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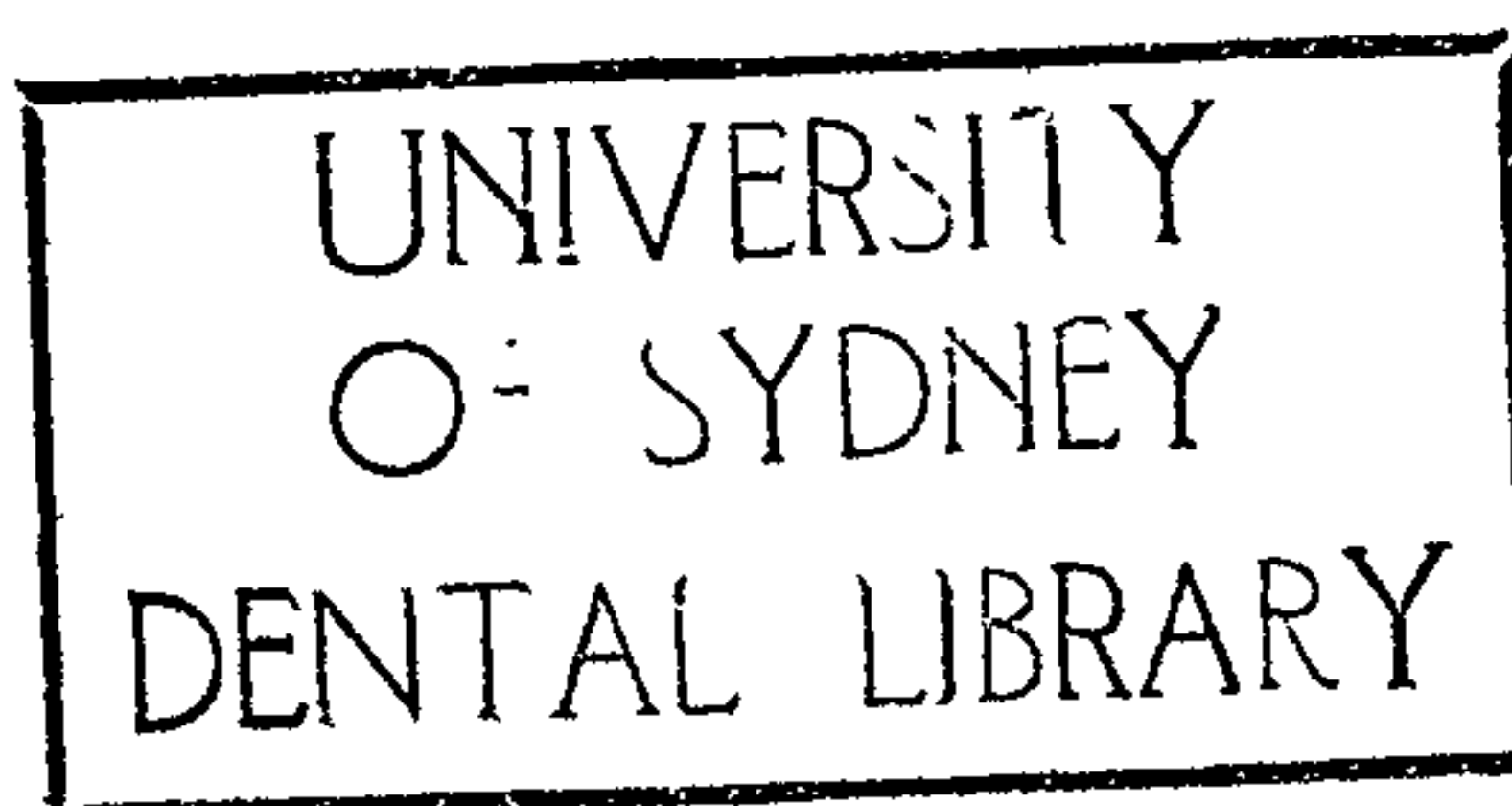
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A CRITICAL APPRAISAL OF THE
DEVELOPMENT AND IMPLEMENTATION
OF THE HEALTH MANAGEMENT INFORMATION
SYSTEM IN MALAYSIA - DENTAL SUBSYSTEM

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A thesis submitted in partial
requirement for the
DIPLOMA IN PUBLIC HEALTH DENTISTRY



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The writer gratefully acknowledges the
assistance of others during the research and
preparation of this work:

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The Public Services Department and the
Ministry of Health
Government of Malaysia

Dr. N.A. Talib
Information and Documentation System Unit
Planning and Development Division
Ministry of Health
Malaysia

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International House
The University of Sydney

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INTRODUCTION

The writer has produced this treatise with the aim of making a critical appraisal of the Health Management Information System (HMIS) that was developed and implemented in Malaysia between 1976 and 1982. The Dental Subsystem is one of the Programme Subsystems incorporated within the HMIS. The writer has made close reference to this subsystem in the latter part of this work.

In the first chapter theoretical considerations of health information systems have been made. The writer has attempted to link the systems theory in the organization of health and dental services, and the utilization of the systems approach to health management. Discussion on the role of information in health management followed, and how health information has been organized within its own system called the health information system. The writer has then attempted to incorporate the concepts of 'health', 'management' and 'information' with the introduction of the generic term 'health management information system'.

Health management information systems operating at the local, regional, national and international levels have been described in Chapter 2. In the first section the writer has discussed the diverse applications of health management information systems operating at the local and regional levels of health care delivery, citing examples in the United States of America. The concept of a National Health Information System (NHIS) has been introduced in the following

section and its utilization in some countries, including Malaysia, described. The final section of this chapter has dealt with the international implications of health information systems, the role played by the World Health Organization (WHO), and the events that have led to the formation of the WHO Information System.

To maintain a proper perspective of the main theme of this work, the writer has drawn a brief picture of the organization of health and dental services in Malaysia in the next chapter. The dental health status, dental health programmes and strategies developed within the Fourth Malaysia Plan to deal with prioritized dental problems have been described. This has been necessary in order to acquaint the reader with some background information of the dental set-up in Malaysia since the Dental Subsystem has been discussed in more detail in the greater part of this work.

The development and implementation of the HMIS has been described in detail in Chapter 4. The protocol and conceptual phase have been described as involving the total system. The system design, test-run and implementation phases have been discussed with close reference to the Dental Subsystem.

In the following chapter, the continued development of health indicators based on the objectives and information content of the Dental Subsystem has been discussed. The 1981 dental data from the State of Penang

where the subsystem was first implemented, and reported in forms designed for the subsystem, have been utilized as a model in the application of the dental health indicators.

This work has not concerned itself with the various concepts and methods of evaluation of health services. However, through the application of the dental health indicators based on the Penang data, a direct, though limited, form of evaluation of the dental health programme has been made. Since the data generated have been based on the information content of the Dental Subsystem, this has provided the writer with a method for measuring, to some extent, the effectiveness and efficacy of the information subsystem itself. The subsystem shortcomings and overall performance have been discussed in Chapter 7.

It should be mentioned that the writer has been personally involved with the implementation phase of the Dental Subsystem and the continued development of the dental health indicators. Based on the limited experience in these task assignments, the writer has attempted, in the concluding chapter, to make some recommendations that may help to improve the Dental Subsystem when the total HMIS comes up for review in the near future.

1. THEORETICAL CONSIDERATIONS

1.1. THE SYSTEMS CONCEPT

A good historical account of the development of the systems concept has been given by Kramer and de Smit (Kramer, de Smit., 1977). As stated by the authors "... an attempt to arrange present popular concepts and catchwords in rank order would certainly put the word 'system' high in the list ... this concept is used in almost all sciences and has penetrated into the jargon of the mass media ... systems thinking, systems science, systems design, systems analysis, systems engineering ..." all these are different aspects and applications of the system s concept.

As stated by Kramer and de Smit, the development of the systems theory started in 1924, when the German physicist Kohler, in his book on physical 'gestalten' (wholes), discussed the concept of a general systems theory. In 1925, Lotka introduced the concept of 'open systems': he observed systems interacting with the environment. The theory of open systems was further developed in biology, the foundations of which were laid down by Ludwig von Bertalanffy in 1932. The essence of the general systems theory can be expressed as 'the whole is more than the sum of its parts'. This idea was given support by the economist Boulding, the mathematical biologist Rapoport, and the physiologist Gerard. Von Bertalanffy and Boulding were able to distinguish interrelationships among complex phenomena and then integrated them into a systematic whole. Viewed by another authority (Sisk, 1973), in its simplest form

"... a system is composed of parts that is more than the mere summation of its components".

1.2. ORGANIZATION AS A SYSTEM

An organization is an integrated whole, where each subsystem and supporting subsystem is associated with the total operation. A simple and easily understood definition of a business organization which may also be applied to a health organization has been given by Johnson et al (Johnson, Kast, Rosenzweig, 1967). "... the organization is an assemblage of people, materials, machines and other resources geared to task accomplishment through a series of interactions and integrated into a social system. The system's concept emphasize the integration of all activities toward the accomplishment of overall objectives, but also recognize the importance of efficient subsystem performance".

Under the system's concept, the organization comprises a series of parts which include the individual, the informal working groups, the formal structure, and finally the environmental systems, which have a direct effect on the organization. Consideration must be given to means for integrating and co-ordinating the various subsystems. These parts are integrated through various processes such as the information and communications network, the decision system, and built-in mechanisms which exist in every organization.

Organization, then, is a system comprising an array of components designed to accomplish a particular objective

according to plan. As already mentioned, first there must be a purpose, or objective which the system is designed to perform. Secondly, there must be a design, or an established arrangement of the components. Finally, inputs of information, energy and materials must be allocated also according to plan.

According to Johnson et al (Johnson et al, 1967a), the design of the system must be such that the components are arranged to produce the desired goal. There must also be system procedures, or detailed instructions outlining the specific duties, responsibilities and operating instructions. After system design, it should be ready to operate. Inputs of information, energy and materials should then be used for processing output.

A basic system is illustrated in Fig. 1. It consists of input, according to plan, a processor for converting inputs into goods or services, and output, the measurable achievement of the system.

A system should include some means of control i.e. a sensor for measuring output, a means of comparing the measurement with a standard or norm, and an activating group to adjust inputs to correct indicated deficiencies. The object should be to control variables so that the system will tend to stabilize near the ideal equilibrium point. A complete system, including control, is shown in Fig. 2. It also shows the flow of planning information when decisions are made to release resources of materials, energy and processing information.

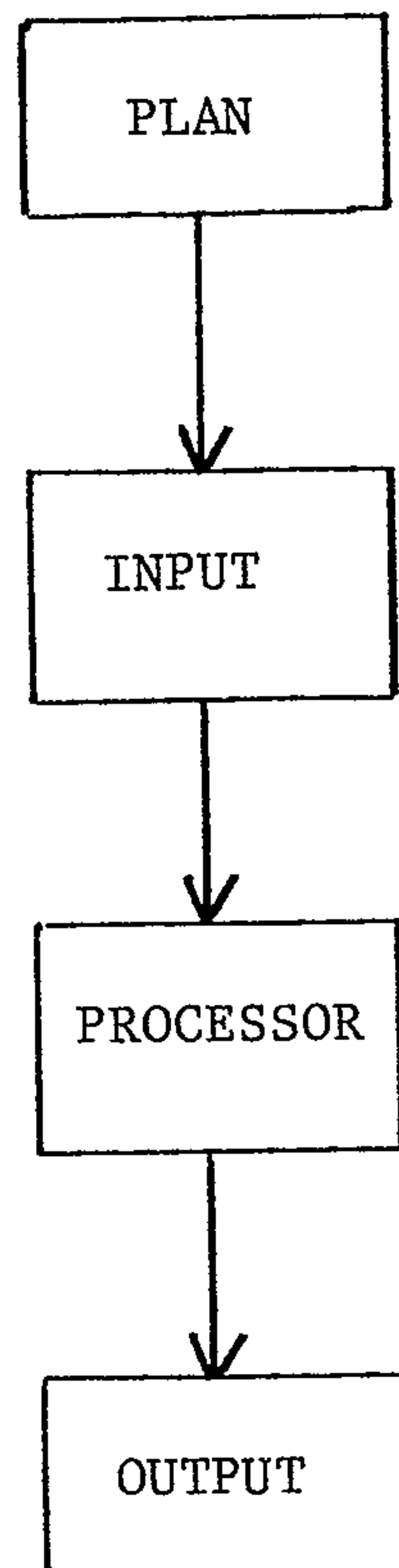


Fig. 1: The design of a basic System

(Adapted from Johnson, R.A., Kast, F.E., Rosenzweig, J.E., 1967. The Theory and Management of Systems. 2nd Ed. McGraw-Hill Book Company. p. 115)

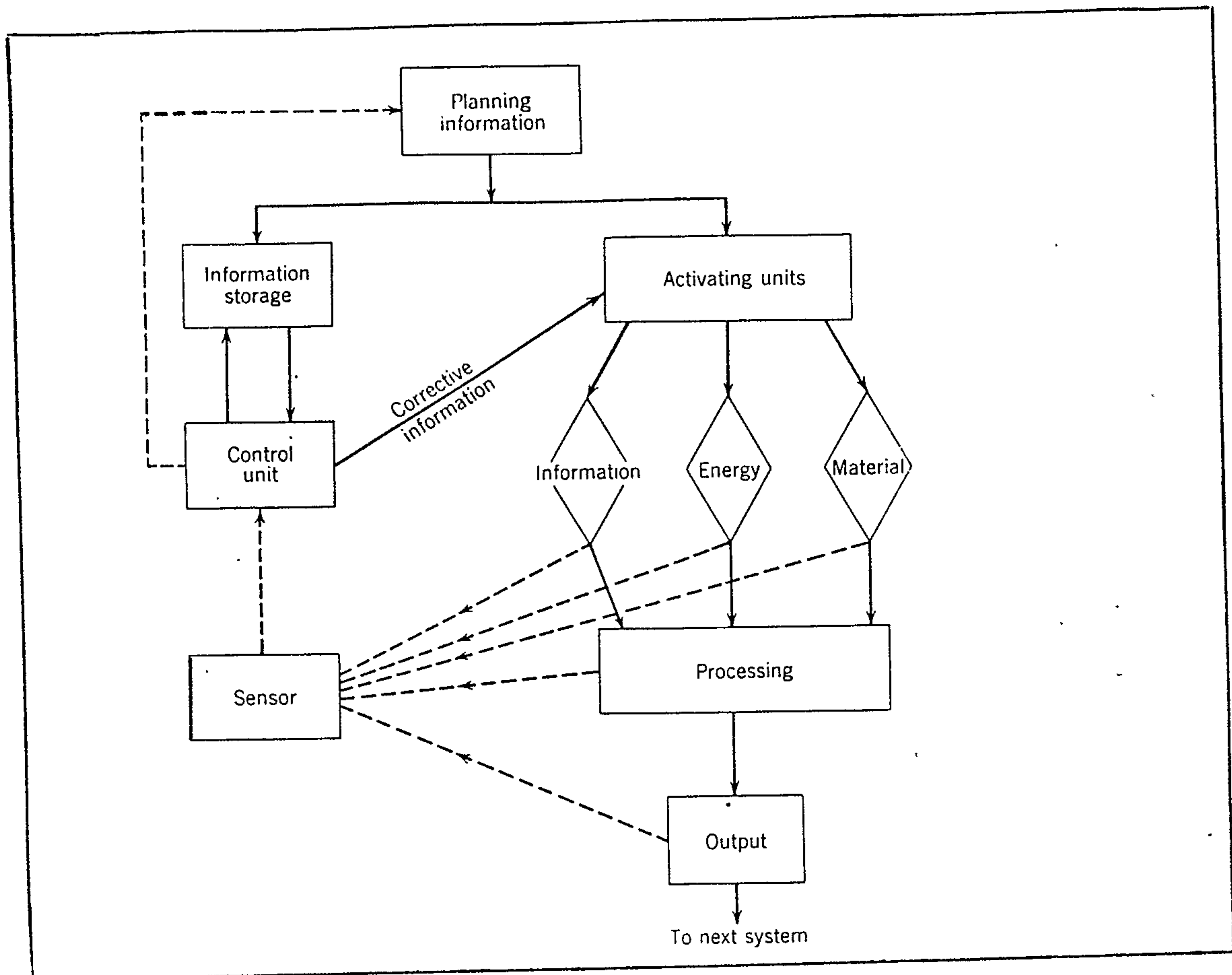


Fig. 2: The total system with control and information planning

(Adapted from Johnson, R.A., Kast, F.E., Rosenzweig, J.E., 1967. The Theory and Management of Systems. 2nd Ed. McGraw-Hill Book Company. p. 117).

A model of the system should include a master planning council or committee to make decisions relative to the products or services the organization provided; a resource allocation committee to provide the facilities, manpower, technical assistance for design; operating systems, including major products and facilitating systems. A system model with top management is shown in Fig. 3.

The system should be made self-sufficient to a degree that this is economically feasible. A reasonable amount of redundancy or extra capacity should provide more flexibility, guard against breakdown, reduce flow time, require less planning, eliminate many problems associated with interdepartmental communication, and reduce the amount of materials handling.

Finally, communication must be established to provide integration and linkage within the system network. The flow of information, energy and materials - the elements of any processing system - must be co ordinated via a communication system. A common language facilitates integration and improves the efficiency of the whole.

1.3. SYSTEMS CONCEPT AND MANAGEMENT

One of the spin-offs of the systems concept is its application to management or corporate problems (Kramer, de Smit, 1977a). As described by the authors, Russell A. Ackoff and C. West Churchman tried to apply the systems approach to management problems via operations research, while Herbert A. Simon attempted this as one of the first researchers in organization.

Management can be viewed as a process which may be analysed in terms of several functions performed separately but simultaneously (Sisk, 1973a). These functions include planning, organizing, directing, and controlling, with the aim of obtaining stated objectives. Managers are needed to convert the disorganized resources of men, machines and money into a useful and effective enterprise (Johnson et al 1967b). Essentially, management is the process whereby unrelated resources are integrated into a total system for objective accomplishment.

1.4. THE SYSTEMS APPROACH TO HEALTH MANAGEMENT

A systems approach or systems thinking is a means of tackling problems, a methodology. Much has been written by health planners and managers about utilizing this approach as a convenient and pragmatic framework for the delivery of health care services (Engel, 1962; Hedinger, 1969; Reinke, 1973; Sheldon, 1970; Howard, 1972; Kohn, White, 1976; Reeves, Bergwall, Woodside, 1979; Cormier, Levy, 1981). As leader in world health matters the World Health Organization has advocated the use of the systems approach in health management (WHO, PHP 55, 1974; WHO, TRS 596, 1976).

Hedinger has described a health services delivery system co-existing with its relevant environmental complex (Hedinger, 1969a). Fig. 4 shows that the context of management in terms of external linkages requires an enlarged, community-wide perspective as a relevant and recognizable position from which diverse interests and views can be brought into focus. Problems related to the

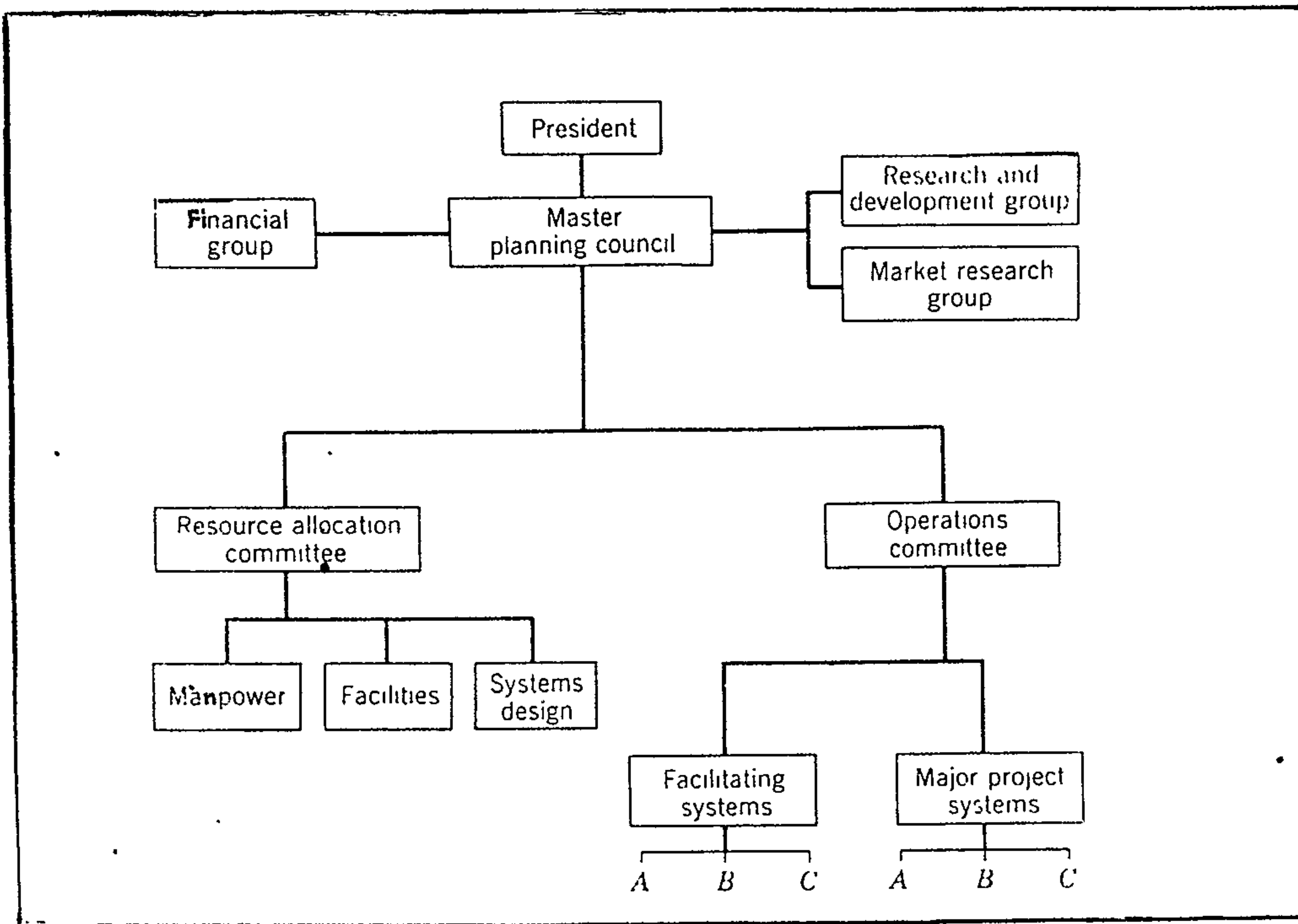


Fig. 3: The systems model: top management

(Adapted from Johnson, R.A., Kast, F.E., Rosenzweig, J.E., 1967. *The Theory and Management of Systems*. 2nd ed. McGraw-Hill Book Company. p. 119).

to the external environment must be known so that the health executive can closely co ordinate system management and system adaptation.

At a more specific level, Kostlan has described a schematic representation of the oral health system and its links with the community (WHO, 1979). Fig. 5 shows that several influences act on the functional concept of the system. The population expresses its attitude towards oral health and oral health services indirectly through established political institutions. The political institutions interpret the attitudes of the population, translating these attitudes into political options and expressing these through their own political programmes and plans. The views of dentists and other categories of oral health personnel delivering the oral health services are expressed through their own professional organizations.

According to Kostlan, the health service proper is characterized by four basic parameters: the task, the resources mix, the organization, and the output. The output should balance the task, the organization should optimize the use of resources. The system depends on inputs of requirements, information, and resources. The requirements are determined by the concept of the service and mainly influence the organization. The information input, on one hand, relates to the task of the services, and on the other hand, to the output of the service yielding feedback through service evaluation. The resources mix comes from a resource basis and includes human, material and technological inputs.

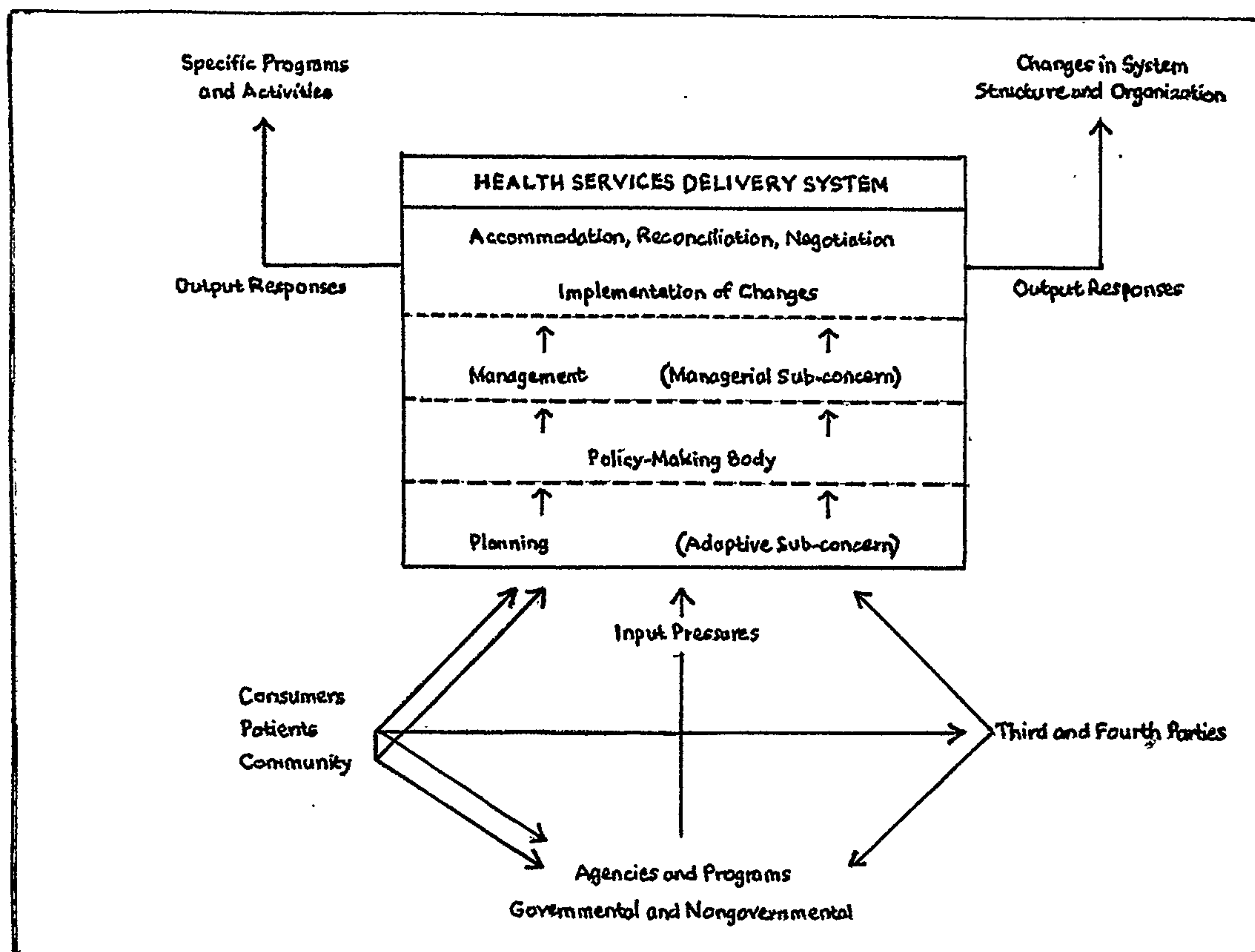


Fig. 4: Health Services Delivery System—Relevant Environment Complex

(Adapted from Hedinger, F.R. 1969. The Systems Approach to Health Services: A Framework. Health Care Research Series No. 11, p. 74).

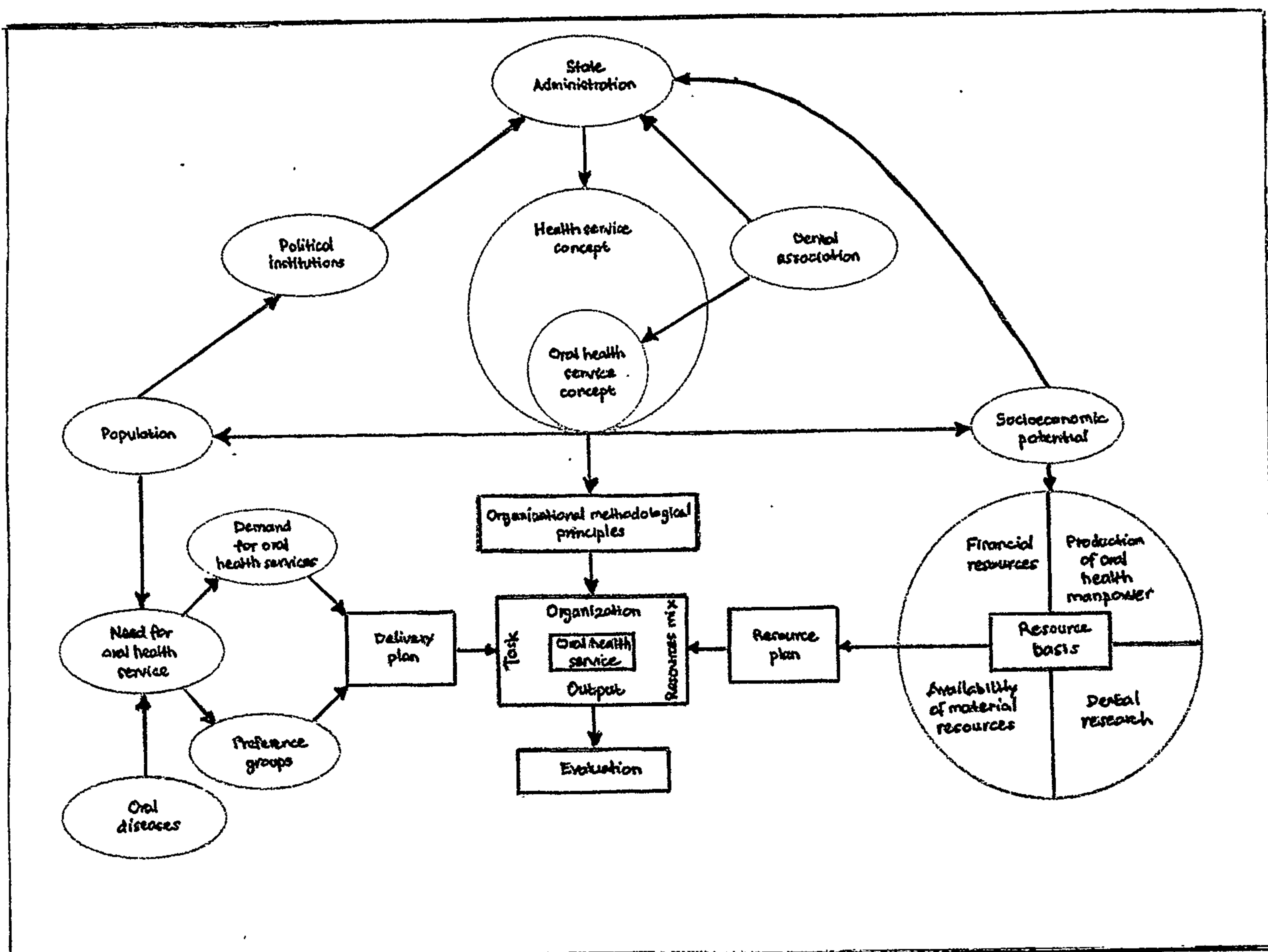


Fig. 5: The Oral Health Service System and its National and Community Setting

(Adapted from WHO Regional Office for Europe, Copenhagen 1979. Oral Health Services in Europe. Regional Publications European Series. No. 5. p. 25).

The use of the systems concept in health services organization and the utilization of the systems approach to health management have been summarized by Kohn and White (Kohn, White, 1976a): "... within this framework it is possible to define several levels of internally organized and dynamic parts, proceeding from man as an organism existing in an external environment and comprising several subsystems to macrolevel health services systems in which manpower and facilities are organized to achieve societal objectives".

