
7	Number of discharges by destination of patient by hospital	a l	Crosstab*		Annually
8	Number of operations by service by hospital	m,n,t b	Crosstab*		Monthly Annually
9	Number of operations by physician by hospital	m,o o,p	Crosstab*		Quarterly, Annually
10	Number of operations by selected type of operation by hospital	m,q,r m,q,r	Crosstab*		Monthly
11	Number of operations by type of operation by hospital	m,r r,s	Crosstab*		Monthly

* Although these outputs are technically crosstabs, they will look like frequency distributions if data for each hospital begin on a new page.

TABLE 2 (Continued)
LIST OF OUTPUTS ON HOSPITAL DISCHARGES

<u>REPORT</u>	<u>VARIABLES</u>	<u>NOTES</u>	<u>TYPE OF PROGRAM</u>	<u>RECIPIENTS</u>	<u>HOW OFTEN PRODUCED</u>
12	Number of operations by rank of operation (1st, 2nd) by hospital	m t	Crosstab		Monthly
13	Number of births by birthweight of newborn by gestational age by hospital	u v	Crosstab		Annually
14	Number of fetal deaths by birthweight of fetus by gestational age by hospital	w u v	Crosstab		Annually
15	Number of deaths by days since admitted by whether autopsied by hospital	x y x	Crosstab		Annually
16	Number of deaths following surgery by days since last operation by whether autopsied by hospital	z,A y,A z	Crosstab		Annually
17	Occupancy rate by service by hospital	B,C b	Crosstab*		Annually
18	Turnover rate (Doentes/cama) by service by hospital	C,D b	Crosstab*		Annually
19	Average length of stay by service by hospital	E b	Crosstab*		Monthly
20	Average length of stay by selected diagnosis by hospital	E e,g,h	Crosstab*		Monthly

* Although these outputs are technically crosstabs, they will look like frequency distributions if data for each hospital begin on a new page.

Percentages for multiple-response variables must be calculated using the appropriate denominator. For example, when calculating percentages for principal diagnoses, the denominator will be the same as the total number of discharges, whereas if all diagnoses were included, the denominator would be bigger. If one wishes to use data from two separate reports, then for some analyses it may be necessary for both reports to have the same denominator (for example, number of discharges and number of operations, both by service).

Each report which contains a multiple-response variable must specify whether the output should contain the principal observation or all recorded information for that variable.

b. Choice of Selected Categories or Most Frequent Categories

The variables for diagnoses and operations can have multiple responses, so the specification of reports containing these variables permits a refinement beyond the distinction between principal and all categories mentioned above. The Technical Group can specify certain codes in advance to monitor medical management; they can also specify outputs which will permit managers to analyze case-mix, using data on diagnoses or operations which occur most frequently.

i - Medical Management Indicator. For each of the four major medical services (medicine, pediatrics, obstetrics, surgery), several diagnoses and operations are selected. The choice is based upon considerations such as:

- diagnoses which are common and which often lead to medical complications if not treated correctly (e.g., otitis media)
- operations which have an accepted incidence in the population (e.g., hysterectomy) or which have well-established expectations concerning length of stay (e.g., appendectomy)

The frequency with which these cases occur and average length of stay give an indication of how different hospitals are managing relatively standard cases. Extraordinary cases tend to be absorbed by aggregating the statistics, but systematic variations away from the norm will become obvious over time. The technique of publishing hysterectomy rates from different hospitals was used as a passive management tool in Michigan in the 1940's; the frequency of hysterectomies declined noticeably in response to this information.

The data can also be used as an active management tool, by comparing information on selected problems from a specific hospital with information on the same problems in similar institutions. Hospitals which consistently vary from the norm can be studied further to find the causes of variation. Are their complication rates high? What is the post-operative infection rate? How are the services managed? Analysis of "positive deviants" (i.e., institutions or services which perform noticeably better than average) may give additional guidelines for improving the situation in all hospitals.

- ii - To demonstrate case-mix. If all recorded information on diagnoses or operations is processed, and the 25 most frequent codes are reported, then one has an indication of the hospital's case-mix. In hospitals where a large percentage of observations are accounted for by 25 codes, the case-mix is probably less complex. If the distribution looks relatively flat, with each diagnosis accounting for only 1-2 percent of the total, then this suggests that the facility is treating a wide range of cases. Case-mix will provide some explanation of variations in length of stay, staffing problems, and budgetary allocation between hospitals.

c. Births

Table 2 contains two outputs (13 and 14) relating to births. We recommend that the Technical Group considers dropping these outputs for the following reasons:

- i - Small cell sizes - Some hospitals have very few deliveries, and the incidence of births compared to total discharges is quite low. The cell sizes are likely to be so small that it is not worth devoting space on the ficha and clerical training time to obtain these data from the MIS.
- ii - Duplicating Data Collection - The information on fetal deaths is recorded on the death certificate, which is processed by the Instituto Nacional de Estadísticas. Rather than collecting the same information again, the data should be obtained from the INE.
- iii - Problems of Definition. Defining when an embryo becomes a fetus, when a fetus becomes an infant, whether a baby is born alive or dead presents a problem which may prove too specialized and complex for MIS to solve. If patient records do not contain accurate information on fetal deaths, the data which the clerical staff can copy onto the discharge ficha will be incomplete. Given the small cell sizes, this specialized effort is likely to prove very costly in terms of staff time.

Data on fetal deaths should be obtained from the INE; if specialized information on birthweights and gestational age are needed, then it would be more appropriate to use a specialized study than to overload the MIS.

d. Deaths

Table 2 specifies three outputs (14, 15, 16) on deaths. The Portuguese legal code may stipulate that hospitals have to report the number and percentage of deaths, or that patient records have to show the number of hours since admission or last operation. It will require extra clerical time or machine time (see Notes w and y to Table 2) to calculate these outputs, and it is not clear that they can be calculated to the level of accuracy specified in the outputs; for example, if the patient's record does not show both hour of admission and hour of death and hour of operation, then the MIS cannot be expected to report accurately on the number of deaths occurring less than 48 hours since admission or surgery. Unless the law requires hospitals to report these data, we suggest that data from death certificates be used, rather than duplicating collection of information on deaths and stressing the MIS unnecessarily.

e. Occupancy Rate

This statistic is used in Report 17, and is defined as follows:

$$\% \text{ ocupação} = \frac{\text{Dias de internamento}}{\text{Dias do ano} \times \text{lotação}} \times 100$$

The data collected for the MIS are discharge data; thus we can calculate the number of in-patient days of patients who have already left the hospital, but have no information on length of stay of patients still in hospital. To calculate occupancy rate perfectly accurately on a periodic basis as implied by "dias do ano", one needs hospital census data, based on a daily count of patients. Clearly this is beyond the scope of the MIS. A close approximation to occupancy rate can be calculated once per year, and this is proposed for Report 16. The imperfections in this statistic stem from some patients who were admitted in a previous period being aggregated in the year in which they were discharged. This tends to be cancelled out by patients who were admitted this period but are still inpatients when the current period ends.

f. Automated Processing of DGH Data

The reports specified in Table 2 cover many of the statistics which are now calculated by hand to complete the DGH's Elementos Assistenciais A Serviços de Internamento e de Consulta Externa. The chart below shows which report will contain the information.

INTERNAMENTO										
Lotações	NÚMERO DE:				Existência média do doentes	Demora média global dos doentes	Doentes tratados por cama	Percentagem de ocupação	Desocupação média das camas	Percentagem de falecimentos
	Doentes tratados	Doentes saídos	Doentes falecidos	Dias do internamento						
Inter-mediate file	-	Report 1	Report 15	-	-	Report 19	Report 18	Report 17	-	-

The first column (number of beds) must be supplied to the MIS from an intermediate input file, not from the ficha. Doentes tratados is not available from discharge data, as discussed in (e) above. Total Dias de internamento (calculated from discharged patients' data) will not be reported but could be calculated by multiplying the number of discharges in Report 1 by average length of stay in Report 19. None of the reports shows percent of deaths by service, although all the data needed to produce this output are available.

The Elementos Assistenciais contains two statistics which have no obvious utility as medical management tools:

$$\text{Existência média} = \text{Dias de internamento} \div 365$$

$$\text{Desocupação média} = \frac{\text{Capacidade} - \text{Dias de internamento}}{\text{Doentes saídos}}$$

where capacidade = dias do ano X lotação

None of the reports contains these items.

g. Reducing the Number of Outputs

Section II recommended that the array of reports already specified should be reduced by the Technical Group. This section has suggested some candidates to be dropped. It will not be necessary to run all the specified reports every month. (Review the last column of Table 2, How Often Produced.)

Valuable management information is provided by two or three of these outputs; careful analysis may suggest further investigation of certain hospitals' data. It will be easier to manage the MIS if analysis is targeted in this way.

h. Differences between Working Draft and Table 2

Here we summarize the reorganization of the hospital discharge outputs specified in November, 1981.

- Report 11 is an addition to show which operations are performed most frequently.
- Report 12 combines two outputs on the Working Draft which would each have consisted of one piece of information per hospital.
- Report 13 combines information on birthweight and gestational age, since this information is far easier to analyze in this format.
- Report 14, on fetal deaths, now follows the report on births.
- The reports on deaths by length of stay (15) and deaths by days since surgery (16) include the information about autopsies.

As for ambulatory outputs, the Technical Group and SIS should review the hospital discharge outputs, bearing in mind the points raised above and the technical considerations raised in the Notes (Appendix II).

F. Variables

Having specified the outputs in Tables 1 and 2, the necessary variables can be identified quickly. The variables for ambulatory contacts and hospital discharges are listed in parallel, to demonstrate which items are needed for both fichas. We have also dismantled the variables into the data elements which must be collected in order to construct them; for example, age-group is constructed by calculating age from date of contact and date of birth, then aggregating age into the six categories described in the Notes to Tables 1 and 2.

Table 3 was drawn up using the tables of outputs; a study of these tables reveals that some data elements which everyone has agreed are essential to the MIS are not yet used in any outputs. This does not necessarily mean that they should be dropped from the ficha, but their inclusion should be reviewed. They may be necessary for second-round analysis of conditions identified during preliminary analysis. Table 3 also highlights the absence of outputs which are aggregated at the district level; high-level managers and planners will need data aggregated by administrative areas in order to assess health service delivery and needs in different regions of the country. Thus the list of ambulatory variables should include patient's district of residence, although this will not be needed for the field-test.

TABLE 3

LIST OF DATA ELEMENTS NEEDED TO
CALCULATE MIS OUTPUTS

Ambulatory Contacts

Facility ID, including
District
Concelho

Date of Contact

Where contacted (Contacto em)
Patient's Residence, including
Freguesia
Concelho

Sex
Date of Birth
Identification Number
Registration Status (New/Established)
Provider 1
Provider 2
Type of Visit (First/Follow-up/Routine)
Type of Consultation (Geral/S. Mat/etc.)
Diagnosis - Principal only

Procedures (Actos) 1
2
(How Many?)

Hospital Discharges

Hospital ID, including
District

Service from which
patient was discharged

Date of Contact
Date of Discharge (including
death)
Date of Last Operation
or
Hours/Days since last
operation

Patient's Residence, including
Concelho
District

Sex
Date of Birth

Médico Assistente
Médico Cirurgião 1

Diagnosis - Principal
- Secondary
Operations - Principal
- Secondary

Origin
Destination (includes death)
If died, whether autopsied
Newborn - Birthweight
- Gestational age
Beds per service (Lotações)

G. Codes

In order to automate processing of the data, many items which have been referred to in words must now be given numeric codes. The decision about which number should represent each category is often based on arbitrary yet reasonable grounds. In the case of sex (1=male, 2=female), the codes follow widespread usage. If no widely accepted system of codes exists for a variable (e.g., type of service in hospitals), there will be a choice. For example, codes for service could follow the sequence on the DGH's Elementos Assistenciais (Medicina = 01,, Cirurgia Plastica = 20; those not printed assigned unique codes by DGH and SIS); alternatively, a complete list of types of service could be drawn up, in alphabetical order, and codes assigned sequentially.

There are a few codes which need special attention, because of the way they can be used in an automated data processing system. We discuss codes for diagnoses and operations, geographic codes, and patient identifiers in this section. The final decisions about codes and variables are closely related, so these decisions should be made cooperatively by the services and SIS, and not in the isolated ad hoc manner in which codes have been determined on other informatics projects to date. The choice of codes should not be determined by what has been developed for special-purpose projects with limited applications. The MIS is designed as a national system with managerial and public health applications which imply integrated coding, especially of data elements with geographic components and those which move between facilities (e.g., providers and patients).

1. Codes for Diagnoses and Operations

The array of possible problems, diagnoses and surgical procedures which coders will encounter is enormous. A well-established coding system which covers the vast majority of medical conditions and operations already exists. We recommend that the International Classification of Diseases, Ninth Edition (Geneva: World Health Organization, 1977) be used for problems and diagnoses, and for surgical procedures. The aggregated outputs which users of a Management Information System need make it clear that the codes' level of detail should be appropriate to this level of aggregation; thus three-digit codes are recommended for both diagnoses and surgical procedures.

2. Geographic Codes

The ambulatory outputs indicate that we will need geographic indicators for patient's freguesia and concelho, and the concelho and district of the health facility. The hospital discharge outputs use patient's concelho. In order to identify freguesia and/or concelho unambiguously, one also needs district codes. When the MIS expands beyond the pilot study in one district, each facility and hospital must also have a district code. Future analysis has been

discussed which will identify how many patients obtain health care outside the concelho where they live. Thus, the following geographic codes are needed:

<u>Hospitals and Ambulatory Facilities</u>	<u>Patients</u>
Concelho	Freguesia
District	Concelho
	District

a) Hospitals and Ambulatory Facilities

Hospitals which have outpatients will have concelho recorded on the Ambulatory Ficha. For any given hospital, the same hospital identifying code will be used for both ambulatory contacts and hospital discharges. Thus we propose that the coding system for facilities and hospitals include both concelho and district codes, which are already well-established.

The 3rd Draft of the ambulatory ficha (see Section II) contains a six-digit code which identifies entidade using district (2 digits), unit number (3 digits), and type (1 digit). An earlier draft had an eight-digit code which included concelho. We discussed the unit number to investigate whether it was connected in any way with concelho, and discovered that it is not; the unit numbers already in use by SMS were assigned in sequential order when the facilities opened. There are at least three ways to identify the facility's concelho within the MIS:

- i) Add a two-digit concelho code to the facility code. Over time, this will take extra clerical time, keypunch time, and space on the magnetic tapes, and is not necessary if Options 2 or 3 are considered feasible.
- ii) Instead of constraining the entire coding system for facilities and hospitals by SMS's existing unit codes, build a new code which incorporates concelho. This may entail a four-digit unit code, two for concelho and two for unit within concelho.
- iii) Use an intermediate file which uniquely connects the existing three-digit unit code with concelho within a district. For example:

<u>Unit No.</u>	<u>Concelho</u>
001	14
002	22
003	03
004	05

This is possible; for example, concelho code could be added to the data file during the utility program which moves the data from floppy disc to tape and restructures the record. The intermediate file would have to be created, then used every time a new set of data were processed. This option would take little machine time but would make each record on the tape two characters longer.

SIS should investigate existing coding for hospitals and facilities, and consider these three options. SIS should then make recommendations concerning facility and hospital codes to the Technical Group and the services.

b) Patients

The MIS could obtain geographic data on patients either by recording freguesia, concelho and district directly, or by using the postal code.

Informal discussion suggested that patients may not know what freguesia they live in. The written address would have to be converted into codes by clerical staff using a specially prepared dictionary. This could be done either at the facility or at a coding center. Clerical staff would memorize local codes rapidly; facilities which treated patients from a large catchment area would need more clerical support for this activity.

A brief examination of the postal code indicated that it did not cross administrative boundaries at the district level. The postal code is constructed differently depending on whether an area is a city or a barreiro. In cities, the last two digits of the four-digit postal code appear to end in 00 for residences; businesses, banks and some government services use the Codex system, constructed by the Post Office using the last two digits, for more precise definition of location. For barreiros, the last two digits identify the village. These codes seem to end in 0 or 5. Codex codes never end in 0 or 5.

The considerations regarding whether postal code could be used to identify patient's residence are the following:

- i) Do patients know their postal code?
- ii) Can the postal code be linked uniquely with freguesia and concelho, or does it cross these administrative boundaries?
- iii) Is there an existing dictionary (preferably on tape or disc) which links postal code with freguesia/concelho/district?

If postal code were used, an intermediate file to convert this code to freguesia/concelho/district would be needed.

Examining these options may lead to a reconsideration of whether outputs are needed by freguesia of patient, or whether concelho would be a fine enough distinction.

3. Patient Identification Number

Three reasons for including a patient identification number (ID) were mentioned in an earlier report:

- a. Confidentiality: no name would appear on the data file.
- b. Tracing Patients: if a diagnosis of cholera or some other highly infectious disease appeared, the patient could be traced via the clinical records. This is an epidemiological application.
- c. Quality of Care: for specified diagnoses, a list of patient IDs can be sent to the facility, where the patient files are reviewed and evaluated.

These applications imply that the ID number used on the patient record at the facility must be identifiable with the ID on the MIS ficha, preferably the same ID.

The MIS was not originally conceived as a patient tracking system, that is, a mechanism for keeping data about individuals. However, both discussions with the Technical Group and recent developments connected with financial constraints faced by the Ministry of Social Assurance indicate that it would be prudent to develop a system of identifying patients which will permit the MIS to track patients.

- The Technical Group said that they wanted to know how many individuals used a facility at least once in a year. The MIS data files could be used to produce this output quite simply, using a data base management system.
- A logical extension is to find out how many different facilities individuals use in a year. The same data base management system can generate this information if and only if the patient has the same ID number at all facilities.
- If private expenditure on medical care and drugs is to supply an increasing proportion of funding for health services, it would be wise to plan for monitoring such payments. The MIS could also be used for this purpose, if it could identify when patients were the same individual.

In order to implement these applications, there would have to be a unique ID number for everyone who uses government health services. Given that it is unconstitutional in Portugal to have any single identifier for all uses (e.g. taxes, driver's license, etc.), the legal status of a single ID for all health services needs to be investigated. If a single health care ID is judged unconstitutional, the likely improvements in continuity of care and in management of government health services make it worth considering changing the law as it applies to the health services.