1.5. THE ROLE OF INFORMATION IN HEALTH MANAGEMENT

It has been recognized that one of the prerequisites of efficient management of health care, or in any field for that matter, is information. In the preceding section, information has been described as existing within the resource basis of the (oral) health care system. For the purpose of this treatise, information is organized within its own system which is the health information system, and information pertaining to oral health requirements contained within the dental subsystem of that total system.

In systems concept, information theory was developed by Shannon and Weaver in 1948 (Shannon, Weaver, 1949). Shannon was responsible for the formalization and quantification of information and even arrived at a mathematical definition of the concept of information.

Within the health sector, Kohn and White have described a model which implicates the role of information in health care policy (Kohn, White, 1976b). Fig. 6 shows the

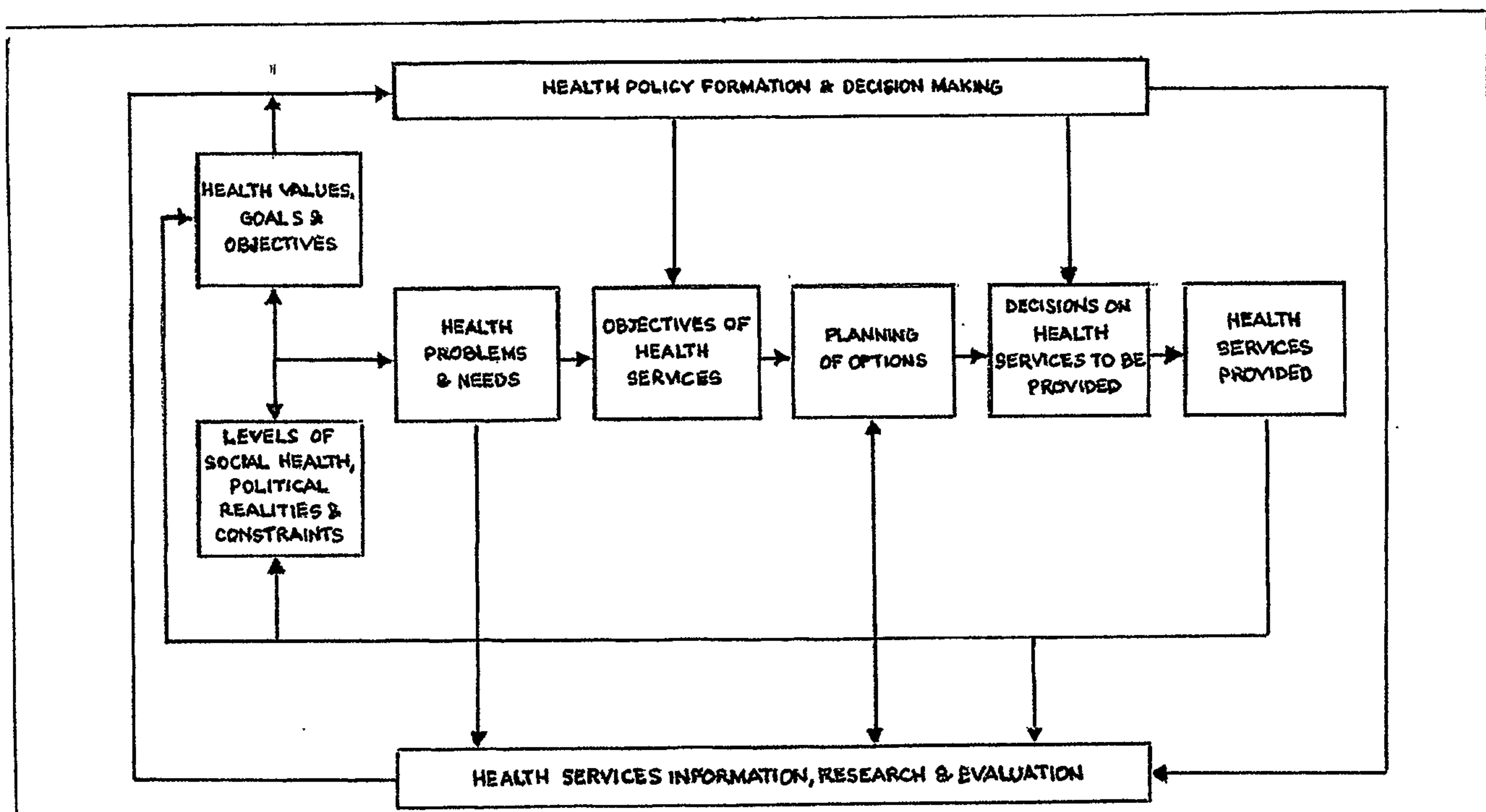


Fig. 6: Model of health services systems policy formation: the functions of information, research, and evaluation

(Adapted from Kohn, R., White, K.L., 1976.
Health Care: An International Study. London,
Oxford University Press. P.6.)

integration of educational, research, evaluation, statistical, planning and decision-making processes on the basis of information that guides and enlightens. These are all essential ingredients of a system designed to serve a population. The model emphasizes the central role of a dynamic information system at improving the bases of decision-making: it must be related to the informal or mental model of administrators and policy-makers, and the political, economic and social constraints of their work.

Perhaps before going any further, it would be appropriate to distinguish between the terms 'data', 'information' and 'intelligence' (WHO, 1977).

1. Data

Isolated or independent observations of attributes and events that carry little meaning. [Stated simply by Blumenthal, a datum is an uninterpreted raw statement of fact (Blumenthal, 1969).]

2. Information

The aggregation of data over time, space and populations, and in the context of decision-making constitutes information for the planner, manager and evaluator. According to Blumenthal, information is data recorded, classified, organized, related or interpreted within context to convey meaning.

3. Intelligence

Transformation of information through integration with experience and perceptions based on social and political values and also on constraints.

When integrated together, all the above terms constitute knowledge, and in the health section, provide the basis for managers and decision-makers in the planning and evaluation of health care delivery.

1.6. INFORMATION SYSTEM

Sackman has defined an information system as "... an organization of people, computers, and other equipment, including associated communication and support systems, and their operation to regulate and control selected environmental events to achieve systems objectives" (Sackman, 1967).

Vazsonyi has stressed the control of man over machines in his description of information handling systems "... Man controls his environment by manipulating matter and energy through information handling systems. Information is generated by recognizing and sensing events; then information is transmitted, processed, stored and displayed, so that decision can be made to bring about desired events. The complexities of modern society created the need for a type of information management which appears to be beyond the capabilities of man's unaided intellect. New electronic computers created a promise to assist man in these tasks, but so far, systems have not emerged that provide man with the degree of control he needs Man will regain control by a man-machine symbiosis, which will reinstate man to a dominant position in the hierarchy of information networks" (Vazsonyi, 1965).

1.6.1. Information System Components

Reeves et al have described an information system as comprising four sets of components: procedures and documentation, people, equipment and communication (Reeves et al, 1979a). The first component tells what the system should do and how it should be done; it includes performance standards for evaluating the system. These procedures should be clearly and fully documented, since they will provide an important basis for training new users and operators of the system.

Although an information system may vary from a pencil and paper operation to one which is completely automated, people inevitably will be involved in its operation and use. Since people are the most important variable part of any such system, it is important that a substantial investment be made in ensuring that both users and operators be trained to perform their functions correctly and intelligently. It is also important for system designers to consider carefully the possibilities of substituting people for equipment and vice versa.

Equipment possibilities may range from the pencil and paper to computers. The latter are dependent on a set of instructions commonly called programs, to carry out assigned functions. These programs are called software, and the mechanical or electronic equipment is called hardware.

Since the data base, data sources, analysts and decision-makers are unlikely to be centrally located, an information system must provide the means by which data can be communicated from one functional area to another.

1.6.2. Information System Functions

An information system, according to Reeves et al, must perform seven generic functions (Reeves et al 1979b).

1. Collect Data

The system designer must take particular care to ensure that the methods selected for data collection minimize the chance for errors to enter the system.

2. Validate Data

The importance of this function is indicated in a term commonly used in the data processing industry: GIGO, or garbage in, garbage out. This term implies that the product of an information system can be no better than the quality of the information introduced into the data base. It is important, therefore, to detect and correct errors before they are permitted to enter the system.

3. Operate on Data

Once the new data are ascertained to be correct and as error-free as possible, they must be added to the files as additional records or corrections to existing ones.

4. Store Data

After data transaction has been completed, the amended data must be stored in a safe and accessible place until they are needed. From the decision-maker's point of view, storage-cost considerations must be weighed against the important characteristics of an information system: responsiveness, flexibility and comprehensiveness.

5. Transform Data

Generally, decision-makers will have little interest in the entire content of a single file. A selection of a subset of records or a set of specific items from all records may suffice for analysis, or a combination of

materials from several files in order to do a complete analysis.

6. Retrieve Information

Once the data have been transformed into an appropriate configuration, the next step is to convert them into information, i.e. to develop answers to specific questions. In the past it has been the common practice to create many data tabulations that would provide descriptions of the item of interest; however, these tables seldom provide solutions to questions confronting decision-makers. Consequently, a great deal of manual manipulation of the data displayed has been necessary to arrive at the information required for the decision at hand. Still, this method is widely used, since it is a relatively inexpensive way of providing information to multiple users.

7. Present Data

This is the last step in getting information to the decision-maker. It involves choices such as whether the display of that information be temporary or permanent. A decision should be made between printed information and graphic formats such as charts, graphs or maps. Usually the choice involves a trade-off based on cost factors.

1.7. HEALTH INFORMATION SYSTEMS

An exhaustive definition of a health information system has been given by Glasser (Glasser, 1971) "... a conglomerate whose function is to collect, analyze, interpret, disseminate measures, indices and messages related to the human condition as they reflect health states, requirements, services, and utilization of health systems in defined populations the system must produce reliable indices, methods, and media presentations of sufficient detail and sensitivity to serve the purposes of objective planning, monitoring and evaluation of health states programmes and policies in defined populations. It also provides the subjective presentation of the larger health related issues to the society at large".

A distinction must be made at this point between statistical information systems and health information systems: the latter is a much wider concept and comprise other types of health and biomedical information (WHO, 1980). It also includes centres for information services, methodology, information flow, information processing and appropriate technologies for these services.

Reeves et al have described a schematic model of an information system used in health planning (Reeves et al, 1979c). Fig. 7 shows that the data resources contribute facts to a data base which is the central component used for proactive decision-making. Analysis implies combining data on inputs, and process to estimate what outputs will be obtained, including data on external factors which would affect the utilization and productivity or effectiveness

of the outputs. Optimization implies choosing the best alternatives, considering interaction with other parts of the system. Once this process has been completed, the decision-maker takes the necessary steps to implement the decision; this stimulates the data source to modify the data base by reporting those actions. The new information is then used in the control and evaluation processes.

Control can be considered as a short-term monitoring of the plan's implementation and ordinarily will focus on the availability of resources and services. Evaluation, on the other hand, is a long-term assessment of the system's performance. It requires that all decision variables be considered and in particular focuses on effectiveness. It also permits examination of a planning agency's accomplishments in improving the health care system.

Thompson and Handleman have described the operational role of health data and information management (Thompson, Handleman, 1978). Fig. 8 shows that by adding analyses and reporting of stored data to the persons and organization responsible for action, a feedback cycle for control of health care operations is created. This control through health data and information management is essential to a manager's or administrator's function, to see that the resources of an organization are utilized appropriately. Health data and information management should be used to deliver the most and best health care to consumers.

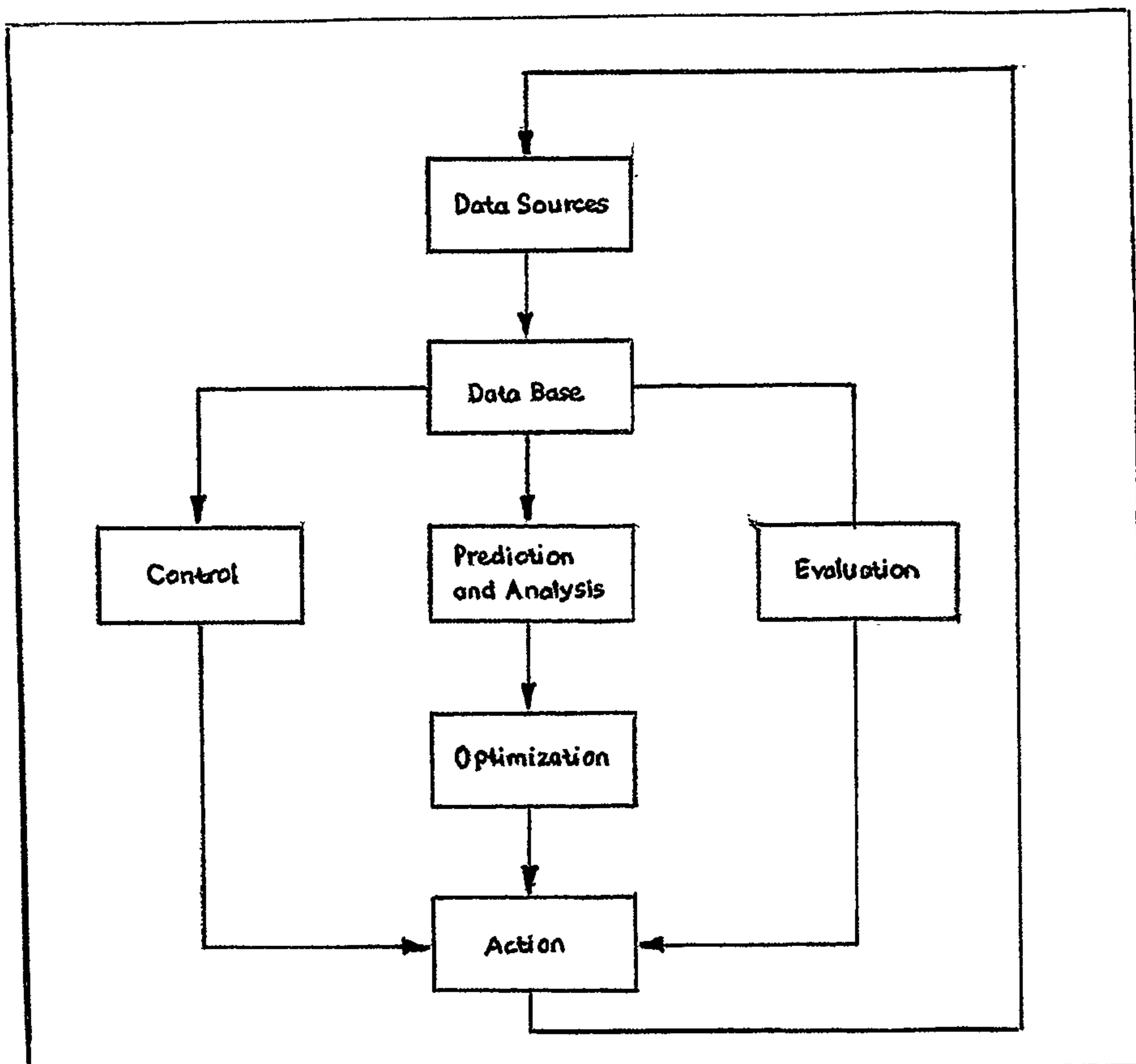


Fig. 7: Information System Model

(Adapted from Reeves, P.N., Bergwall, D.E., Woodside, N.B. 1979. Introduction to Health Planning. 2nd Ed. Information Resources Press. P. 237)

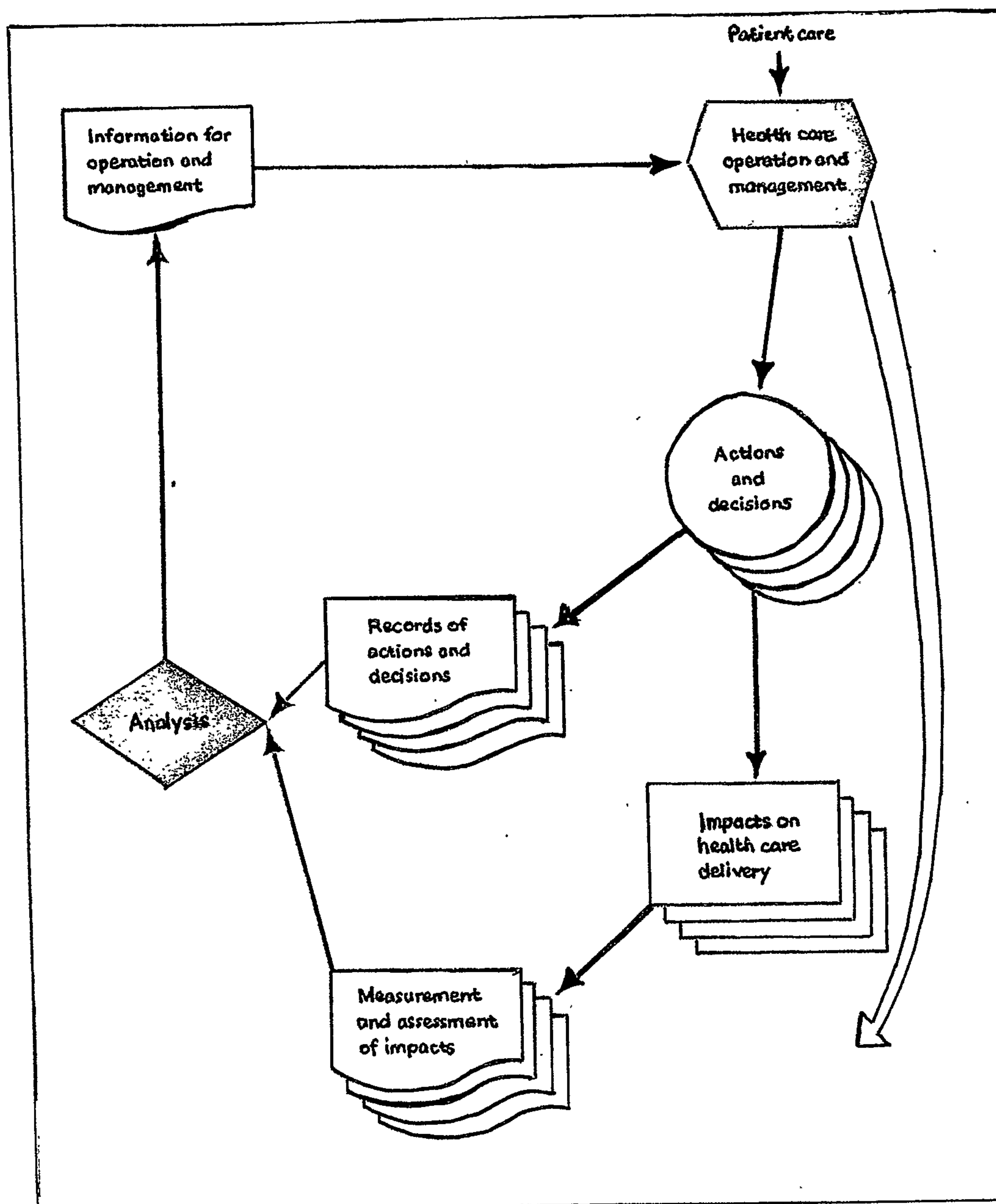


Fig. 8: Management and Operational Role of Health Data and Information Management

(Adapted from Thompson, G.E., Handleman, I., 1978. Health Data and Information Management, Butterworth Inc., Boston. P. 3.)

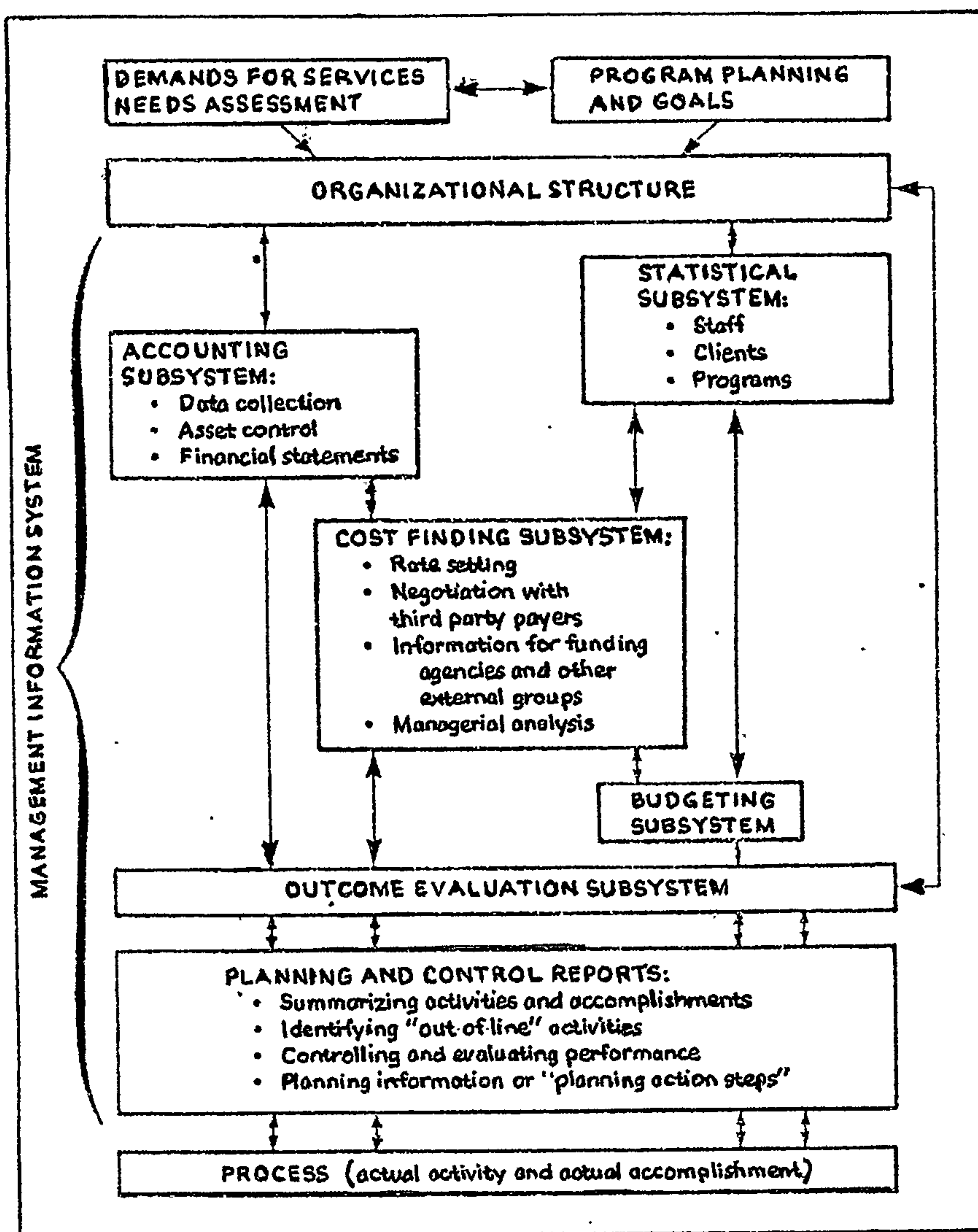


Fig. 9: A Management Information System

(Adapted from Sorensen, J.E., Phipps, D.W. 1975. Cost-finding and rate setting for community mental health centres. DHEW Publ. No. ADM 76-291. Washington, DC. U.S. Govt. Print Office).

1.8. HEALTH MANAGEMENT INFORMATION SYSTEMS

In the preceding sections, a health information system has been defined and its components and functions discussed. Reeves' and Thompson's models essentially depict a health information system as applied to management of health services. It would be appropriate at this juncture to introduce the generic term 'health management information system'.

Health management information systems have emerged in the 1970's as a vital tool for the provision of patient care by public health and community health agencies (Saba, Levine, 1978). A Management Information System (MIS) per se, according to one authority, is "... an organized system that manages the flow of information in the proper time frame, and thus assists in the decision-making process" (National League for Nursing, New York, 1974). Another authority has described it as a system that generates data on all phases of operations, including financial and statistical information (Sorenson, Elpers, 1978). The role of the MIS in connecting the organization's structure to its process is shown in Fig. 9. However, to relate back the role of the MIS to health aspects the definition given by Glasser in the previous section, which is essentially HMIS defined, should suffice.

In the health context the main task of a Health Management Information System is simply to manage health information: this is the immediate or system objective. In doing so the HMIS attains the ultimate objective, and that is to help related health organizations achieve their goals.

2. HEALTH MANAGEMENT INFORMATION SYSTEMS IN OPERATION

INTRODUCTION

The concept of utilizing information in the management of health services is not new. The use of information in the context of organized health information systems, however, is a more recent event. Health information systems as defined and described in Chapter 1 have only been in existence since the late 1960's. Since then, management-oriented health information systems have emerged as a vital tool in the provision of efficient and effective health care delivery by public health and other related health agencies. An increasing amount of literature is now available describing health information usage as single-purpose operations in local and regional health agencies leading right up to the concept of total systems applied at the national and global levels.

The first section of this chapter has dealt with examples of health management information systems in operation at the local and regional levels in the United States of America, where technological advances in the art and science of communication have developed to sophisticated levels. The aim of this section is essentially to point out the applications of health information systems in various aspects of health management.

The following section has described the concept of health information systems organized at the national level. National health information systems operating in some countries, including Malaysia, have been described briefly.

The organization of health information systems at the international level has been considered in the final section. The role of the World Health Organization and events that have led to the formation of the WHO Information System forms the main subjects for discussion in this section.

2.1. HEALTH MANAGEMENT INFORMATION SYSTEMS IN OPERATION

2.1.1. A Medical Health Insurance Information System

The Division of Social and Rehabilitation Services in the United States has developed a model Medicaid Management Information System (Anderson, Farseth, 1977). The purpose of the MMIS was to provide guidance to states in computerizing and upgrading payment claims operations, fraud investigation and overall control of utilization of the health insurance scheme. A pilot implementation of the model was carried out in Ohio state in 1972. Minnesota followed suit, becoming the first state to utilize this model in its own Medicaid programme. The MMIS has been subjected to criticism from government administrators, legislators and providers of health services. The authors, however defended the system as being sound in design and suited to its aims and objectives. The fault apparently was in its implementation, which, as pointed out to the critics, should be viewed as an on-going process.

2.1.2. A State Department HMIS

The Pennsylvania State Department of Health, a governmental health agency in the U.S.A., has developed an information system that was designed to be adaptive to changes in the environment and responsive to the needs of its decision-makers (Haas, 1974). The theoretical considerations e.g. systems theory and

information theory were discussed by the author in the system design. The information requirements of the various programme subsystems were laid out in detail in the report. As stated by Haas "... types of informational items which indicate passage from one dependency subsystem to another within the health system should conform to the requirements of completeness, operationality, economy of resources and timeliness ..." for varied use the system was designed to be flexible, open-ended and responsive to societal and system values. The paper showed that apparently such a system could be designed from a systems theory perspective.

2.1.3. Hospital Information Systems

Several authors have described the application of information systems for hospital and primary health care (Austin, 1982; Budkin et al, 1978; White, 1973). Austin has reported on the utilization of information systems by hospitals to support quality assurance, cost containment, productivity improvement, utilization analyses, programming planning and evaluation, and research and education. White has described the introduction of a uniform basic data set for ambulatory care following a National Hospital Discharge Survey conducted by the National Centre for Health Statistics in the U.S.A. Budkin and his colleagues have discussed an automation project at the Miami Heart Institute, conceived as a comprehensive hospital information system which had been functional since 1969. A management subsystem for process budgetting, staffing and revenue projection reporting was among some of the subsystems described.

2.1.4. An Information System for Mental Health Administration

The use of an adequate information system to improve management especially in the planning programming - budgetting aspect of mental health administration has been described (Wachs, 1969). The system was designed to provide data to mental health managers and to help them in keeping abreast of current events in the internal organization of the various mental health agencies in the U.S.A.

2.1.5. Laboratory Information System

An information system designed to improve management of laboratory services has also been described (Scalfani, Ramkissoon, 1981). In Chicago, the Hinsdale Sanitarium and Hospital Pathological Department installed a Pathlab Laboratory Information System in 1977. Acquisition of the system was based on a feasibility study carried out previously, and the reports represented the findings on the system after two-and-half years in operation. There appeared to be a positive reaction of the personnel towards the system. The system itself has proved to be an effective management tool in improving communication of services towards quality of patient care.

2.1.6. HMIS for Public Health Nursing

In recent years, the Division of Nursing of the Bureau of Health Manpower, Public Health Services of the U.S.A. has supported several projects in the utilization of management information systems in public health nursing (Saba, Levine, 1978a). To learn more about the status of such systems in public health and community health nursing agencies, 58

official and non-official agencies were evaluated by the Nursing Division in 1976. In summary, the use of such systems was found to produce the following benefits:-

1. reduced the number of people needed to generate statistical and management reports and to provide financial information on billings for patient services;
2. improved cash flow;
3. reduced the amount of professional staff time spent in paperwork;
4. identified significant trends in the use of the services;
5. assisted in programme planning and budgetting;
6. identified new community needs; and
7. helped evaluate the impact of the nursing services.

2.1.7. Health Information System for Referral Services

Cauffmann et al have described a project aimed at exploring the possibility of developing a comprehensive and integrated data system designed to help manage referral services in Los Angeles County (Cauffmann et al, 1973). The system hoped to supply providers with up-to-data information about resources of health care tailored to meet individual needs of patients.

2.1.8. A School Health Information System

In 1972 the American Association for Health, Physical Education and Recreation issued a statement on the school health services. Part of the school health programme was the development of an information system which would provide data on a school health system (Johansen, Orthoefer, 1975). An experiment was carried out in making school health records responsive to the needs of school nurses which in turn would

be responsive to the needs of school children. A systems approach helped organize the thinking and definition of sets of measurable objectives as to design and management of the information system.

2.1.9. A Dental Manpower Information System

In Minnesota state, a facility has been established which helped monitor dental manpower resources in the context of the socio-economic trade areas they served so that location of areas of critical need could be determined (Born, 1975). This was achieved with the establishment of the Dental Information Service Centre applying the management information system concept to the dental manpower sector. The basic objective was to provide dental manpower administrators with a comprehensive, reliable, up-to-date manpower information and statistical analyses appropriate to the requirements of decision-making, policy development and long-term planning.

2.1.10. Information System for Social Work

The John Hopkins Hospital in Philadelphia has developed a social work information system involving referral problems identified by the social work services (Volland, German, 1979). The information system used standardization of the social work process and definition of psychological problems to meet its objectives. Some of the objectives listed were as follows:-

1. formulate contact for social work services to patient and families based on clearly identified problems;
2. communicate information to same;
3. demonstrate social work can change patient rehabilitation or recovery;
4. measure effectiveness of social work services;

5. provide data base on information regarding patient, social work problems, services provided and outcome; and
6. assess costs for social work services and variability by population.

2.1.11. A Drug Information System

A new drug information, the most comprehensive of its kind available in the U.S. was developed in 1970 (Programmes, Practices and People, Public Health Reports, 1971). It offers physicians and pharmacists ready access to data covering drug interaction, poison control information, drug listing and data on experimental drugs. The subsystem on harmful drug interaction received priority in development and implementation.

2.1.12. An Information System for Occupational Health

Morill et al have described the concept and functions of an occupational health information system (Morill Jr., Oser, Kusnetz, 1971). The authors expressed concern at the "...efflorescence of many new chemicals and products..." and stressed the need to develop an information system that will provide readily available data to occupational health specialists.

2.1.13. Nuclear Medicine Information System

The concept of a nuclear medicine information system has been the subject for discussion by physicians specializing in clinical nuclear medicine (Fletcher, Donati, Herbig, 1973). A plan has been proposed to develop a Nuclear Medicine Information System (NMIS), where patient data could be generated and stored through a nuclear medicine communication

network. A pilot programme has been implemented by the Saint Louis Veterans Administration Hospital in Missouri. The need for developing more of such systems would be dictated by geographic regionalization of health services.

2.1.14. An Information System for Health Research

The National Library of Medicine's Lister Centre in Maryland has developed a data based prototype information system to translate new research results in a form useful for health care practitioners (Programmes, Practices and People, Public Health Reports, 1978). The system aims at providing a comprehensive bank of information that answers practitioners' questions on current research, provides data supplements to answers, as well as citations to primary publications for more detailed study.

2.1.15. Direct-to-Consumer Health Information Systems

Efforts have been made to increase the accessibility of health information direct to the consumer. The development and successful implementation of a client-contact reporting system for a statewide network of crisis intervention programme e.g. drug abuse has been described (Zalkind et al, 1977). In another report the use and effectiveness of a telephone health information system has been discussed (Diseker, Michielutte, Morrison, 1980). The system was introduced in North Carolina in 1977. In increasing accessibility of health information to the consumer, the system helped reduce patients' expenses by cutting down on redundant visits to health facilities. In a separate report, Schell, a medical librarian, has advocated the establishment of a data-based public health

information system (Schell, 1977) because of constant daily requests from the public for health information.

2.1.16. A Health Information Society

An effort has been made to establish communication among health information managers and operators. (Credit Lines, Public Health Reports, 1969). A Health Information Society has been organized in South California based at the University of California, Los Angeles. The Society serves as an aid in communication for those who design, manage, process, analyse or otherwise use health information. The purpose of the Society includes promotion of information exchange on the nature and location of health data; research in the methodology and operation of health information systems, and the development of methods and standards for collection and evaluation of health data.

2.2. NATIONAL HEALTH INFORMATION SYSTEMS

Introduction

In the previous section health information systems operating at the local and regional levels were described. When viewed through the systems perspective, the different examples cited were essentially various components or subsystems of a total health information system. The concept of a total system, for the purposes of discussion in this section, comprises a system with all components integrated and organized at the national level. A national health information system implies some form of centralization in the management and control, and some standardization in its usage and application at all levels in all parts of a country.

Haro had defined a health information system organized at the national level as a "... broad concept aiming at the provision of timely and relevant information for health managers at all levels, and at the sharing of technical and scientific information by all personnel participating in the health services of a country". (WHO, 1980a).

National health information systems as utilized in some countries has been described in this section. By doing so, the writer has attempted to illustrate the concept of health information systems organized at the national level before considering the international implications in the final section.

2.2.1. United States of America

The various examples of health information systems in operation described in Section 2.1 of this chapter were all cited in the U.S.A. It is therefore ironic to consider that in spite of the widespread use of such systems in the health care delivery in the U.S., the country does not as yet have a totally integrated national health information system.

At second glance, however, this does not at all appear strange since the political structure and health care delivery system does not permit the development of a national health information system. The primary responsibility for the initiation and implementation of health programmes still remain at the local level (Hanlon, 1974). Local governments comprising the municipal, county, township and metropolitan governments are mainly responsible for health care delivery in the U.S.A. According to Hanlon, considering the historical

development of health services in the U.S., "... the states by no means surrendered their individual rights and prerogatives of which they were already intensely jealous and proud. Instead they took the attitude that most governmental problems would continue to be met and solved best on a separate and independent basis, with only a relatively few matters of common interest and concern requiring reference to the joint federal government established by their union" Furthermore "... the federal government cannot dictate to the states the manner in which they should organize their governmental structure, establish their policies, or conduct their programmes actual dictation of these matters is not necessary for federal agencies to play a part in the improvement and expansion of public health and other services throughout the nation" (Hanlon, 1974a).

However, interest in the development of a national health information system (NHIS) appears to be growing (Austin, 1982a). Some have suggested that institutional needs for information to support patient care, administrative decision-making, education and research can be combined with governmental information requirements for policy-making and regulatory purposes through the development of a co ordinated health data system.

Congressional committees and federal agencies have been devoting increasing attention to this problem. An NHIS would aggregate data from health delivery organizations throughout the country. This would prove useful in trend analyses and projections of demand for institutional planning within the context of local and regional needs.

As reported by Austin, two systems have been discussed: federally-mandated systems, and voluntary system participations. It has been difficult, however, to integrate all subsystems of health into a total system controlled at the federal level. This has been due mainly to the reluctance of private hospitals to participate, especially if such systems were mandatory as a requirement for receipt of federal funds. This condition still prevails even though incentives to participation include funding of development costs, standardized computer software, guarantees of system stability, and prompt reporting back to participating hospitals.

The U.S.A. has, however, established a National Health Planning Information Centre to aid health planners and government administrators and community leaders (Programmes, Practices and People, Public Health Reports, 1975; Morrone, 1976). The Centre was authorized by the National Health Planning and Resources Development Act of 1974 and is administered by the Bureau of Health Planning and Resources Development, Health Resource Administration. The Centre has been designed to improve access of health information to state and local health agencies.

The National Centre for Health Statistics has also launched a programme called the Co operative Health Statistics System for all involved in health planning, management and evaluation (Perrin, 1974). The system provides an economical and effective method for establishing and maintaining a data base to guide decision-makers regarding health care in the U.S. Some of the components of the system include manpower, facilities, hospital care, ambulatory care, long term care and vital statistics.

2.2.2. The U.S.S.R.

Unlike the U.S.A., the responsibility for providing health care to the population in the U.S.S.R. lies solely with the government (WHO, 1980b).

Information systems for management of public health are constructed in accordance with government plans for developing the national economy and are promoted by the system of health statistics developed in the U.S.S.R. This has made it possible to provide management at all levels with information on the health status of the population and development of public health services. Standard registration documents and report forms have been designed for use within the statistical services.

In recent years there has been a growing need for a substantial increase in the volume of information used in decision-making, and the use of computers in public health has been utilized considerably.

The health information system being developed in the U.S.S.R. is shown in Fig. 10. Because of the size of the country and large population, the Ministry of Public Health has the overall responsibility for developing the system, but allowance has been made for a certain amount of duplication. This flexibility has made it possible to study the effectiveness of different approaches to specific problems. Despite different progress rates of the subsystems, they are gradually being integrated into a single, unified health information system.

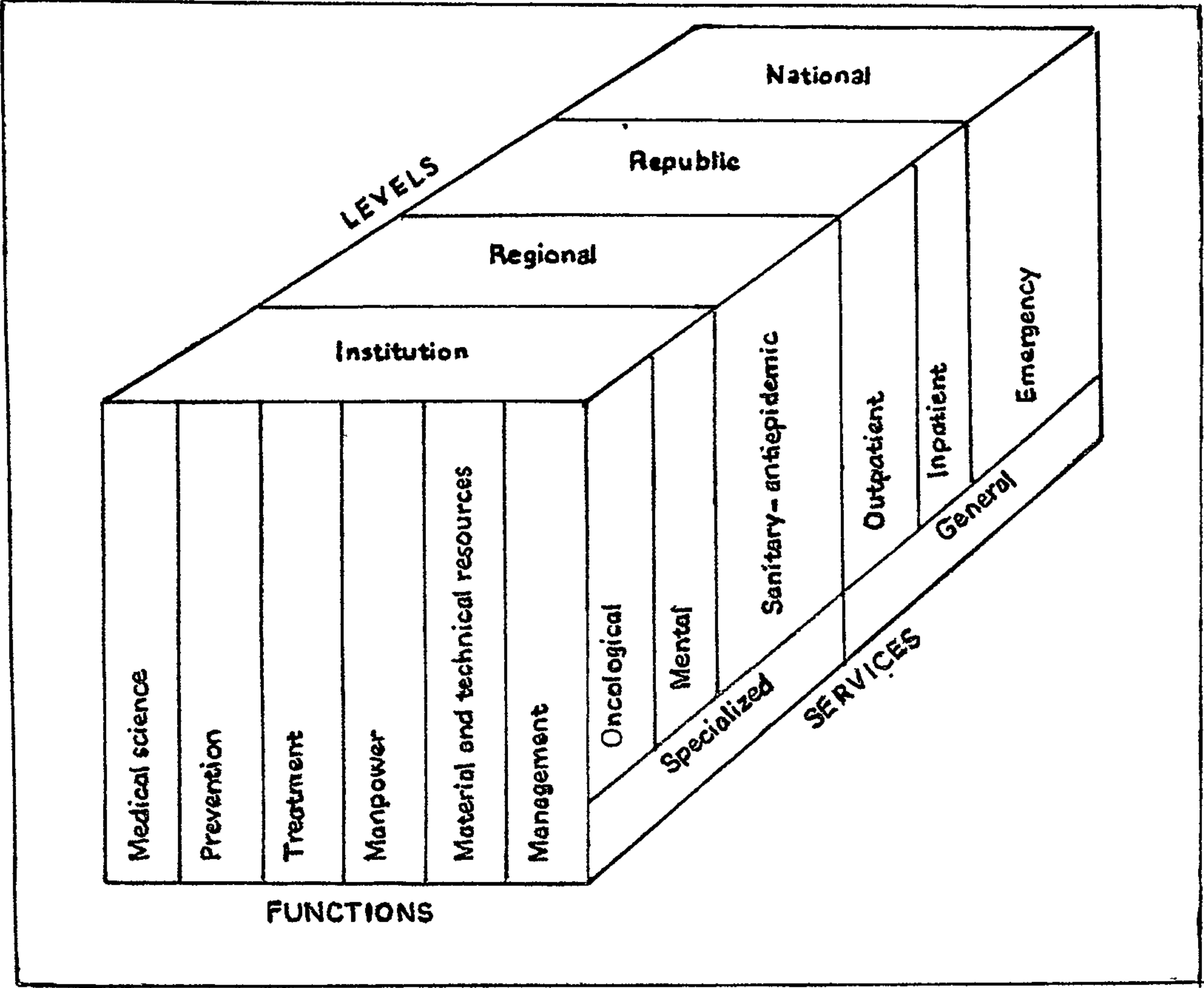


Fig. 10: Scheme of health information systems in the
U.S.S.R.

(Source: WHO, 1980. Information Systems for Health Services at the National Level. Regional Office for Europe, Copenhagen, P. 40).

2.2.3. Federal Republic of Germany

Because of its decentralized political structure and three governmental levels (Federal, State, country or large city) the Federal Republic of Germany has divided responsibilities for health affairs (WHO, 1980c).

The prevailing health information system has been organized hierarchically and is run by official statistical services of the three levels mentioned. These statistical services collect health data from various sources and produce health statistics based on federal or state law. Although electronic data-processing (EDP) is widely used, there has been a considerable delay between the generation of data and the publication of the aggregated health information. Hence its value to health planners has been rather limited and consequently the necessary feedback has been reduced.

Within the field of health information, two different groups have been distinguished: those based on federal health law which report on vital statistics (birth, death, morbidity, disability rates, communicable diseases, etc.) and those statistics based on statutory requirements i.e. the social security system which collects information on persons subscribing to the different types of health insurance schemes.

Because of the organizational health structure in the Federal Republic of Germany, the resulting distribution of responsibilities in health care delivery and system of social security, there is no comprehensive health information

system but a variety of single-purpose systems similar to that in the U.S. Although all the information necessary for a reasonably comprehensive multipurpose health information system is available, there are serious political objections to such a system, one of which is the possible violation of patient/consumer privacy and confidentiality.

2.2.4. Scotland

The National Health Service in Scotland comprises 15 health boards, each responsible for the provision of health services within its area. A Common Services Agency (CSA) provides services common to all health boards and also to the Scottish Home and Health Department (SHHD), the government department responsible for health in Scotland (WHO, 1980d).

The Information Services Division (ISD) of the CSA has the task of providing a service for producing information used in the planning, management and administration of health services. It provides computer advisory and support services and has personnel with statistical and research expertise for collecting, analysing and interpreting statistics. Other important areas of a total health information system, such as information on research, drug monitoring and bibliographical services are not dealt with by the ISD but by either the central government or the National Health Service.

The most important future development involves the design of a system able to collect and process data on ambulatory care for hospital out-patients and in general practice. This presents a problem since primary health care is mainly

provided by general practitioners employed on a contract basis.

The last few years have seen active growth in the use of information in Scotland. However, expertise in solving the imperfections or to appreciate the potential of the system is still lacking. The HIS as a whole is still not responsive to changes within the health system itself and certainly the lack of data on ambulatory care is an important obstacle to the full development of statistical health information services.

2.2.5. Italy

Italy is currently involved in the reorganization of its health care system and development of a health information system (De Rosis, Pizzutilo, 1979). A recent law has established a National Health Service based on a new approach to preventive health care and decentralized administration of health care delivery. Hence the development of the information system had to be designed to be responsive to the evolving needs mentioned above. Italy has given priority to primary prevention and decentralization to local authorities not merely in operational functions but also in decision-making. It was therefore essential that a comprehensive scheme be drawn up so that various subsystems to be implemented could be consistently inserted into the information system.

2.2.6. The Philippines

In the Philippines health information is collected at the most peripheral levels, forwarded to the Provincial Health Offices, Regional Health Offices and Central Staff units respectively. Vital statistics are collected by the local registrar which feeds the information to the National Census and Statistics Office (Health Information for National Health Planning in SEA, 1976).

Recently the Philippine government has passed a decree to support the establishment of a five-year Project Management Staff. One of its functions is the development of a health management information system. The project has financial support from the World Bank. The Project Management Staff for developing the information system consists of a steering committee and a project team. The WHO has assisted in the detailed analysis of existing problems of health information in the Philippines. It has given direction toward redesigning the responsibilities and roles of health personnel in the collection, compilation, analysis and presentation of statistics. One of its prime concerns is to reduce active time spent in health service statistical work by 25 percent. It has successfully classified the types of information that should be collected on a routine basis, ad hoc and sample surveys.

2.2.7. Malaysia

Malaysia, as a developing country, recognizes the need for a national health information service. The Ministry of Health, as the public health agency, realized that there were wide disparities between targets and achievements in the quality and quantity of its service performance. It also recognizes that these disparities can be minimized if appropriate action is taken and timely intervention made. But these actions need to be based on informed and considered decisions which in turn depends on accurate and timely information.

With this in view, the Ministry of Health in Malaysia in 1976, initiated the development and implementation of a national health information service called the Health Management Information System (HMIS). A project management concept similar to that utilized in the Philippines was used in the development and implementation phases. The Planning and Development Division of the Ministry of Health was assigned the task of creating a feasible management information system which, at the stages of planning, design and development, was called the Health Management Information System Development Project (HMISDP) (Ministry of Health, Malaysia, 1976). Special staff called the Information System Development Group (ISDG) provided technical input to the development and implementation of the project. Prior to system design, expert consultation with the World Health Organization via the WHO Regional Office for Western Pacific was sought, and a preliminary review was made by a WHO consultant on the existing information system and its related problems (Subramaniam, 1975).

In November, 1979, in collaboration with the WHO WPRO, Manila, Philippines, a technical report on the conceptual phase was released (Ministry of Health, Malaysia, 1979).

The total system comprises several subsystems based on functional divisions within the Health Ministry. The Dental Subsystem is one such example. The subsystems are in turn divided into sub-subsystems based on the various existing health programmes operating within each subsystem. The system was tested in the state of Penang in 1978 (Ministry of Health, Malaysia, 1980) before being implemented in 1981-1982.

It must be borne in mind that the development and implementation of the HMIS is an on-going process. The Patient Care Subsystem and Health Subsystem are to be computer-based; the Dental Subsystem is not. By virtue of the simplicity of its design and other factors, the Dental Subsystem has forged ahead and was fully implemented in all states of West Malaysia by early 1982. Continued implementation is now being carried out in East Malaysia.

The process of creating the HMIS involves four essential steps: systems planning, systems development, systems testing and implementation and systems management. This last stage has now been reached. In June, 1981, an exercise was carried out on the continued development of health indicators based on the objectives and information content of the various health programmes within each subsystem. At the time of writing, a management consultant firm has been employed which, among some of its terms of reference, is to help

develop linkages between subsystems, and to provide software and hardware for those subsystems that will be computer-based. It is hoped that within two or three years the total health management information system will be fully functional.

2.3. INTERNATIONAL IMPLICATIONS OF HEALTH INFORMATION SYSTEMS: THE ROLE OF THE WHO AND THE WHO INFORMATION SYSTEM

Before discussing the international implications of health information systems and the role played by the World Health Organization, it should be mentioned that at the beginning the terms 'health statistics' and 'health information' were used synonymously by the WHO.

Haro has given a good account of the use of information, and the scope, elements, design and planning of health information systems (WHO, 1980e). The 14th Report of the WHO Expert Committee on Health Statistics has also given a historical background on the use of health statistics in health planning and management (WHO, TRS 472; 1971).

As early as 1948, at the First World Health Assembly, a recommendation was made that Member countries should establish special committees to plan and co ordinate vital and health statistics. Statistical collections in relation to health planning were considered at the 18th World Health Assembly in 1965; basic statistical requirements for an analytical approach to the provision of health services were discussed. The collection and use of statistics in national and local health services was the subject of technical discussions at the 19th World Health Assembly in 1966. It was established

that statistics could play a growing and essential role in the planning, organization, surveillance and evaluation of health services.

Since then, a series of reports by WHO Expert Committees on Health Statistics have been released. In 1968, an Expert Committee on Health Statistics considered the types of statistics required for planning, administration and evaluation of health services (WHO, 1969). It was pointed out that a systematic approach to the production of statistics would lead to more efficient health services delivery. The WHO Expert Committee on National Health Planning in Developing Countries (WHO, 1967), the WHO Expert Committee on Hospital Administration (WHO, 1968), and the WHO Expert Committee on Training in National Health Planning (WHO, 1970) recognized the need for data as well as training of health planners and administrators in statistical methods, epidemiology, demography, operational research, economic analysis and systems analysis.

In 1977, a report was released on a WHO-sponsored International Collaborative Study on Medical Care Utilization carried out in 1964 (WHO, 1977a). The study represented a decade of effort that involved 12 study areas in 7 countries (Canada, U.S.A., Yugoslavia, Argentina, Finland, Poland and United Kingdom). Even at the time of the feasibility study in 1964, there was a growing recognition that health information systems required radical rethinking if the information applied in planning, managing and evaluating health services was to be useful.

The 14th Report of the WHO Expert Committee on Health Statistics also discussed the nature of health planning, problems of evaluation, linkage between health planners and health statisticians, and also types of statistics to be used (WHO, TRS 472, 1971a). It was at this expert committee meeting that the development of a model health information system for planning was discussed. Stress was placed also on standardization of definitions and classification of types of information to be collected.

New attitudes, new statistics and new methods were the topics for discussion at another Expert Committee meeting in Health Statistics (WHO, TRS 559, 1974). The new statistics to be collected should be able to predict health indicators that could be translated into demand for action. The new methods discussed include survey design and computer applications to processing and analysis of statistical data.

In the oral health sector, the planning and evaluation of dental health services was the subject for discussion of a working group of the WHO Regional Office for Europe in 1971 (WHO, 1972). Types and sources of information required for dental health planning and evaluation were discussed. As a follow-up to the above-mentioned working group, the WHO Regional Office for Europe conducted a study of information used for evaluation of oral health services in 5 European countries (Czechoslovakia, Federal Republic of Germany, Norway, Romania and United Kingdom). A report of the study appeared in 1974 (WHO, 1974, Copenhagen). The subject of dental health planning and evaluation was again discussed at another WHO

Expert Committee meeting in 1976 (WHO, TRS 589, 1976). In another report, Kostlan discussed three basic types of information to be collected for the oral health services: information for management, information related to alternative methods for oral health care delivery, and information on management methodology (WHO, 1979a).

In 1973, the 20th World Health Assembly stressed the need for a complete reconstruction of health information systems (WHO, 1973, Geneva). In the same year, a conference on health information systems was held in Copenhagen (WHO, 1973, Copenhagen). At this conference the concept of a health data bank was defined: "... a system for accepting or storing data concerning defined groups of persons, events or institutions in such a way that the information may be aggregated according to users' needs". In 1976, the development of health data banks was considered by a WHO Working Group (WHO, 1977, Prague). The 1976 Working Group discussed some of the broad uses and types of proposed data banks, and problems in their establishment and operation. Strong emphasis was laid on the need for the data banks to be cost-effective and for their objectives to be realistic "... in setting up data banks it is often wise to consider what to leave out than what to include".

2.3.1. The WHO Information System

During the Prague meeting mentioned above, one of the types of data banks considered was one that should be established within WHO for the exchange of information between Member states and WHO, and for the central exchange of health information.

A comprehensive account of the WHO Information System (WHO/IS) and its interaction with National Health Information Systems (NHIS) has been given by Haro (WHO, 1980f). A summary of the WHO/IS is also contained in the 1976 Working group report mentioned above (WHO, 1977a, Prague).

According to Haro "... the WHO's priorities should not differ from that of its Member States ... the Organization's role is that of a co operative partner in the national health programmes of Member States in seeking the most effective use of health resources on intercountry, regional or global levels". In this context, the terms 'interaction' and 'interface' have arisen between NHIS and the WHO/IS. 'Interaction' was expressed by Haro as "the exchange of concepts, ideas and experience for developing and administering the systems: 'interface' between systems means the transfer of data and/or information in a form that can be processed by both systems".

Haro has described among other things, country expectations and responsibilities, types of technical information to be collected, the establishment of a standing committee on information for WHO, the rationalization of special-purpose

information systems, and the basis for interaction and interface among NHIS.

In summary, the WHO/IS can be divided in two parts:

1. The Programmes Information System, consisting of subsystems to support technical co operation by providing the information required for programme planning, management and evaluation; and
2. Special Purpose Information Subsystems, mainly technical and/or scientifically oriented subsystems; the WHO is used as a neutral ground for information interface among NHIS for solving their problems. In terms of its volumes of data/information, the Special Purpose Information Subsystem account for the greater part of the WHO/IS.

By January 1978, the Programmes Information Systems and a few Special Purpose Information Subsystems were expected to be completely redesigned and largely to have become operational. Subsequent implementation of the other components of the WHO/IS would then proceed incrementally.

CONCLUSION

Health information systems operating in various aspects and areas of health management have been discussed in the first section. The concept of national health information systems was introduced in the following section and its application in some countries, including Malaysia, described briefly. The role of the WHO and events that have led to the formation

of the WHO/IS have been discussed in the final section,
From the foregoing it can be seen that, as a 'co operative
partner in the national health programmes of Member States'
the WHO has already played its rôle in assisting Malaysia
in developing the information system.

3. GOVERNMENT DENTAL SERVICES

IN MALAYSIA

INTRODUCTION

In the preceding chapters the theoretical concept of health information systems and their operation at different levels of health care delivery have been discussed. In this chapter, the writer has attempted to draw a brief picture of the health and especially dental services within the government sector in Malaysia before considering the detailed aspects of the development and implementation of the HMIS in the next chapter.

Before acquainting the reader with the health and dental health set-up in Malaysia, the writer has given a brief demographical description of the country, including education in the first section. To maintain a proper perspective, the overall health services organization has been described first before discussing the dental health services. In discussing the latter, the organization at the National and State levels, the manpower, facilities and financial resources have been included.

In the next section, the dental health status, dental problems and strategies developed to deal with the problems have been described. The writer has stressed the need to keep these strategies in mind since the description of the continued development of dental health indicators in Chapter 5 have been based on these strategies. In this section, the dental health programmes have also been discussed, and how they have fitted in with the development of the Dental Subsystem of the Health Management Information System.

The account given in this chapter is a summary of the latest report on the dental services released by the Dental Division, Ministry of Health (Dental Division, Ministry of Health, Malaysia, 1981). All figures, diagrams and charts have been taken directly from the report.

3.1. THE COUNTRY, THE HEALTH AND DENTAL SERVICES ORGANIZATION

3.1.1. The Country

Malaysia is located in Southeast Asia, situated between latitudes 1° and 7° North and longitudes 100° and 119° East. It is a federation comprising 13 states and the Federal Territory. It consists of Peninsular Malaysia (West Malaysia) and Sabah and Sarawak (East Malaysia), the two separated by the South China Sea at an average of about 1000 kilometres. (see Fig. 11 for relief map of Malaysia).

The country covers a total area of 332,660 square kilometres: Peninsular Malaysia has an area of 131,313 square kilometres, and Sarawak and Sabah a combined area of 201,320 square kilometres.

Climate-wise, the country is hot and humid with most places having more than 80 inches of annual rainfall. The average daily temperature throughout Malaysia varies from 21°C and 32°C with the exception of the highlands where temperatures are lower.

According to the 1980 Census figures, the total population of Malaysia is 11,138,227, and Sarawak and Sabah 1,294,753 and 1,002,608 respectively.

Peninsular Malaysia has three major population groups: Malays, Chinese and Indian/Pakistanis each with its own cultural, linguistic and religious background. The Malays represent 50% of the population, the Chinese 37% and the Indians 11%. The remaining 2% comprise the Eurasians, Europeans and Aborigines. In Sarawak, the major population groups include Chinese, Malays, Land and Sea Dayaks and Melanaus; in Sabah they include the Kadazan, Chinese, Muruts, Bajaus and Malays. Malaysia has a relatively young population; approximately 50% of the population is less than 20 years of age. The population by age groups is shown in Fig. 12.

Malaysia received its independence from the British in 1957 and is a member of the Commonwealth. The education system in Malaysia is a legacy of the British system. Four levels of education are identified: preschool kindergarten, primary, secondary and tertiary. In recent years many privately administered organizations introducing nursery and kindergarten classes for preschool children have cropped up. Primary education of six years duration is free for children between the ages of 6 and 12 at all National-type schools where the medium of instruction is the National Language. Other mediums of instruction are permitted in private schools. The secondary education is normally of 5 years duration. After three years of lower secondary education those who do well are channelled into either the academic, technical or vocational streams depending on their performance. Those who do well in the upper secondary classes proceed to the pre-

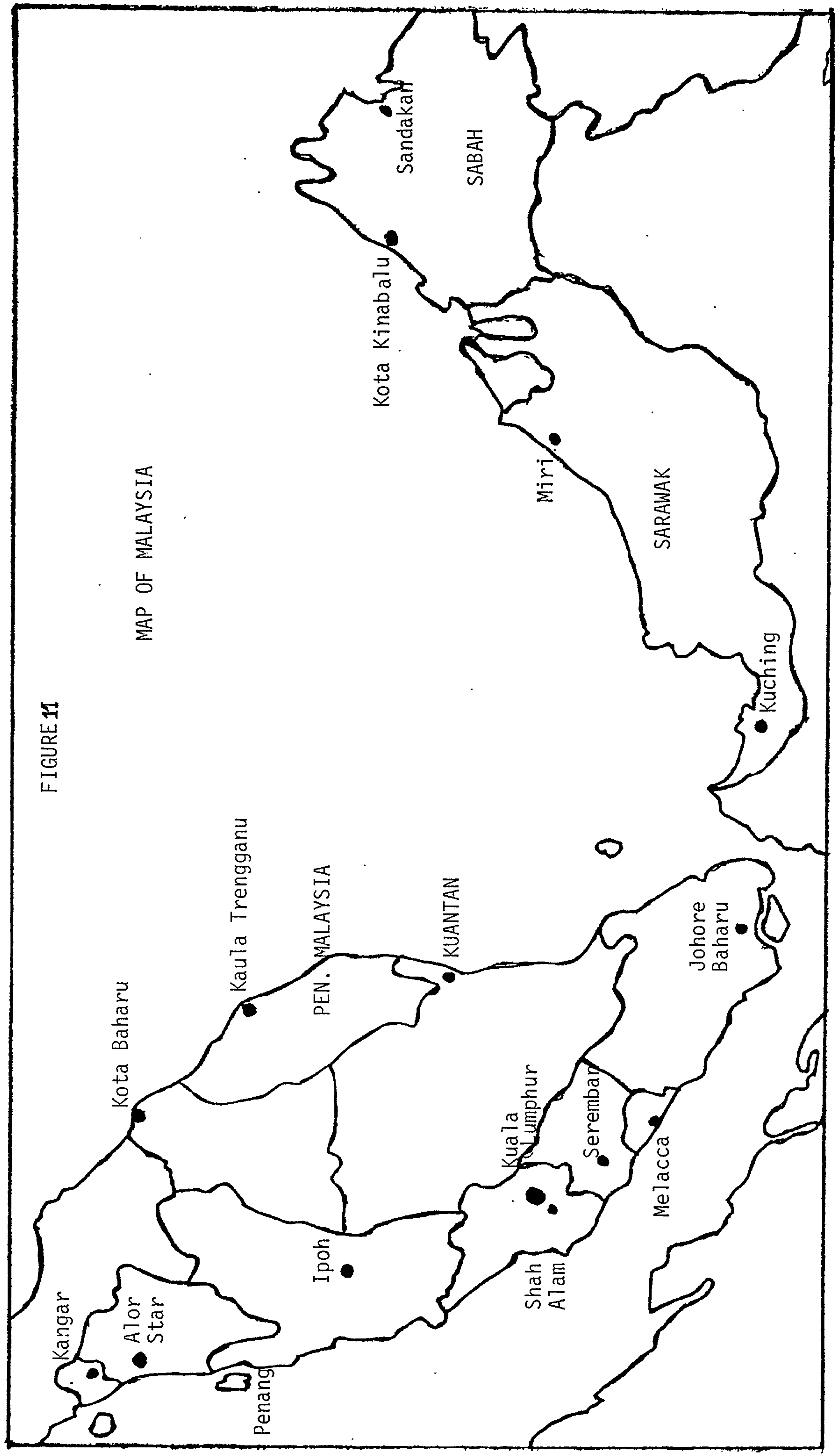
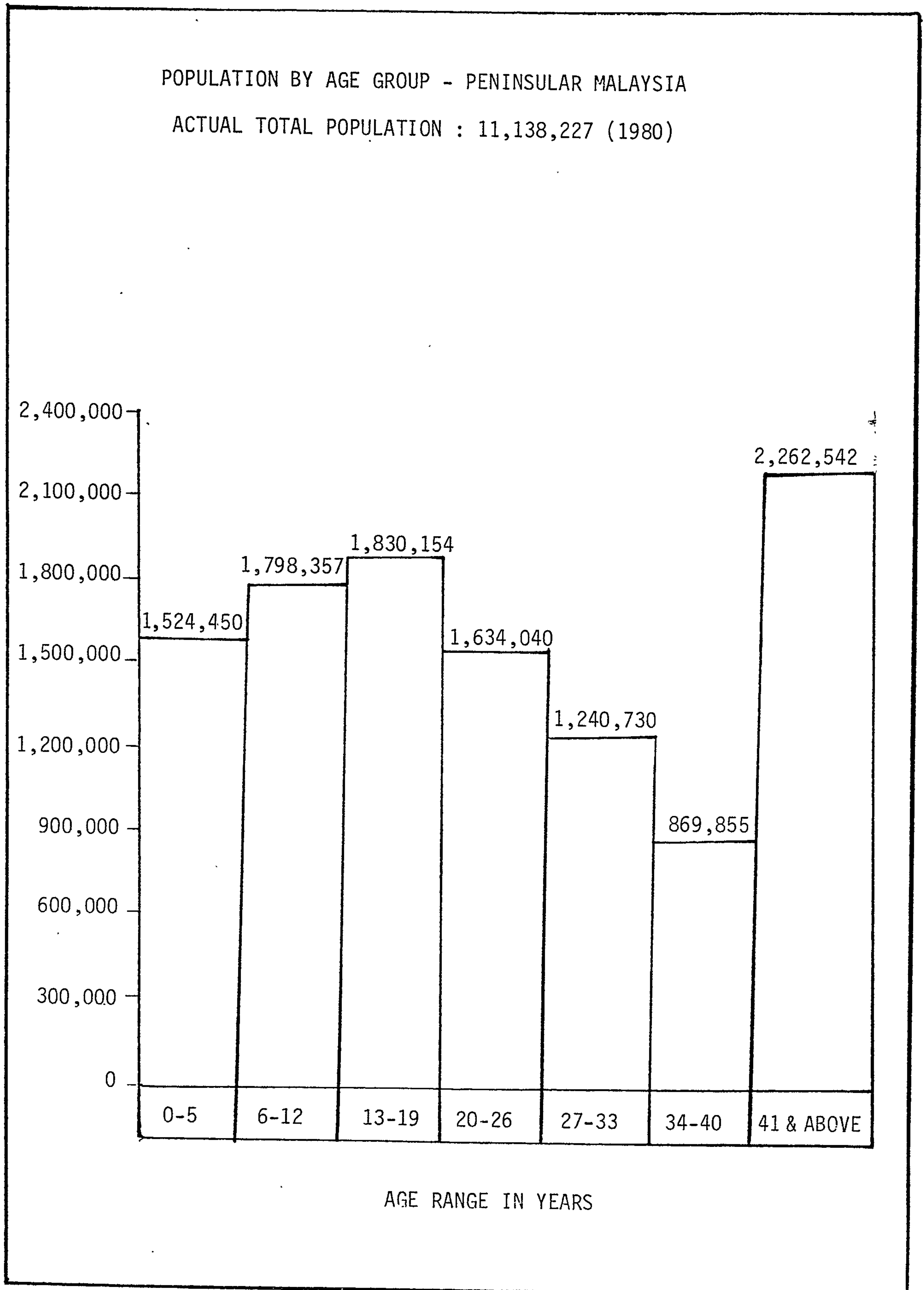


FIGURE 11

Source: Dental Division, Ministry of Health, Malaysia.