Choice of a system for constructing individual ID numbers merits serious attention. Many types of ID have been developed and are being used successfully in automated data processing systems. A particular type of ID should not be copied simply because it works in its own environment; the criteria which each ID was designed to meet should be examined, along with the basic principles used in its construction, to see which principles apply to the criteria generated by the Portuguese health system. Some examples of different health systems and criteria for organizing health care are given below:

- One health care system sees the family as the unit of health care; one general practitioner provides general health care for all family members and is responsible for referrals and follow-up.
- The individual is the unit of interest in another system, in which individuals register with the general practitioner of their choice, who refers and follows up as needed.
- In a third system, individuals enroll in a health insurance plan and can obtain a wide range of services (via the physician appointed to them) within this plan. The population enrolled in the plan may vary between a few thousand and hundreds of thousands; it is essentially a private, elective scheme rather than a public service.
- A fourth system is fee-for-service; the overriding concern is to ensure that providers are paid quickly and accurately for services provided. Patients carry a health insurance card, which they can use (like a credit card) anywhere. Abuses by both physicians and patients can be monitored.

The first step, therefore, is to analyze the environment in which Portugal's health services function, and to identify the criteria which government health services are aiming to meet. Then the efficacy of various types of identifying numbers can be evaluated. Some of these types are discussed below.

- A family based number. Based on some ID (e.g., social security number) of the head of the household (usually the father). Wife and children can have sub-codes which indicate sex, relation to head of household, and birth order within sex (e.g., third daughter). It permits analysis of family variables (e.g., total contacts with health services, expenditure on drugs, tests). Problems arise when a household subdivides because of divorce. When children leave home or reach a certain age they receive their own number. This interrupts the system's ability to track an individual's medical care over time, but in many health care systems such tracking is not considered to be a crucial element of patient care. The public health service (fee-for-service) in Quebec found the family-based ID number so problematic that it was abandoned; patients lost their plastic cards and their ID number was not reconstructed accurately (because they didn't remember their head-of-household's code) so the central data files on patients rapidly disintegrated. The State of California, oriented towards family care, has used this system successfully where health service institutions keep accurate records of patient ID numbers.

- An existing individual number. For a universal system, the existing ID should be one that everybody (especially children, who are frequent users) will have. Otherwise the health system will have to become involved in creating and issuing IDs for those not covered by the chosen existing system. For example, a driver's license is not suitable. The advantage of using an existing number is that it is already in use, and the more often the same number is used, the better it will be remembered. It also minimizes the administrative burden of creating a new ID number and assigning new IDs to the entire population. If health facilities have patient records which permit cross-referencing of names and ID numbers, then if a patient turns up without valid documentation of his ID number, the clerical staff should be able to find it. This works well in stable populations, but for emergency cases and hospital care, the facility will not be able to verify or reconstruct an arbitrary sequence of digits, but will be dependent upon the organization which issued the original number; this will lead to bottlenecks and breakdowns of a universal tracking system. However, the importance to Portuguese health services of tracking patients in this way should be examined and evaluated; it may not be considered necessary or desirable.

- A special-purpose individual number. For a universal system, the ID could be one that can be constructed easily from information which rests in the individual's memory. If a patient loses his card, the same ID can be reconstructed, to

avoid creating new patients in the data files. Information such as birthdate, sex and letters from the patient's name can be combined with a check digit to create such an ID. The probability of non-unique IDs can be calculated, given some data on incidence of common names (e.g., this system would not work in Korea if last name were used, because many people have the same last name, and all birthdays are New Year's Day rather than actual date of birth). Information about whether users of health services do in fact know their date of birth (day, month, year) must also be assessed. An ID based on this information was developed to replace the family-based ID in the universal health coverage system in Quebec.

Some desirable attributes of a patient ID number are listed below. These may help clarify discussion of the attributes which are considered necessary for the Portuguese health system.

Unique - allowing the identification of individual patients.

Permanent - the patient keeps the number for his whole life, which allows continuity over time. This is desirable in a universal health care system which is organized around the patient and his general practitioner (e.g., the British National Health Service).

Family-oriented - parents and their dependent children are linked through their ID numbers, if the family is the unit of interest. This number would change as children became adults, and with marriage and divorce.

Short - a population of 10 million requires a 5-character ID if numeric and alpha characters are used; 8-characters for an all-numeric ID. A short ID saves space and reduces transcription errors during manual recording of information.

Extendable - even with a short, permanent number, it should be impossible to run out of new numbers for new patients.

Memorable - if the information upon which the ID is built rests with the patient, then the ID can be reconstructed more easily than a random sequence of numbers.

Checkable - a check-digit will allow mechanical verification, to catch most transcription errors and bad IDs.

It may not be possible to find a number which includes all of these attributes; the decisions about which are essential will depend upon an analysis of the policies and needs of the Portuguese health system.

The MIS faces some crucial decisions regarding patients' IDs. First, will a unique ID be used by all health services and facilities, not only for the fichas but also for patient records?

- If the decision is yes, then the questions of when the ID will be introduced and what type of ID must be answered.
- If the decision is no, then the MIS will not be able to perform the analysis that will probably be required in the future.

Because of the magnitude of this issue, we recommend that for the field-test, which will include tracing patient IDs back to their files in the facility, the MIS use whatever patient IDs are currently used on the patient record. For facilities which do not have a patient ID number, a surrogate ID could be constructed from information already on the ficha, such as date of birth, name, address, etc.

H. Intermediate Files

The discussion of outputs, variables and codes has led to the identification of several intermediate data files or dictionaries, which will be needed in order to produce the desired reports. The need for some of these files is contingent upon other decisions. SIS should review the following list to see whether it will be possible to obtain or construct the necessary data. If it is not, then this constraint will affect either the outputs or the information which is coded on the ficha.

1. Patient's Residence if freguesia/concelho/district are not recorded:
 - Postal code must be linked to freguesia/concelho/district
2. Location of Facility/Hospital if concelho is not recorded:
 - Unit number (by district) must be linked to concelho
3. Rates for Hospital Discharge Data - Occupancy rate, turnover rate
 - Number of beds for each service in each hospital

Gestão Financeira will also need data on number of beds by service for its analysis of productivity; this information need be collected only once for both the productivity analysis and the MIS. Coordination between Gestão Financeira, SIS and GEPS (e.g., on hospital and service numeric codes) should reduce the burden of data collection which the hospital statistics departments have to bear. Eventually, such data should be available to interested users, to prevent duplication of data collection activities.

I. Fichas

After reviewing the variables required by the outputs in November, 1981, it became clear that there were considerable parallels between the data elements on the ambulatory ficha and those on the hospital discharge ficha. Further discussion with the Technical Group about future uses of the MIS suggested that it might be crucial to have the two types of data in comparable format, for example, to find out how many different facilities patients used (given a unique health service ID). In order to develop an MIS which was flexible enough to absorb such expansion of applications over time, we suggested combining the two fichas. A revised version of this form is attached as Figure 4. It will be clear from comparing it with the discussion of the outputs, and the list of variables in Table 3 that further revisions are needed. However, this exercise forced some clarification of data items, and demonstrated that it was feasible to treat the Ficha de Contacto em Ambulatorio and the Ficha de Internamento (Alta) as one data file as far as the floppy discs, data files and programs were concerned.

ENTIDADE:

DISP. TO [] SAÚDE TIPO [] SER. []

DADOS: CONTATO /
INSCRIÇÃO []
ALTA []

CONDIÇÃO EM:

- 1 NORMAL
- 2 DOMICILIO
- 3 SAP
- 4 URGÊNCIA
- 9 OUTRO

PRESTADOR(E)

Número: []

Nome: []

CONSULTA:

- 1 PRIMEIRA
- 2 SEQUENTES
- 3 ROUTINE
- 1 CLINICA GERAL
- 2 SAÚDE INFANTIL
- 3 SAÚDE MATERNA
- 4 SAÚDE ADULTOS
- 5 PLANO FAMILIAR
- 6 ESPECIALIDADES
- 9 OUTRO

PROBLEMA / DIAGNÓSTICO

- | | | | |
|------------------------------|------------------------------|------------------------------|------------------------------|
| <input type="checkbox"/> 106 | <input type="checkbox"/> 052 | <input type="checkbox"/> 720 | <input type="checkbox"/> 007 |
| <input type="checkbox"/> 749 | <input type="checkbox"/> 302 | <input type="checkbox"/> 247 | <input type="checkbox"/> 062 |
| <input type="checkbox"/> 600 | <input type="checkbox"/> 117 | <input type="checkbox"/> 306 | <input type="checkbox"/> 543 |
| <input type="checkbox"/> 438 | <input type="checkbox"/> 128 | <input type="checkbox"/> 947 | <input type="checkbox"/> 861 |
| <input type="checkbox"/> 442 | <input type="checkbox"/> 028 | <input type="checkbox"/> 948 | <input type="checkbox"/> 654 |
| <input type="checkbox"/> 027 | <input type="checkbox"/> 219 | <input type="checkbox"/> [] | |
| <input type="checkbox"/> 310 | <input type="checkbox"/> 805 | <input type="checkbox"/> [] | |
| <input type="checkbox"/> 625 | <input type="checkbox"/> 238 | | |

ACTOS (Maximum ?)

- | | | | |
|--|--|-----------------------------|-----------------------------|
| <input type="checkbox"/> 01 BIÓPSIA | <input type="checkbox"/> 07 HEMORRÓIDA | <input type="checkbox"/> 13 | <input type="checkbox"/> 20 |
| <input type="checkbox"/> 02 HEMORRÓIDA | <input type="checkbox"/> 08 R. INTERNA DO SANGUE | <input type="checkbox"/> 14 | <input type="checkbox"/> 21 |
| <input type="checkbox"/> 03 M. DA ÚTERO | <input type="checkbox"/> 09 ETC | <input type="checkbox"/> 15 | <input type="checkbox"/> 22 |
| <input type="checkbox"/> 04 BRONC. CRÔNICA | <input type="checkbox"/> 10 | <input type="checkbox"/> 16 | <input type="checkbox"/> 23 |
| <input type="checkbox"/> 05 SUCCO GAST. | <input type="checkbox"/> 11 | <input type="checkbox"/> 17 | <input type="checkbox"/> 24 |
| <input type="checkbox"/> 06 TRANSFUSÃO | <input type="checkbox"/> 12 | <input type="checkbox"/> 18 | <input type="checkbox"/> 25 |
| | | <input type="checkbox"/> 19 | |

OPERAÇÕES:

DATE OF LAST OPERATION: []

ORIGEM

- 1 OUTRO HOSPITAL
- 2 CLINICA GERAL
- 3 CONS. ESPECIALISTA
- 4 URGÊNCIA
- 5 RECEM-NASCIDO → [] PESO (gr)
- [] SEMANAS DE GESTAÇÃO COMPLETAS
- 9 OUTRO

UTENTE:

NOME []

ENDEREÇO []

LOCALIDADE []

SEXO: H M

DATA DE NASCIMENTO []

JÁ INSCRITO? SIM NÃO

PAGAMENTO? SIM NÃO

IDENTIFICAÇÃO []

ADMISSÃO []

Best Available Document

DESTINO

- 1 OUTRO HOSPITAL
- 2 CONSULTA GERAL
- 3 CONS. ESPECIALISTA
- 4 INTERNAMENTO
- 5 MORTES → AUTOPSIA? SIM NÃO
- [] SURGERY? NÃO
- 9 OUTRO
- < 2 DIAS
- 2-10 DIAS
- > 10 DIAS 51

The Functional Analysis of current clerical practices may suggest that it would be easier for clerical staff to use separate forms for ambulatory data and for discharge data. However, we recommend that the key-columning instructions (i.e., the fields on the floppy disc layout) be written as though the fichas were combined. This can be illustrated by referring to Table 3; for example, there will be no ambulatory data on service, yet the ambulatory ficha should be data-entered as if there were two characters in those spaces, and the characters are always skipped.

The advantages of this approach are that only one protocol for keypunching needs to be developed; only one verification program would be needed; and data on use of all health services can be analyzed together in the simplest possible way (for example, physicians' work load, or hospital case-mix between emergency care and inpatient care). The disadvantages are that the data tapes will be longer than if separate file layouts were used for ambulatory contacts and hospital discharge data.

The most important aspect of trying to combine the two fichas may have been to introduce uniformity into the way some variables were classified. The decision about using a single ficha or two layouts depends upon the Functional Analysis and rests with SIS and the Technical Group.

The fichas should contain no more than 128 characters; Figure 5 shows a self-documenting list of data elements derived from the ficha shown in Figure 4. "Self-documenting" means that the list shows the internal representation of each data element (i.e., alpha, numeric, real/integer/ character), its length (number of characters), the number of times it occurs, and if possible the meaning of its numeric codes. For example, 999 signifies a three-character numeric item, and DDMMYY indicates a date (day, month, year). Note that this list will need to be revised after the ficha has been revised, and that the codes used are merely illustrations. It would be wise to leave room for future adjustment, and not use all 128 characters now.

Alpha fields should default to blank, and numerics should default to zero, if no data are recorded in them.

The layout of the ficha should be pre-tested before it is printed for the field-test. The present concept of placing data items in the order which follows the flow of activities in ambulatory facilities is a good one. Details such as the following should be pretested:

- whether precoded categories will be circled or have a check-mark placed in a box next to them;
- the size and shape of spaces in which numbers will be recorded (e.g., closed boxes vs. topless boxes)

- spacing and size of print; use of color.

We saw some well-designed forms for clinical records; SIS should review the experience of clerical staff and form designers, and make sure that clinical personnel, registration clerks and data data entry staff can all work with the document quickly and accurately.

FIGURE 5

Dictionary of Data Elements

<u>Name of Element</u>	<u>Format</u>	<u>Comments/Codes</u>
SEQUENCIA	999999999	Sequential number printed on the ficha, to avoid duplicate data-entry
ENTIDADE		
DISTRITO	99	Existing administrative classification
CONCELHO	99*	This may not be coded; see H- <u>Intermediate Files</u>
SAÚDE	999	Existing health unit number within the district
TIPO	9	Code indicating type of health unit (See CONTACTO EM)
SERVICO	99	Hospital service code. Consider including this for <u>outpatient ambulatory contacts</u> in hospitals
DATA(S)		
DE CONTACTO/INTERNAMENTO	DDMAA -	
DE ALTA	DDMAA	
CONTACTO EM	9	1=Normal, 2=Domicilio, 3=SAP, 4=Urgência, 9=Other How will these codes differ from or overlap with TIPO?
UTENTE		
LOCALIDADE	9999(99*)	<u>Either</u> Postal Code (9999) <u>or</u> District/Concelho/Freguesia (99 99 99)
SEXO	9	1=Male (H), 2=Female (M)
DATA DE NASCIMENTO	DDMAA	
REGISTRATION STATUS	9	1=Yes 2=No
PAYMENT	9	1=Yes 2=No
IDENTIFICATION	CCCCCCCCCC	May include alpha as well as numeric; C means character
PRESTADOR(ES)	(3*)99999999	May be only 2 if second Medico Cirurgião is not recorded
CONSULTA		
TYPE OF VISIT	9	1=First visit, 2=Follow-up, 3= Routine check-up
TYPE OF CONSULTATION	9(9*)	1=Clinica Geral, 2=Saúde Infantil (etc.)... If exact speciality will be coded, this element will need <u>two</u> characters.

FIGURE 5 (Continued)
Dictionary of Data Elements

<u>Name of Element</u>	<u>Format</u>	<u>Comments/Codes</u>
PROBLEMA/DIAGNOSTICO	(2)999	Codes from ICD9. Only one coded on ambulatory contacts
ACTOS	(5)99*	Not yet specified how many, or what codes
OPERAÇÕES	(2)999	Codes from ICD9.
DATE OF LAST OPERATION	DDMMYY*	See discussion of calculating time since last operation, in Table 2, Notes y, A (Appendix II). <u>Either this field or "SURGERY?" field will be used, but not both</u> Note that last operation may or may not be principal operation coded in first space of OPERAÇÕES
ORIGEM	9	1=Outro Hospital, 2=Clinica Geral, 3=Consulta Especialista, 4=Urgencia, 5=Recem-Nascido, 9=Outro
DESTINO	9	1=Outro Hospital, 2=Consulta Geral, 3=Consulta Especialista, 4=Internamento, 5=Mortes, 9=Outro
PESO	9999	For newborns and fetal deaths in grams
SEMANAS	99	Number completed weeks of gestation, for newborns and fetal deaths
AUTOPSIA?	9	For deaths only. 1=Yes, 2=No
SURGERY?	9*	For deaths only. 1=No, 2= less than 2 days, 3=2-10 days, 4= more than 10 days See DATE OF LAST OPERATION

94 Minimum^a
122 Maximum^b

a Minimum: Excluded ENTIDADE-CONCELHO, 2 digits from LOCALIDADE, one prestador (8 digits), 1 digit from TYPE-OF-CONSULTATION, ACTOS, DATE-OF-LAST-OPERATION.

b Maximum: Included all items excluded from minimum; excluded SURGERY?

J. Programming

The Consultant Programmer reviewed the equipment, software and human resources currently available at SIS's central office and at the Lisbon Regional Center. .

1. Equipment

The IBM 4331 computer has a central memory of 1000 K bytes which will be doubled at some future date. The disc drives are IBM 3340 and the tape drives are IBM 8809 (1600 BPI). (Tape and disc drives designed specifically for the 4300 line of computers have been ordered.) The operating system is ECPS/VSE (extended DOS). The current on-line capacity using discs is 140 million bytes; half is fixed and half is demountable (two fixed and two flexible head disc drives). There are also several local 3270 Cathode Ray Tube (CRT) terminals, a floppy disc reader, and five CII Honeywell Bull floppy disc data entry machines (Model KDU 7280); each has two keyboards, so ten operators can work simultaneously on the present equipment. Each floppy disc has 73 useable tracks, 26 sectors and 128 characters (letters, numbers or symbols) per record, giving a total of 242,944 characters per disc. The machine's intelligence is limited to validation of alpha or numeric codes, range checks on single data elements (i.e., not logical checks between fields), and calculation and verification of check digits (Modulus 10 is standard; other systems such as Modulus 23 are programmable.)

If each ficha has no more than 128 characters (as in the case with the latest version), then one floppy disc can hold information on 1,898 ambulatory contacts or hospital discharges (73 usable tracks X 26 sectors = 1,898 records). If the ficha becomes longer than 128 characters, then the number of records per floppy disc is halved, and the number of discs and magnetic tapes needed doubles (assuming the ficha did not use more than 256 characters).