FIGURE 12



Source: Dental Division, Ministry of Health, Malaysia.

university classes. Tertiary education may be pursued at any one of the 5 existing universities or other institutions of higher learning in the country or abroad.

3.1.2. Government Health Services

The objective of the government health services has always been to provide the population with the highest attainable standard of health, medical and dental care. In the Fourth Malaysia Plan, continued emphasis has been given to the rural population so as to ensure participation from these people in the economic development of the country.

By means of the various Malaysia Plans, health services have been extended to most parts of the country. Basic medical and dental services are now available to a larger segment of the population through the expansion of the Rural Health Services and the establishment of new district hospitals and dental clinics. Specialized medical and dental care are available in all general hospitals.

The delivery of government health services is the responsibility of the Ministry of Health. The health organization including top management and functional divisions is shown in Fig. 13. Management at all state levels and listing of federal institutions is shown in Fig. 14.

There has been a significant increase in the health facilities throughout the country with the development of health, medical and dental services. To maintain efficient and effective operation of this infrastructure, the administrative

ORGANISATION — MINISTRY OF HEALTH

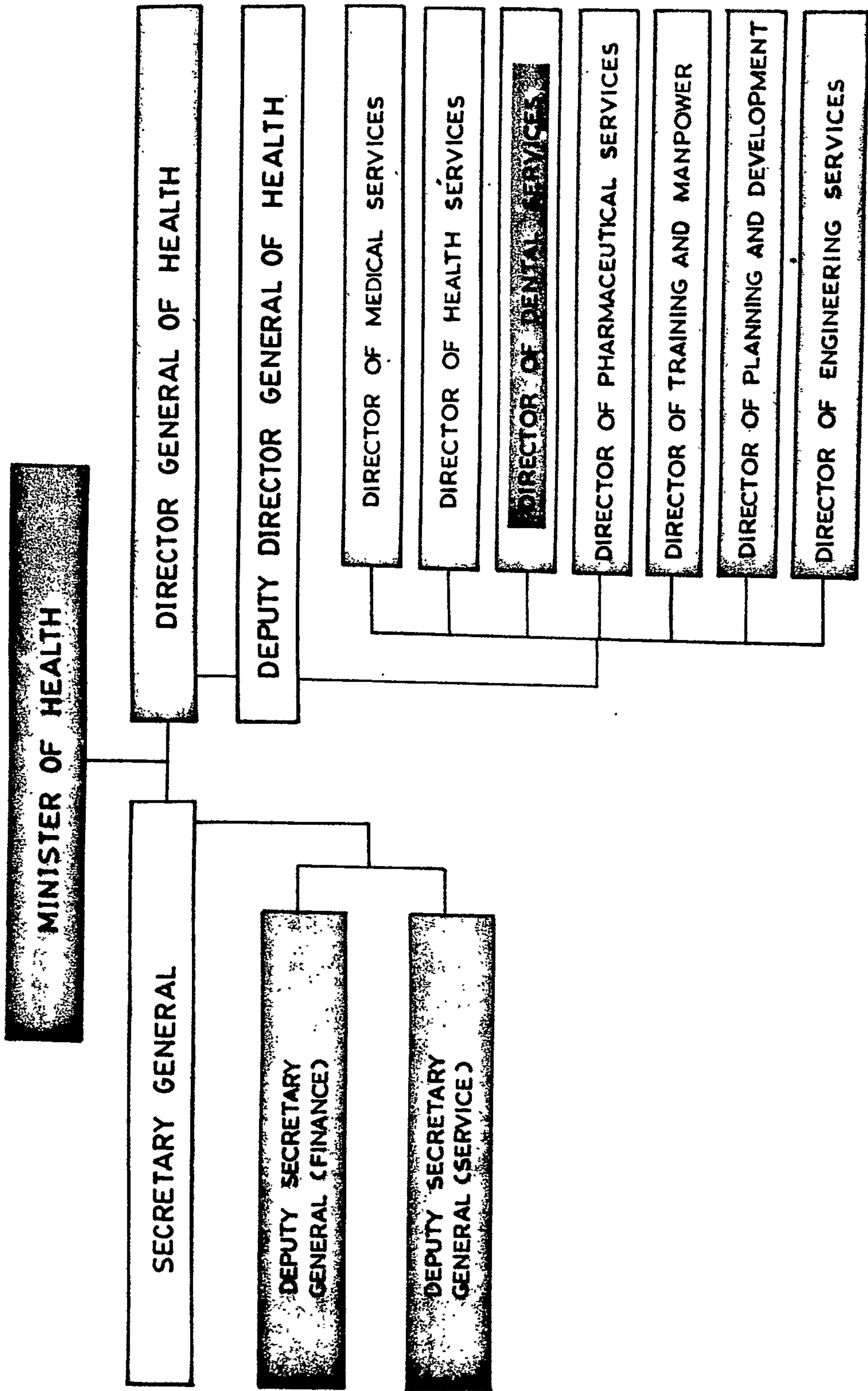


Fig. 13

STATE LEVEL

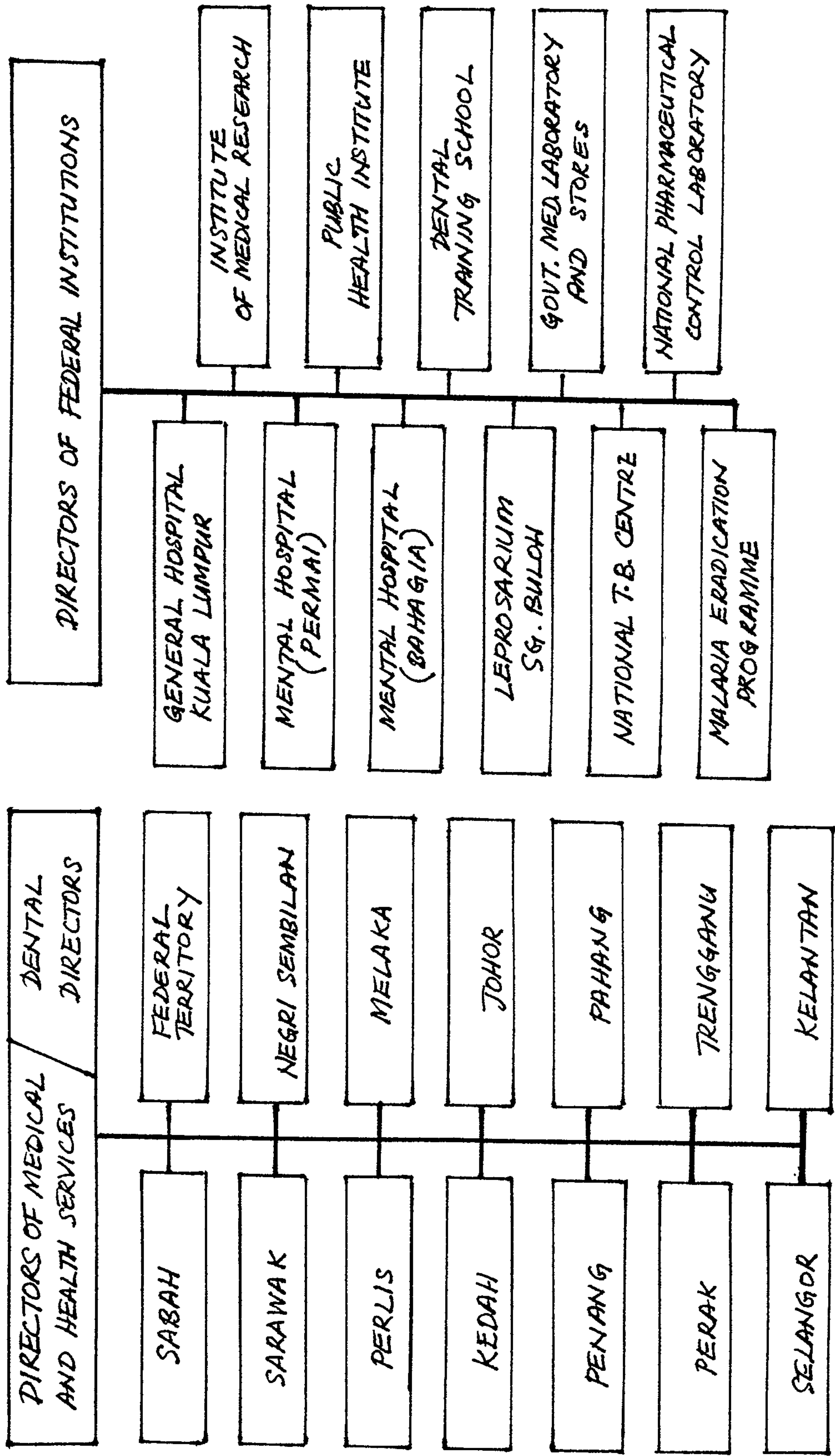


FIG. 1A

and manpower components of the health services have also been expanded. Preventive health programmes to control or eradicate debilitating diseases endemic in Malaysia have also been intensified.

3.1.3. Government Dental Services

In Malaysia, dental care is provided both by private and government dental clinics as well as the Dental Faculty of the University of Malaya. However, the responsibility of providing dental care for the population still lies mainly with the government. The government dental clinics include those under the Ministry of Health, the Ministry of Defence and the Aborigines Department.

The Government Dental Service in Malaysia started essentially as a school dental service. Since its inception fifty years ago, it has grown and expanded with other components of the health services. To date, the dental service has extended its policy to include dental care for the whole population. However, priorities earlier accorded to school children, preschool children and expectant mothers continue to be maintained.

As stated by the Dental Division, Ministry of Health, the objective of the Government Dental Service is to "... raise the dental health status of the population of Malaysia through the provision of promotive, preventive, curative and rehabilitative dental services with special emphasis on the less fortunate groups so that the health status of the

nation will continuously be in conformity with the socio-economic progress of the country. To achieve this objective, emphasis is also given to the creation of national unity".

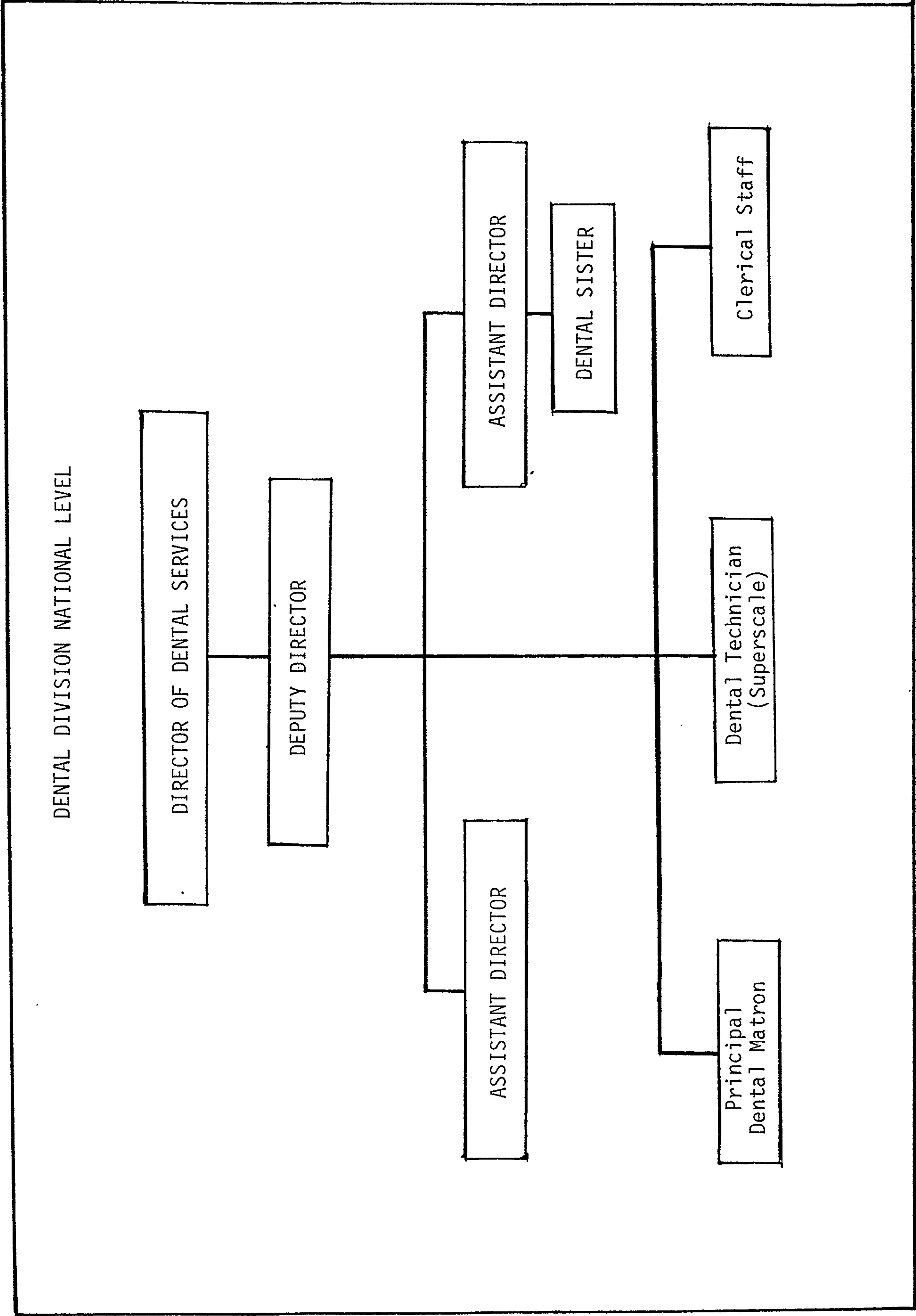
The dental service is organized at two main levels:-

1. National level
2. State level

At the national level, the Dental Division in the Ministry of Health is headed by the Director of Dental Services and assisted by a Deputy Director, two Assistant Directors, one Principal Matron, one Dental Sister, one Superscale Dental Technician, and supported by a core of administrative clerical staff. The formulation of policies and co ordination of services are carried out at the national level.

At the state level, the State Dental Director is responsible for running the dental service in each state. Staff under the State Director include the Senior Dental Officers, Dental Officers, Dental Specialists, Dental Matron, Dental Sisters, Staff Nurses, paradental staff and clerical staff. The organization charts both at the national and state levels are shown in Fig. 15 and 16 respectively.

FIGURE 15



Source: Dental Division, Ministry of Health, Malaysia.

3.1.3.1. Resources

3.1.3.1.1. Manpower

With expansion of the Government Dental Service, there has been a steady increase in manpower resources.

1. Dental Surgeons

Before the establishment of the Dental Faculty in the University of Malaya, Kuala Lumpur, the main bulk of the supply of dentists in the country were graduates from the University of Singapore. The rest of the supply comes from other universities mainly from Commonwealth countries. The first batch of 30 dentists from the University of Malaya, Kuala Lumpur graduated in 1976. The number will be increased to 46 in 1983 and 64 in 1986. The number of dentists from recognized universities of other countries is between 10-15 a year. The other source of dentists is from the approved list of universities in India and Taiwan. These graduates have to undergo two years training before being registered for practice in Malaysia. Their number is about 30-40 per year.

2. Dental Nurses

These are the only operative dental auxiliaries in Malaysia. They are trained at the Dental Training School in Penang over a period of two years and are basically similar to the New Zealand type of dental nurse. On completion of training they are only employed by the Government and work under the supervision of dental officers. The first batch of dental nurses graduated in 1950 and the present annual

output is 60. The utilization of dental nurses has greatly enhanced the coverage of students receiving treatment. With increased intake recently in the Dental Training School, it is hoped that more dental nurses will be available to provide treatment to school children under the planned expansion of the School Dental Service.

3. Dental Technicians

They are also trained at the Dental Training School in Penang for a period of over two years. The present annual output is 25.

4. Dental Surgery Assistants

Formerly the training of DSA's has been an in-service programme carried out in each state under the supervision of the State Dental Directors. As of 1982 they will be trained at the Dental Training School in Penang under a formal programme.

The professional dental manpower is shown in Fig. 17.

It can be seen that for a period of ten years (1970-80) there was an increase by a factor of 1.5 in the number of dental surgeons in the government sector. The total number of dental surgeons in 1980 for the whole of Malaysia is 736 giving a dentist:population ratio of 1:18,000 (see Fig. 18). The projection of dental officers required in the government service for the years 1975, 1980 and 1990 is shown in Fig. 19. It can be seen that the target dentist:population ratio is 1:5,000. In 1980, a total of 2,304 dental officers would have been required

to achieve this target. It is therefore obvious that there is still an acute shortage of dental surgeons in the government service. Trained dental personnel in the government service is shown in Fig. 20. It can be seen that there was an almost threefold increase in the number of dental nurses in the service over a period of ten years (1970-1980) but a less substantial increase in the number of dental technicians.

3.1.3.1.2. Facilities

Dental treatment is provided through a network of dental clinics located in urban and rural areas. They are classified as follows:-

1. Dental clinics in urban areas

(i) Main Dental Clinics

An urban clinic located in each district, staffed with dental officers and dental nurses with facilities for comprehensive dental treatment. Clinics in major towns have the services of an orthodontist.

(ii) Decentralized Dental Clinics

An urban clinic located in a large town with similar staff and facilities as above. It provides treatment for a specific area within the town.

(iii) Hospital Dental Clinic

Located in a hospital with services of a consultant dental surgeon providing treatment for in-patients of the hospital, outpatients, maxillo-facial and referral cases.

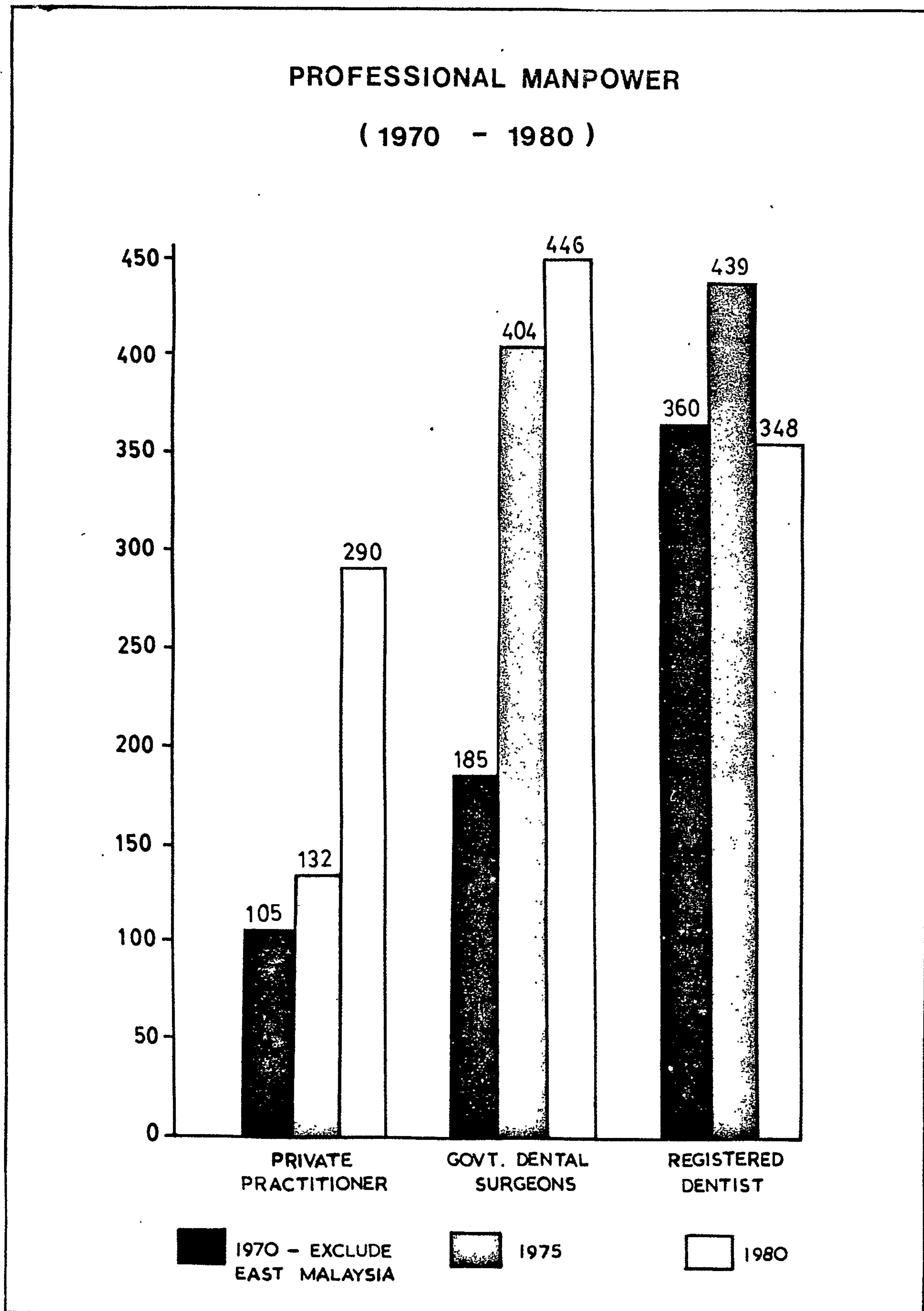
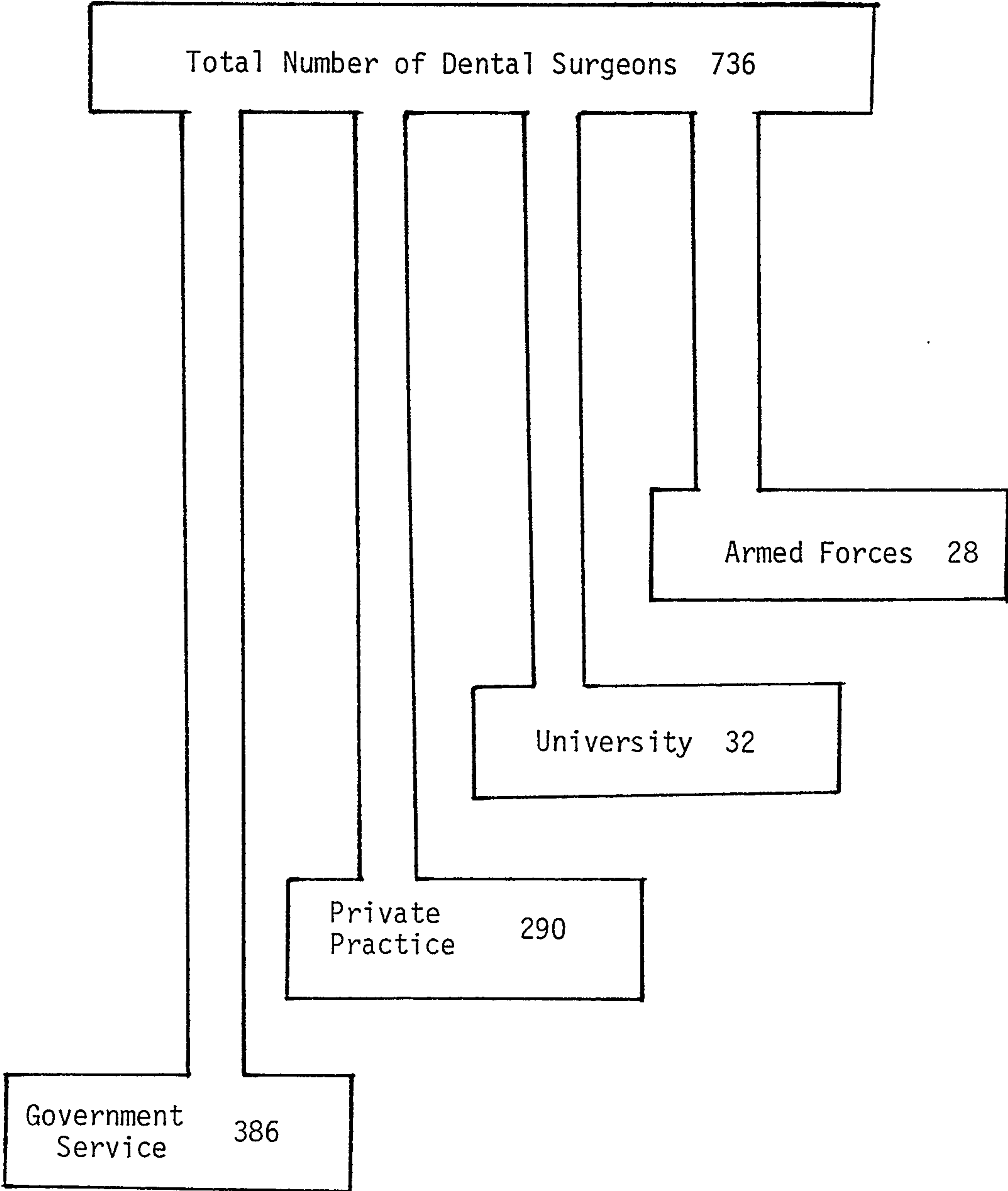


Fig. 17

TOTAL NUMBER OF DENTAL SURGEONS
AS IN 1980
FOR THE WHOLE OF MALAYSIA



Dental Surgeon : population — 1 : 18,000.

Source: Dental Division, Ministry of Health, Malaysia.

PROJECTION OF DENTAL OFFICERS REQUIRED

STATE	FOR YEAR 1975		FOR YEAR 1980		FOR YEAR 1990	
	POPULATION	No. of Dental Officer Required based on Ratio: 1:10,000 1:5,000	POPULATION	No. of Dental Officer Required based on Ratio: 1:10,000 1:5,000	POPULATION	No. of Dental Officer Required based on Ratio: 1:10,000 1:5,000
Peninsular Malaysia	10,061,428	1,006 2,012	11,517,144	1,152 2,304	14,893,248	1,489 2,978
Sarawak	1,118,631	112 224	1,299,266	130 260	1,789,371	179 358
Sabah	747,049	75 150	863,039	86 172	1,178,044	118 236
Malaysia	11,927,108	1,193 2,386	13,679,499	1,368 2,736	17,860,663	1,786 3,572

Fig. 19

TRAINED DENTAL PERSONNEL IN THE GOVT. SERVICE

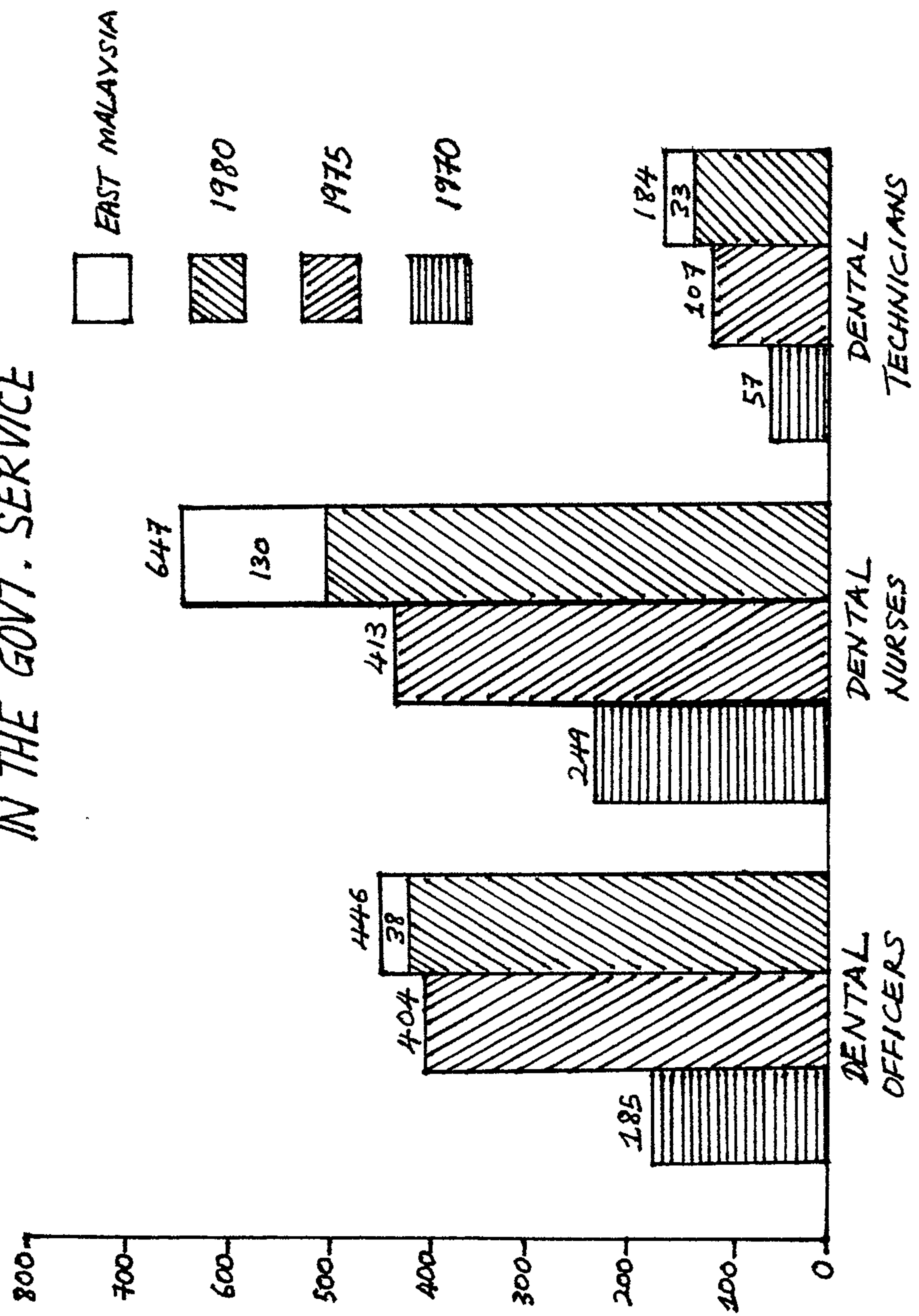


FIG. 20

(iv) School Dental Clinics

A dental clinic located mainly in a primary school and under the charge of a full-time dental nurse.

Some secondary school clinics are served by dental officers.

2. Dental clinics in rural areas

(i) Dental Clinic in the Health Centres

A dental clinic with full-time dental officers and dental nurses serving the rural population from the main health centres. Dental officers and dental nurses provide treatment once a week or once a fortnight, depending on demand, at the health sub-centres.

(ii) Mobile Dental Clinic

A large van converted into a dental clinic and equipped with one or two dental units. It provides treatment to schools with less access to other clinics.

(iii) Mobile Dental Squad

A team of dental officers and dental nurses providing service to schools with small enrolments located in remote rural areas. Portable equipment is utilized; treatment is mainly the preservation of the permanent dentition and relief of pain.

Dental facilities for the years 1970 and 1980 are shown in Fig. 21. It can be seen that within the ten years there has been a two-fold increase in the number of dental clinics and dental units. The increase is most evident in the

number of school dental clinics; considering the expansion of the School Dental Services this is expected. With further development of the Rural Health Services, there has also been a substantial increase in the number of Main Health Centres which provide service to the rural population. The hospital (specialist) dental services have also been strengthened with the establishment of more hospital dental clinics.

3.1.3.1.3. Financial resources

With the expansion of health services in the country, there has been a concurrent increase in the Federal allocation for the Ministry of Health. Although there is virtually no change in the percentage allocation for the dental services, there has been a real increase in the allocation of actual federal funds from the years 1975 to 1978 and up to 1980. The operating expenditure of the Ministry of Health for the years mentioned above is shown in Fig. 22.

FACILITIES

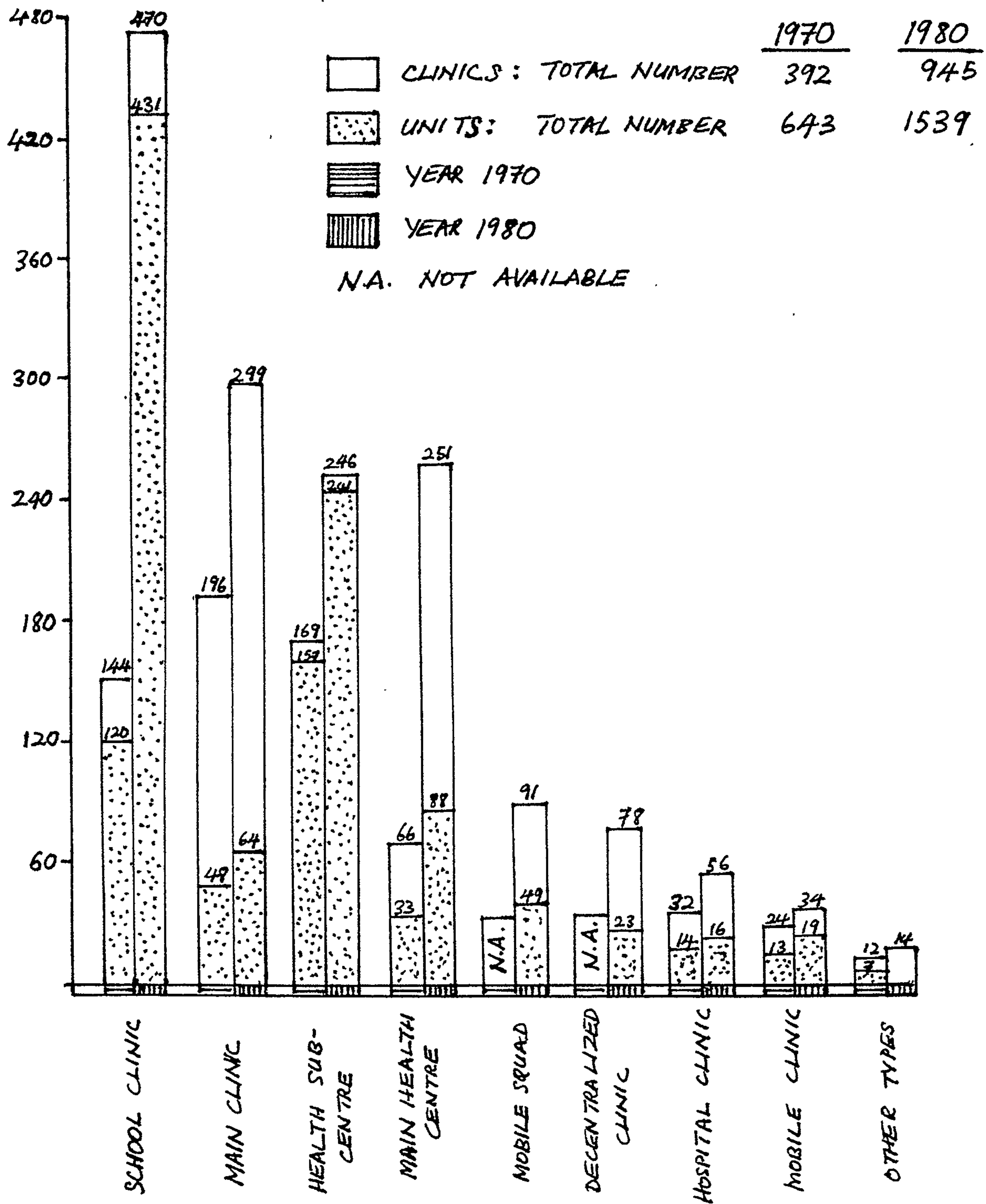
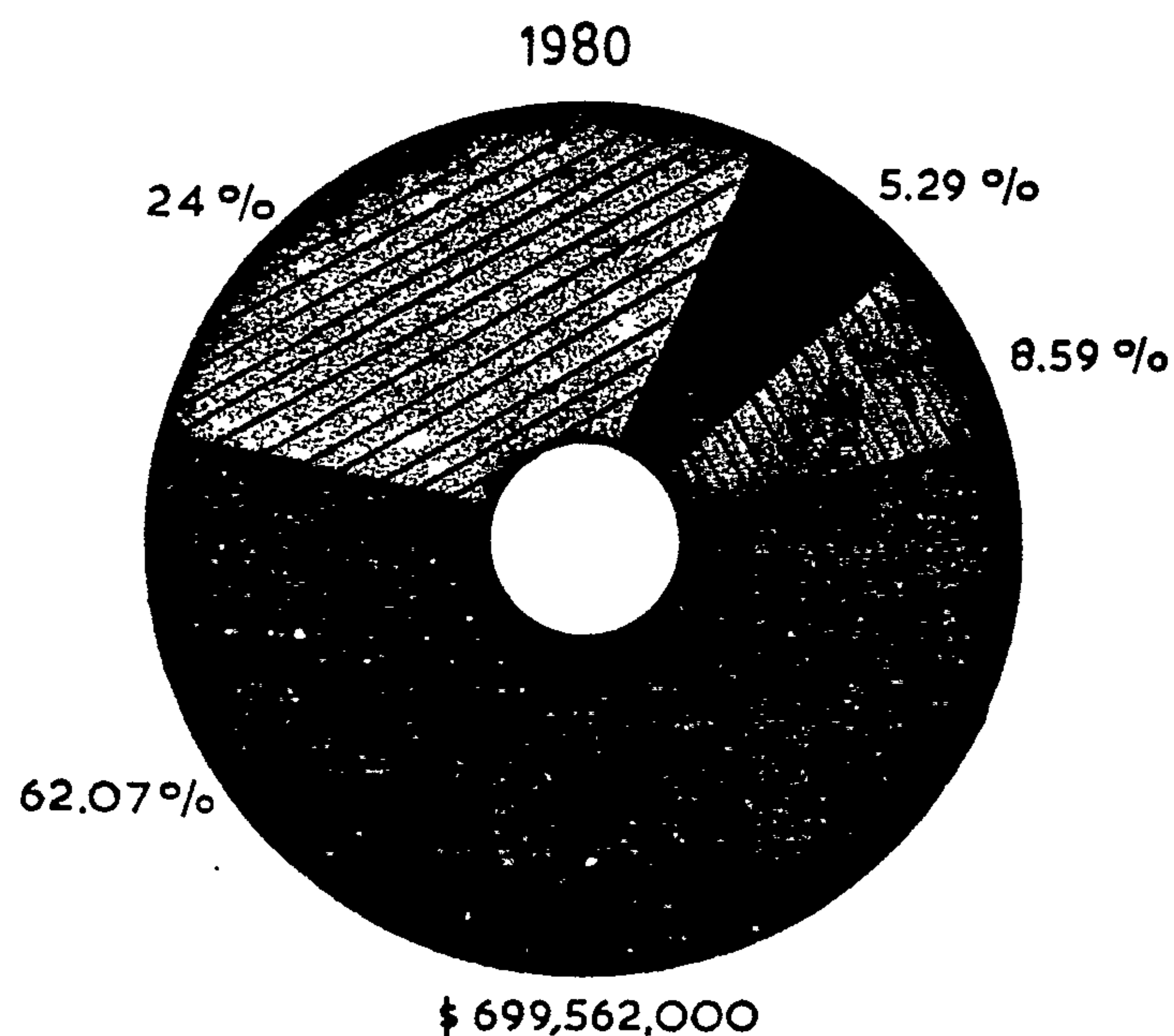
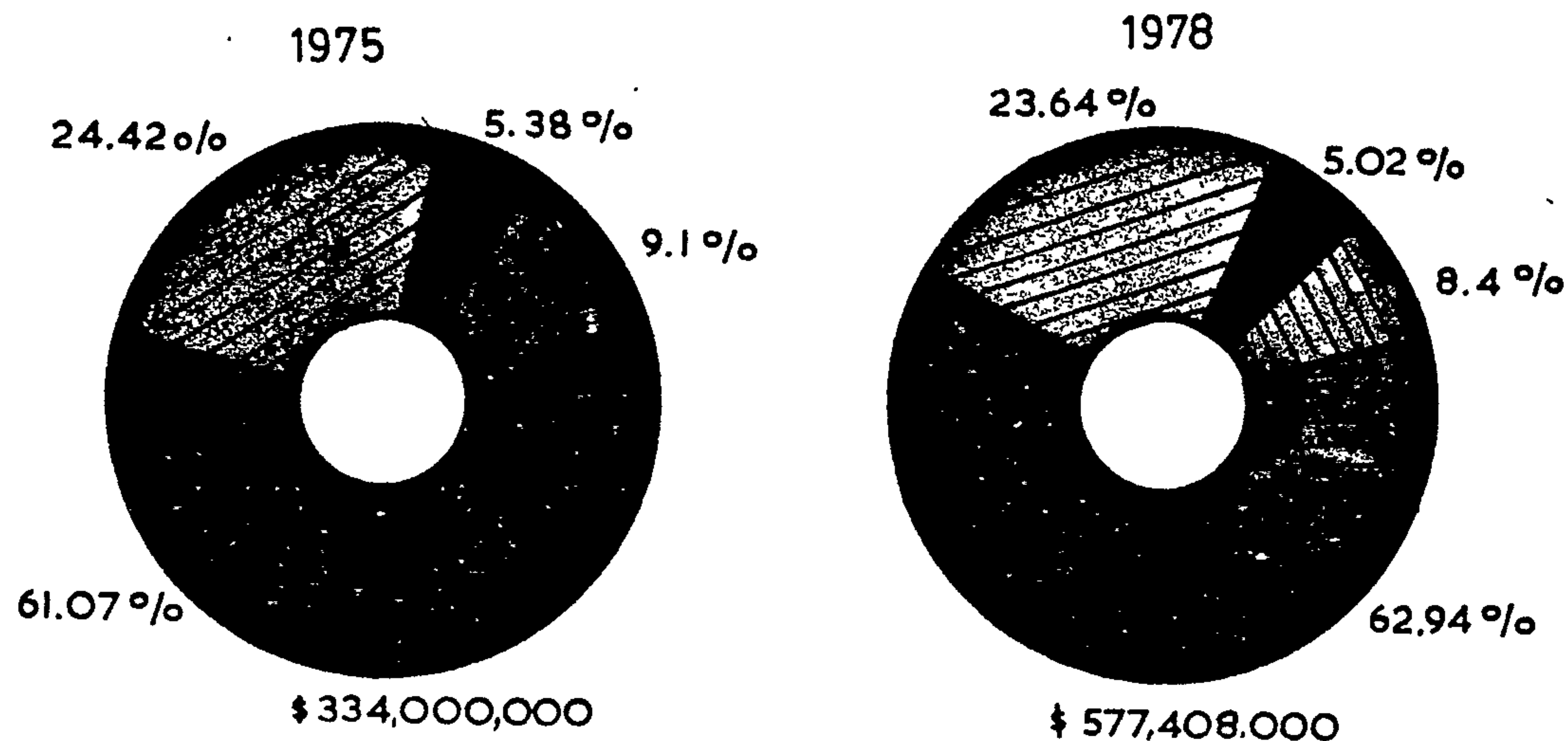
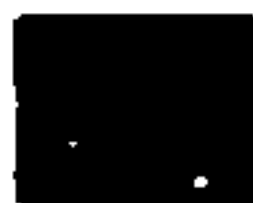


FIG. 21

OPERATING EXPENDITURE-MINISTRY OF HEALTH



 MEDICAL CARE SERVICES
 PUBLIC HEALTH SERVICES
 DENTAL SERVICES

 RESEARCH
 ADMINISTRATION
 PHARMACY AND SUPPLIES
 TRAINING
 PLANNING AND DEVELOPMENT

Fig. 22

3.2. DENTAL HEALTH STATUS, STRATEGIES AND PROGRAMMES

3.2.1. Dental Health Status

3.2.1.1. 6-18 years age group

A dental epidemiological survey of school children in West Malaysia was carried out by the Dental Division, Ministry of Health in 1970-1971. The objective was to obtain a reliable estimate of the dental health problems among school children in the country. A sample of 15,197 children from 47 schools were examined. A stratified cluster random sampling design was employed. The standard and criteria for examination procedures emulated the one used in the dental survey carried out in Fiji in 1965. A few adjustments were made to meet local requirements and five examiners were involved for the whole duration of the survey. Recorders and other supporting staff were locally trained for the different states. A few of the more significant features of the survey are as follows:-
(refer to Fig. 23)

1. 88.9% of the sample examined were found to suffer from dental caries.
2. The mean df teeth per child is 1.9 and the mean DMF teeth per child is 3.0.
3. 59.9% of the children had gingival inflammation, and the mean number of inflamed gingival units per child is 2.8.
4. 34.1% of the children examined have handicapping dentofacial anomalies which required treatment.
5. 20% of the children 6-18 years required partial dentures.
6. 46.9% of the children use well water for drinking. 76% of the sample receive town water supply as a source of their drinking water. No fluorosis was detected in any of the subjects.

3.2.1.2. Adult population

A dental epidemiological survey of a random sample of the adult population aged 15 years and above in Peninsular Malaysia was undertaken by the Dental Division, Ministry of Health in 1974-1975. The primary objective of the survey was to determine the magnitude of dental health problems among the adults in the country. A total of 9,061 persons from 300 randomly selected clusters comprised the sample. The criteria and recording instructions utilized during the survey was designed to meet local needs, but adhered closely to the standards set by the World Health Organization in its Oral Health Surveys, Basic Methods, 1971. A standardized examination procedure was established; the use of radiographs was not included. Ten examiners with dental public health qualifications participated in the survey. Other supporting staff were locally trained for the different states. Some of the more significant findings of the survey are as follows:- (refer to Fig. 24)

1. There was a very high prevalence of dental caries (95%) in the sample examined; the mean DMFX teeth per adult is 13.2.
2. 72.4% of the sample had some form of periodontal disease, with 29.0% having periodontal pockets greater than 3mm.
3. The mean OHI-S Score for all subjects examined is 2.2. 81.4% of the sample reported using the toothbrush to clean their teeth.
4. 23.7% of the sample were wearing dentures and 54.7% required dentures.
5. A total of 944 cases (10.4%) with handicapping dento-facial anomalies requiring treatment were detected.

6. Smoking was the commonest form of precancerous/cancerous oral habit. 114 subjects (13%) suffered from leukoplakia. Only one case of oral cancer was detected.
7. 60% of the sample receive town supply as the main source of drinking water. No fluorosis was found in any of the subjects examined.

While on the subject of surveys, it should be mentioned that the Dental Division has carried out the following Dental Epidemiological surveys:-

1. Feasibility studies on the fluoridation of Public Water Supplies in West Malaysia, 1971.
2. A Report of the Result of the Seven Years of Fluoridation at Kluang, Johore, 1966-1973.
3. Dental Epidemiological Survey of School Children in Sarawak, 1981.

3.2.2. Dental Health Strategies

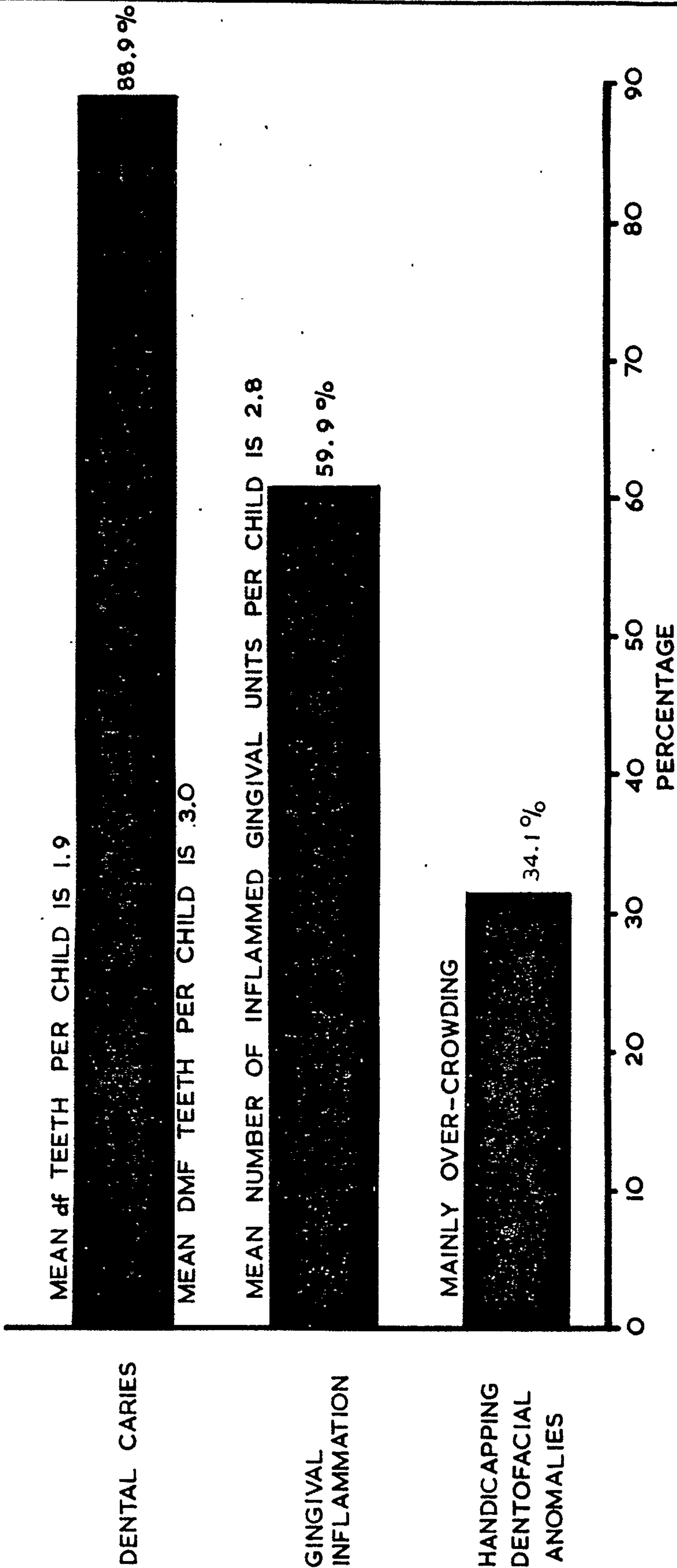
To meet its service objectives and to deal with the dental problems identified in the foregoing sub-subsections, the Dental Division, Ministry of Health has developed the following strategies:-

1. Fluoridation of water supplies as a national programme for the prevention and control of dental caries.
2. Dental Health Education with special emphasis on the school-going population, the preschool children and expectant mothers.
3. Topical application of fluorides to preschool and primary school children especially in areas where water fluoridation is not yet available.

4. Expansion of the dental services more extensively to the rural areas.
5. Establishment of more school dental clinics and school dental centres to cater for the expanding school-going population.
6. Formation of more dental mobile squads to serve small schools in remote rural areas.
7. Consolidation of urban dental clinics by establishing main dental clinics in all administrative districts.
8. Strengthening the hospital (specialist) dental services to cater for maxillo-facial and referral cases.
9. Provision of increased orthodontic services to cater for handicapping dento-facial anomalies.
10. Setting up of periodontal units in all states.
11. Improvement of the preschool dental service.
12. Further development of the Dental Nurses Training School to provide for an increased annual output of dental nurses and dental technicians.
13. Centralized and standardized training for dental surgery assistants.
14. Periodic surveys to assess existing dental problems and to evaluate dental services programmes.
15. Dental research programmes in the field of oral cancer and other lesions of the hard and soft tissues of the oral cavity.

Fig. 23

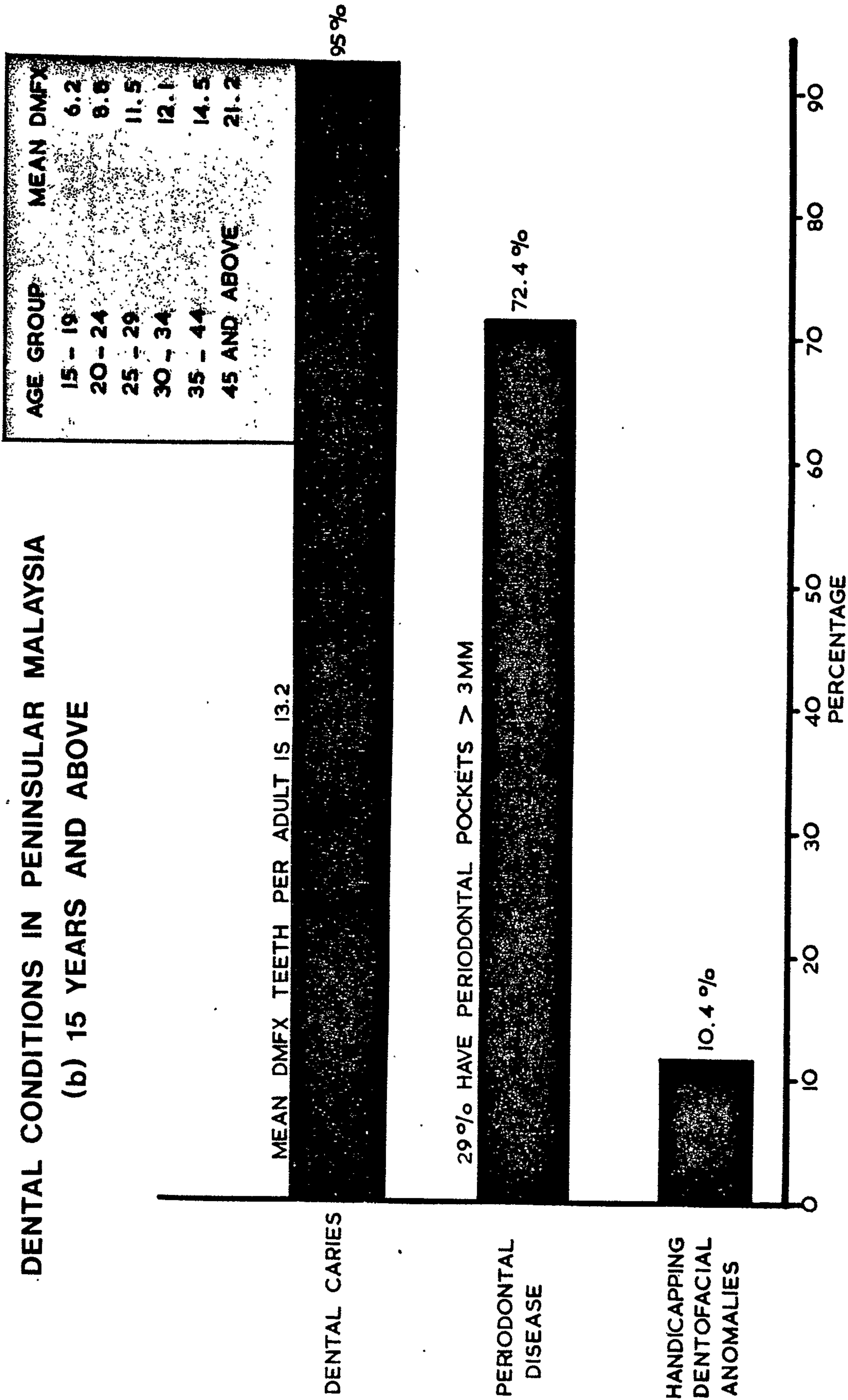
DENTAL CONDITIONS IN PENINSULAR MALAYSIA
(a) 6-18 YEARS AGE GROUP



TAKEN FROM DENTAL EPIDEMIOLOGICAL SURVEY OF SCHOOL CHILDREN IN WEST MALAYSIA 1970/1971.

Fig. 24

DENTAL CONDITIONS IN PENINSULAR MALAYSIA
(b) 15 YEARS AND ABOVE



TAKEN FROM DENTAL EPIDEMIOLOGICAL SURVEY OF ADULTS IN WEST MALAYSIA 1974/1975.

3.2.3. Dental Health Programmes

The dental service programmes are of two main types i.e. the preventive and curative. Both programmes receive equal priority and are implemented simultaneously through the network of the various dental clinics.

3.2.3.1. Preventive Programme

The general objective of this programme is to provide preventive and promotional dental services. There are two sub-programmes:-

1. Fluoridation
2. Dental Health Education

1. Fluoridation

A committee on Fluoridation of Public Water Supplies was formed in 1969. It has recommended that fluoridation of public water supplies be instituted and an optimal level of 0.7 ppm fluoride be maintained in the reticulation system. The implementation of the fluoridation project was carried out in stages with the objective of preventing and reducing the incidence of dental caries by 50%. Maintenance of all units and proper control of the fluoride levels are carried out with the co operation of the Public Works Department. To date, 77 plants in West Malaysia and 15 plants in Sarawak have been fluoridated, benefiting six million people. The target of the programme is to instal fluoridation plants, where feasible, at all water treatment plants throughout the country.

2. Dental Health Education

The objective of the Dental Health Education programme is to "instil dental consciousness and to attain behavioural changes for the improvement and maintenance of the dental health of the child, family and the community through their own and organized community efforts".

To achieve this objective, a National Dental Health Education Unit was set up in 1979. It has the task of formulating policies for the programme and co-ordinating all dental health education in the states. All such activities are now being standardized and intensified.

Dental Health Education Units are also set up in the various states to ensure that the programme is being implemented at the ground level. Co ordination between the DHE Units at the national and state levels is maintained to ensure effectiveness and success of the programme.

DHE activities include oral health instruction, talks, lectures, tooth-brushing drills, fluoride mouth-rinsing drills, campaigns, exhibitions, film shows and others. The actual implementation of the various activities depends on the target group concerned.

It should be mentioned that the Preventive Programme has not yet been formally included in the Dental Subsystem of the Health Management Information System. Health indicators for the DHE programme and fluoridation programme have, however, been developed in the exercise. For this reason, the writer

has not attempted to make any form of analysis or evaluation of the Preventive Programme in the latter chapters of this work.

3.2.3.2. Curative dental services

Curative dental care is available at all dental clinics. Priority is given to the treatment of school children, pre-school children and antenatal mothers.

Treatment of school children is carried out at the School Dental Clinic, Mobile Dental Clinic and also by the Mobile Dental Squad. The children may be brought for treatment at the Main Dental Clinics and clinics in the Main Health Centres. The bulk of treatment is, however, carried out at the school dental clinics located in many primary schools and some secondary schools. A dental nurse attached to the primary school dental clinic is responsible for the dental care of all students enrolled in the school. Secondary school children are encouraged to seek dental treatment and those who attend the clinics are given systematic and comprehensive treatment.

Children up to age 17 years may be treated by the Dental Nurse working under the supervision of the Dental Officer. The nurses are trained to do prophylaxis, amalgam and silicate fillings, topical fluoride application, and extraction of primary teeth by local infiltration anaesthesia. In Sabah and Sarawak the dental nurses are trained to do extraction of permanent teeth. Cases beyond the expertise of the dental nurse are referred for treatment to the supervising Dental Officer.

Within the Fourth Malaysia Plan, treatment for preschool children is being intensified with the establishment of the Preschool Service Units initially to be introduced in the Federal Territory. These units will make regular visits to kindergartens. Preschool children attending the other dental clinics will also be given systematic and comprehensive treatment.

A more comprehensive treatment is given to expectant mothers where treatment is being reemphasized. Treatment for the general public include relief of pain and the provision of dentures. Government servants may be given more comprehensive treatment.

Specialized treatment is provided by consultant dental surgeons working in dental clinics located in general hospitals and many district hospitals in the main towns throughout Malaysia. Apart from treating maxillo-facial injuries, the dental specialist also deals with referred cases requiring specialist care.

Cases requiring orthodontic treatment are referred to the consultant orthodontist stationed in the state capitals. Regular visits are made by the orthodontist to other main dental clinics in the states.

Within the Fourth Malaysia Plan, periodontal clinics are also being set up, each to be located at a state capital. These clinics will be under the charge of a Periodontologist, working in close collaboration with the Dental Public Health Officer.

Dental services to the rural areas are provided through a network of dental clinics including the Mobile Dental Clinics, Mobile Dental Squads and dental clinics in the Health Centres.

It should be pointed out that, for the purpose of this treatise, the Curative Dental Services described above have been called the Personal Dental Care Programme. This name has been used throughout this work in describing the only Programme Sub-subsystem that has so far been developed and implemented within the Dental Subsystem of the HMIS.

CONCLUSION

In this chapter the writer has given a brief account of the dental services in Malaysia. The service organization, resources available, dental problems, strategies and programmes have been described. Most of the strategies listed have been utilized in the continued development of the dental health indicators described in Chapter 5. In the description of the Curative Dental Services, the target population groups, category of operating staff and types of treatment have been identified. The design of the Dental Subsystem and its information requirements have been based on the variables identified above. In doing so, the writer has hoped to provide the reader with a better understanding of the various factors involved in the development and implementation of the Dental Subsystem of the HMIS described in the next chapter.

4. DEVELOPMENT AND IMPLEMENTATION OF HMIS IN MALAYSIA - DENTAL SUBSYSTEM

INTRODUCTION

In this chapter the writer has given an account of the development and implementation of the Health Management Information System in Malaysia, with special reference having been made to the Dental Subsystem.

The writer has divided this chapter into five parts. The first section has dealt with the protocol for the overall development and implementation of the information system. The system objectives, methodology, project schedule, outputs and requirements have been included in this section.

The conceptual phase has been described in the next section. This phase has involved the formulation of principles for the system development, basis for organizational study and identification of the various functional components of the Ministry of Health, and outputs. The conceptual phase described has been only one aspect of the system procedure, which in turn has been part of the system methodology described in the first section. It has been the writer's opinion that a detailed synopsis of the conceptual phase and protocol may suffice to provide the reader with a description of the development and implementation of the HMIS as a whole.

The next three sections relate mainly to the Dental Subsystem. The third section has dealt with the design and development of the Dental Subsystem: the information requirements, data elements,

frequency of generation, development and design of the formats and instruction manuals. The test run of the subsystem in Penang State and evaluation prior to implementation have been described in the fourth section. The objectives, preparation, training strategies, outcome and recommendations have been included in the discussion. The final section has dealt with the implementation of the Dental Subsystem throughout Malaysia.

4.1. PROTOCOL

4.1.1. Objective

The overall objective of the Health Management Information System at the stage of development as a project was "... to design and develop a dynamic and responsive information system that would satisfy the information needs for strategic (policy) planning and management, and operational control functions of the Ministry (of Health) by providing different decision centres at various levels of the Ministry timely and relevant information at a minimal cost". (Ministry of Health, Malaysia, 1976a).

According to the Ministerial report, strategic planning has been defined as the process of deciding on the objectives of the Ministry, the changes in these objectives and policies which govern the acquisition, use and disposition of available resources.

Management control has been described in the report as involving decisions related to acquirement, and effective and efficient utilization of resources to achieve organizational objectives; operational control to decisions for carrying out tasks

adequately and economically.