The present equipment is quite suitable for processing the MIS. The eventual volume of data per year from a national MIS will be about 20 magnetic tapes of 6200 BPI density; this calculation is based on 30 million fichas at 100 characters uncompressed on 6200 BPI tapes. Thus we recommend that SIS pursue their current plans to use higher density tapes and install compatible tape drives.

2. Software

The languages that have been used by SIS are RPG I, RPG II and COBOL. The official programming language in which SIS programmers are being trained is COBOL. Old applications using RPG I are being updated to use RPG II.

Although some SIS staff may know other languages (e.g., PL1), we found no evidence of these being used at the Lisbon Regional Center. It seems that no statistical packages or file management systems or data base management systems are used.

3. Personnel

It eventually became clear that SIS's in-house programming capacity is extremely limited. Most of the projects already in progress appear to have been developed with the technical assistance from private companies such as NORMA and SEMAP. Although SIS's systems analysts who participated in preparing the functional and organic analysis for current projects feel as if they did most of the work, it turns out that none of them knows programming well, and most have never used a computer themselves. SIS could not identify a single programmer who was free to work with the Consultant Programmer for more than an hour or two; the programmers who were contacted appear to work solely in COBOL (and RPG II). Over 30 new programmers have been trained in COBOL, but have little experience as yet. The combination of limited knowledge of programming languages, and shortages of experienced staff led us to conclude that SIS is ill-prepared to develop the software needed by the MIS. In summary,

- The official language of SIS and the languages known by SIS programmers are not the most suitable for this application.
- The use of a relatively low-level language such as COBOL means that it would take more time and effort to prepare the programming code. Debugging would also take longer.
- The programmers' inexperience means that testing and debugging will take even longer.
- Special-purpose programming for further analysis, requested after managers have studied the outputs described earlier, will be labor-intensive and slow. SIS evidently does not have enough staff to support this kind of responsive maintenance of the MIS under its current protocol of using COBOL and programming all reports from scratch. Thus two basic principles of the MIS - timeliness and flexibility - will be violated.

4. Statistical Packages

For these reasons we recommended that SIS investigate statistical packages. Many packages have been developed, and given the personnel constraints, SIS would do well to use the

work already done by previous programmers, and use the results for analyzing the MIS data. Even though the initial price of a package seems large, the benefits should be considerable. Some advantages and disadvantages of packages are listed below:

- Greatly reduced development costs: a package requires little real programming skill, so is suitable when trained personnel are in short supply. Correct results can be achieved far more quickly (for example, in one-tenth the number of person-weeks) than with a lower level language such as COBOL.
- Easier and less costly maintenance: the cost of maintaining programs is always underestimated when programming is done in-house.
- Already fully documented:
- Known quality and cost:
- General solution: the package has worked successfully on other data sets, and can be used for other applications and projects, and for rapid response to ad hoc user requests.
- Formats of outputs predetermined: the package layouts (mapas) may not correspond exactly to the layouts envisaged by users, but the reports will contain all the specified information.
- Heavy use of computer resources: may be expensive in machine time.

From the multitude of available packages, the most suitable should be selected. This involves a process of evaluation according to strict criteria which are themselves dictated by the MIS. The evaluation process should include a trip to the U.S. by Dr. Soares D'Oliveira, technical assistance during the selection process, and technical assistance to install the package and train SIS staff and statisticians in its use.

The statistical package should:

- a) produce all the desired outputs (e.g., relevant statistics, crosstabs)
- b) produce compact reports (good layout, not wasting space)
- c) have high quality documentation which non-programmers can understand
- d) be designed so that users' programs are written in a very high-level language (higher than COBOL, PL1 or FORTRAN)

- e) permit use of several intermediate data files (e.g., dictionaries of postal codes linked to district/concelho codes; data on hospital beds per service per hospital)
- f) allow exits to be taken for special processing (e.g., algorithms, compression/decompression)
- g) have a DOS version that will run on an IBM 4331 machine which is now running under the ECPS/VSE operating system
- h) have a file management or a data base management capability. This is highly desirable since several outputs entail analyzing the data on a unit of observation (e.g., diagnosis) which differs from the record unit (i.e., contact or discharge).

Training for users should be in Portugal, using the selected package on SIS's equipment. It is hoped that a broad range of SIS staff will participate in package selection and training, since no packages are yet in use in SIS and the staff should have the opportunity to examine what packages can do.

K. Expansion

The MIS must be designed so that it can handle the volume of data generated not only by the field test, but also by expansion to national coverage. It should also be flexible so that it can meet the needs of managers and planners for second-stage analysis indicated by the results of the regular reports. Policy analysis within the Ministry of Social Assurance may also be performed if the data base and system of codes are carefully conceived.

1. Increased Volume

The first application of the MIS will be in the field-test in Santarem District. During November, 1981, the Technical Group decided to reduce the scope of the field-test to three concelhos (Santarem, Chamusca and Salvaterra), with an estimated volume of 21,000 ambulatory contacts per month from a population of 126,400 people. This volume of fichas may stress the clerical and supervisory functions initially, and SIS will have to provide data-entry operators for the floppy-disc machines. The volume of data will not stress the capacity of the hardware in any way.

In a national system, with an expected volume of 30 million ambulatory contacts, we have reported that approximately 20 high-density magnetic tapes would be filled with data per year. Thus to run reports covering all districts and giving national totals on an annual basis, the relevant data would have to be processed in one of the SIS Regional Centers.

After some experience with using the MIS's reports, it might become clear that a national MIS is not necessary, but that sample data can achieve the same managerial and planning objectives.

2. Second-Stage Analysis

Some results from the outputs already specified will prompt further investigation. If SIS obtains a suitable statistical package, ad hoc requests for special reports can be produced quickly and accurately, without a great expenditure of programming time. The combination of well-conceived data files (i.e., appropriate variables and codes), a data base management system, and a powerful, high-level programming capacity makes the MIS capable of responding rapidly to the needs of senior administrators and analysts.

3. Policy Analysis

The MIS's immediate application is to provide accurate and timely data which can be used by managers and administrators at all levels of government health services. The outputs reflect the emphasis upon the needs of local managers, at the facility or hospital level. Further local analysis, and some district and

national level analysis not specified in the outputs, could be performed without adding any more data elements, as long as the possibilities of these reports are recognized now. For example, an MIS can identify how many individuals (as compared with contacts) used a facility during the year, as long as the same ID code was used each time the individual used that facility. The principal of unique IDs can be extended; if each patient used his own ID code whenever he received medical care, then the MIS can generate data on how many individuals use government health services, and a frequency distribution showing how many different facilities patients visit during a period.

These examples are not recommendations concerning use of the MIS, but are given to illustrate the importance of designing a responsive, flexible system which can grow over time.

L. Recommendations

In this section, we have gone into the level of detail which is necessary to analyse some of the more technical components of the MIS. Here we present our recommendations regarding collection, processing and analysis of the MIS data in more general terms.

1. The scope and purposes of the MIS need to be understood and accepted within SIS, and appropriate resources committed to implement it.

The MIS is a system which can be extended to improve medical management and administration in all primary health care facilities and general hospitals. It will enable managers and planners at all levels to allocate the resources within their control more effectively, and therefore should result in improved health services.

Although the proposed MIS had been announced in the Portaria (23rd September 1981), it had not yet been given a place in SIS's list of priority projects. Another information system with a far more limited field-test (SMS Posto No. 6), was under way and had a higher priority. Human resources to work on the MIS seemed to be scarce, yet staff were authorized to work on highly specialized projects with very limited scope.

SIS may need assurances from the highest policy-making levels that they should commit resources to the MIS.

2. A continuing exchange of information between users and technicians is needed.

The MIS is designed to integrate the separate systems of collecting and analysing data from the three health services, DGS, DGH and SMS. If the MIS is to function smoothly, SIS and the services must work co-operatively in the iterative process of identifying and resolving the technical problems which any endeavour of this nature will encounter. For example, if the use of a certain type of code will complicate data processing enormously, then SIS should raise this technical matter and present alternative strategies. The question of geographic codes provides an example of this kind of problem. Similarly, if a variable specified in the outputs is unclear, SIS should seek clarification from the Technical Group, rather than trying to guess in isolation what information was wanted in the report.

Time and energy can be saved if technical considerations of the kind mentioned in this section are included in the decision-making process. For success, the MIS should be built on informed consensus, reached iteratively, rather than on a strictly linear model of isolated and sequential decision-making.

3. Specifications of the outputs should be reviewed and finalized.

The discussion of outputs, variables and codes in E. Outputs, and in Appendix I and II indicates the level of detail necessary for specifying reports clearly. The Technical Group should now be able to answer the questions of definition raised in this report, so that design of the ficha and preparations for the field-test can proceed.

SIS's technical input will be needed here; some of the decisions about outputs depend upon information about the availability of intermediate files, the codes currently in use, etc. This demonstrates the interactive, iterative nature of planning and implementing the MIS.

Essential management reports can be obtained from the variables included in the most recent (revised) version of the ficha (Figure 4); further refinement of the outputs can take place when the field-test is evaluated.

4. SIS's capacity to produce the outputs quickly and reliably should be increased.

SIS is a relatively new service, and has relied upon private consultants to augment its shortage of experienced technical staff. From a brief review of Functional and Organic Analyses completed for other projects, and meetings with programmers and systems analysts, it appears that the method of analyzing, designing, and programming current projects would not necessarily be appropriate for the MIS.

- Systems analysts typically have no experience in using a computer, and work separately from the programmers. This means that they are not equipped to design systems which require familiarity with the mechanics of large-scale data management.
- Programmers typically work in COBOL, the official language of SIS. This language is not designed for aggregating data and calculating statistics.

In order to permit SIS to produce the array of outputs accurately and on time, we recommended that an appropriate statistical package be selected, on the basis of criteria which were dictated by the needs of the MIS. The central administration at SIS received this recommendation positively, and further recommendations were made for technical assistance with choosing and installing a suitable package, and with training programmers, systems analysts and statisticians in the use and scope of the selected package. These recommendations were:

- that the President of SIS's Installation Commission, Dr. Soares de Oliveira, visit the United States for two to three weeks, to observe management information systems, data base management systems, and statistical packages which might be suitable for the Portuguese MIS. It might be very advantageous for another member of SIS's staff (for example, a programmer or systems analyst) to participate in the same trip, since, as yet, packages and their potential are unknown quantities within SIS.
- that two to three weeks of technical assistance be provided with selecting a package which meets the criteria listed in J. Programming. This assistance should be provided by a programmer who has:

- minimum of five years' experience with high level languages and large data bases;

- thorough knowledge of IBM systems;

- used a wide variety of software packages, preferably including products developed outside North America;

- designed software packages;

- experience with analyzing health service statistics;

- experience with management information systems;

- prior work experience in Portugal;

- language ability in Portuguese, Spanish and/or French.

- that three to four weeks of technical assistance be provided to install the chosen package; to teach an introductory course in use of the package to SIS programmers and systems analysts, and statisticians from the health services, and to provide some on-the-job training for the programmers who would use the package on MIS data. This consultant should also assist SIS with preparing the program which verifies raw data as it is entered from the ficha onto the Honeywell Bull floppy disc machines, and with modifying the utility program which concatenates data from the floppy discs into a single data file on magnetic tape. (Ideally, the verification program and modification of the utility would be completed first, so that some raw data for testing the package were available.) This assistance should be provided by a programmer who has:

- thorough working knowledge of the selected package;

- familiarity with the intended applications of the package to the MIS;

experience at training new users, preferably in Portuguese;

several years' experience with COBOL (so that he/she can translate trainees' COBOL approach into that of a higher-level language);

ability to install the software in the IBM 4331 operating system;

*knowledge of verification programs, and check-digit algorithms;

*experience with modifying utility programs;

experience with analyzing health service statistics;

prior work experience in Portugal;

language ability in Portuguese, Spanish and/or French.

NOTE: It may be difficult to find the necessary technical knowledge and training ability in one individual. The technical assistance could be provided by two people, one who fulfilled all but the starred items, and one who met the starred criteria and had the last three qualifications.

- that one week of technical assistance be provided when the first data from the field-test are available, to assist with producing the first reports. This should be provided by the trainer, to maintain continuity.

In addition, we recommend that technical assistance be provided for completing the Functional Analysis and the Organic Analysis, since these analyses have never been performed for applications which will use a software package. This assistance could be provided by a systems analyst or programmer with knowledge of health service statistics, data collection, processing and analysis, and should be combined with assistance to the Technical Group co-ordinated by GEPS. Because of the apparent absence of staff experienced in field-work, this assistance could be provided for three to five months, during the period of implementing the field-test. The systems analyst or programmer should have:

Master's degree in policy analysis, public administration, management or public health

minimum of five years' experience in data collection, processing and analysis; including field work and use of computers and statistical packages;

experience with analyzing health service statistics, and their use in management information systems;

prior work experience in Portugal, and knowledge of the health system;

language ability in Portuguese, Spanish and/or French.

It is also recommended that one or two programmers from SIS receive specialized training in the U.S. in a higher level language than COBOL (e.g., PL1). This training should include the use of file management systems and data base management systems. It is proposed as a means of increasing the capacity of SIS to respond to future needs in the area of automated processing of large data files.

5. Technical decisions should be governed by the purposes and requirements of the MIS, not by precedent.

As far as possible, the MIS should fit in with the manual clerical systems which are used in health facilities. Part of the Functional Analysis investigates these systems. However, the Technical Group should not specify outputs simply because their services historically have collected certain data. We have identified variables which seem to have little utility for managerial decisions. Implementation of the MIS might provide a convenient vehicle for simplifying the list of items that is required by the services, and reducing the burden of supplying the same data to different users.

Similarly, SIS should not necessarily use a code simply because it has already been constructed for another project. We have gone into some detail to demonstrate how choosing an appropriate code can simplify the creation of the specified reports (e.g., geographic indicators). Thus decisions concerning codes should depend upon current usage, the required outputs, and the possibility of using intermediate files to link incompatible data.

Sometimes there are circumstances which override technical considerations; however, this does not justify bypassing a careful assessment of the technically "first best" solution. The process of weighing the merits of each alternative helps reveal the source of differing points of view, and may make it easier to reach consensus.

IV. PRODUCTIVITY AND COST INDICATORS FOR HOSPITALS

A. Scope of Work

This report presents the results of a two-week visit from November 2 to November 17, 1981, by Don C. Holloway, Ph.D., technical advisor in hospital administration for Management Sciences for Health. The goals of this consultation were to assist the Departamento do Gestão Financeira (DFG) with:

1. Determining the extent to which similar health delivery units can be grouped for purposes of comparative analysis;
2. Determining the kinds of productivity and cost indicators that could serve as guidelines for evaluating relative performance between and among similar units;
3. Determining initial targets or standards for each performance indicator, subject to revision as experience is gained and better information obtained.

These goals were originally specified in a previous MSH report submitted to USAID in February 1981, pages 43-44. These goals were recommended in response to the following needs:

- to control the rapidly escalating costs of health care in Portugal;
- to initiate management controls over productivity and operating costs in health delivery units; and
- to develop explicit measures of performance for evaluating health delivery units.

While the primary assignment for this consultant was to assist in the development of explicit measures of performance for evaluating health delivery units, the scope of work also included developing the basis for implementing a management control process that can result in achieving desired performance once it is defined. In this regard the scope of this project needs to be expanded to include:

4. Developing the ability to provide timely feedback on performance measures to managers responsible for achieving desired performance;
5. Training cost center managers who are capable of solving the problems that keep desired performance from being achieved; and
6. Developing the capability to project performance one month, one year, and five years into the future, so that problems can be anticipated and solved before they occur.

Although central and district hospitals represent only 45 percent of Portugal's health care costs, it was decided that productivity and cost indicators should be developed for these larger facilities first, with the intention of expanding their application to the other health care delivery units when fully implemented in these hospitals.

B. Activities During Consultation

The Director of the Departamento do Gest3o Financeiro, Dr. Augusto Mantas, appointed the following working group to implement the development of productivity and cost indicators:

Jo3o Urbano - Hospital de Santa Maria
Jose Luis de Matos - Hospital de S. Jose
Rosa Sim3es Paci - Departamento do Gest3o Financeiro
Antonio Correia de Campos - Escola Nacional de Sa3de Publica

Don Holloway met with members of this group each day during the two-week consultation. Included were visits to the following facilities:

Hospital de S. Jose (Central)
Hospital de Santa Maria (Central)
Hospital das Caldas da Rainha (District)
Hospital de Cascais (District)
Hospital de Santarem (District)
Hospital de Abrantes (District)

The feedback was very much appreciated and has been included in this report. Feedback from additional hospital administrators should be obtained as the project progresses.

The cooperation and reception from the hospitals visited demonstrated that there is definite need for a management control system at all levels of hospital management. Some of the recommendations in this report are easier to implement than others, but everyone we visited appeared willing to give them a try.

In addition, Don Holloway and Jose Luis de Matos visited the Lisbon facilities of Serviço Informaç3o da Sa3de (SIS) and met with Mr. Almeida to review their capabilities. Mr. Almeida indicated a willingness to support this working group once the group established its needs.

The attention and interest in this work shown by health care managers we visited in Portugal is very high and was very helpful in completing this scope of work.

C. Results of Two-Week Consultation

1. Background

The development of productivity and cost indicators was done with the basic principles of information systems development in mind (outlined in Dr. Hartman's November, 1980, report):

- Base the design on information needs at each level of management.
- Keep the system simple.
- Allow the system to grow over time.

a. Base design on information needs at each level of management.

Currently there are two primary levels of management that require productivity and cost indicators:

Hospital Administration

- Prepares budget proposals
- Accounts for actual expenditures

Gestão Financeira

- Provides guidelines to hospitals for budget preparation
- Reviews budget proposals
- Recommends revisions to budget proposals
- Submits budget to Secretary of State for Health

The development of productivity and cost indicators during this consultation has been made to support the following additional functions at these two levels:

Hospital Administration

- Compares actual to budgeted performance within three weeks after the close of a month for each cost center (Serviço)
- Projects activity levels for each cost center, initially for the next year, but eventually for each month of the coming year
- Analyzes monthly trends in activity levels, productivity, and expenditures per activity unit

- Identifies opportunities to improve productivity and reduce costs

Gestão Financeira

- Compares actual to budgeted performance within four weeks after the close of a quarter for each key cost center and in total for each hospital
- Reviews projections of activity levels for each key cost center and in total for hospital
- Analyzes quarterly trends in activity levels, productivity, and expenditures per activity unit
- Identifies opportunities to improve productivity and reduce costs by comparing key cost centers of comparable hospitals
- Approves budget with productivity improvements included

In addition, a third level of management should be added, or if in place, should be encouraged and supported with information feedback on performance: the Cost Center Manager.

Cost Center Manager

- Prepares cost center budget proposals for Hospital Administrator and Medical Director's review and approval (Hospital Administrator combines cost center budgets for submission to Gestão Financeiro)
- Compares cost center performance of actual to budgeted productivity and costs
- Solves problems keeping budgeted productivity and costs from being achieved.

If a cost center has 50 or more non-physician employees, the cost center manager may need to be full time. Smaller units may have part time managers. Physicians may become cost center managers, but as a rule, they will be busy taking care of patients and managing the medical staff. The working group recommends that for large departments, a chief technologist or head nurse be assigned cost center manager for matters that are not related to managing physicians. The cost center manager would be responsible for achieving budgeted performance on the productivity and cost indicators related to non-physician staff.

Finally, a fourth level of management is the Medical Director of the Service.

Medical Director

- Compares average lengths of stay by diagnosis from one hospital to another and identifies opportunities to reduce lengths of stay
- Reviews admissions and discharge decisions for opportunities to treat patients in less expensive settings
- Evaluates medical care for opportunities to improve quality

Our focus during this consultation was on the needs of the first three managers; however, once the hospital component of the MIS is completed and summary data is available, this project should provide the Departamento do Gestão Financeira with technical assistance in the use of the system for productivity monitoring of medical decisions. Figure 6 is a model that illustrates the concepts presented here.

b. Keep the System Simple

Every effort should be made to use the information already available. SIS is currently implementing the "Plano Oficial de Contabilidade para os Serviços da Saúde" (POCSS) in several district hospitals and has a schedule for including all hospitals in the country. Although several different payroll systems exist in the country, all payroll systems will have to interface with POCSS so that salary expenses by cost center can be reported. Therefore, cost centers should be made compatible with the Serviço codes in POCSS.

There are three types of data that will be required to develop productivity and cost indicators:

- activity measures, called units of service, for each cost center
- personnel hours, separated by physicians and non-physicians, for each cost center
- costs separated by personnel, supplies and other, for each cost center

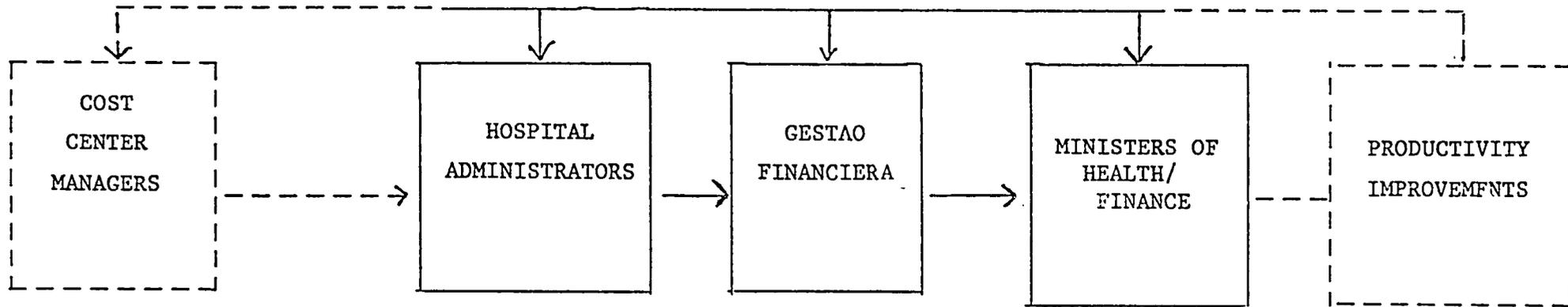
Activity measures will have to be collected manually. The statistics department in the hospitals we visited have most of the data already gathered, or with minimum additional effort, can arrange to have the data collected. This will not require a computer, and can remain relatively straightforward.

Hours are difficult to collect because all employees are salaried. While overtime hours are available for each pay period, regular hours are not. At one hospital we visited, absent days are recorded, but

_____ = Current

----- = Proposed

MODEL FOR ANALYSIS OF HOSPITAL PRODUCTIVITY



Current Functions

Budget Preparation
Accounting

Guidelines for
Budget
Review
Recommends Re-
vision
Submits

Review
Approval

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Reviews
Combines Cost Center
Budgets for Hospital
Budgets
Compares Actual to
Budgeted (monthly)
Projections
Identifies Producti-
vity Improvements

Compares Actual to
Budgeted (quarterly)
Analyzes Trends
(quarterly)
Review Projections
Identifies Producti-
vity Improvements
Recommends Producti-
vity Improvements

Approves with Productivity
Improvements

Proposed
Additional
Functions

Cost Center Budgets
Compares Productivity
and Costs
Implements Improvements/
Solves Problems

FIGURE 6

the number of hours missed on absent days is not recorded. Hours worked per day are not always the same from day to day. The working group suggests that total paid hours (36 hours per week plus overtime hours) be used if necessary to keep the system simple.

Actual costs by cost center are available from POCSS. The working group recommends that costs be used only if a hospital is using POCSS. Otherwise, the actual costs by cost center will have to be obtained manually, a difficult task for hospital accounting departments.

Further description of these three types of information follows below.

Finally, the system has been developed so it can be implemented manually or by computer. The working group anticipates manual implementation in the first two or three hospitals, and computer implementation when applied to the entire country. At this time, manual preparation of the reports will increase the chances of more timely feedback.

c. Allow the System to Grow

There are several ways in which the system can grow:

- start with a limited number of key cost centers and add more cost centers over time
- start with annual budgets for cost centers and divide by 12 to get monthly budgets - eventually add seasonal variations
- start with total paid hours and add further break downs into productive and non-productive hours
- start with a manual system and automate portions of it as it grows
- start with a few district hospitals and add more hospitals as expertise is developed within the demonstration hospitals.

Although productivity and cost indicators can be calculated for all hospitals and used by the Departamento do Gest3o Financeiro within two years, it will take five to ten years for cost center managers to learn problem solving techniques for controlling their budgets.

The system will have to be implemented in several hospitals in order to determine the level of complexity that hospitals can meet.

2. Proposed Groupings of Central and District Hospitals and the Key Cost Centers

The Departamento do Gestão Financeiro had developed four groupings of hospitals prior to the consultant's arrival. These groups were:

1. Central Hospitals
2. Group I District Hospitals
3. Group II District Hospitals
4. Group III District Hospitals

Groupings were based on bed size of the hospitals.

Although hospitals within each group may not be entirely comparable, when each hospital is broken into cost centers and compared to other hospitals at the cost center level, the groupings will result in useful information. For example, comparing radiology, laboratory, or laundry will provide useful information, even if the total hospital is not entirely comparable. Therefore, the working group recommends that the hospital groupings developed by the Departamento do Gestão Financeira continue to be used. However, these groupings may change over time as experience is gained, or as more information becomes available, such as "case-mix" of patient diagnosis obtained through the Hospital Discharge information system.

Each hospital will want to eventually develop productivity and cost indicators for all of its cost centers. However, the working group recommends that, in addition to reviewing performance of the total hospital, Gestão Financeira also review performance of only key cost centers. Table I lists the suggested key cost centers, or combination of cost centers, as well as the cost centers that need not be reviewed at this time. A key cost center is one where significant operating expenses are incurred, or where there is the potential for unnecessary capital equipment purchases. Since the hospitals should be collecting data on all of their cost centers, the decision to add or remove a cost center from the list of key cost centers can be made at any time.

The cost centers and codes in Table 4 are taken from POCSS and the payroll system used by district hospitals in the Lisbon Center of SIS. Serviço codes and the corresponding cost centers should be kept compatible with POCSS and the payroll system. Since the payroll system produces output that is entered into POCSS, these two systems will have to be kept compatible by SIS. However, it will be important for hospitals that have their own payroll system (for example, Hospital das Caldas da Rainha) to assure the Serviço codes are identical to POCSS.

TABLE 4. KEY CENTROS DE CUSTO

CODIGO	
11730	UNIDADE DE CUIDADOS INTENSIVOS
11740	
11750	
11760	
	UNIDADE DE CUIDADOS AGUDOS
11100	11510
11200	11520
11300	11530
11320	11550
11330	11560
11340	11570
11350	11580
11360	11630
11370	11650
11410	11660
11420	11670
11430	11710
11440	11720
11450	11770
11460	11780
11470	11800
	11900
11540	UNIDADE DE CUIDADOS OBSTETRICIA
11610	UNIDADE DE CUIDADOS PEDIATRIA
11620	
11640	UNIDADE DE CUIDADOS PSIQUIATRIA
12000	CONSULTA EXTERNA
15000	SERVICO DE URGENCIA
21100	LABORATORIOS
21200	
21520	SERVICO CENTRAL DE RADIOLOGIA
21650	
21660	
21700	MEDICINA FISICA E REABILITACAO
21710	
21720	
21730	
21740	
21790	

Table 4. Key Centros de Custo (Continued)
Page 2

CODIGO

21820	BLOCO OPERATORIO	
21890		
22100	ALIMENTACAO E DIETETICA (DOENTES E PESSOAL)	
33100		
22300	EMBALAGEM E ESTERILIZACAO	
22600	SERVICO DE TRANSPORTES (DOENTES)	-
35500		
22700	SERVICO DE TRATEMENTO DE ROUPAS	
31000	ADMINISTRACAO GERAL	
	Administration	Central Supplies
	Finance	Data and Statistics
	Personnel	Patient Admissions
34300	SERVICOS FARMACEUTICOS	
34600	SERVICOS DE INSTALACOES E EQUIPAMENTOS	
35600	PAVILHAO DE CONVALESCENTES	

NOT KEY CENTROS DE CUSTO

13000	SERVICO DE DIALISE
14000	SERVICO DOMICILIARIO
21300	LABORATORIO DE EXPLORACAO FUNCIONAL RESPIRATORIA
21400	SERVICO DE HFOTERAPIA
21510	APLICACAO DE PACEMAKERS
21530	ANGIOGRAFIA
21540	ELECTRO CARDIOLOGIA
21550	
21560	
21610	
21620	
21630	
21640	
21810	ANESTESIA

Table 4 Not Key Centros de Custo (Continued)
Page 2

CODIGO

22200 ALOJAMENTO DAS MAES

22400

22500

32000

33200

33400

33500

33600

34100

34200

34400

34500

35100

35200

35300

35400

36100

36200

36300

The working group recommends that Cost Center 31000, Administração Geral, be broken into six cost centers:

Administration
Finance
Personnel
Central Supplies
Data and Statistics
Patient Admissions

This will give hospitals better control of their administrative costs.

D. Proposed Productivity and Cost Indicators

The working group developed the following indicators:

- Each key cost center will have a measure of activity, called its unit of service
- Resources for personnel will be measured in hours, and separated for physician and non-physician
- Costs for personnel will be measured by average escudo per hour (separated for physicians and non-physicians)
- Productivity for personnel will be measured by hours per unit of service (separated for physicians and non-physicians)
- Costs will be measured as a) physician costs per unit of service, b) all other costs per unit of service, and c) consumable costs per unit of service.

1. Units of Service

Each cost center should have a measure of its activity, called its unit of service. For example, a nursing ward's primary unit of service is "patient day." Some cost centers may have secondary measures of activity. For example, a nursing ward's secondary unit of service is "patient admissions." The unit of service is a measure of the volume of service performed. Productivity is measured by calculating the quantity of resources (personnel, supplies, or total cost) per unit of service. For example, personnel hours per patient day is a measure of productivity on a nursing unit, as is supplies per patient admission.

Table 5 lists the proposed unit of service for each cost center. Two cost centers required further investigation: Embalagem e Esterilização and Farmácia. The work group anticipates that a unit of service can be developed for these cost centers, but time did not permit this to be done during the two-week consultation.

TABLE 5. UNITS OF SERVICE FOR KEY COST CENTERS

<u>Cost Center</u>	<u>Unit of Service</u>
UNIDADE DE CUIDADOS INTENSIVOS	1. Patient Days 2. Admissions
UNIDADE DE CUIDADOS AGUDOS	1. Patient Days 2. Admissions
UNIDADE DE CUIDADOS OBSTETRICIA	1. Patient Days 2. Admissions
UNIDADE DE CUIDADOS PEDIATRIA	1. Patient Days 2. Admissions
UNIDADE DE CUIDADOS PSIQUIRIA	1. Patient Days 2. Admissions
CONSULTA EXTERNA	Number of consultations
SERVICO DE URGENCIA	Number of visits
LABORATORIOS	Weighted Procedures
SERVICO CENTRAL DE RADIOLOGIA	Weighted Procedures
MEDICINA FISICA E REABILITACAO	Weighted Procedures
BLOCO OPERATORIO	Weighted Procedures or Operating Minutes
ALIMENTACAO E DIETETICA	Number of meals
EMBALAGEM E ESTERILIZACAO	To Be Determined
SERVICO DE TRANSPORTES	Number of Kilometers
SERVICO DE TRATAMENTO DE ROUPAS	Number of Kilos
ADMINISTRACAO GERAL	1. Adjusted Patient Days 2. Adjusted Admissions
SERVICOS FARMACEUTICOS	To Be Determined
SERVICOS DE INSTALACOES E EQUIPAMENTOS	Number of requests
PAVILHAO DE CONVALESCENTES	1. Patient Days 2. Admissions
TOTAL HOSPITAL	1. Adjusted Patient Days 2. Adjusted Admissions

The total hospital's unit of service is adjusted patient days or adjusted admissions. An adjustment is made to convert outpatient and emergency visits to an equivalent number of patient days or admissions. The working group recommends the following procedure.

1. Calculate each hospital's ratio of total operating costs to inpatient operating costs:

$$R = \frac{\text{total operating costs}}{\text{inpatient operating costs}}$$

2. Multiply R times total patient days to arrive at adjusted patient days
3. Multiply R times total admissions to arrive at adjusted admissions.

Notice that, since average length of stay equals patient days divided by admissions, the average length of stay does not change with the above adjustment.

Further explanation of weighted procedures in Laboratorios, Radiologia, Medicina Fisica e Reabilitação, and Bloco Operatorio is given in the next section on information flow.

2. Personnel Costs

Since 70 percent of the hospital's operating expenses are for personnel, a measure of personnel used is very important. Currently, there is no measure of total personnel hours used, either in the total hospital or in the cost centers. The payroll system provides the escudos paid, but not the hours. Since escudo per hour varies depending on the mix of skill levels, mix of regular and overtime hours, timing of salary increases, and mix of staff seniority, hours should be measured separately from escudos per hour. Further, since personnel are paid the same each month, payment does not reflect the actual hours worked. This is not a serious problem if several months are combined, but it is a problem for the cost center manager if he (she) is comparing one month to the next.

Since physician and non-physician personnel can be managed separately, the work group recommends personnel time and escudos for these two groups be measured separately. Non-physician administrative staff will have more control over the non-physician staff, and can therefore monitor productivity more easily if physician and non-physician time is measured separately.

The measurement of hours has the potential of becoming very complex given the simplicity of the current time keeping systems observed at the hospitals that the work group visited. The work group recommends the measurement of hours remain as simple as possible and yet be useful.

Some employees, nurses for example, are assigned to particular hours of the day so that regular hours can be measured. However, many employees work a variety of hours, with different amounts depending on the day of the week, or even the week of the month. To start, the objective is to measure the total paid hours per month for each cost center. The work group recommends that 36 hours per week be used as the base since overtime pay is based on 36 hours. Although total overtime hours are available from the payroll system (Mapa 26), this report is too late to be useful. Overtime hours will need to be summarized manually. The work group also recommends that the average number of weeks per month, 4.33, be used to calculate paid hours per month.

As managers are assigned to cost centers to control productivity, they will need to keep more accurate records of hours worked and hours absent. In this initial effort, the work group recommends waiting until more experience is gained with total paid hours, and until specific cost centers are identified for potential improved productivity.

Once the total paid hours are measured for physician and non-physicians, they can be divided into total escudos paid each group (POCSS, Mapa 23) to obtain average salary per hour. Comparison among hospitals will highlight those that are depending heavily on overtime or potentially using more expensive skill levels than necessary. However, hours per unit of service are more important to monitor productivity.

3. Other Costs

Mapa 23 of POCSS provides actual monthly and year-to-date expenditures for each cost center. It does not currently have the ability to provide actual units of service, and, therefore, costs per unit of service. Eventually this Mapa, or another, should show budgeted monthly and year-to-date expenses and budgeted units of service (since there is no budget at the cost center level, this has not been needed). Each cost center should be on a separate page so it can be distributed to the cost center manager.