Specific objectives of the HMIS Development Project were:-

1. To carry out a total systems study and develop a conceptual framework to identify different functional subsystems of the total system given the objectives and functions of the Ministry;
2. To identify information requirements, frequency and purpose of utilization and organizational level;
3. To design an effective and efficient information system that would generate, transmit, store, retrieve and process data thus providing the right information to the right person at the right time;
4. To identify appropriate technological data processing (hardware and software requirements) support required for proper functioning of the system;
5. To integrate different information subsystems to a total system, and test run and evaluate it in selected areas;
6. To develop a mechanism to make the designed system dynamic and responsive to changing needs; and
7. To establish a schedule for smooth implementation of the system on a national scale.

4.1.2. Methodology

This has included two aspects: Information Systems Development planning, and procedure.

4.1.2.1. Planning

Management has been described as a key element in any information system (Ministry of Health, Malaysia, 1976b). The Information Systems approach has been utilized for identifying and evaluating information flows associated with decision-making activities throughout the organization, and designing new ones when required.

The information systems process has been described as a set of activities encompassing the identification of information needs, specifying information requirements, locating data sources and designing information networks that effectively and efficiently match data sources with information requirements (Prince, 1975). Management requires information that may be provided by the information system but the function of the latter should be subordinate to the concept of management permeating the total system.

Working on the above premise, the Ministry recognized the need for collaboration between designers and users of the system, and that this collaborative effort could only be possible with top management support. In this context, a Steering Committee was established which was responsible for the Information Systems Development, and formulation of policies concerning the planning and co ordination of different aspects of the system.

The Steering Committee was headed by the Director-General of Health Services. Its members comprised the heads of technical

and administrative divisions of the Ministry, viz., Planning and Development, Health, Hospital, Dental, Training and Manpower, Pharmaceutical Services, and Services and Finance Divisions. The Director of Planning and Development Division served as the Steering Committee's Secretary. The organizational structure of the project is shown in Annex 1; the functions and responsibilities of the Steering Committee is shown in Annex 2.

To assist the Committee in its efforts, an Information Systems Development Group (ISDG) was established. Each divisional director/head has designated as his representative one staff member as a full-time member of the ISDG. The ISDG member was responsible for the development of each subsystem, working under the direct supervision of a team leader appointed by the Steering Committee. While the Committee provided top management support to the project through allocation of needed resources, giving guidance in the developmental efforts including critical reviews of activities undertaken and formulating recommendations based on the findings and proposals of ISDG, the latter was responsible for the technical aspects of the Information System Development. Under the direction of the team leader, the individual members contributed to the overall compatibility of individual efforts to project objectives and participated in an effective and efficient development of the HMIS. The ISDG members have collaborated in establishing the system framework, strategy for development to be followed, and identification of common concepts, definitions, etc. to facilitate system integration. The terms of reference and functions of the ISDG are shown in Annex 3.1 and 3.2 respectively.

Though the development of an information system through the HMIS Development Project has mainly been through the Government's own efforts, the World Health Organization has provided technical support for the purpose.

4.1.2.2. Procedure

The system procedure has included six phases: identification of system boundary, conceptual phase, situational analysis, system design, system development, and test run and evaluation.

4.1.2.2.1. System Boundary

This has been identified by determining the content of the system and placing limits on the subsystems under study. It has provided a better perspective for viewing the problem as a whole and projecting the proper relationships of the subsystems. For the Ministry, the system boundary has been defined in both spatial and sectoral terms. The information system has been developed to cater for both internal management of health services and external co ordination purposes. Spatially the system should cover both West and East Malaysia. Sectorally, the Ministry of Health is responsible for health services performance in both public and private sectors; hence the information system should cover the Ministry's functions related to both sectors. However, initial efforts have been directed to satisfy the Ministry's requirements for the public sector only.

4.1.2.2.2. Conceptual phase

This phase has involved specification of principles underlying the Information Systems Development process, establishing a framework plus guidelines for identifying different functional components for the Ministry. The conceptual phase has assisted in identifying information requirements for decision-making that were then matched with information sources to establish information flows. This phase has been a time-consuming activity in planning and designing the information system, but once accomplished facilitated completion of the rest of stages in the system procedure.

4.1.2.2.3. Systems analysis phase

This phase has essentially been an organization review carried out through a survey of the Ministry's functions, decision-making activities and information support at the time of study. The study has specified the information requirements for major decision-making activities throughout the Ministry, the availability and flow of the information. In short, the phase has identified:

1. Information available and needed;
2. Information not available but needed; and
3. Information available but not needed.

For the purpose of this treatise, the writer has not included a detailed description of the above phase in the development of information requirements for the Dental Subsystem. For the sake of simplicity and brevity, only the information available and needed in the design of reporting formats has been considered.

4.1.2.2.4. System design phase

This phase has involved two aspects: data development and communication design. During the situation analysis phase several networks of information flows have been considered and discussed with each division. These individual modules have been integrated and the best conceptual arrangement to serve the overall Ministry effectively and efficiently has been formulated, with primary consideration given to reducing delivery staff time in generation and transmission of data. According to the Ministerial report, existing technological support has not been a constraint (Ministry of Health, Malaysia, 1976c). The most appropriate technological support has been chosen after considering the requirements for each module and existing/potential constraints affecting each module.

4.1. 2.2.4.1. Data base development

In developing the data base attention has been given to consolidating the data requirements for information generation, rectifying discrepancies in data definitions used by different parts of the system, identifying frequencies of occurrence of the data elements, and relating the data elements to its information set. The reporting formats for generating and communicating data to predetermined levels have been designed for potential EDP usage. The forms designed for the Dental Subsystem have been the exception. Procedure for filling the forms and schedule of reporting have been specified in instruction manuals developed for the purpose.

4.1. 2.2.4.2. Communications design

This has essentially involved designing the information flow i.e. identifying data originating terminal, aggregation, reduction and transmission points, receiving terminals, and determination of storage, retrieval and processing requirements. In designing the communication system, permissible response time catered to information requests and timeliness of needed information have been considered. All these together have led to determining the best technological support required for data generation, processing, storage/retrieval and optimal utilization of manpower, machinery and money.

4.1.2.2.5. Systems development phase

This has essentially been a detailed system design phase which integrated the outputs of data development, communication design and technological master plan in creating a system to satisfy the Ministry's needs at all levels. In this phase, the theoretical 'Information System Design' has been simulated to determine the conformity in definition of terms, evaluate relationship between input documents and output reports, the redesigning of forms if need be, and evaluate information produced through the system. Manuals for data generation procedure, transmission and processing, storage and retrieval have been prepared and utilized.

Two forms of system control have been identified in this phase: operational control, and management control. The former concerns management of activities at all the peripheral levels where decisions are routine, repetitive and responsive to local on-going operational situations related

to service delivery. Management control, on the other hand, is non-routine, unpredictable, judgemental and intermittent, and based on information periodically abstracted from master files developed for operational control purposes. The integration of the two has led to the development of a theoretically feasible information system with necessary operating and procedural manuals and recommended technological support needed.

4.1.2.2.6. Test run and evaluation

After the theoretical design of the information system has been formulated, it has to be tested. This preimplementation phase has also been called the system debugging phase. Prior to start, evaluation criteria have been agreed upon, resources mobilized and procedures for the test run established. After completion, modification and improvements of the tested system design have been made. Once modified, a phased implementation plan was formulated, and an institutional structure developed compatible with the requirements of this design after the project has been terminated. The project manpower resources were then utilized in the institutionalization stage.

The HMIS Development Project and its processes and steps is shown in Fig. 25.

4.1.3. Project Schedule

The HMIS Development Project has been scheduled to run for a period of two years: the first year for design of the system and the second year for test run and evaluation. The project was due to start in January, 1976 and the tested HMIS was

supposed to be ready for phased implementation by early 1978. In reality, due to delay in the completion of the conceptual phase which subsequently affected the system analysis, design and development phases, the test run and evaluation phase was only carried out in 1978. Contrary to the one-year period scheduled for this last phase, the test run and evaluation took two years to complete. Phased implementation of the tested HMIS only commenced in March 1981.

4.1.4. Project Outputs

During the HMIS Development Project documents have been produced by the ISDG members as and when appropriate, and submitted to the Steering Committee for review. The documents have included the following, all with detailed procedures and findings:-

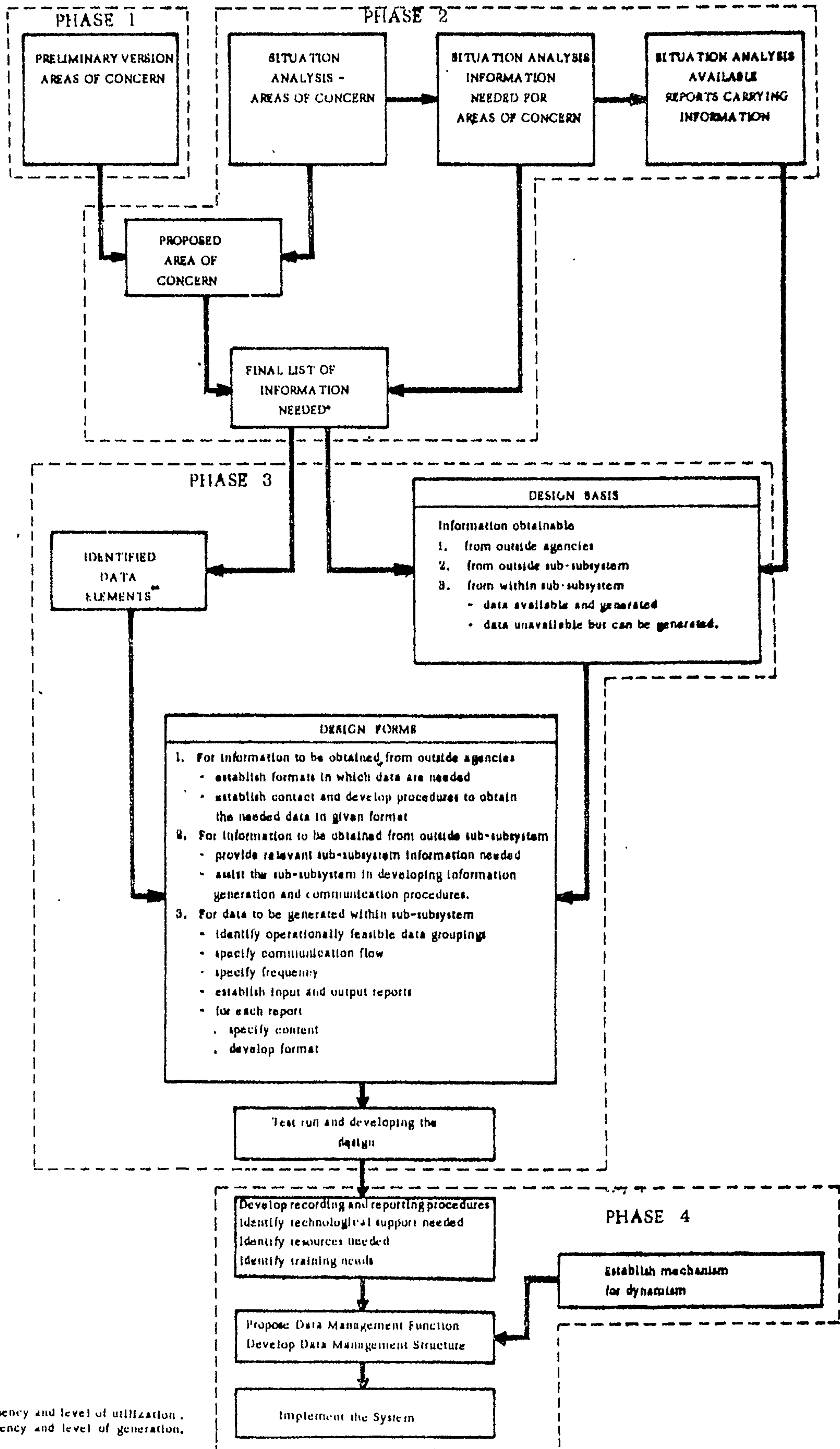
1. Report 1 : Conceptual Phase
2. Report 2 : Systems Analysis Phase
3. Report 3 : Systems Design Phase
4. Report 4 : Systems Development Phase
5. Report 5 : Test Run and Evaluation

4.1.5. Project Requirements

The project objectives were to be achieved in an effective and efficient way. Resources available within the Ministry have been fully utilized. The ISDG has proved an effective mechanism by which representative staff from divisions in the Ministry have been brought together to work intensively in developing the Health Management Information System.

HEALTH MANAGEMENT INFORMATION SYSTEMS
DEVELOPMENT PROJECT

Development Process and Steps



*Includes frequency and level of utilization.
**Includes frequency and level of generation.

Fig. 25

4.2. CONCEPTUAL PHASE

The conceptual phase has been concerned with formulation of principles governing the information system, and with the development of a basis for organizational study for the Ministry of Health (Ministry of Health, Malaysia, 1979a).

4.2.1. Formulation of Principles

According to the Ministerial report, the principles to be adhered to include the following:-

1. The information system that was to be developed had to suit the country's specific needs; no model external to the country situation was to be imposed;
2. Solutions were to avoid any prejudged and premature institutionalization of any aspect - manpower resources, EDP facilities, etc. for they provide self-perpetuation of dysfunctions within the system;
3. The technological, manpower requirements and data elements were to be the end products of the project and not be the constraints;
4. For the project itself, any flexible mechanism that could integrate needed resources, expertise and support to solve the problem would be acceptable provided the developmental efforts, process and outcome were not constrained by the mechanisms.

4.2.1.1. Principles for data base development

The terms 'data' and 'information' have been defined in Chapter 1. To recapitulate, 'data' are uninterpreted statement of facts; 'information' is data recorded, processed, reduced and presented in an understandable format for

meaningful interpretation. For further clarification the following example is given:

<u>Information</u>	<u>Data Elements</u>
Prevalence Rate	* Number of Cases * Relevant Population
Coverage	* Number of Cases Under Care * Number of Cases
Continuity of Care	* Number of Cases Under uninterrupted Case * Number of Cases Under Care

The relationship of data elements to the information set should be over the relevant denominator, time and space. For example, the number of school children given dental treatment (data element) divided by the denominator i.e. the number requiring treatment (data element) yields the coverage (information). The coverage may then be related to different years or different areas or states.

The project has aimed at minimizing information cost through effective and efficient data generation; and mechanisms for storage, retrieval and transmission of relevant information to the right person at the right time in the right format.

To achieve this the Ministry has been guided by 5 basic levels viz. efficacy, effectiveness, efficiency, equity and expectation achievement (Ministry of Health, Malaysia, 1979b). For the purpose of the project the following definitions have been used:

1. Efficacy - the intrinsic technical value of therapeutic, diagnostic, preventive or rehabilitative regimens as established through clinical trials;
2. Effectiveness - the application of efficacious modes of intervention for all those in population who can benefit from them;
3. Efficiency - the prudent and economical use of resources to effective interventions for eligible population;
4. Equity - the availability of appropriate and adequate care to needed population and right of access to care; and
5. Expectation achievement - the results achieved by the services in relation to targets and efforts expended.

In this respect, the data development efforts have emphasized purposeful selection of data, parsimony and simplicity, population and patients as the basic units, primacy of patients and service concerns, validity and reliability, confidentiality, and compatibility.

To summarise, the information system developed has to support managerial and technical functions of the Ministry. Contents of the information system have to be designed based on the question of who wants to know what and why. The data collection has to avoid imposing additional workload on operational units whose main concern is patient management. Finally, additional requirements for data classification and standardization has to be ensured in developing data generation activities.

4.2.1.2. Framework

The framework has been one of the more complicated elements of the information system development exercise, but it has been the foundation and its existence and influence has served to fulfil the stated objectives more than any other item in the project requirements.

The framework underlying the information system development efforts have been defined in terms of the relation between information, decision and action, areas of decision, and type of decision.

4.2.1.2.1. Information - decision - action

For the Ministry of Health, health services have been conceptualized into two distinct interrelated components: service delivery and service support subsystems. Service delivery concerns patient management, and service support with service management. The latter includes technology improvement and has three main functions, viz., strategic or policy planning, management control and operational control. Together with service delivery, viz., actual action or operations, a package for health services systems performances is formed.

Service delivery to the population has been taken as the end product of the Ministry's activities which contributes to its overall objective. Linkages among decisions and operations between and within a given echelon is shown in Fig. 26. At the peripheral level, a number of actions towards service delivery take place from or through a centre called the

'activity centre'. Associated with this actions are decisions made to ensure effective and efficient service performance. Decisions are made at the 'decision centre'. A 'functional unit' is an activity centre and its decision centre. For example, a school dental clinic can be taken as an activity centre with the main dental clinic as its decision centre. The two facilities constitute the functional unit. A 'management control centre' is also identified, which acts as a decision centre for a group of subordinate management control centres. For example, the State Dental Director is the decision centre for the main dental clinic while the National Director is the decision centre for the State Director, the subordinate management control centre.

An 'action subsystem' is the group of activity centres involved in the performance of different types of action but belonging to the same or different functional units. The activity centre can be part of more than one action subsystem. At a higher level, a 'decision subsystem' is the group of decision centres, and management control centres can be part of more than one decision subsystem.

An 'information subsystem' is one which consists of information generated and used in the action and decision subsystem. The relationship is therefore: information - decision - action.

MANAGEMENT INFORMATION SYSTEM

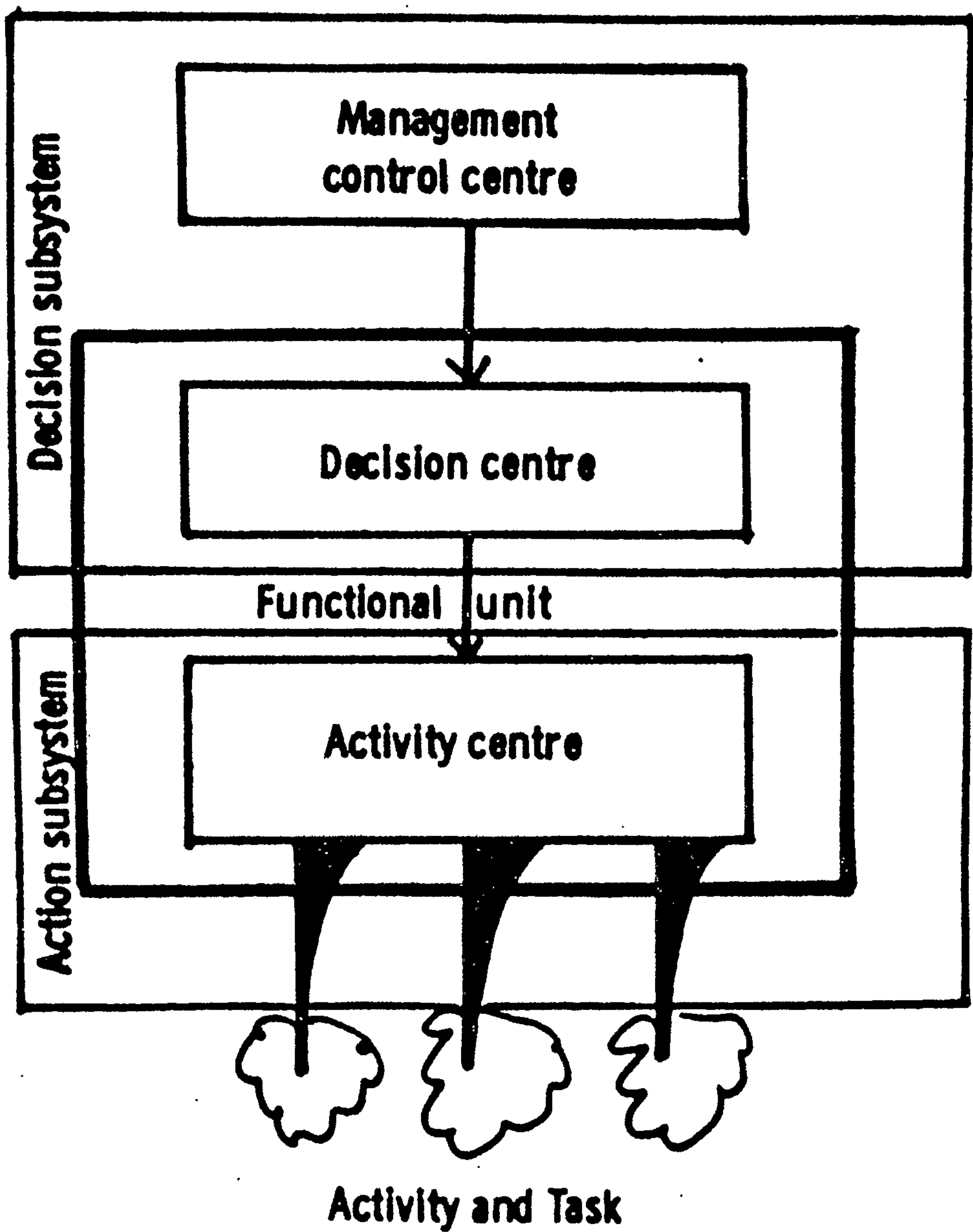


Fig. 26

(Source: Ministry of Health, Malaysia, 1979. Project for Health Management Information System Development (HMISD) Tech. Rep. No. 1, Conceptual Phase. In collaboration with WHO/WPRO. Manila, Philippines. P. 5).

4.2.1.2.2. Areas of decisions

Decisions are also made for different purposes: strategic planning, management control, and operational control (see Fig. 27). Associated with these three aspects, a number of action-oriented decisions are made through the different echelons of the Ministry's hierarchy. It has been assumed that there be no overlapping in the areas of concern. For example, decisions at the district level may be concerned with operational outputs from service delivery, at the state level with performance aspects, and at the federal level with effectiveness and efficiency aspects. However, the lower level decisions are inputs to the higher decision levels and vice versa.

4.2.1.2.3. Types of decision

There are two types: programmed (structured) decisions and non-programmed (unstructured) decisions. Programmed decisions are repetitive, routine and imply a definite procedure for handling them as they occur. Non-programmed decisions are made at the higher level of management and are novel, unstructured and consequential. Such a division implies that programmed decisions can be automated while non-programmed decisions cannot. A graphical representation is shown in Fig. 27.

4.2.2. Basis for Organizational Study

The objective of this step has been to develop a basis for an organizational study of the Ministry of Health with the utilization of the 'information system approach' perspective (Ministry of Health, Malaysia, 1979c).

MANAGEMENT INFORMATION SYSTEM

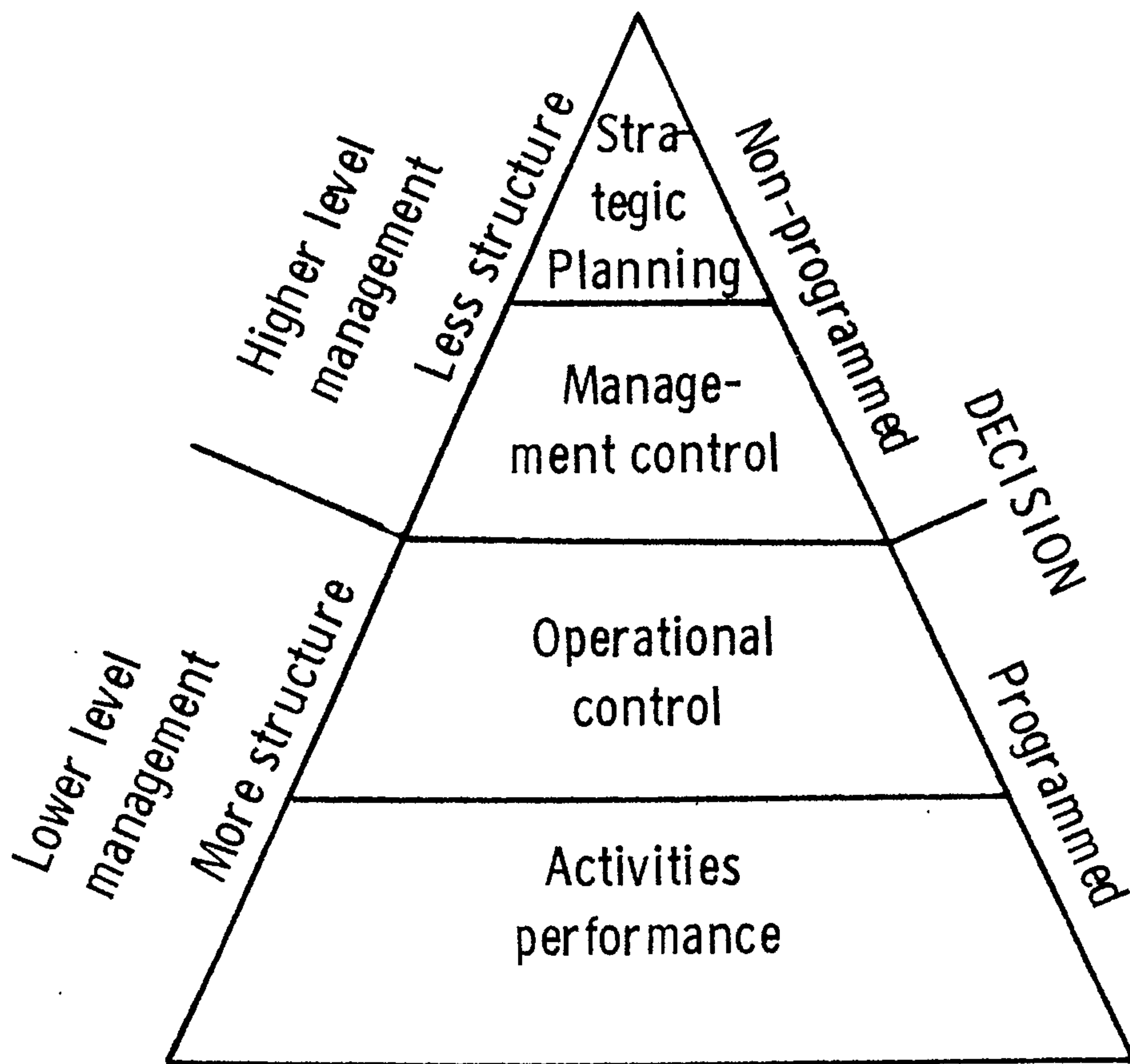


Fig. 27

(Source: Ministry of Health, Malaysia, 1979. Project for Health Management Information System Development (HMISD) Tech. Rep. No. 1, Conceptual Phase. In collaboration with WHO/WPRO. Manila, Philippines. P.9/10).

4.2.2.1. Approach

In an information system, data can be characterized in terms of what programme areas need them, for what purpose and frequency, and what complementary data are required for meaningful interpretation. It has been necessary to identify the levels and functions for each programme area as a basis for specifying information requirements. The function-data relationship is shown in Fig. 28.

The ISDG has defined the boundaries of the system and identified the functional components (subsystems). These subsystems have been further studied to isolate the lowest identifiable and distinct functional component (sub-subsystem). The lowest identifiable components have been used to specify the areas of concern. The following guidelines have been used:-

4.2.2.1.1. Guidelines for hierarchical identification of subsystems/ sub-subsystems

The subsystems have been identified up to that level in the functional hierarchy where it became the lowest specified aggregate of functional elements. It should be noted that the 'functional' approach and not a 'structural' one has been followed. The various divisions of the Ministry have no significance except for its relationship to different functional components.

FUNCTION-DATA RELATION

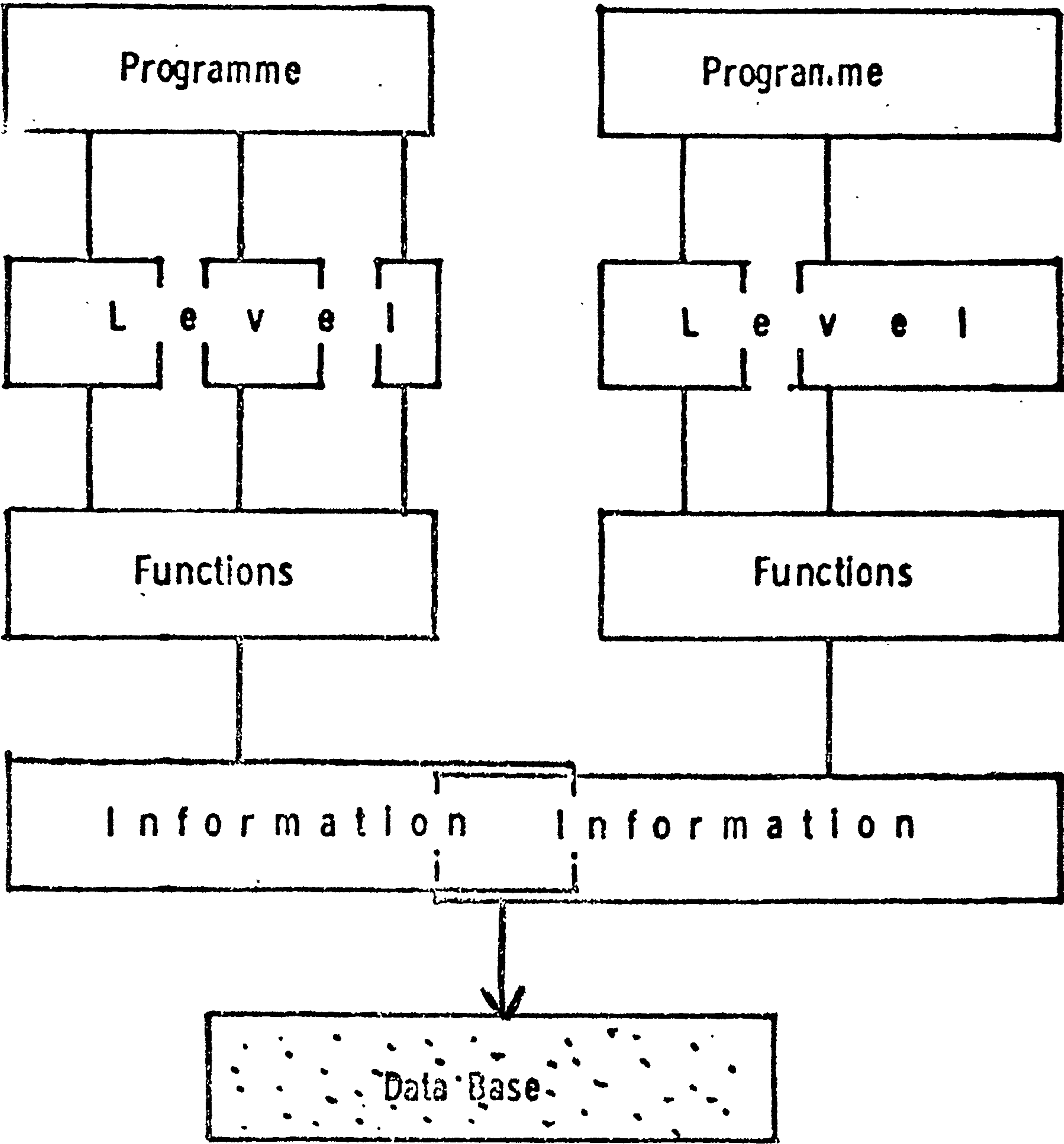


Fig. 28

(Source: Ministry of Health, Malaysia; 1979. Project for Health Management Information System Development (HMISD) Tech. Rep. No. 1, Conceptual Phase. In collaboration with WHO/WPRO. Manila, Philippines P. 17/18).

The following diagram has been utilized to illustrate the functional/structural relationship:

DIVISION	SUBSYSTEM				
	Medical Care	Health Care	Dental Care	Training	Supplies
Hospital	X				X
Health	X	X		X	X
Dental			X	X	X
Pharmacy	X	X	X		X
Training				X	X

A. Identification of subsystems

The following steps have been utilized in the process:-

1. Starting at the highest and most general echelon of authority, the objectives of the overall Health Ministry have been determined;
2. Looking at the lowest and most peripheral level, actual outputs of the health services system have been identified;
3. The objective of the Ministry in terms of selected actual outputs was then interpreted;
4. The contributors to programme inputs were then identified. These have been referred to resource inputs; and
5. Contributors possibly existing within the Ministry and subscribing to the above resource areas have also been identified.