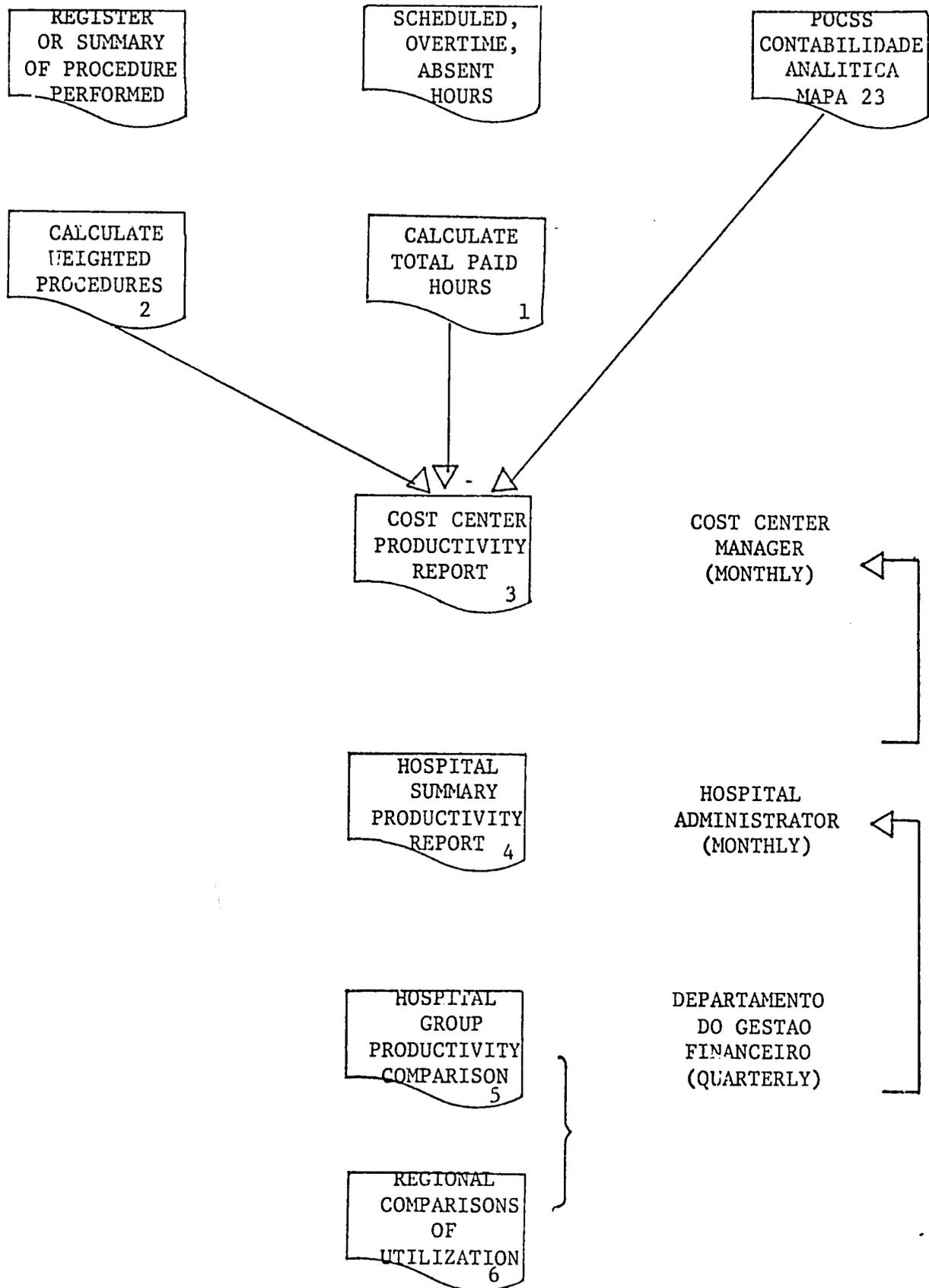
Mapa 23 was being produced on November 17, 1981, for July and August, 1981. A ten-week delay is understandable with a newly installed system, but a two-week delay should be the objective.

E. Proposed Information Flow

Figure 7 shows the flow of information for measures of activity, personnel hours, and costs. Measures of activity are manually totalled; personnel hours are manually totalled; and costs are taken from POCSS Mapa 23. Six new Mapas have been tentatively developed by the working group:

- Mapa 1 Total paid hours by Cost Center
- Mapa 2 Total weighted procedures by cost center

FIGURE 7. ILLUSTRATION OF
INFORMATION FLOW
FOR EACH COST CENTER



- Mapa 3 Cost Center Productivity Report
- Mapa 4 Hospital Summary Productivity Report
- Mapa 5 Hospital Group Productivity Comparison
- Mapa 6 Regional Comparisons of Utilization

All Mapa can be prepared manually until specifications can be compiled for SIS.

Each Mapa is described in detail below.

1. Mapa 1 Total paid hours by Cost Center

Total paid hours are the total of scheduled hours and overtime hours. Since each month has a different number of weekdays and weekends, a mapa similar to Table 6 would be required. For each employee, the scheduled hours would be recorded under the day of the month. When totalled along with overtime hours, the Cost Center's total paid hours are obtained. Totals would be made separately for physicians and non-physicians.

This Mapa can be simplified or made more complicated. The simplified version would assume each employee is scheduled to work 36 hours per week. Since there are 4.33 weeks per month, the total monthly scheduled hours for each employee would be $4.33 \times 36 = 156$ hours per month. Total scheduled hours would be 156 hours times the number of employees.

The more complicated version would require each employee's schedule to be recorded each month. Then when the employee was absent, that day would be circled with a code for the reason. Total productive hours could then be calculated by subtracting the hours of absenteeism from the cost center's total paid hours, and nonproductive hours could be monitored by recording total absenteeism hours for each reason.

The working group suggests these alternatives be evaluated in a demonstration hospital.

2. Mapa 2 Total weighted procedures by Cost Center

Four cost centers require procedures to be weighted: Laboratorios, Radiologis, Reabilitação, and Bloco Operatório. Although total number of procedures could be used as the unit of service, if the mix of procedures changes over time, or is different from one hospital to another, the measure of productivity will not be comparable. In order to adjust for mix procedures, each procedure should be assigned a weight. The unit of service is the total number of weighted procedures. Consider the following example for Reabilitação.

The Reabilitação Cost Center for two hospitals are very simple and only provide four procedures as illustrated in Table 7.

TABLE 6

HOSPITAL NAME
TOTAL PAID HOURS-NON PHYSICIANS

MAPA 1
MONTH _____

COST CENTER: _____

EMPLOYEE NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL NORMAL	TOTAL OVER- TIME		
X X X X X NORMAL	7.5	7.5	7.0	7.0	7.0			7.5	7.5	7.0	7.0	7.0			7.5	7.5	7.0	7.0	7.0				7.5	7.5	7.0	7.0	7.0			7.5	7.5	7.0	166.0		
OVERTIME		2.0		2.0								2.0				1.0								3.0						2.0				12.0	
X X X X X NORMAL	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0			6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	162.0	0.0
OVERTIME																																		0.0	
X X X X X NORMAL	12.0	12.0	12.0					12.0	12.0	12.0					12.0	12.0	12.0						12.0	12.0	12.0			12.0	12.0	12.0			180.0	0.0	
OVERTIME																																		0.0	
																TOTAL											508.0	12.0							
																COST CENTER TOTAL PAID HOURS											520.0								

TABLE 7. SAMPLE CALCULATIONS OF WEIGHTED PROCEDURES

PROCEDURES	WEIGHT	HOSPITAL A		HOSPITAL B	
		FREQUENCY	WEIGHTED	FREQUENCY	WEIGHTED
1. DIATERMIA DE MICRO-ONDAS	1.0	50	50	50	50
2. DIATERMIA DE ONDAS CURTAS	1.0	75	75	55	55
3. HIDROMESSAGEM GERAL	2.3	20	46	60	138
4. DETERMINACAO DE CRONAXIA	7.3	30	219	10	73
	TOTAL	175	390	175	316

During a one-month period, the two departments provided the number of procedures as shown. The total number of procedures for Hospital A is 175 and for Hospital B is 175. However, if we assign weights to each procedure as shown, the total weighted procedures are 390 for Hospital A and 316 for Hospital B. The differences in mix of procedures is taken into account by assigning weights. Weighted procedures can be used for the four cost centers mentioned above, but it will require hospitals to count the number of procedures of each type, not just the total. Also, the hospital will have to assign someone to make the above calculation.

An important step is establishing weights for these cost centers. The work group was not able to complete this step during the two-week consultation, although several rate tables were collected.

The work group proposes to use the rates paid to private physicians as the basis for setting the weight since there has been considerable review of these rates. Several physicians from these cost centers should review the weights to be sure the weights approximate the difference in time required to perform the procedures. It will be very difficult to change the weights once they are established, so it is recommended that they be based on rates that are already in general use. Even if the rates change in the future, the weights should not change without thorough review.

Bloco Operatorio presents special problems. Operating procedures are not usually coded so it may be difficult and inaccurate to count the total number of each procedure. The work group considered counting the number of operating minutes. Further evaluation of these two alternatives is required in a demonstration hospital.

Table 8 shows a proposed format for calculating weighted procedures

3. Mapa 3 Cost Center Productivity Report

The Cost Center Manager should monitor the productivity and cost indicators each month. Table 9 shows the indicators month by month. The year-to-date accumulated indicators could be shown also. This Mapa should also be completed for the hospital total. Each line is described as follows:

1. Primary Unit of Service - measures the activity level in the cost center. Taken from Mapa 2 if weighted procedures are used.
2. Secondary Unit of Service - for some cost centers, such as nursing units, the number of admissions to the unit each month is important to monitor.
3. Paid Hours - Physicians - taken from Mapa 1.

TABLE 4

HOSPITAL NAME

MAPA 2

TOTAL WEIGHTED PROCEDURES

MONTH _____

COST CENTER Medicina Fisica e Reabilitacao

PROCEDURES	(A) WEIGHT	(B) FREQUENCY	(A)X(B) WEIGHTED
1. DIATERMIA DE MICRO-ONDAS	1.0		
2. DIATERMIA DE ONDAS CURTAS	1.0		
3. HIDROMESSAGEM GERAL	2.3		
4. DETERMINACAO DE CRONAXIA	7.3		
TOTAL			

HOSPITAL SUMMARY PRODUCTIVITY REPORT

MONTH

INDICATORS		INTENSIVE CARE	ACUTE CARE	OBSTETRICS	PEDIATRICS	URGENCIA
UNITS OF SERVICE	1. PRIMARY (FOR EXAMPLE PATIENT DAYS) 2. SECONDARY (FOR EXAMPLE NO. OF ADMISSIONS)					
	3. PAID HOURS-PHYSICIANS 4. PAID HOURS-NON PHYSICIANS 5. TOTAL PERSONNEL COSTS-PHYSICIANS 6. TOTAL COSTS WITHOUT PHYSICIANS 7. CONSUMABLE AND OTHER COSTS					
AVERAGE SALARY	8. COST PER HOUR-PHYSICIANS 9. COST PER HOUR-NON PHYSICIANS					
PRODUCTIVITY	10. HOURS PER UNIT OF SERVICE-PHYSICIANS 11. HOURS PER UNIT OF SERVICE-NON PHYSICIANS 12. COST PER UNIT OF SERVICE-PHYSICIANS 13. COST WITHOUT PHYSICIANS PER UNIT OF SERVICE 14. CONSUMABLE AND OTHER COSTS PER UNIT OF SERVICE					
OTHER	15. PERCENT OCCUPANCY 16. AVERAGE LENGTH OF STAY					

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4. Paid Hours - Non-Physicians - taken from Mapa 1.
- 5, 6, and 7. Cost taken from POCSS, Mapa 23.
8. Cost per Hour - Physicians - Line 5 - line 3.
9. Cost per Hour - Non-Physicians - Line 6 - line 4.
10. Hours per Unit of Service - Physicians - Line 3 - line 1.
11. Hours per Unit of Service - Non-Physicians - Line 4 - line 1.
12. Cost per Unit of Service - Physicians - Line 5 - line 1.
13. Cost without Physicians per Unit of Service - Line 7 - line 1.
14. Consumable and other Costs per Unit of Service - Line 7 - line 1.
15. Percent Occupancy - patient days - (number of beds x days in month).
16. Average length of Stay - patient days - number of admissions.

This report could be simplified by reducing the number of indicators. The working group felt these indicators should be tested in a demonstration hospital before eliminating any. This Mapa is the basic report from which the remaining reports are produced. The cost of having this mapa produced by SIS should be evaluated.

Although only total paid hours is shown in Mapa 3, the working group recommends that cost center managers and hospital administrators also monitor absenteeism. Absenteeism can be added to the report if it is available.

4. Mapa 4 Hospital Summary Productivity Report

This report, shown in Table 10, is identical to Mapa 3, except the months across the top would be replaced with key cost centers. A different Mapa 4 would exist for each month. On a computer, Mapa 4 could be produced directly from the set of Mapa 3 for each hospital. Mapa 4 may be an excessive manual effort. The administrator could review copies of Mapa 3 and send copies of Mapa 3 to the Departamento do Gest3o Financeira. The amount of time required to produce this report manually should be evaluated in a demonstration hospital. The cost of producing it at SIS should also be evaluated.

5. Mapa 5 Hospital Group Productivity Comparison

An illustration of Mapa 5 is shown in Table 11. The Departamento do Gest3o Financeira would receive Mapa 3 (or 4) each month and prepare Mapa 5 quarterly and annually for each cost center. The cost of having this report produced by SIS should be evaluated. Once Mapa 3 is computerized, Mapa 4 and 5 are straightforward to produce on the computer.

The comparisons prepared by the Departamento do Gest3o Financeira should be distributed to the hospital administrators, who in turn should distribute the relevant comparisons to cost center managers and Medical Directors.

6. Mapa 6 Regional Comparisons of Utilization

While Mapa 5 compares cost centers of hospitals that are similar, it is also important to compare utilization from region to region. This comparison may be made annually and the following indicators are examples of the type that should be calculated:

patient days per 1000 population

admissions per 1000 population

births per 1000 population (admissions to OB unit could be used to approximate this)

While the productivity indicators on Mapa 3-5 indicate the cost of providing a unit of service, some review of the necessity to provide the unit of service at all is required. For example, are there large differences between the number of patient days per 1000 population from one region to another? If so, further investigation of the reasons is required if the total cost of health care is to be reduced.

The working group did not develop a layout of Mapa 6. It remains to be done after the previous mapas are further developed.

F. Use of Productivity and Cost Indicators for Developing Targets in Budget Preparation and Approval

Once information is available, even for one hospital, units of service for each cost center can be projected. Hours per unit of service can be agreed upon based on historical performance and anticipated changes in performance. Average salaries per hour can be estimated using anticipated pay raises, use of overtime, and past payment. Other costs per unit of service can likewise be based on past performance and anticipated inflation. When performance in several hospitals is compared, cost centers that are exceptionally high or low can be selected for further study, or budgets can be approved in anticipation that performance will change over the year.

HOSPITAL GROUP PRODUCTIVITY COMPARISONS

COST CENTER: OBSTETRICS

PERIOD: 1980

INDICATORS		ABRANTES	CALDAS	SANTAREM		
UNITS OF SERVICE	1. PRIMARY (FOR EXAMPLE PATIENT DAYS)	3849	7754	11490		
	2. SECONDARY (FOR EXAMPLE NO. OF ADMISSIONS)	867	1821	2280		
RESOURCES	3. PAID HOURS-PHYSICIANS	6351	6471	3952		
	4. PAID HOURS-NON PHYSICIANS	15854		40992		
	5. TOTAL PERSONNEL COSTS-PHYSICIANS	1924000	1763000	3899000		
	6. TOTAL COSTS WITHOUT PHYSICIANS	2667600	1386000	7453000		
	7. CONSUMABLE AND OTHER COSTS	669000	1911000	2202000		
AVERAGE SALARY	8. COST PER HOUR-PHYSICIANS	303	272	655		
	9. COST PER HOUR-NON PHYSICIANS	168		182		
PRODUCTIVITY	10. HOURS PER UNIT OF SERVICE-PHYSICIANS	333	355	261		
	11. HOURS PER UNIT OF SERVICE-NON PHYSICIANS	1828		1797		
COSTS	12. COST PER UNIT OF SERVICE-PHYSICIANS	500	227	339		
	13. COST WITHOUT PHYSICIANS PER UNIT OF SERVICE	867	425	840		
	14. CONSUMABLE AND OTHER COSTS PER UNIT OF SERVICE	772	1049	966		
OTHER	15. PERCENT OCCUPANCY					
	16. AVERAGE LENGTH OF STAY					

The budget for a hospital is then prepared and approved by totalling the decisions made for each cost center.

As the year progresses, actual performance should be compared to budgeted performance - monthly by the hospitals and quarterly by the Departamento do Gestão Financeira. If large differences occur (greater than 5% for example), immediate corrective action can be taken so that the budget is achieved by the end of the year.

Eventually, each cost center should have a manager assigned to it. For ancillary departments, this would be a chief technologist. For nursing wards, it would be head nurses or charge nurses for each shift. Although physicians are responsible for the medical services provided in the hospital, it is suggested that a non-physician be given administrative responsibilities for coordinating the job assignment of non-physician staff and achieving desired performance on the productivity and cost indicators related to non-physician staff. In this way, physicians are freed from day to day administrative responsibilities so that they can focus on their patients. The cost center manager will need sufficient time, resources, knowledge, and skills to solve problems.

Indicators have been developed at the cost center level even though there are not managers assigned to all cost centers. As problems are identified and opportunities for improving productivity become apparent, the working group assumes that a manager would be assigned to improve its performance.

The working group did not develop targets or standards for the productivity and cost indicators. Budgeted productivity and costs are the targets, and budgets should be approved with the participation of the hospital administrative staff.

Based on the eventual use of the productivity and cost indicators, the above information flow has been designed to provide timely feedback to managers who are responsible for achieving desired performance. In addition, the scope of this project needs to include:

- training cost center managers who are capable of solving the problems that keep desired performance from being achieved, and
- developing the capability to project performance one month, one year, and five years into the future so that problems can be anticipated and solved before they occur.

G. Recommendations and Work Plan

The working group will review this report during January, 1982, with representative hospital administrators. Based on their feedback and input, the following recommendations will be modified.

- a. Implement system in one hospital to make data collection efficient and useful, and to provide a demonstration site for other hospital administrators to observe.
- b. Develop sequence of hospitals in which to implement system so that hospitals can learn from each other (easy access to one another).
- c. Assign staff from Departamento do Gestão Financeira to assist hospitals in implementation, to develop written instructions for data collection and report preparation, and to train hospital administrators and cost center managers to use reports.
- d. Evaluate the cost of automating the preparation of the reports - most of the data will be manually collected and totalled, but the reports themselves are simply different presentations of the same data.
- e. USAID should provide technical assistance at the following steps:
 1. Three to four weeks when the system is implemented in the demonstration hospital (March or April, 1982).
 2. Two weeks when the Departamento do Gestão Financeira receives its first reports to assist them in using the data for budget review and approval (October or November, 1982).
 3. Two weeks to assist Departamento do Gestão Financeira with training hospital administrators and cost center managers to use reports (Spring, 1983).
 4. Two to four weeks of telephone assistance and written correspondence throughout the implementation process.
- f. USAID should provide an observation trip for two members of the staff of Gestão Financeira to the U.S. to observe functioning information systems to analyze hospital productivity. The State of Washington has an excellent system that the Working Group found useful in this analysis. This, plus some other sites, could provide a rich 2-4 week experience that could significantly advance this project. The summer of 1982 would be a good time for this activity.

The proposed time table is shown in Table 12.

TABLE 12. CALENDAR OF ACTIVITIES FOR IMPLEMENTATION OF PRODUCTIVITY REPORTS

TASKS	1982						1983											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1. Review consultant's report with hospital administrators	-----																	
2. Select first demonstration hospital			▼															
3. Review mapas with demonstration hospital statistics staff and administrative staff				-----														
4. Finalize formats for mapa at demonstration hospital				▼														
5. Develop weights for weighted procedures	-----																	
6. Preprint mapa for use at demonstration hospital						-----												
7. Prepare instructions for completing and using mapa										-----								
8. Train staff in demonstration hospital to complete and use mapa													-----					
9. Initiate program in demonstration hospital																		▼
10. Assign D.G.F. staff to implement in demonstration hospital and develop training materials for national implementation	▼																	

Table 12. Calendar of Activities for Implementation of Productivity Reports
Page 2

TASKS	1982												1983					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
11. Review plans with SIS and coordinate timing with POCSS				▼														
12. Evaluate automation of productivity reports																		
13. Review experience at demonstration hospital																		
14. Conduct training seminars for next implementation																		
15. Develop sequence of hospitals for national implementation																		

V. BUDGET ANALYSIS

A. Scope of Work

The activities for this consultancy were proposed in the Management Sciences for Health Report of February, 1981. The objectives were to perform three tasks working with staff from the Departamento do Gest3o Financeira (DGF):

- 1) to categorize the budget according to controllable and non-controllable items;
- 2) to compare actual to budgeted costs; and
- 3) to specify ways in which financial and cost reports could be simplified.

In the nine months between that report and the present visit, DGF has addressed many problems related to the allocation and coordination of budget accounts and financial information within the health system, particularly with the hospital sector. These efforts have produced several useful results. The budgeting and accounting process within the national health system was systematized and automated using the P.O.C.S.S. program developed by SIS. A computerized system of feeding back financial reports to individual hospitals also was developed and implemented. Detailed reports for central and district level hospitals have been produced. These reports summarize comparative physical statistics and related financial information by hospital for each year from 1978 to 1980. Finally, a system of allocating hospital budgets based on performance was developed and implemented. This system represents a substantial improvement over the past when budgets were allocated according to a standard line-item increase. This new system encourages hospital efficiency, gives DGF a better basis for allocating next year's budget, and provides DGF with a vehicle for making hospitals live within their original allocations. If DGF means it, hospitals can no longer expect automatic supplemental budgets to be approved at the end of each year.

As a result of this significant progress within the DGF, financial reports have been simplified, comparison of actual to budgeted costs is now possible, and comparisons between hospitals can be made. Thus, the original scope of work for this consultancy needed adjustment to fit current realities. After considerable discussions with members of the DGF Working Group for Orçamentos, Control de Custos, e Analise Financeiro, we decided to focus our work on examining the issues involved in controllable vs. non-controllable costs, especially in relation to the impact of investment decisions on operating expenses. The specific tasks we performed were:

1. to examine the real growth in hospital costs net of inflation.
2. to compare various hospitals and their rates of growth.

3. to project growth of costs into the future assuming various alternatives.

B. Relation Between Current Expenditures and Investment Decisions

Restraining the rapid growth of recurrent expenditures is a major goal of the DGF. The focus of DGF is on control of current expenditures in the area of hospital-based care. However, investment decisions in previous years contribute to the present day problem of rising recurrent hospital costs. Therefore, plans to control future operating expenses must include an analysis of the effect of investment decisions on those costs.

1. Analytical Framework

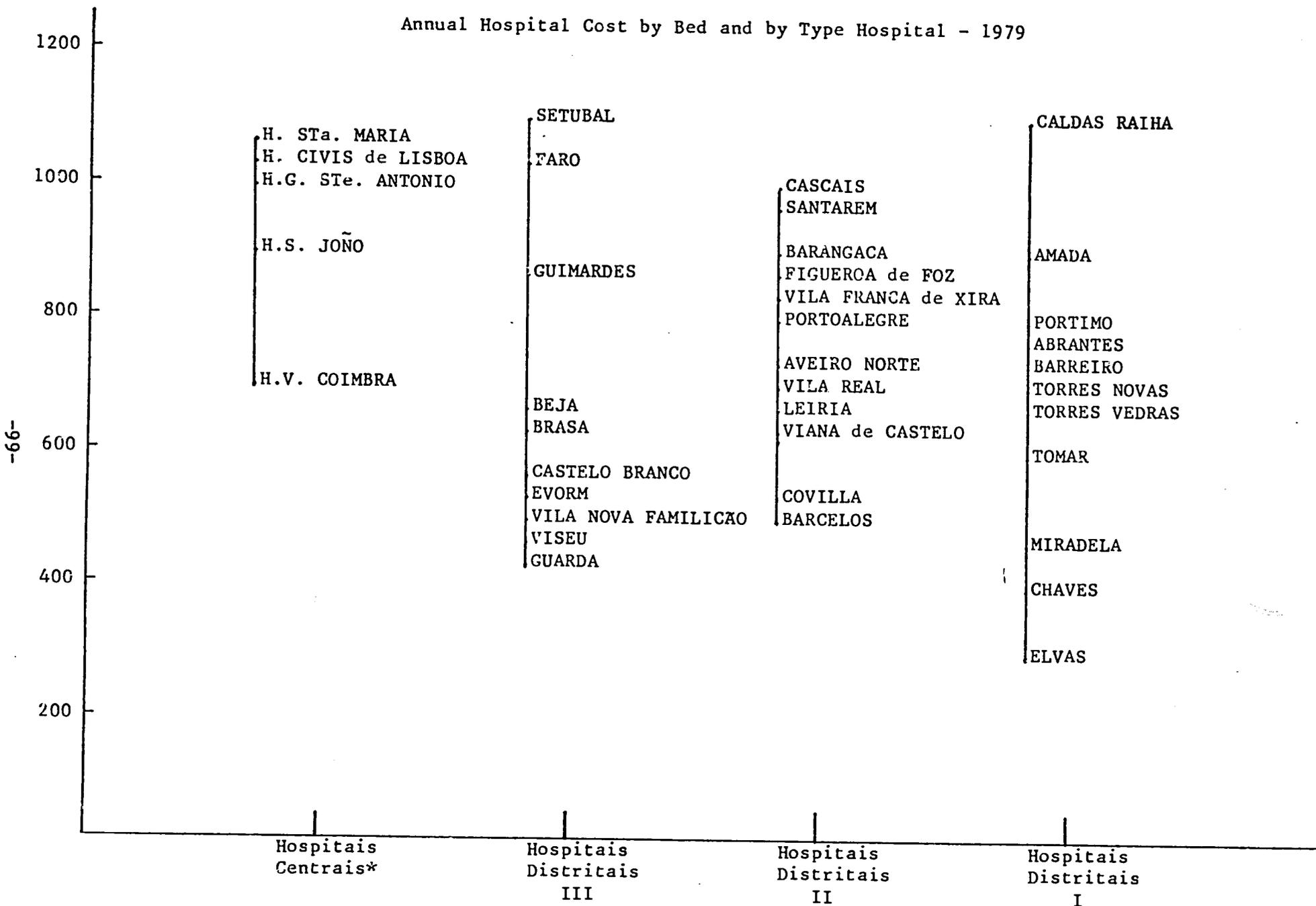
The purpose of this report is to present a relatively simple method of examining the effect of investment decisions on the growth of costs in the hospital sector. The method takes the hospital bed as an index or proxy for the quantity of total services (inpatient and outpatient) delivered in hospitals. It assumes that hospital costs rise as a result of three factors: 1) an expansion in the extent of hospital services measured by the number of beds; 2) an increase in the intensity and complexity of care (for both inpatient and outpatient) represented by each bed; and 3) inflation in the prices of hospital inputs. Estimating the effects of the combination of the first two factors separately from the effects of inflation form the core of the procedure for examining the impact of investment decisions on operating costs. If one assumes that the costs of hospital services will follow past trends, the results of this procedure also can be used to project hospital costs over the planning horizon of several years.

We first examined whether beds should be disaggregated by type and analyzed separately. Factors which potentially affect the cost per bed include the level of the hospital (central, district, specialty, or concelho) and the size. Specialty hospitals were considered to be different cases with the structure of their costs likely to be unique. Therefore, those hospitals have not been included in this analysis. Inadequate information for concelho hospitals forced them to be excluded from this analysis as well. The available data for concelho hospitals is examined separately, however.

For the remaining hospitals, we concluded that separate analytical groups of hospitals would be justified if higher levels and/or larger sizes corresponded with higher costs per bed. Figure 8 depicts the relationship between level of hospital and cost per bed for 1979. The plots reveal a pattern of somewhat higher bed costs for central hospitals with a slight downward trend in cost per bed as the level of the hospital declines. For district level hospitals, however, the differences between levels are not as great as the substantial variation within levels. Figure 9 is a scatter plot of the relation between hospital size and cost per bed for district hospitals only. Visual

Figure 8

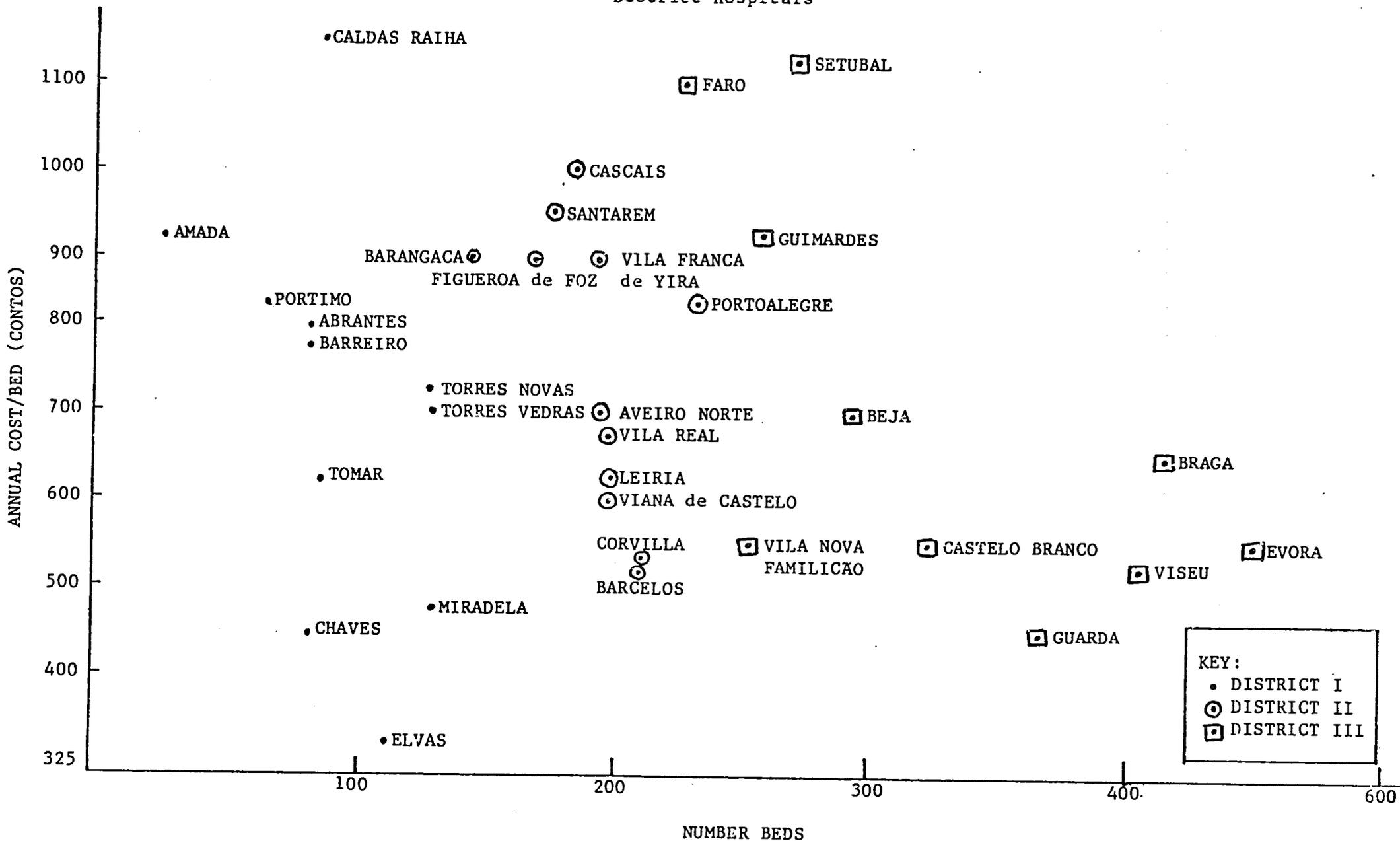
Annual Hospital Cost by Bed and by Type Hospital - 1979



*Total Expenditures unavailable for 5 Central Hospitals

Figure 9

Relation Between Annual Bed Cost and Hospital Size
District Hospitals



inspection reveals considerable variation among district hospitals and no strong trend with respect to size.

We should ask why is this so? Theoretically, larger hospitals provide more complex services and, therefore, have higher costs per bed. Does this lack of a consistent pattern with respect to size relate to management patterns and/or productivity differences between hospitals? Is it due to a different "case-mix" of diagnoses treated independent of size? Answers to these questions are important for control of costs, but current information does not allow us to answer these questions. Because there were no clear differences with respect to size, hospitals were disaggregated into central and district beds, with all district level beds treated as a single entity.

2. Method for Analysis

a. Number of Beds: Historical data were obtained from the DOH's official records for the years 1972 through 1980.

b. Cost per Bed (current prices): This was calculated on a historical basis by dividing the total reported expenditures by the number of beds.

c. Cost per Bed: (constant 1972 prices): The cost per bed in current prices must be corrected for inflation. It was assumed that inputs to hospital care (i.e., salaries, supplies, etc.) have risen at the same rate as the general Consumer Price Index for Portugal. That index showed the following average level for each year from 1970 through 1980:

1970 = 100	1976 = 232.0
1971 = 107.5	1977 = 297.1
1972 = 116.9	1978 = 355.1
1973 = 128.3	1979 = 452.5
1974 = 162.6	1980 = 533.2
1975 = 195.9	

For this analysis the index is normalized to 1972. Dividing the cost/bed in current prices by the index gives the cost per bed in real terms (constant 1972 escudos).

3. Results

This method is used to examine costs for central and district hospitals (Tables 13 and 14). The most important results in these tables are that current costs for central and district hospital beds are 1051\$contos and 575\$contos respectively. These costs have been rising in real terms (i.e., above inflation) by 5.9 percent per year in central hospitals and by 10.9 percent per year in district hospitals; expansion of beds in central and district hospitals has risen by 3.4 and 4.3 percent per year, respectively.

Table 13

Estimated Annual Growth of the Cost of Hospital Beds
Central Hospitals (N=10; excludes specialty hospitals)

<u>Year</u>	<u>No. Beds</u>	<u>Total Expenditures</u> <u>(en contos)</u>	<u>Cost/Bed</u> <u>(current prices)</u>	<u>Index</u>	<u>Cost/Bed</u> <u>(constant '72 prices)</u>
1972	8009	1,233,677	154	1.00	154
1973	8102	-	-	1.098	-
1974	7945	1,961,038	247	1.399	176
1975	9495	-	-	1.676	-
1976	9917	3,697,115	373	1.985	188
1977	10164	-	-	2.542	-
1978	10319	6,235,409	604	3.038	199
1979	10292	8,096,343	783	3.871	202
1980	<u>10160</u>	10,675,608	1051	4.561	<u>230</u>
Increase over base year 1972	27%				49%
Average annual compound rate of growth	3.4%				5.9%

Table 14

Estimated Annual Growth of the Cost of Hospital Beds
District Hospitals

<u>Year</u>	<u>No. Beds</u>	<u>Total Expenditures</u> <u>(en contos)</u>	<u>Cost/Bed</u> <u>(current prices)</u>	<u>Index</u>	<u>Cost/Bed</u> <u>(constant '72 prices)</u>
1972	7285	439,175	60	1.00	60
1973	7513	-	-	1.098	-
1974	7895	882,952	112	1.399	80
1975	8573	-	-	1.676	-
1976	9371*	2,350,661	251	1.985	126
1977	9529	-	-	2.542	-
<u>1978</u>	9445	4,764,053	504	3.038	166
<u>1979</u>	9782	-	-	3.871	-
1980	<u>9800</u>	5,630,961	575	4.561	<u>126</u>
Increase over base year 1972	35%				110%
Average annual compound rate of growth	4.3%				10.9%

* Montas reports a total of 9661 beds for 1976. If this figure were used, cost/bed in constant prices would be somewhat lower.

There are at least two possible explanations for the real rise in cost per bed. First, there may be a general trend towards more sophisticated and expensive care. This explanation is partially confirmed by an examination of the distribution of new beds at the central hospital level. Cardiology beds have increased by 16 percent over the last three years while infectious disease beds have decreased by 61 percent. General surgical beds have increased by 0.7 percent whereas more sophisticated surgical beds have increased as follows: neurosurgery, 80%; thoracic surgery, 76%; plastic surgery, 103%. These cardiology and specialized surgery beds require complementary investments for sophisticated (and expensive) equipment as well as increased technical staff, more supplies, etc. The second explanation concerns how intensely hospital facilities are used, i.e., how frequently patients are processed through the system. The increase in number of discharges per bed in central hospitals provides partial confirmation for this explanation.

C. Projection of Hospital Costs

If we assume that the costs of hospital services will follow past trends, the estimated growth rates can be used to project costs for central and district hospitals over the next several years. Projections for 1985 operating costs for these hospitals are presented in Table 15. Dr. Mantas (see Panorama Geral da Rede Hospitalar Oficial) projects a total of 15,611 district hospital beds and 10,283 central beds for 1985. Case 1 in Table 12 assumes that none of the new beds are constructed, Case 2 assumes half of the projected number are built, and Case 3 assumes all are in place by 1985.

The most important result from Table 15 is revealed in the last column. If no new beds are constructed, costs still rise by 45.2 percent above inflation over the base year 1980 due to investments for delivering more sophisticated care and to the increasing intensity of care. If all projected hospital beds are built by 1985, operating expenses will increase by 80.6 percent above inflation over the base year 1980.

This analysis excludes the costs of specialty and concelho hospitals. The method has been applied to maternity hospitals in Table 16 and concelho hospital in Table 17, however. Data on number of beds for the concelhos were not available. Therefore, the number of concelho facilities rather than number of beds was used as the unit of analysis. Total concelho facilities are known with certainty only for 1980. Therefore, that number is used for each year from 1974 to 1980. Probably there were a somewhat larger number in 1974, and if in fact there were more, the actual growth rate would be greater than what we have estimated. If we assume no new maternity hospital beds and no additional concelho hospitals, the analysis indicates that maternity hospital beds and concelho hospitals would add 616,929\$contos and 3,398,409\$ contos respectively to the total estimated hospital expenditures in Table 15. It should be noted that the cost of the concelho hospitals, under these assumptions, will increase from 8% of the hospital sector budget in 1980 to 10% in 1985.