The above steps when applied have shown that the Ministry's objectives were being achieved through three programme areas

i.e. health, medical and dental care. These have been the three subsystems identified. Step 4 has shown that there were four resource areas - manpower, finance, supplies, and facilities. The manpower area has been further subdivided into two distinct components: maintenance of manpower or personnel, and development of manpower or training. The following have thus been identified as the resource input areas: personnel, finance, supplies, facilities, and training. Step 5 has shown that one subsystem i.e. research contributes indirectly through improved technology to the Ministry's overall objective.

Thus nine subsystems have been identified to express the Ministry of Health functions:

- | | | |
|-----------------|---|------------------------|
| 1. Health |) | |
| |) | |
| 2. Dental Care |) | - Programme Subsystem |
| |) | |
| 3. Medical Care |) | |
| |) | |
| 4. Personnel |) | |
| |) | |
| 5. Finance |) | |
| |) | |
| 6. Supplies |) | - Resource Subsystem |
| |) | |
| 7. Facilities |) | |
| |) | |
| 8. Training |) | |
| |) | |
| 9. Research |) | - Technology Subsystem |

B. Identification of sub-subsystems

The sub-subsystems have been identified using the following steps:

1. Identification of the subsystem objective consistent with the Ministry's objective;
2. Listing of organizational subdivisions of each subsystem e.g. Epidemiology, Maternal Child Health Care under Health Subsystem, Personal Dental Care under Dental Subsystem, Outpatient and Inpatient Care under Medical Subsystem, etc;
3. Listing of the programme functions of these subdivisions;
4. Identification of subprogrammes by splitting organizational divisions into functional components and specifying objectives of the subprogramme in relation to the objective of each subsystem;
5. Separation of these subprogrammes which directly contribute to the output of the parent programme subsystem. Generally these are special delivery subprogrammes or sub-subsystems; and
6. Classification of the remaining subdivisions whose function provide support and contribute indirectly to the output of the service delivery sub-subsystem e.g. laboratory and radiology sub-subsystems under Medical Care Subsystem.

The sub-subsystems are listed in pages 114 and 115. The sub-subsystems which together form the functional components of the Ministry of Health are shown in Fig. 29.

Functional subsystem	Functional sub-subsystem	Category
<u>Programme Subsystems</u>		
1. Health	1. Maternal care	Service delivery
	2. Child care	" "
	3. Family planning	" "
	4. School health	" "
	5. Food sanitation	" "
	6. General sanitation	" "
	7. Filariasis control	" "
	8. Disease control and international health	" "
	9. Vector control	" "
	10. Occupational health	" "
	11. Malaria eradication	" "
	12. Leprosy control	" "
	13. Tuberculosis control	" "
	14. Health education	Service support
	15. Applied food and nutrition	" "
	16. Epidemiology	" "
2. Medical care	17. Outpatient care	Service delivery
	18. Inpatient care	" "
	19. Laboratory (including blood bank and mortuary)	Service support
	20. Physiotherapy	" "
	21. Dietary services	" "
	22. Laundry services	" "
	23. Anaesthesia	" "

Functional subsystem	Functional sub-subsystem	Category
3. Dental	24. Ambulance	Service support
	25. Central supply sterilization Department (CSSD)	" "
	26. Radiology	" "
	27. Personal dental care	Service delivery
	28. Flouridation	" "
<u>Resources Subsystems</u>		
4. Supplies	29. Quality control	Programme support
	30. Regulatory	" "
	31. Supply	" "
5. Training	32. Technology for training	" "
	33. Training of manpower	" "
6. Finance	34. Budget	" "
	35. General finance	" "
7. Personnel	36. Manpower supply	" "
	37. Manpower maintenance	" "
8. Facilities	38. Physical facilities	" "
9. Research	To be determined.	

Note: (28) has since been amended to
"Preventive Dental Care"

Figure 29: Subsystems and Sub-subsystems of the Ministry of Health

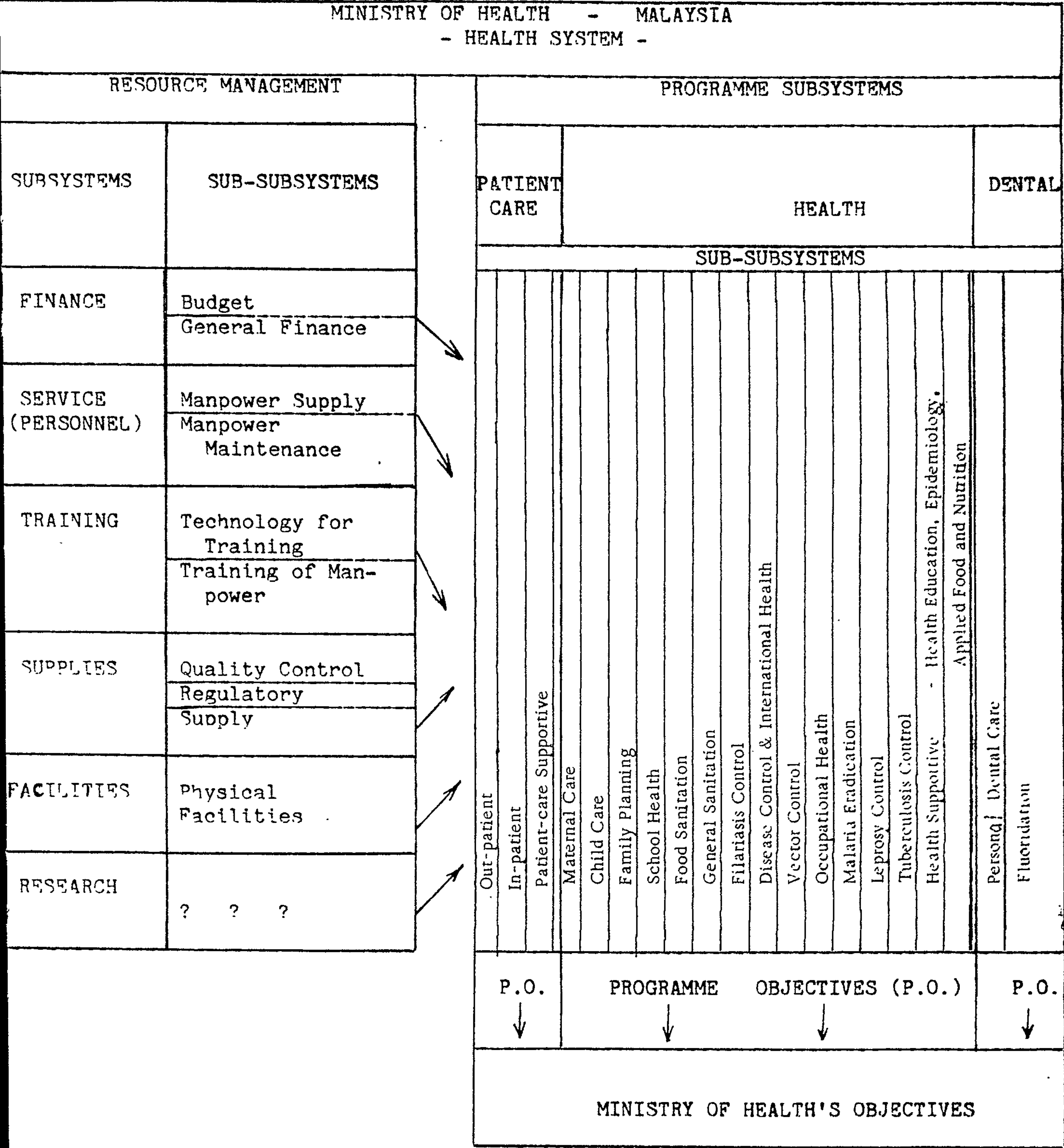


Fig. 29

4.2.2.1.2. Guidelines for identification of functions and associated areas of concern

The objective of this stage was to obtain a preliminary set of areas of concern at different levels of the Ministry for various programmes and different managerial functions. Each of the sub-subsystem, be they resource or programme, has certain managerial functions identified as follows: planning, programme/budgeting, implementation (monitoring or control), evaluation and co ordination. The levels for determining these functions vary from programme to programme. They have been identified as national, state, district, unit (eg. hospitals, main dental clinics), sub-unit (eg. school dental clinic) and sub-subunit (eg. wards in hospitals, etc). A table for identifying the subsystem information development framework is shown in Fig. 30. Samples of decision levels, decision areas and associated areas of concern are given in pages 119 and 120.

4.2.2.2. Outputs

In the conceptual phase, the subsystem and sub-subsystems have been identified, and samples of the results for different programme areas as seen by the programme managers/divisional directors have been given. The Directors with their programme managers have used these results to identify the information needed, designation of person at a given echelon needing that information, and frequency with which they are needed.

SUBSYSTEM DEVELOPMENT
FRAMEWORK FOR INFORMATION

For each of the sub-subsystem identified, the following table should be established:

(I) Sub-subsystem _____

Level echelon (2)	Functions (3)	Concerns (4)	Information required (5)	Individual requiring information (6)	Frequency at which required (7)

Fig. 30

SAMPLES OF DECISION LEVELS, DECISION AREAS AND ASSOCIATED AREAS OF
CONCERN - HEALTH SERVICES PROGRAMME

Decision Centre/Level	Decision Area	Areas of Concern
District	◦ Management control	Operational target setting Resource distribution and delivery to units Evaluation - sectoral achievement - spatial achievement - selectivity - procedural efficiency Feedback
	◦ Operational control	Quality of care - technical content
Unit	◦ Operational control	Penetration - sectoral - spatial Quality of care - behavioural Diagnosis
Sub-unit	◦ Patient management	Application of task

4.3. THE DENTAL SUBSYSTEM

Introduction

In this section the writer has attempted to describe the Personal Dental Care Sub-subsystem of the Dental Subsystem. - As noted in Section 4.2, Fluoridation has been listed as the other sub-subsystem. This has since been amended to Preventive Dental Care Sub-subsystem comprising the Fluoridation plus another component i.e. Dental Health Education. Although reporting formats have been designed for the latter, they have not been formally included in the Dental Subsystem; hence the Preventive component of the sub-system has not been described.

The Dental Subsystem has also been called the Dental Health Information System (DHIS); both terms have been used by the writer in the subsequent sections. The overall objectives of the DHIS have been described, followed by a brief discussion on the framework and system description. The objective of the Personal Dental Care Sub-subsystem has also been given:

In this section the writer has also discussed the summary of working papers utilized in 1977 to derive the information content of the programme subsystem. The final product as of 1981 has been illustrated as contained in the reporting formats designed. A summary of contents of the manual for the Personal Dental Care Sub-subsystem has been included.

4.3.1. Dental Health Information System Objectives

According to a ministerial report (Ministry of Health, Malaysia, 1981) the DHIS has been established to achieve the following objectives:

1. Assist dental planners and administrators to determine future requirements and evaluate past performances of the

dental services;

2. Facilitate the establishment and revision, if necessary, of the standards and norms for management of dental health services;
3. Serve as a basis for the monitoring and control of and assessing the effectiveness of dental care service delivery system; and
4. Establish a standardized reporting system on dental care such that expansion and evaluation of the service management can be made.

All the above apply to the **Personal** Dental Care Sub-subsystem in achieving its ultimate objective: to provide maximum coverage of the population with the highest quality of personal dental care.

4.3.2. System Framework

1. The DHIS, as a component of the HMIS, will interact with the other information subsystems to generate information that will provide a more comprehensive view of the Dental Care delivery system.
2. The DHIS will provide information to dental personnel at the various administrative levels. These levels include: National, State, Regional and Unit Levels.
3. Under the DHIS reporting system, data are generated at the peripheral dental unit level, aggregated, compiled and transmitted in the reporting formats to the next higher level.

4.3.3. System Description

The system capabilities include:

1. Generation of all information necessary for measurement of performance to form the basis of management at the different operational unit levels.
2. Generation of all management reports for use to subscribed users on a timely basis.
3. Interaction with the other information subsystems to generate integrated reports for management use.
4. Flexibility to allow for and accommodate any additional requirement that may be necessary after a certain period.

4.3.4. Derivation of Information Content

The information content of the programme sub-subsystem has been worked out by the Dental ISDG member in 1977. Five working papers called Documents A,B,C,D and E have been utilized for this purpose. The writer has not described the first three documents; they were used during the situational analysis phase when the different categories of dental personnel at the various levels of service delivery were first consulted to determine their information requirements. Documents D and E have been discussed. These two documents comprise the list of data elements from which the pretested information output has been derived.

4.3.4.1. Document D

This document consists of the description of data elements and the level of generation (refer to Annex 4.1 P.226-231). As can be seen, 92 data elements have been identified at this stage. They include total and first attendances by type of

treatment and type of target/age group, data on population, facilities especially the school dental service, workload by category of staff and items of care, and other miscellaneous items. The level of generation include three aspects: frequency, type of dental personnel and type of facility. The frequency of generation have included monthly or annually; the dental personnel have been identified as the Dental Nurse (DN), Dental Officer (DO), Dental (Oral) Specialist (DS), the Orthodontist, and the Dental Technician (DT). The service delivery points have included all the types of dental clinics fully described in Chapter 3.

4.3.4.2. Document E

This document essentially describes the information output derived from the data elements listed in Document D (refer to Annex 4.2. P.232-236). Related data elements in the latter document have been aggregated and fitted into its information set. For example data elements No. 1-14 have been aggregated to yield the total attendances by type of treatment - the information set or output.

In Document E the level requiring the derived information has been identified at the District, State and National levels to be used by the managers concerned with dental and related health care service delivery. The latter have included, at the District level, the Senior Dental Officer (SDO) and the Dental Officer-in-charge (DOY/M). At the State level they have included the State Dental Director (P-PPN) and Chief Medical Health Officer (CMHO). At the National level: the National Dental Director (P-PPM), the Director of Planning

and Development Division (P-PP), Director of Pharmaceutical Services (P-PKU), and the Deputy Secretary-General for Finance (KPSU-B). The frequency with which the information is required varies from monthly to once in 5 years when the next Malaysia Plan is to be formulated.

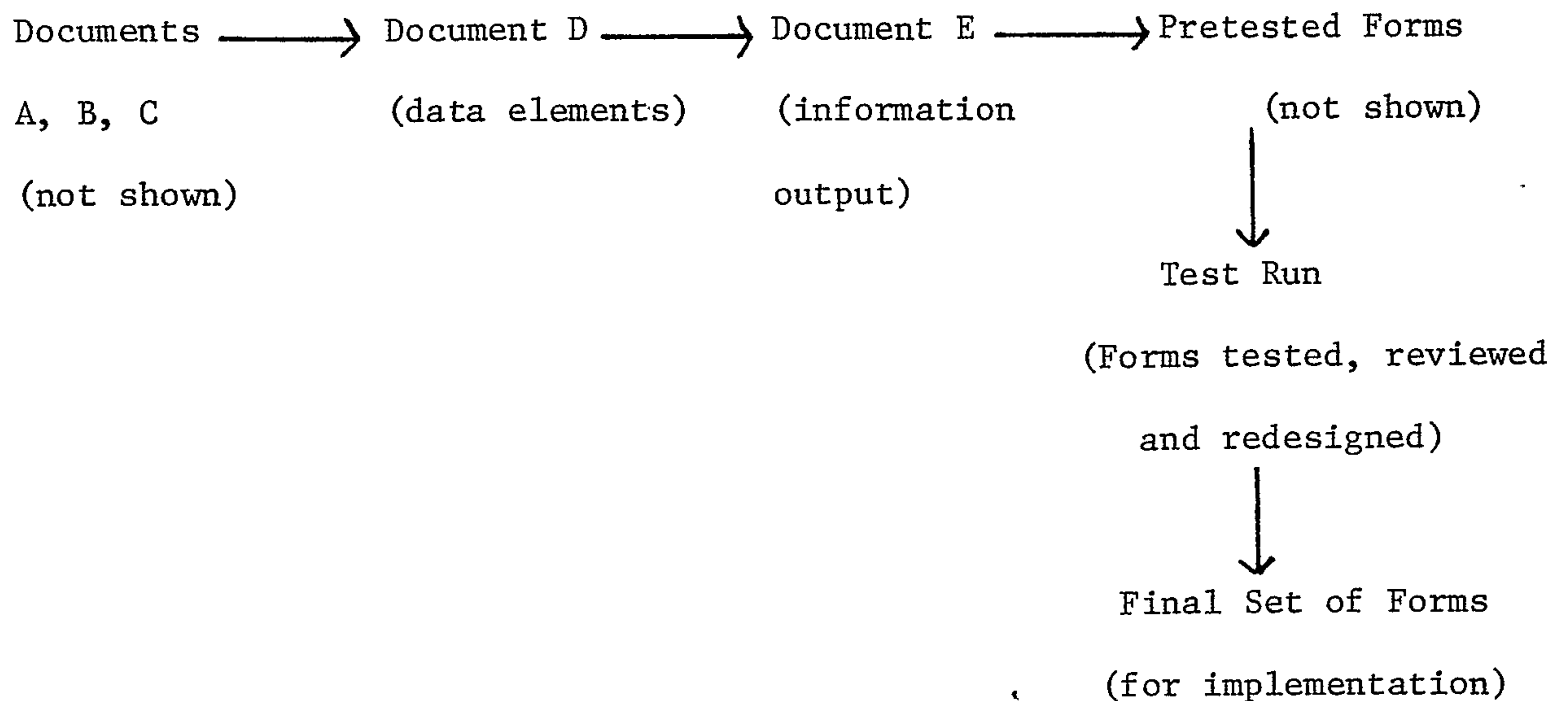
It can be seen that by studying both documents, some of the data elements in Document D have not been used in deriving the information output in Document E. For example, data element No. 55 (Document D P.229)- the total number of first attendances among farmers, fishermen, etc., data elements on population (No. 56-61), defaulters (No. 83), complaints (No. 84-86) and registered dentists (No. 88-89): all these have been excluded in the derivation of information output in Document E. This has meant that the information was not being captured in the formats designed for the Programme subsystem at that time.

The information output from Document E was utilized in the design of formats to be tested. During the test run phase the formats were redesigned, modified and improved, and the final, tested formats produced for implementation. In this thesis the writer has not shown the pretested formats including those reviewed during the test run phase. Only the final sets have been described and illustrated.

The steps taken in deriving the information content of the Dental Subsystem are shown in Fig. 31.

Fig. 31: Steps taken in Derivation of Dental Subsystem Information

Content



4.3.4.3. Reporting formats for Personal Dental Care Sub-subsystem

The set of formats illustrated in this work has been those that have been finalized prior to implementation (refer to Annex 5 P.237-254). 18 formats have been designed.

The formats consist of 3 basic sets:

1. The Basic Documents or Registers
2. The Daily Summaries
3. The Reporting Formats

It should be mentioned that the source documents or treatment cards have not been designed by the HMIS. Each set has been assigned a code number eg. the Basic Documents with the number 1, the daily summaries with the number 3, and the reporting formats the number 2. Code initials have also been used to identify the subsystem i.e. PG for Pergigian or Dental.

There are 3 basic documents: the basic patient register, (PG 101), the continuous care register for the orthodontist (PG 102) and the daily record for the Dental Technician (PG 103).

The daily summaries comprise 4 forms: Daily Summaries for attendances and items of care for preschool children (PG 301), for primary, secondary school children, antenatal mothers and adults (PG 302); the daily summary of attendances and items of care provided by the Orthodontist (PG 303) and by the Dental (Oral) Specialist (PG 304). The first two forms are used by the Dental Nurse and Dental Officer, the other two by the specialists mentioned.

As can be seen from the forms illustrated, the attendance factor in the daily summaries have 4 variables: ethnic group, category of treatment, category of patient and type of attendance new and total (new plus repeat). The types of treatment have also been itemized according to the needs of the personnel delivering them.

The third set of documents designed, the reporting formats, have been designated the codes PG 201-211. The forms PG 201 - 205 report the monthly workload of the Dental Nurse, Dental Officer, Orthodontist, Dental Specialist and Dental Technician respectively. The individual reports are aggregated into forms PG 206 - 210, the same forms being used either at the District or State levels. The last form, PG 211, is the Annual Report on Population Coverage, School Coverage and Average Performance of Staff to be filled by

each State Dental Director at the end of each year. A schematic representation of the forms designed for the Dental Subsystem is shown in Fig. 32.

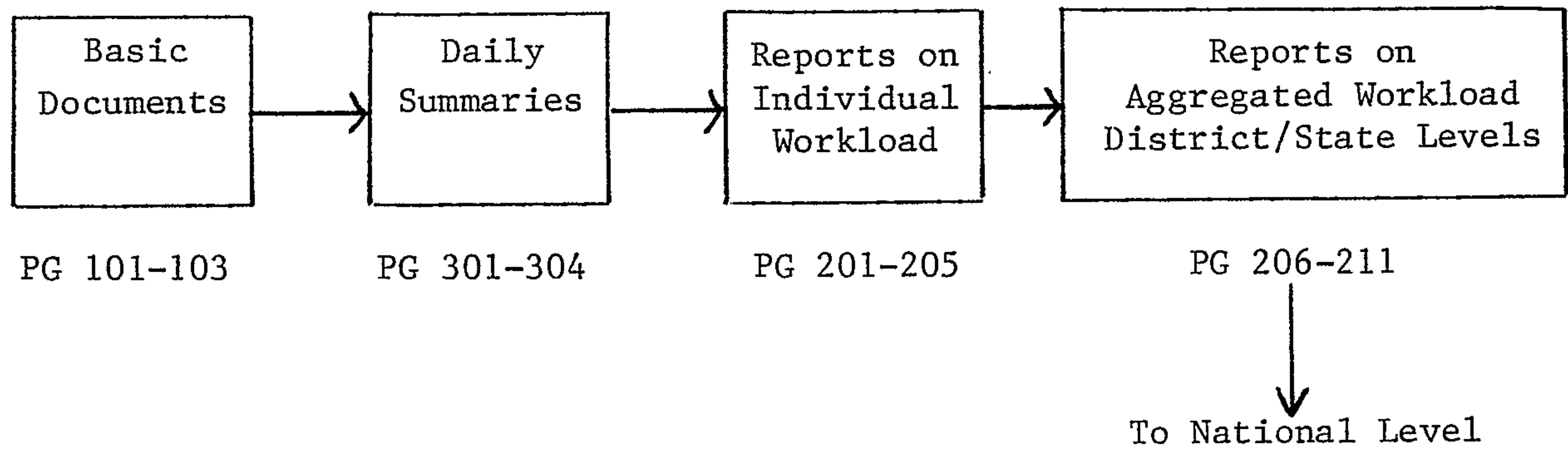


Fig. 32: Forms designed for Dental Subsystem

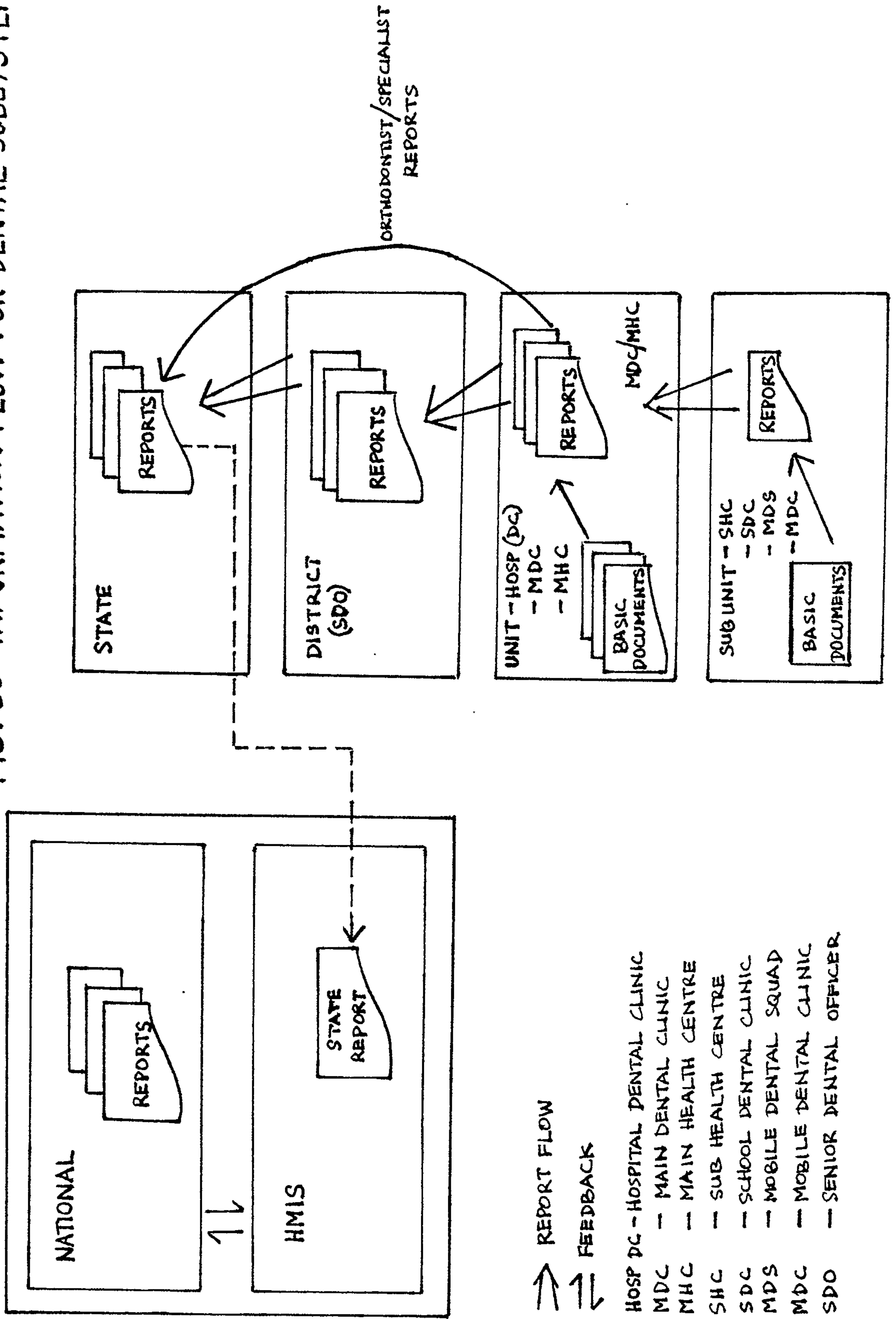
4.3.4.4. Dental Care Information System Manual

This book has been produced to guide the various categories of staff on the use and purpose of the forms described; detailed instructions are given on who is to fill which form and when. A list of definitions of terms used in the Dental Subsystem is also given. Instructions are also given on requirements for submission of reports from the most peripheral level to district, state and national levels. For further clarification, a diagram on the communication flow has been included (refer to Fig. 33).

4.3.4.5. Processing

The Dental Subsystem is manually based: all information collected by the basic documents and aggregated reports are ultimately sent to the national level to be manually compiled, processed, stored, retrieved and disseminated. There may be an indication in the future, with development of the other components of the subsystem more information will be generated. This may

FIG. 33: INFORMATION FLOW FOR DENTAL SUBSYSTEM



necessitate redesigning of the forms for potential EDP method of processing. With the establishment of linkages with the other computer based information subsystems the need may arise to provide integration of the Dental Subsystem with the total system through the same method of data processing.

4.4 TEST RUN AND EVALUATION

Introduction

This preimplementation phase took place in the State of Penang and was carried out in 1978-1980, thus taking two years to complete instead of the scheduled one year period. A report was released (Ministry of Health, Malaysia, 1980a) on the test run and evaluation of all subsystems except the Personnel, Facilities, Finance and Supply Subsystems. The objectives, preparation, outcome and recommendations of the test run have been included in the report.

4.4.1. Objectives of the Test Run

1. To test the applicability of the basic documents in the field in order to find out if the required data elements could be obtained from the existing source documents, and to determine if there was need to modify the latter or design new ones;
2. To test out the instruction manuals under field conditions to determine the clarity of instructions and whether there was need to amend them;
3. To identify problems associated with a 'non-parallel' run i.e. complete switch made to the new recording system without using the old one at the same time; associated problems were to be solved before they undermined the confidence of the managerial, supervisory and operational staff on the new system;

4. To identify the training needs, the preferred methods and to work out a training strategy for long term use;
5. To identify resource requirements (manpower, finance, supplies, etc.) by types and quantity to ensure successful implementation of the system;
6. To test and redesign, if necessary, the communication flow.

4.4.2. Preparation for Test Run

This has been done with the establishment of a State Level Co-ordinator and a Focal Group in the test run area, and development of the training strategy.

4.4.2.1. State Level Co-ordinator

As overall technical administrative head of Health and Medical Services for State, the Chief Medical Health Officer (CMHO) of Penang was, in this case, the State Level Co-ordinator whose main function was to ensure the smooth implementation of the test run for the whole information system. Other functions of the SLC have included providing liaison between ISDG members and State Officers involved in the test run, release of staff for training, provision of transport, clerical and printing facilities, and purchase and supply of necessary stationery for the ISDG members.

4.4.2.2. Focal Group

The Focal Group comprised the CMHO, the State Medical Officer for Health, Medical Superintendent and State Dental Director. For the Dental Subsystem, the latter has been responsible for selection of local staff for training and organization of training at the ground level. The State Dental Director acted as counterpart to the Dental ISDG member: reporting to the latter any changes required to formats and manuals, informing the member on any ad hoc requests from staff for new information, ensuring the discontinuation of old record books and registers replaced by the new system, and transmission of decisions/solutions to problems encountered in the day-to-day running of the test run operation.

4.4.2.3. Training Strategy

For the Dental Subsystem, the training strategy, including content and method, has been developed by the Dental ISDG member. The member was responsible for locating the most suitable venue for training and carrying out the actual training of the supervisory staff. Training has been carried out centrally at a Main Dental Clinic; the supervisory staff have included the Senior Dental Officer, State Dental Matron, Dental Sisters, the Orthodontist, Dental Specialists and Senior Dental Technicians. The trained supervisory staff in turn trained the operational staff. The forms and manuals had been sent one week prior to training so that the trainees were able to study them and seek clarification on doubts and problems during the training sessions. Training has been in the form of lectures; the following aspects were highlighted; purpose and value of each form, need for accurate recording

and identification of sources of the data elements. This has been followed by practicals in the form of mock entry of data into the forms, during which time the trainees were taught the proper use of the instruction manuals.

The ultimate objective was to utilize the trained staff from Penang to assist in training of personnel in other parts of the country during the phased implementation period. This multiplier effect of the training strategy was hoped to ultimately result in the training of all staff in the country within the shortest time possible.

4.4.3. Outcome of the Test Run

According to the Ministerial report on the test run (Ministry of Health, Malaysia, 1980b) all source documents (treatment cards) were checked by the Dental ISDG member; it has been found that all data elements were available for filling the basic documents. The main problem encountered was wrong interpretation of terms used in the Dental Subsystem which resulted in wrong entries. As far as the reporting formats were concerned there was some difficulty in understanding the communication flow i.e. proper identification of levels for submission of the reports. There were also complaints about the extra workload involved in filling the forms and frequent redesigning of the forms during the test run phase.

4.4.3.1. Probable causes of the problems

1. The operational staff required more time to familiarize themselves with the new recording procedure of the total information system;
2. More information being generated resulting in the extra workload;
3. Inadequate supervision by the trained supervisory staff;
4. Insufficient training especially emphasis on importance of understanding the information flow;
5. Lack of a standard list of definition of terms at the time to guide the staff in filling the forms; and
6. Lack of motivation on the part of some of the operational staff.

4.4.3.2. Suggested solutions

1. The problem of additional workload encountered for the total system could have been solved by increasing manpower, and reducing the amount of information collected by reviewing and simplifying the system. For the latter, two WHO consultants were to be assigned to review the system prior to implementation;
2. The operational and supervisory staff were to be motivated to appreciate the importance of the information system in order to improve the quality of data collected;
3. A more effective supervisory mechanism was to be developed to monitor training of all operational staff;
4. The training strategy was to be reviewed and improved with respect to duration, method, scope and depth of training; and
5. Revision of formats and instructions during the test run should have been kept to a minimum.