Table 15

Projected Costs for Central and District Hospitals

	<u>No. Central Beds</u>	<u>Cost/Bed (constant 1980 prices)</u>	<u>No. District Beds</u>	<u>Cost/Bed (constant 1980 prices)</u>	<u>Total Hospital Expenditure</u>	<u>Percentage Increase Over 1980</u>
Baseline	10160	1051	9800	575	16,313,000	0
Case 1 (1985)	10160	1400	9800	965	23,681,000	45.2%
Case 2 (1985)	10221	1400	12706	965	26,556,000	62.8%
Case 3 (1985)	10283	1400	15611	965	29,460,000	80.6%

Table 16

Estimated Annual Growth of Cost of Beds in Maternity Hospitals

<u>Year</u>	<u>No. Beds</u>	<u>Total Expenditures</u>	<u>Cost/Bed</u> <u>(current prices)</u>	<u>Index</u>	<u>Cost/Bed</u> <u>(constant '72 prices)</u>
1972	491	100.528	205	1.00	205
1974	486	128.878	265	1.399	190
1976	450	251.896	560	1.985	282
1978	492	301.457	613	3.038	202
1980	<u>452</u>	527.028	1,166	4.561	<u>255</u>
Increase over base year 1972	-8.6%				24%
Average annual compound rate of growth	-1.2%				3.2%

Table 17

Estimated Annual Growth of Costs of Concelhos Hospitals

<u>Year</u>	<u>No. Beds</u>	<u>Total Expenditures</u>	<u>Cost/Facility</u> <u>(current prices)</u>	<u>Index</u>	<u>Cost/Concelhio</u> <u>(constant '72 prices)</u>
1974	205	253.125	1,235	1.399	883
1976	205	481.699	2,350	1.985	1,183
1978	205	982.421	4,792	3.038	1,577
1980	205	1,689.508	8,242	4.561	<u>1,806</u>
					105%
					15%

D. Analytical Refinements

1. Technical Procedures

There are several possible refinements that can be made to this analysis. The most immediately useful would be to separate total hospital costs into inpatient and outpatient costs. Number of hospital beds would still be the unit of analysis for inpatient costs, but number of outpatient consultations (i.e., both outpatient and emergency visits) should become the unit of analysis for outpatient costs. If the relevant information can be assembled, this refinement would give more specific information as to which category of hospital costs is growing most rapidly. In addition, comparative analysis of unit costs for hospital inpatient and outpatient services would provide more information for Gestão Financeira and hospital administrations as to where to focus their attention for better financial management (see previous section on Productivity Analysis).

2. Future Requirements

DGF plays an important accounting function in DOH. However, it has an equally important management function. DGF needs to assemble financial and cost information for all sectors of the national health budget, and then analyze and utilize this information to spot budget overruns, to reduce expenditures when they are excessive, and to secure increased productivity and cost efficiency in all health delivery units. DGF also needs to develop more sophisticated analysis such as cost-effectiveness analyses, in order to improve decision making for resource allocation as well as financial management.

In addition, mechanisms for faster retrieval of information need to be developed. They currently receive financial information from hospitals 6-12 months after the fact, and some hospitals do not respond at all, even though many hospitals receive current financial information through the P.O.C.S.S. program at SIS. The current system allows hospitals to send financial inputs to SIS for processing; SIS then sends the finished reports back to the hospitals, often with only a 6 week turn-over time. However, under current procedures in effect, SIS cannot send these reports directly to DGF. They are first sent to the hospitals, who then reprocess the data and send it on to DGF (with a 6-12 month delay). This system thus allows DGF only to analyze last year's costs and productivity to allocate resources in next year's budget. It does not allow DGF to exercise any management control function on the current year's operating expenses, and this leads to cost overruns and end-of-year supplemental budgets.

E. Recommendations

1. Include comparisons of hospital financial performance in budgetary allocations.

This year's budgetary allocations to hospitals were made using a formula based on volume of services. Next years allocations also will be made using the same formula. We recommend that a comparative analysis of hospital financial performance using the financial indicators presented in the recently prepared hospital reports be incorporated into the decision-making process regarding next year's hospital budgets.

The indicators calculated using expenditure data for 1979 were:

- cost/patient discharged (global, and by service)
- cost/outpatient visit
- cost/emergency treatment
- cost/unit laboratory, X-ray, other services
- cost/unit laundry or meal service

In addition, an annual cost/bed and a cost/inpatient day can be calculated. To be most useful for decision-making, these calculations should be made using 1980 expenditure data, and for hospitals who had submitted no financial information. Using this information, hospitals with the worst performance records can be identified and closer scrutiny given to their next year's budgetary allocations.

A comparative analysis of population-based hospital utilization performance should also be a factor in budgetary decision-making. Indicators such as admissions/1000 population, outpatient visits/1000 population, patient days/1000 population, emergency consultations/1000 population, and category of discharges/1000 population should be developed for each hospital and incorporated into decisions regarding next year's budgetary allocations.

No technical assistance is required to implement this recommendation.

2. Improve the flow of financial information to allow more effective cost management.

During the past year SIS has computerized the accounting system for the health sector. Monthly financial reports to hospitals are currently provided with a lag of approximately two months. DGF, as the financial management center of DOH, also needs to receive these reports. DGF cannot be expected to perform its function efficiently using last year's data when more current information is available and easily accessible. DGF should be viewed as a management support system designed to assist hospitals control excess expenses and make more effective use of scarce resources, not as a regulatory agency.

The financial information should be as readily available to DGF as it is to the hospitals, and mechanisms need to be established for this flow of information.

We recommend that two outputs that are presently produced monthly for each hospital would be the most important and relevant for DGF to receive: the first is a breakdown of costs by cost center; the second is a report of monthly and accumulated expenditures grouped by class-of (or line-item) expenditure.

We also recommend that a review committee be established within DGF. Its task would be to review these reports on a monthly basis and prepare a quarterly hospital newsletter or report identifying which hospitals are performing well, which hospitals are doing poorly, and which hospitals have made the greatest improvements over the quarter. This committee could also provide technical assistance to hospitals with poor performance records, helping them to identify those areas most in need of improvement and suggesting mechanisms for making those improvements.

No technical assistance is required to implement this recommendation.

3. Use the techniques presented here to analyze ambulatory health services.

Expenditures in the hospital sector represent about 45 percent of the DOH's annual budget. The share of the budget directed towards primary care is also about 45 percent. Therefore, the structure and growth of rising costs in this sector must be identified as part of an overall plan to control costs within the DOH.

The accumulation and reporting of financial and statistical information, such as has been done for hospitals, should be implemented for primary care facilities. Reports similar to these prepared for hospitals would be particularly useful for comparative analysis of costs. Analysis of the growth of costs in this sector should also be implemented. The suggested unit of analysis is either the facility or the number of visits. At the same time, productivity indicators for evaluating efficiency need to be developed for these facilities.

The central administrative agencies are the key to the accumulation, analysis and utilization of financial information. The present state of the information for primary care facilities is somewhat chaotic. Coordination with Serviço Médico-Sociais, Direcção Geral de Saúde, and GEPS would greatly facilitate the process.

The Technical Group on development of an integrated management information system is addressing these issues, and DGF should coordinate activities with this group.

Technical assistance could be useful for developing productivity indicators, for comparative cost analyses, and for analysis of growth of costs in ambulatory services. However, progress on accumulating the required statistical and financial information should be accomplished first.

4. Capital investments should be considered controllable costs and DGF needs to develop financial criteria for new investments.

Capital investment decisions, both for more sophisticated equipment and for infrastructure, have been shown here to have a significant effect on future operating expenses. Capital expenditures, therefore, need to be regarded as controllable costs. For this reason, DGF needs to develop financial criteria by which to evaluate all proposed new capital investments.

It is recommended that a working task force be created within DGF to carry out this task. The task force should include representatives from GEPS/PIDDAC as well. This working group should establish the financial criteria by which future capital investments will be evaluated, and devise a plan for implementation of the criteria for decision-making. A project appraisal format may provide the most useful framework for this task.

Technical assistance, with a financial analyst working with the task force for 7 to 10 days, may be quite useful.

5. Develop management training programs for DGF staff and program managers in use of information in financial management.

The DGF needs to increase its capacity to utilize the information it is producing for improved decision-making. Therefore, as part of its output, DGF should develop concrete in-service training programs for administrators/managers of facilities and staff of the DGF in the effective use of information for financial management. Staff of the central administrative agencies should also receive this in-service training.

Technical assistance for 4-6 weeks could be quite useful for helping develop the appropriate training materials and assisting in implementation of the seminars. This has already been discussed in more detail in Recommendation No. 4 in Section II.

APPENDIX I
TABLE 1

LIST OF OUTPUTS ON AMBULATORY CONTACTS

<u>REPORT</u>	<u>VARIABLES</u>	<u>NOTES</u>	<u>TYPE OF PROGRAM</u>	<u>RECIPIENTS</u>	<u>HOW OFTEN PRODUCED</u>
1	Number of Contacts by Provider by Facility (Entidade)	a b c	Crosstab		Monthly, Quarterly, Annually
2	Number of Contacts by Patient's Freguesia by Patient's Concellio by Facility	a d d c	Crosstab		Annually
3	Number of Contacts by Sex by Age Group by Facility	a e c	Crosstab		Monthly, Quarterly, Annually
4	Number of Contacts by "Contacto em" by Facility	a f c	Crosstab*		Monthly, Annually
5	Number of Contacts by (25) Problem/Diagnosis by Facility	a g c	Crosstab*		Monthly, Annually
6	Number of Contacts by Type of Consultation by Registration Status by Facility	a,h i j c	Crosstab		Quarterly, Annually
7	Number of Contacts by Type of Consultation by Type of Visit by Facility	a,h i k c	Crosstab		Quarterly, Annually
8	Number of Procedures by Type of Procedure by Facility	l m c	Crosstab*		Quarterly, Annually
9	Number of Patients by Type of Consultation by Facility	n i c	Crosstab		Annually
10	List of Patient IDs by Diagnosis by Facility	o p c	Listing		Upon Request

*Although these outputs are technically crosstabs, they will look like frequency distributions if data for each facility begin on a new page.

APPENDIX I - TABLE 1 (Continued)

<u>REPORT</u>	<u>VARIABLES</u>	<u>NOTES</u>	<u>TYPE OF PROGRAM</u>	<u>RECIPIENTS</u>	<u>HOW OFTEN PRODUCED</u>
11	Number of Contacts (by Facility) by Provider	a q r	Frequency distribu- tion (or Crosstab)		Quarterly? Annually
12	Number of Contacts by (25) Problem/Diagnosis by Provider	a g r	Crosstab*		Upon Request
13	Number of Contacts? Patients? by Registration Status by Provider	a,s j r	Crosstab		Quarterly? Annually
14	Number of Contacts by Type of Consultation by Type of Visit by Provider	a i k r	Crosstab		Quarterly Annually
15	Number of Procedures by Type of Procedure by Provider	l m r	Crosstab		Quarterly, Annually
16	Number of Contacts by (25) Problem/Diagnosis? by Concelho?	a t u	Crosstab*		Annually?

*Although these outputs are technically crosstabs, they will look like frequency distributions if data for each facility begin on a new page.

Notes to Table 1

a) A contact is one visit to a facility. Several consultations may be provided, and more than one diagnosis or medical problem may be identified. However, on the ficha for ambulatory care, only one consultation will be recorded, and only the diagnosis or medical problem which prompted the patient's visit - one code - will be recorded. The patient's record at the facility can contain fuller information.

b) A provider can be a physician or a nurse. Even though only one consultation is recorded on the ficha, there is space for recording up to two providers.

c) If the reports "by Facility" are to be dispatched to individual facilities, then the data on each facility must start on a new page.

d) A freguesia boundary never crosses a concelho boundary. Thus the sum of all the contacts from the freguesias within one concelho will produce the same number as a report asking for "Number of Contacts by Patient's Concelho by Facility." Ideally, a statistical package should be able to produce sub-totals (i.e., data for concelhos) in something like the following format:

<u>Variable</u>	<u>Code</u>	<u>Number of Contacts</u>	
Facility	A	1721	
Concelho	01	392	
Freguesia	01	15	$\sum_{F=1}^n = 392 = \text{Concelho 01}$
Freguesia	02	4	
Freguesia	03	356	
Freguesia	04	17	
Concelho	02	1243	
Freguesia	01	187	
Freguesia	02	.	
Concelho	nn	.	
Freguesia	01	.	

The administrators at the facility can transfer these data to a map for easier analysis of their patient population's geographic distribution.

e) Age will be calculated from date-of-service minus date-of-birth, as described in Section III. D (6). Six age-groups have been defined:

- less than one year
- 1 - 4.99 years
- 5 - 14.99 years
- 15 - 44.99 years
- 45 - 64.99 years
- 65 and older

Notes to Table 1 (Continued)

f) "Contacto em" indicates the place of contact; this variable also indicates the type of care. The categories that have been identified are listed below; those included on the latest version of the ficha (December, 1981) are marked with a star (*):

- * Normal (Atendimento Normal or Consulta Externa)
- * SAP (Servicio Atendimento Permanente)
- * Domicilio
- * Urgência
- Escola
- Consultório Medico
- * Outro

At present, this variable's code is only one character; up to nine categories (1-9) could be included without making the record longer.

g) Even though a patient may have several medical problems, only one problem or diagnosis will be recorded on the ambulatory ficha; the physician will decide which problem was the major reason for the visit, and this problem will be coded. The ficha clinica, which stays at the facility, can contain a complete record of the patient's medical problems.

The computer program will calculate the number of contacts for each diagnostic code, and then print out a report which shows only the 25 (or fewer) most frequent problems/diagnoses, the frequency (number of contacts) with which each occurred, and the percentage of all contacts for these 25 most frequent diagnoses. The frequency distribution will decrease exponentially; data from ambulatory services in the Harvard Community Health Plan show that:

- the most frequently coded problem/diagnosis (i.e., periodic health review) accounted for 21 percent of the total;
- the ten most frequent codes accounted for 42 percent of the total
- the top 25 codes accounted for 56 percent of the total.

Note that this example is from a frequency distribution of codes in an automated system which permits more than one problem per contact. The MIS should find similar results using one problem code per contact.

h) Number of Contacts was specified as number of Services in the earlier draft of these outputs. If the decision to code only one service per contact does not change, then the number of contacts is the same as the number of services. If two services are provided, then the service which corresponds to the reason for the visit should be coded so that this links in with the protocol for coding problem/diagnosis.

Notes to Table 1 (Continued)

i) Type of Consultation was specified as type of service in the earlier draft. The categories that have been identified are listed below; those included on the latest version of the ficha are starred:

- * Clinica Geral
Saúde Infantil
- * Saúde Materna
Saúde Adultos
Saúde Escolar
Plan. Familiar
- * Especialidades
Outro

At present, this is one variable with a 2-character field (codes for "especialidade" may be too numerous to fit in a one-character field). The decision about which categories to print on the ficha and which to code or leave in "Outro" should be taken with the following considerations in mind:

- If the clerical staff at the facilities have a clear perception of Type of Consultation, then the form will be easier for them to fill out if it has the appropriate categories on it.
- If there is a need to distinguish between the types of consultation listed above, and if the precoded categories are reduced, then coding requirements (resources of staff and time) will increase.
- If "Outro" contains a large proportion of total consultations, it will consist of diverse types of consultations and will be difficult to analyze.
- If specific Especialidades are to be coded, will these be shown for each code on this output, or will they be shown as an aggregate group, "Especialidades"? It may be enough to know the total number of speciality consultations that were provided. If there is no need to distinguish between types of speciality consultation, then all specialities could be designated by one code. This would reduce coding time, and space on the ficha.

j) Registration Status is a new term designed to describe one of the three variables discussed with the Technical Group and staff at Santarem, i.e., "primeira consulta." The term "primeira consulta" had three meanings for the participants in that discussion:

Notes to Table 1 (Continued)

- i) The first visit which this patient has ever made to this facility; the patient was registered for the first time during this contact.
- ii) The first visit of this patient to this facility during the current calendar year.
- iii) The first visit of this patient to this facility for this medical problem or allness episode.

The variable for this output is (i), Registration Status; the categories are:

newly registered patient
established patient

(Note that Report 6 corresponds to Report 7 in the earlier report.)

Variable (ii), which reports the first visit within a given calendar year, is currently collected by some services, but its usefulness for the MIS is questionable. The data for January will be entirely different from the data for December. A more interesting statistic would be a frequency distribution showing the number of patients by the number of visits, by facility; this output would be produced once per year and would also show the average number of visits per year. A unique ID per patient within each facility is necessary for generating this output, which can be produced very easily if SIS has a package with data base management.

k) Type of Visit is a new term designed to describe the third type of "primeira consulta" in (j) above, namely:

- iii) The first visit of this patient to this facility for this medical problem or illness episode.

As well as indicating whether the visit was the first for this problem or a follow-up, it could also capture the distinction between "routine check-up" and "sickness", which motivo was designed to represent in Report 6 of the earlier draft of the outputs. The categories for this variable would thus be:

First visit for this problem
Follow-up visit
Routine check-up (periodic health review)

The leading "problem/diagnosis" in the example of frequency distributions cited above in (g) was "periodic health review" which accounted for 21 percent of codes; thus it is worth considering

Notes to Table 1 (Continued)

including a category for "routine check-up". If such types of visit are common in the Portuguese health services, then the clerical staff will find it easier to code the fichas correctly if the relevant category is provided on this variable.

At present, DGS has a category, "Cons. Extr." or "extraordinary consultation" on the monthly summary of contacts. This type of consultation is one that took place after the first visit but before the scheduled follow-up visit. In other words, for DGS, "Cons. Extr." is a patient-initiated follow-up visit, and the term "seguintes" refers only to follow-up visits initiated by the provider. The Technical Group must decide upon the utility of this distinction for the MIS; if the number of categories for the variable type of visit is expanded to separate provider-initiated and patient-initiated follow-up visits, the managerial value of the information should justify increasing the complexity of MIS clerical functions at the facility level, in all services.

l) More than one procedure can be recorded during one contact.

m) Type of Procedure has been discussed using the terminology "Actos" and "Servicos Complementares de Diagnóstico." There does not appear to be a strong reason for maintaining this distinction, and on the latest version of the ficha, "Actos" was used to cover all these activities. Thus Report 9 in the earlier draft of outputs is now contained within Report 8. The categories of this variable which have already been identified for ambulatory services are listed below:

Vacinações
Injecções
Pensos
Curativos
Entrevista Plan. Familiar
Entrevista S. Infantil
Entrevista S. Materna
Incisão, Drenagem ou Sutura
Laboratorio
Raio-X
Fisioterapia
Electrocardiograma
Electroencefalograma
Outros

Current calculations of the record length assumed that up to five procedures can be coded. This assumption and the list of procedures must be reviewed, and a decision made concerning which procedures the recipients of the outputs want to see on the report. This variable is important for capturing the activities of nurses

Notes to Table 1 (Continued)

(but see Note below), and the amount of diagnostic testing generated during ambulatory contacts. The volume of complementary services is relatively amenable to managerial influence, and since patients may be legally required to pay for some of these services, the data produced by this report will provide a basis for calculating private expenditure within government health services.

NOTE: According to present plans, nurses' activities will only be recorded in the MIS if the patient also sees a physician (see r(i) below).

n) This output refers to individual patients rather than patient contacts; it is run once per year on the preceding 12 months of data to generate a report of how many individuals used the facility per year. This information can be combined with the number of contacts per year, to obtain the average number of visits to the facility per year.

o) This listing is produced upon request only. The patient ID numbers must correspond to those used in the facility so that clerical staff can find the ficha clinica for follow-up and evaluation of the case.

p) The diagnoses must be specified. They could fall into two broad categories:

- diagnostic codes for notifiable communicable diseases (e.g., rabies, cholera)
- diagnostic codes for common medical problems so that protocols for treating patients with these medical conditions can be evaluated.

q) This report will contain the same information as Report 1, but it will be organized differently; Report 1 has data on one facility per page, and shows how many contacts these were with each provider who worked there. Report 11 shows the total number of contacts per provider, according to where they occurred. This will generate an enormous matrix; the number of cells will be the (number of facilities + 1) times (the number of providers + 1).

We suggest simplifying this output so that the Report simply contains Number of Contacts by Provider. It may be sufficient to generate this report quarterly or even annually; further analysis can be specified if necessary.

r) More than one provider can be coded during a single contact; usually the second provider will be a nurse.

Notes to Table 1 (Continued)

- i) A decision was made that if a patient saw a nurse but not a physician during a visit, then an ambulatory contact ficha would not be filled out, because the volume of such visits would generate an overwhelming quantity of paperwork for the clinic staff. (Tally sheets showing number of contacts with nurses can still be kept.)
- ii) It is not possible to assign procedures to the physician or to the nurse, using the present ficha. Connecting provider information with the other variables of interest would complicate the MIS enormously. If a patient saw more than one provider during a single visit, the only way to connect the provider code with other variables (e.g., diagnosis, procedures, etc.) using the present ficha is to make a ruling that diagnosis, type of consultation and type of visit all refer to the principal physician provider, coded in the first set of boxes.

If Reports 11-15 (by provider) count all cases which have more than one provider twice, this will not give an accurate picture of nurses' contacts, because some will be included, some excluded (see i). Accurate information on who did what is also not available, unless some variables (e.g., certain procedures) are only coded if a specified type of provider did them (see ii). It may be better to do the following:

- specify that Reports 11-15 refer to principal provider only. The number of observations in Reports 11, 12, 13, 14 and 15 will then correspond to the number of observations in Reports 1, 5, 6, 7 and 8 respectively.
- specify additional reports which show how many contacts involved more than one provider; what physicians, problems/diagnoses, types of consultation, types of visit and types of procedure are associated with more than one provider could also be investigated. (A powerful statistical package may be able to do this without Reports 11-15.)

s) If this Report is by individual patients rather than contacts, then it will indicate what proportion of each providers' case-load consists of newly registered patients, compared with established patients. For the MIS to report the number of individuals accurately each facility must keep one unique ID number for each person, and not assign a new ID for patients already registered.

Notes to Table 1 (Continued)

t) the Technical Group must specify whether the report will contain:

- the (25?) most frequently coded diagnoses (see g above)

or - a list of diagnoses specified in advance (see p above).

u) The earlier draft of outputs does not specify whether "concelho" refers to the entidade or to the patient's place of residence.

APPENDIX II
TABLE 2

LIST OF OUTPUTS ON HOSPITAL DISCHARGES

<u>REPORT</u>	<u>VARIABLES</u>	<u>NOTES</u>	<u>TYPE OF PROGRAM</u>	<u>RECIPIENTS</u>	<u>HOW OFTEN PRODUCED</u>
1	Number of discharges by service by hospital	a b	Crosstab*		Monthly, Annually
2	Number of discharges by concelho of patient by hospital	a c	Crosstab*		Annually
3	Number of discharges by sex by age group by hospital	a d	Crosstab		Annually
4	Number of discharges by selected diagnosis by hospital	a,f,g e,f,g,h	Crosstab*		Monthly, Annually
5	Number of discharges by diagnosis by facility	a,f,i e,f,i,j j	Crosstab*		Monthly Annually
6	Number of discharges by crigin of patient by hospital	a k	Crosstab*		Annually
7	Number of discharges by destination of patient by hospital	a l	Crosstab*		Annually
8	Number of operations by service by hospital	m,n,t b	Crosstab*		Monthly Annually
9	Number of operations by physician by hospital	m,o o,p	Crosstab*		Quarterly, Annually
10	Number of operations by selected type of operation by hospital	m,q,r m,q,r	Crosstab*		Monthly
11	Number of operations by type of operation by hospital	m,r r,s	Crosstab*		Monthly

* Although these outputs are technically crosstabs, they will look like frequency distributions if data for each hospital begin on a new page.

APPENDIX II - TABLE 2 (Continued)
LIST OF OUTPUTS ON HOSPITAL DISCHARGES

<u>REPORT</u>	<u>VARIABLES</u>	<u>NOTES</u>	<u>TYPE OF PROGRAM</u>	<u>RECIPIENTS</u>	<u>HOW OFTEN PRODUCED</u>
12	Number of operations by rank of operation (1st, 2nd) by hospital	m t	Crosstab		Monthly
13	Number of births by birthweight of newborn by gestational age by hospital	u v	Crosstab		Annually
14	Number of fetal deaths by birthweight of fetus by gestational age by hospital	w u v	Crosstab		Annually
15	Number of deaths by days since admitted by whether autopsied by hospital	x y x	Crosstab		Annually
16	Number of deaths following surgery by days since last operation by whether autopsied by hospital	z,A y,A z	Crosstab		Annually
17	Occupancy rate by service by hospital	B,C b	Crosstab*		Annually
18	Turnover rate (Doentes/cama) by service by hospital	C,D b	Crosstab*		Annually
19	Average length of stay by service by hospital	E b	Crosstab*		Monthly
20	Average length of stay by selected diagnosis by hospital	E e,g,h	Crosstab*		Monthly

* Although these outputs are technically crosstabs, they will look like frequency distributions if data for each hospital begin on a new page.

Notes to Table 2

a) Number of discharges (saídos) includes patients who died in hospital (falecidos), and patients who left the hospital alive (regardless of whether they went home, or were referred to another health facility, or discharged themselves).

b) The service within each hospital must be identified on the ficha. The number and types of services vary between hospitals. The total of this column gives the figure for the whole hospital.

c) The Portuguese version did not specify whether "concelho" meant hospital's location or patient's residence. We assume it refers to patient's residence. Concelho of patient has a very large number of possible codes, so it may be more useful for managers to have the report organized slightly differently. For example, the report could show concelho for patients who live within the same district as the hospital, and for patients who live in another district it could summarize the number of patients by district.

d) Age-group is a variable with six categories, and the total.

less than one year
1 - 4.99 years
5 - 14.99 years
15 - 44.99 years
45 - 64.99 years
65 and over

e) The Technical Group has decided that up to two medical problems or diagnoses will be recorded for the MIS. Training protocols for staff who will fill out the ficha should emphasize that if more than one problem/diagnosis appears on the patient's ficha clinica, then

- the discharge diagnoses are recorded, if these are different from the diagnoses made when the patient was admitted.
- if more than one problem/diagnosis is recorded, then the principal diagnosis for this hospitalization must be written in the first space.

Since up to two problems/diagnoses can be recorded, the Technical Group must specify whether these outputs should contain the principal diagnosis, or all diagnoses written on the ficha (one or two).

f) The report should show the number of cases and the percentage of total cases, for each diagnostic code. Total cases (the denominator for calculating these percentages) depends upon whether the Technical Group specifies principal diagnosis (in which case total = total discharges), or specifies all recorded diagnoses (in which

Notes to Table 2 (Continued)

case the total will be larger than total discharges). By adding up the percentages, it is then clear what percentage of the total is covered by the report; for example, the selected diagnoses might capture 40 percent or 85 percent of total principal diagnoses.

If the Technical Group specifies that only one problem/diagnosis per discharge will be included in this report, then the total number of diagnoses (the denominator for calculating percentages) will be the same as the number of discharges.

If the Technical Group specifies that more than one problem/diagnosis per discharge will be analyzed, then the denominator for calculating percentages should be the total number of problems/diagnoses recorded (sometimes one, sometimes two). (If the number of discharges were used as the denominator, the complete percentage frequency distribution of diagnoses would add up to considerably more than 100 percent; thus a listing of percentages of selected diagnoses would be impossible to interpret.)

g) The considerations raised in (f) above suggest that for the report showing selected diagnoses, the number of discharges is the most appropriate denominator. Therefore, only one diagnosis per discharge should be included in the report.

h) The list of selected diagnoses must be specified. This list should initially be restricted to 25 items.

These diagnoses should be ones that are frequently encountered, because managers cannot make valid comparisons between different hospitals unless there are enough discharges with each diagnosis.

Secondly, the selected medical problems should be those with well-established treatment protocols, to make it easier to evaluate whether the type of operation and/or length of stay are differing systematically from the accepted norm. (See Medical Management Indicators and Case-Mix, in Section III. E. 2 (b).)

i) The considerations raised in (h) above suggest that principal diagnosis might be a more suitable denominator for monthly reports, so that these reports are compatible with other data with discharges as the denominator. Secondary diagnoses can be included in further investigations (ad hoc outputs) to analyze case-mix in more detail, for example, as a measure of medical complication rates.

j) The list of all diagnostic codes is so extensive (over 1,000 codes) that this report would be overwhelming if it were produced for each hospital, even on an annual basis. (The report could amount to 20 pages of single-spaced frequencies.) An alternative strategy is:

Notes to Table 2 (Continued)

- to print the 25 most frequent principal diagnoses for each hospital every month, or the 50 most frequency annually.
- to print all principal diagnoses for each district and for the whole country, once per year.

k) The categories which have been suggested for origin of patient (origem) are:

outro hospital
consulta geral
consulta especialista
urgencia
recem-nascido
outro

The value of this information as a management tool should be reconsidered.

l) The categories which have been suggested for destination of patient (destino) are:

outro hospital
consulta geral
consulta especialista
(internamento)
mortes
outro

Patients who are sent home and have follow-up care from a visiting nurse or general practitioner would be coded under "consulta generalista". Those who are referred to a specialist for follow-up care will have Destino coded as "consulta especialista".

(The category "internamento" will not be used for patients discharged from hospital; see Section III, I. Fichas.)

m) The Technical Group has decided that up to two operations will be recorded for the MIS. As with coding diagnoses, clerical staff must be trained to record the principal operation in the first set of boxes (if more than one operation was performed), and to record the next most important operation in the second space.

Each output on operations must explicitly state whether the report should include as many operations as are recorded (one or two), or whether it should only include the principal operation.

The ficha does not at present have space for recording the total number of operations, nor the total number of surgical procedures (more than one procedure can be done during one operation). We point this out to emphasize the need for unambiguous specifications;

if the Technical Group needs to know the total number of times patients went into surgery, then this variable should be recorded explicitly on the ficha. (It is rare for a patient to undergo surgery more than twice during the same hospitalization.)

n) If the Technical Group specifies that only the principal operation should be included, then this output will have the same denomination as Report 1 (Number of discharges, by service, by hospital) and these two reports can be used in conjunction to analyze the services' activity and case mix.

If the specifications call for the principal and secondary operations being included, then the report does not accurately represent the total number of operations, because the latest version of the ficha only has space for recording up to two operations.

An alternative output would be to report the number of discharged patients who had at least one operation, and to show the percentage of discharges from each service who had operations, on the same report.

This report could then be combined with Report 1.

o) The ficha does not specifically link surgeon's identifying code with which operation he performed. It would be impossible to give all the physicians who participate in operations full credit for their activity using the MIS ficha. Therefore we recommend that this report should include only one surgeon and one operation per discharge. If the Technical Group follows this advice, the output can be specified more clearly by saying:

Number of principal operations
by physician or principal surgeon
by hospital

p) The Technical Group has discussed protocols for coding physicians' identifying information:

- the medico assistente, the provider responsible for the patient, would always be coded.
- if surgery were performed, the medico cirurgião would be coded; given the discussion in (o) above, the Technical Group may decide that it will be sufficient to code the principal surgeon who performed the principal operation. The latest version of the ficha had space for recording two surgeons.

q) The operations of interest must be specified; the list should be kept as short as possible, following the guidelines mentioned in the discussion of Medical Management Indicators and Case-Mix in Section III. E. 2 (b).

Notes to Table 2 (Continued)

r) The relative frequency (percentage) should be shown for each selected operation, using the "total number of operations" as the denominator.

NOTE: "Total operations" means either total principal operations or total operations recorded (zero, one or two per ficha). The same definition must be used for adding up the selected types and the total, respectively.

- If this output refers to total principal operations, its data-base will be identical to that reported in outputs with one operation per patient, so comparison with this reports will be possible.
- If this output uses total operations recorded as its denominator, then it will give a fuller picture of what surgery is being performed.

s) The list of all operations is so extensive that we recommend printing only the 25 most frequent operations on a regular basis. Further ad hoc analysis of case-mix can be pursued if the primary analysis indicates it is advisable.

t) Information on the rank of the operation (principal, secondary) is derived from whether it is recorded in the first set of boxes or the second.

At present, Report 12 consists of three numbers per hospital: primary operations, secondary operations, and total operations recorded. It could be combined with Report 8 and provide more information, as follows:

<u>Hospital</u>	<u>Number of Operations Recorded</u>		
	<u>Principal</u>	<u>Secondary</u>	<u>Total</u>
Service			
Medicina	XXX	XXX	XXX
Cirurgia	XXX	XXX	XXX
Cardiologia	XXX	XXX	XXX
.	.	.	.
.	.	.	.
.	.	.	.
Total	XXXX	XXXX	XXXX

u) Categories for aggregating birthweight (in grams) are those used by the World Health Organization.

v) Gestational age in completed weeks can be aggregated into categories defined by international reporting requirements (WHO), Portuguese law, or by medical considerations.

Notes to Table 2 (Continued)

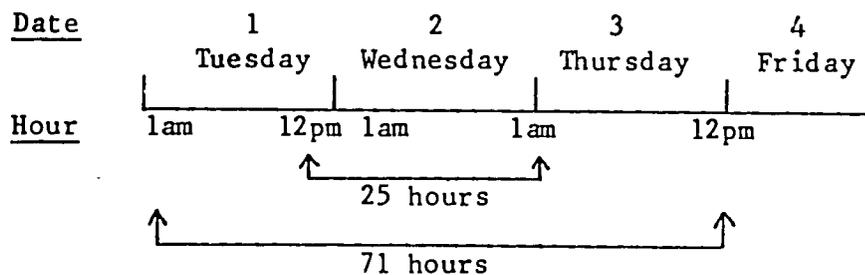
w) The specifications must state unambiguously which cases should be recorded on the Ficha de Anternamento (Alta), so that these data correspond to statistics from other sources. The possibilities are listed here:

- Miscarriages prior to ? weeks
- Spontaneous abortions after ? weeks
- Still births
- Live births

x) This report should also show percentage of all discharges which were deaths, and percentage of deaths which were autopsied.

y) The number of days is calculated by finding the difference between date of discharge and date of admission. This calculation can be done by the computer or by the clerical person. The choice of method affects what information is coded on the ficha. Generally, it is preferable to leave all such calculations to the machine.

- If the computer performs the calculation, and if it is considered vital to know that the death occurred within 48 hours, then hour of admission would have to be recorded for all admissions, and hour of death for deaths. If this information is not currently available on the hospital patient record, then we should be content to calculate days, and accept the fact that a few deaths which occur in the "less than 2 days" category will be after 25 hours in hospital, and a few will be after 71 hours.



If day of admission (or last operation) is Tuesday and day of death is Thursday, the number of days is 2, but the number of hours could be anywhere between 25 and 71.

If a date subroutine is not available, perhaps the easiest way for the machine to calculate this number, is to convert the month and day into Julian dates - 1st January is 1 and 31st December is 365 (except in a Leap Year when it is 366).

Notes to Table 2 (Continued)

- If the clerical staff does the calculation, then there will be unretrievable errors. The ficha must have space for recording the "number of days" information.

The report will show number of days since admission in three categories, plus the total:

less than 2 days (or 48 hours)
2 - 10 days (or 48 hours - 10 days)
more than 10 days
total

z) This report should also show percentage of all discharges with surgery that resulted in death, and the percentage of deaths following surgery which were autopsied.

A) This report only contains data on patients who died after surgery. The number of days (or hours) between date of death (discharge) and date of last operation must be calculated, either by the computer or by the clerical staff. Similar considerations apply as mentioned above in (y):

- If the computer calculates the number of days, date of last operation must be coded. If hours are crucially important, then time of operation must also be coded.
- If the clerical staff calculates days, the ficha must have space for recording this information.

The same grouping of time periods described in (y) will be used on this output.

B) The occupancy rate (percentagem de ocupação) is calculated as

$$\frac{\text{Dias de internamento} \times 100}{\text{capacidade}}$$

where

Dias de internamento is the sum of inpatient days of all discharged patients, including deaths
Capacidade is dias do ano X lotação, i.e.,
days per year X number of beds

C) The number of beds (lotações) per service will not be written on the ficha, since this information does not change very much over time and can be recorded once per year. Thus an intermediate file is needed; it will link the codes of the hospital and service with the number of beds in that service.

Notes to Table 2 (Continued)

D) The turnover rate (doentes por cama) is

$$\frac{\text{Number of discharges (including deaths)}}{\text{Number of beds}} = \frac{\text{Doentes saídos}}{\text{Lotação}}$$

E) The average length of stay (demora média) is

$$\frac{\text{Sum of Inpatient days}}{\text{Number of discharges (incl. deaths)}} = \frac{\text{Dias de internamento}}{\text{Doentes saídos}}$$