4.4.4. Recommendation

Compared to the other Subsystems, the Dental Subsystem fared better during the test run phase. Fewer problems were encountered in the Dental Subsystem. This could have been due to the fact that for the Dental Subsystem only one programme sub-subsystem was tested at the time. Hence relatively less data was being generated. The forms designed for the new system did not differ much from that of the old system and both supervisory and operational staff required less time for familiarizing themselves with the new system. The dental forms were not as yet designed for EDP method of processing and hence no EDP support was required.

After review, the dental formats were pared down to the 18 forms described in Section 4.3.4.3; minor changes were made in the redesign. There were also minor modifications made in the instruction manuals: the definitions of terms used were clarified and the information flow improved.

Despite the many problems encountered by all the subsystems, the Steering Committee agreed during a meeting held in June 1980 to proceed with the implementation of the total HMIS (Ministry of Health, Malaysia, 1980c). The HMIS Development Project was terminated and institutionalized. The institutionalization of the HMIS was carried out by merging the HMIS activity with the in-built structure and by establishing a permanent central unit called the Information and Documentation System Unit (IDS). This establishment serves the total information system.

4.4.4.1. Components and functions of the IDS

4.4.4.1.1. Development Section

1. Implementation of HMIS;
2. Development of other components of HMIS;
3. Review and revision of data and information generation systems;
4. Monitoring utilization of information and their appropriateness in management;
5. Training of supervisors and managers in information usage; and
6. Establishing inter and intra linkages with other information systems both within and outside the Ministry.

4.4.4.1.2. Information and EDP Section

1. Collect, co-ordinate and process data;
2. Produce tables and conduct statistical analyses; and
3. Store and retrieve information.

4.4.4.1.3. Documentation Section

1. Cataloguing of available information;
2. Serve as repository for relevant documents, research papers, circulars and directives;
3. Production of annual reports and other relevant reports;
4. Dissemination and transmission of information; and
5. Maintenance of the Ministry of Health's "Operations Room" where information on the Ministry's activities and performance are displayed and updated periodically.

4.4.4.1.4. Health service research section

1. Design and carrying out all epidemiological surveys, special studies, etc. as and when indicated; and
2. Provision of advisory services on statistical matters to all the functional divisions of the Ministry.

The various sections of the IDS were to be developed in phases, depending on the rate of expansion and implementation of HMIS to other states, and on the extent of development issues involved. Top priority has been given to the task of fully developing the Development Section. The organization and structure of the IDS Unit is shown in Annex 6.1.

4.4.4.2. Manpower support

It has been estimated that about 100 types of reports from states fully operational with HMIS will be forthcoming to the IDS Unit for processing, compilation and analysis. The minimum number and type of staff required for the Unit is shown in Annex 6.2. It can be seen that many posts, especially those for statisticians and systems analysts, have yet to be filled.

After termination of the HMIS Development Project, the ISDG member for Dental has been absorbed into the IDS Unit and now holds the post of Dental Officer in the Development section. The Dental Officer has been fully involved with the phased implementation of the Dental Subsystem to the other states. Since the other sections of IDS have not been fully established, the Dental Officer has also performed functions assigned to those sections e.g. collection and co ordination of data

manually, production of tables, analyses and reports, and updating the information on dental services in the Ministry's Operations Room. Throughout 1981, reports have been received monthly from Penang and the Dental Officer has been involved in further compiling, checking and validating them.

4.5. IMPLEMENTATION OF THE DENTAL SUBSYSTEM

The phased implementation of the Dental Subsystem in Peninsular Malaysia occurred in 1981-1982. A master plan for implementing the total HMIS has been drawn up. The writer has used the plan to describe the schedule of tasks assigned, and the actual events that have taken place in the implementation of the Dental Subsystem.

4.5.1. Organization at the National Level

The Dental Officer in the Development Section of the IDS Unit has been involved in the following activities prior to implementation:-

1. Production of training forms and manuals;
2. Development of training strategy; drawing up the training schedule, determining duration and method of training and sequence of states to be trained; and
3. Actual training and implementation including arrangement for relief of trained staff from Penang to assist in the training.

The concept of a Gantt chart was utilized in drawing up the master plan for the implementation process. The Gantt chart has proved useful since it has shown overlap of tasks and could be used to develop manpower estimates and schedules

(Thompson, Handleman, 1978a). It has also provided a certain amount of flexibility in the schedule and has accommodated change better.

The master plan is shown in Annex 7. As can be seen from the chart, four major tasks were to be accomplished: meeting of the State Directors involved, preparation of documents for training, the actual training, and provision of organization support. The list of detailed tasks has been described in the chart.

The northern states of Perlis, Kedah and Perak were scheduled for training and implementation during the first phase. Being closest to the state of Penang (refer to regional map of Peninsular Malaysia in Fig. 34) these states have been chosen since it facilitates the release of trained staff from Penang to assist in the training.

The first state to be trained was Kedah. Prior to training the State Dental Director was contacted to set the time and place for training and release of staff involved. Before training commenced, the training documents and manuals were printed and sent to the state. The training strategy was similar to that used in Penang during the test run. In Kedah training took place in two centres, each site corresponding to where a Senior Dental Officer has been posted. This was done so that the SDOs could be utilized to supervise training for regions within the state. The centres have also been identified as sites for submission and compilation of reports for the state. This same strategy has been employed for Perlis and Perak.

PENINSULAR MALAYSIA

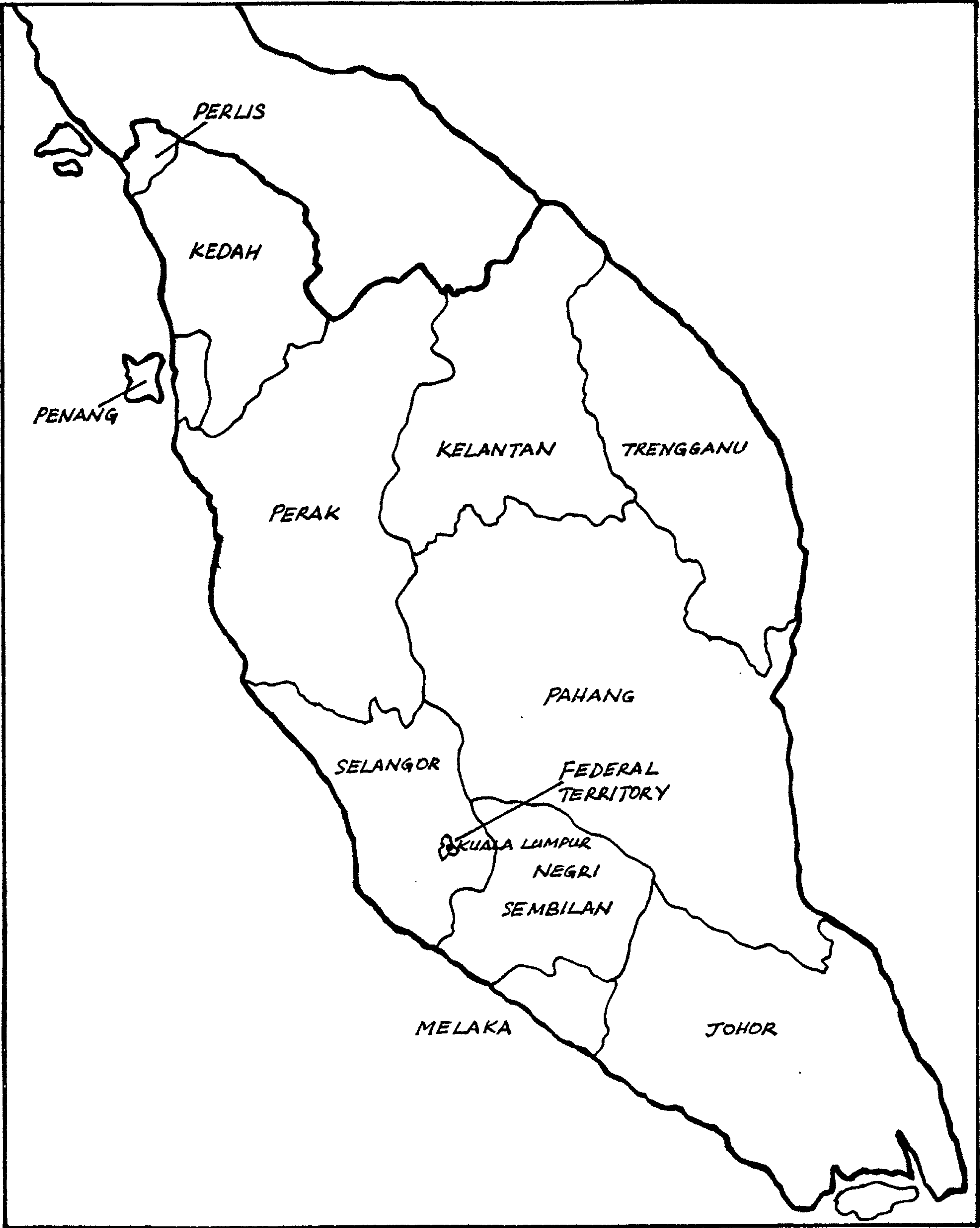


Fig. 34

The Dental Officer from IDS trained both supervisory and operational staff, assisted by the trained staff from Penang. After completion of training, the Dental Officer made periodic checks to ensure that the three states were fully conversant with the new system procedures; problems identified during this period were solved before actual implementation. The states were allowed to carry out a 'parallel run': both old and new reporting systems were used for a period of two months before a complete switch was made to the new system. By the end of 1981 all three states were fully operational with the new information system.

Although the remaining states of Peninsular Malaysia were scheduled to be trained in 1982, there was a request from the National Dental Director to speed up the process. Since the IDS Unit could not cope with the production of documents required for distribution prior to training, to meet this request help was elicited from the Dental Training School in Penang in the printing of the documents and manuals. There was a change in training strategy: instead of training state by state, the three states on the East Coast (Kelantan, Trengganu, Pahang) were trained at one regional centre in the Trengganu state capital in January, 1982. The second training session took place a week later in Kuala Lumpur for the remaining states of Selangor, Melaka, Johor, Negri Sembilan and the Federal Territory. These states are scheduled to be fully operational by mid-1982. At the time of writing phased implementation is being carried out in the two states of East Malaysia, Sabah and Sarawak.

It should be mentioned that all forms and instruction manuals were to be translated into the National Language or Bahasa Malaysia. All states are expected to ultimately use these translated forms for recording all data.

CONCLUSION

In this chapter the writer has described the development and implementation of HMIS in Malaysia. The protocol and conceptual phase has been discussed to provide the reader with a picture of the overall development of the total information system. The development and design phase, test run and implementation phases have been described as pertaining to the Dental Subsystem. The termination of the HMIS Development Project and its institutionalization with the establishment of the IDS Unit has also been discussed. The central unit has been involved in the further development of health indicators of which the dental component has been described in the following chapter.

5. CONTINUED DEVELOPMENT OF DENTAL HEALTH INDICATORS

INTRODUCTION

Since the completion of the first phase of implementation of the Dental Health Information system in June, 1981, the Dental Officer assigned to the Information and Documentation System Unit has been involved in the continued development of health indicators. For the Dental Subsystem, the indicators developed have been based on the objective and information content of the Personal Dental Care Programme Sub-subsystem.

In the first section of this chapter, the writer has briefly dealt with the theoretical aspects of indicators: the definition, uses and criteria for selection, characteristics of the ideal indicator, types of indicators, and the information requirements and sources.

The approach utilized by the Dental Officer in the indicator development exercise and output have been described in the second section. A discussion has followed on the output: types of indicators developed, how they have conformed to the criteria for selection described in the first section and programme objective, and whether the data necessary for computation have been proved forthcoming from the formats designed within the information subsystem.

5.1. THEORETICAL ASPECTS

5.1.1. Definition

As the name suggests, indicators are an indication of a given situation, or a reflection of that situation. According to WHO's guidelines in development of indicators for monitoring progress toward health for all by year 2000 (WHO, 1981), indicators have been defined as "... variables which help measure changes". Often they are used to detect changes that cannot be measured directly.

5.1.2. Uses and Criteria for Selection

Indicators are mainly used at the national level of health management. They are markers for measuring progress in the implementation and evaluation aspects of developed health strategies and health care service delivery. For a Ministry of Health, monitoring of implementation and evaluation take place at two levels: policy level, and the management and technical levels. At the policy level there is need to know if the health status of the population is improving, and if revisions of the policy, strategy and plans are required. At the managerial and technical levels there is need to know if relevant programmes are being properly formulated and if corresponding services and activities for implementing them are being adequately designed. There is also a need to know if programmes are being efficiently implemented through suitably operated health and related social and economic services.

Indicators should not be confused with objectives and targets. As defined by WHO in its Sixth General Programme of Work (WHO, 1976, Geneva)"... objectives are desired aims, and targets are objectives that have been made more specific in quantified terms or in terms of time". A country may define health in terms of general objectives such as improvement in health status of all its citizens, coverage of the population with primary health care, improvement in health-related socio-economic conditions, etc. A country may also define targets with respect to such objectives. Indicators can illustrate the extent to which these objectives and targets are being achieved.

One of the more important uses of health indicators is to monitor the progress of overall socio economic development of a country. The level of health itself is a direct indicator of the quality of life, and an indirect indicator of overall socio economic development. Increasingly, development planners and economists are looking for social indicators such as health status measurements to guide decisions on economic development strategies. As stressed by WHO in its report on indicator development (WHO, 1981a), it is particularly important "to select a small number of national indicators that have social and political punch in the sense that people and policy-makers will be incited to action by them".

Indicators are also used for monitoring health programmes at different levels. Other than the national (health ministry) level, they include the subnational administrative units as states, provinces or districts, and the local, peripheral

and community levels. At the local level it may be useful to identify and use indicators relevant to the community concerned with monitoring changes in health and related socio economic status. As already mentioned, national indicators are used for overall policy decisions or for technical and managerial decisions within the health sector. For example, a district dental officer may need to know the proportion of school children given dental treatment to assess the School Dental Programme. At the national level the indicator needed is similar, but related to the whole country.

5.1.3. The Ideal Indicator

According to a WHO Expert Committee on Health Statistics (WHO, TRS 472, 1971b), the ideal indicator has ten characteristics:-

1. Availability - it should be possible to obtain the data required without special complex investigations;
2. Completeness of Coverage - the index should be derived from data covering the population of an entire country or that part which the index is supposed to refer;
3. Quality - the national data should not vary with time and place in such a way as to have any substantial effect on the index;
4. Universality - the index should express a group of factors that determine and affect the level of health;
5. Calculation - the index should be calculated in as simple a manner as possible; calculation should not be costly in terms of resources required;
6. Acceptance - the indicator should be widely accepted, no doubts should exist about the methods employed for determining the index;

7. Reproducibility - when used by different specialists under different conditions at different times, the results should be identical;
8. Specificity - the index should reflect changes only in those phenomena of which it is the expression;
9. Sensitivity - the index should be sensitive to changes in the phenomena concerned. Allowance should be made for the effect of inflation on the index; and
10. Validity - the index should be a true expression of the factors which it is supposed to measure. Some form of independent or external evidence for this should be provided.

In real life there are very few indicators that comply with all the criteria mentioned. Although indicators have been given scientific respectability, they have to be tempered with a certain humility. As mentioned in the definition, indicators are merely reflections of the "real thing" - an indirect or partial measure of a complex situation. However, if measured sequentially over time they can indicate direction and speed of change, and serve to compare different areas or groups of people at the same moment in time.

5.1.4. Types of Indicators

There are basically two types of indicators: those that measure the health status and related quality of life, and those that measure the provision of health care. In both cases, high selectivity has to be employed so that their use becomes manageable and meaningful.

According to the WHO guidelines for indicator development (WHO, 1981b), indicators may be grouped under four broad categories:-

1. Health policy indicators

- political commitment to health for all;
- resource allocation;
- degree of equity of distribution of health resources;
- community involvement in attaining health for all;
- organizational framework and managerial process.

2. Social and economic indicators related to health

- rate of population increase;
- gross national product or gross domestic product;
- income distribution;
- work conditions;
- adult literacy rate;
- housing;
- food availability.

3. Indicators of the provision of health care

- coverage of primary health care;
- coverage of the referral system.

4. Health status indicators

- infant mortality rate;
- morbidity rate eg. incidence rate or prevalence rate of dental caries;
- nutritional status and psychosocial development of children;
- child mortality rate;
- life expectancy at birth or other specific ages;
- maternal mortality rate.

For the purpose of this treatise, the writer has not attempted to portray the development of all the categories of indicators mentioned. Being confined to the Personal Dental Care Programme, the indicators developed have been those pertaining to provision of dental care and dental health status, and to a certain extent health policy indicators.

5.1.5. Information Requirements

However potentially useful an indicator may be, the organizational, technical and financial feasibility of collecting and analysing the information required for it is the decisive factor as to whether or not to use it. There is a trade-off between what is relatively simple and cheap to collect and the degree of precision of the information or its validity. A balance has to be struck between the allocation of resources to information collection for making priority decisions about alternative strategies and action, and the allocation of resources to the programmes themselves.

For the Ministry of Health, Malaysia, a commitment has already been made to the allocation of resources for information collection with the development and implementation of the HMIS. The system when fully developed should not prove a constraint in facilitating systematic approach to provision of readily available information for the indicator development exercise.

According to the WHO report on indicator development (WHO, 1981c) the data required may be obtained from the following sources:-

1. Vital events registers;
2. Population and housing censuses;
3. Routine health service records;
4. Epidemiological surveillance data;
5. Sample surveys;
6. Disease registers; and
7. Other sources of data (including data from sectors other than health)

Most of the data used for the indicators described in this chapter are to be derived from routine health service records, epidemiological surveys and sample surveys. It would therefore be pertinent to elaborate on some of the advantages and shortcomings of these avenues as sources of information.

5.1.5.1. Routine health service records

The WHO's guidelines on indicator development (WHO, 1981d) have described the information derived from this source as relatively cheap and easy to collect and analyse. It is however incomplete and often inaccurate especially when those responsible for collecting it at the periphery are not taught to use it themselves; are overburdened with so much form-filling so as to seriously interfere with their service functions; have no feedback or see no relevance in collecting the information; or are generally unsupervised. The data collected may not be oriented towards particular problems to be solved or tasks to be fulfilled. The record systems of health services are often kept for administrative purposes rather than for monitoring.

Although it is apparent that the above source has more drawbacks than advantages, it is hoped that the formats and information flow of the Dental Subsystem have been designed with full recognition of the shortcomings mentioned above.

5.1.5.2. Epidemiological surveillance data

In many countries where particular diseases are endemic, special control or action programmes have been instituted to cope with these situations. Surveillance systems are often set up to report on the occurrence of cases and on efforts to control diseases, often corresponding to target population groups or geographical areas. They are often developed outside the national information system and may not have the necessary continuity or representativeness to supply useful data over a long period.

According to the WHO report on indicator development (WHO, 1981e) despite the weaknesses and restrictions as a source of information, epidemiological surveillance data have the following advantages:-

1. The persons carrying out the surveillance are usually trained to recognize or diagnose the disease condition in question and to measure the relevant characteristics of the community;
2. Coverage of a population by various types of health services can be measured;
3. If the population groups covered by surveillance are large enough and considered representative, the mechanisms may be used to obtain other information of public health importance, particularly conditions which are relatively

infrequent eg. oral cancer prevalence. Such events estimated on a small sample would be so imprecise as to render the estimate useless for monitoring purposes;

4. Surveillance is carried out over a period of time and in addition to baseline data, can be used to estimate changes at intervals close enough to provide data for monitoring.

The usefulness of epidemiological surveillance systems in providing information on certain indicators would appear to rest on the following conditions:

1. The control or action programme associated with the surveillance system should be established either on a nationwide scale or in several representative regions so as to provide unbiased measures of the indicators;
2. The duration of the control programme should be such as to provide a useful monitoring period of the indicators; and
3. Some measure of the population at risk should also be available so that appropriate rates can be calculated for morbidity or health care coverage.

In the context of the dental indicators described in this chapter, supplementary data not available in routine service records are provided by epidemiological surveys. In Malaysia two dental epidemiological surveys have already been conducted to determine the extent of dental problems among school children and adults respectively. Some of the more significant findings have been described in Chapter 3. These surveys have provided baseline data on required denominators for

calculation of some indicators. However, the validity of the data may be questioned especially the survey on school children which took place in 1970-1971 - a period of more than ten years has since passed. Evaluative surveys have to be conducted to determine the final outcome of certain control programmes eg. the School Dental Programme which deals primarily with dental caries amongst school children. Generally, surveys are expensive, one time affairs. However, their usefulness is unquestioned as a primary or alternative source of information.

5.1.5.3. Sample surveys

The sample survey is the solution most often resorted to for finding appropriate data to compute indicators. The usefulness of this survey method rests on the ability to provide data when other sources are absent, incomplete, inaccessible or inadequate. A scientifically designed community survey provides estimates of population characteristics within preselected limits of sampling error. The sample may consist of persons, households, houses, schools etc., depending on the aims of investigation and resources available for conducting the study. The household is the most common sampling unit.

According to WHO's guidelines on indicator development (WHO, 1981f), the main advantages of this survey method are as follows:-

1. For household surveys, other related household health information may simultaneously be collected, leading to interpretations not possible if the same information was collected from other sources;
2. Information lying outside the scope of official health services can be collected by direct questioning of the population (eg. utilization of health care resources from the private sector);
3. Data on morbidity and disability conditions not requiring health care but restricting activity can be derived only from this source;
4. Reasons for nonutilization of health services can be investigated by this survey method; these are particularly important for identifying socioeconomic and cultural accessibility of services;
5. Estimates of coverage by various services can be checked by questioning actual usage; and
6. The scientific sampling method can provide estimates of denominator data for the computation of rates and ratios.

The disadvantages of this survey method are as follows:-

1. Surveys based on probability sampling are difficult and expensive to mount and execute properly without an experienced national structure;
2. Information on past diseases and other events reported by the respondent is subjected to memory lapse and deliberate omission;
3. Conditions that rarely occur or measures that show large variation in the population require very large sample sizes for precise estimation;

4. To provide adequate data on indicators for small areas or population groups requires virtually complete coverage rather than sampling; and
5. As with epidemiological surveys, sample surveys are usually one-time activities and seldom lead to a permanent routine data collection procedure.

In the indicator exercise described in this chapter, two sample surveys (special studies) have been planned to provide data not available from the other two sources discussed.

For the purpose of this chapter, the routine service records and epidemiological surveys may be described as primary sources of data, and the sample survey as an alternative source. In the general sense, principle sources of data for indicators or groups of indicators are shown in Table 1. As far as the indicators described in this chapter are concerned, it can be seen from the table that routine health service records and epidemiological surveillance data are the primary sources of data for calculating morbidity rates and percentage of population provided with (dental) health care. It also appears that sample surveys is the main alternative source of data for information not available from the other sources.

(Source: WHO, 1981. Development of indicators for monitoring progress toward health for all by year 2000. "Health for All" Series No. 14. P. 44.)

Development of indicators

Table 1. Principal sources of data for indicators or groups of indicators
P = primary source ; A = alternative source

Indicators	Source of data						
	vital events registers	population and household censuses	routine health service records	epidemiological surveillance data	sample surveys	disease registers	other
Health status indicators :							
Birth weight	P				A		
Weight and height			P	A	A		
Arm circumference			P	A	A		
Infant mortality	P	P		A			
Child mortality	P	P			A		
Under-5 mortality	P	P			A		
Under-5 proportionate mortality	P				A		
Life expectancy at given age	P	P			A		
Maternal mortality	P	P	P			A	
Crude birth rate	P	P			A		
Disease-specific death rates	P		P	P	A	A	
Proportionate mortality from specific disease	P		P	P	A	A	
Morbidity : incidence rate			P	P	A	P	
prevalence rate			P	P	A	P	
Prevalence of long-term disability			P		A		P
Indicators of the provision of health care :							
Physical accessibility		P	P	A	A		
Percentage of population served		P	P	P	A		
Water and sanitation		P			P		P
Immunization coverage			P	P	A		
Population/health personnel ratio		P	P		A		P

5.2. DEVELOPMENT OF DENTAL HEALTH INDICATORS

5.2.1. Approach

The programme objective under the Fourth Malaysia Plan has first been stated. In this case the programme is for Personal Dental Care, and its objective: "to provide maximum coverage of population with the highest possible quality of personal dental care within available resources". This format has been followed so that by scrutinising the list of indicators developed their suitability and criteria for selection can be related back to the programme objective to be achieved.

In the actual development of the indicators, a basic systems approach has been utilized. The development has essentially involved three processes or stages where the output of each stage has been input to the preceding one. This may be further clarified by the diagram in Fig. 35.

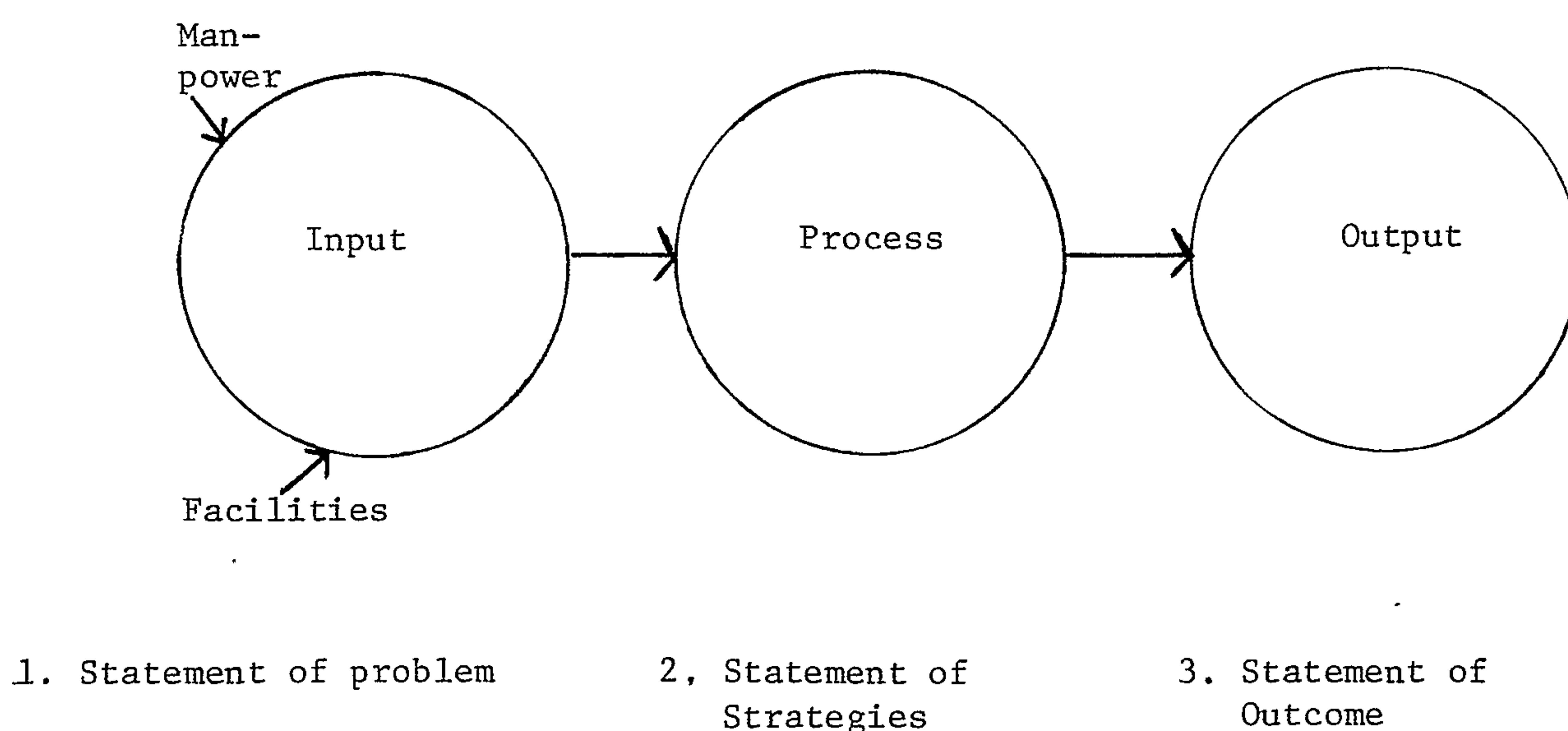


Fig. 35: Development of Dental Health Indicators

In the indicator development exercise the output stage has been used to identify the dental problems. The resources have been indicated as already built in into the input. In the process stage the strategies have been stated to deal with the relevant problems mentioned in the previous stage. The output stage has been used to identify the outcome. In this case the outcome are the actual indicators developed. They have been categorised into two groups: the intermediate outcome indicators and final outcome indicators. The following table has been derived to describe the indicator development exercise:

TABLE DERIVED FOR INDICATOR EXERCISE

Problem	Intervention	Intermediate Outcome Indicators	Final Outcome Indicators

5.2.2. The Indicators

The indicators developed for the programme sub-subsystems are shown in Annex 8 (P258-260). As can be seen there are 28 intermediate outcome indicators and 4 final outcome indicators. They have been grouped according to the relevant problem identified in the 'Problem' column, and corresponding strategies stated in the 'Intervention' column. For some indicators the numerator and denominator to be used for calculation have been included.

Five clinical dental problems have been identified, viz. dental caries, edentulousness, periodontal disease, dentofacial anomalies and maxillo-facial injuries. The problems stated correspond to the major findings of the dental epidemiological surveys described in Chapter 3. The corresponding solutions proposed have been taken from the strategies developed and described in the same chapter. The sixth problem in the indicator exercise has been stated as "Inadequate and inaccessible dental services" and the corresponding interventions as "Increase number of trained staff and physical facilities to cope with increasing demand for dental services, improve coverage of population", and "improve coverage of schools and kindergartens". These statements have been made retrospectively to fit the indicators which could not be grouped with the other five sets.

In the intermediate outcome indicators several variables have been identified for each set, for example level and frequency of usage, category of staff and patients.

The final indicators have been identified as the desired outcome. For example, there mightnot be an actual 'reduction' of the problem after evaluation of the intervention has been made. Only those final indicators relating to dental clinical problems have been stated.

Each indicator marked with an asterisk indicates that the data required for calculation are available within the HMIS.

5.2.3. Discussion

The indicators developed relate mainly to determining the extent of provision of dental care for the most basic dental problems. However, the suitability and correctness of some of the final outcome indicators as related to their corresponding stated problems should be further discussed.

The first problem has been stated as 'high incidence of dental caries' and the corresponding final outcome indicator as 'reduction in DMF and DMFX indices'. These should have been stated as 'dmft and DMFT indices'. However, even these indices are questionable as the final outcome indicator for the stated problem. No mention has been made on the preventive aspect of treatment for dental caries. The percentage of school children (prioritized for treatment as stated in the intervention) given topical fluoride application and prophylaxis should have been developed as indicators since the data for these are captured in the formats for Dental Nurses (PG 301, 201, 206).

The question of suitability also arises in the second problem, stated as 'edentulousness amongst school children and adults'. The corresponding intervention for this problem: 'improve rehabilitative dental treatment through dental prostheses', in the strictest sense, does not really solve the problem; hence the final outcome indicator 'reduction in incidence of edentulousness' is questionable. Restorations and prevention (eg. periodontal treatment) affect the final outcome of the Problem. This may be measured by noting changes in the decayed: missing: filled components of the DMFT index. As

such, periodontal treatment as a preventive aspect of treatment has not been mentioned but stated as a separate problem (see Problem 3). The intermediate outcome indicators developed for the problem of edentulousness merely measure the percentage of patients issued with dental prostheses. This does not necessarily 'reduce the incidence of edentulousness' as stated in the final outcome indicator.

As mentioned in Section 5.2.2. the final outcome indicators measure the desired outcome. When all is said and done, there need not necessarily be an actual 'reduction' of the incidence of the stated problems; the situation may be unchanged or there might be actual increase in the incidence of the problems mentioned.

Two stated problems, viz. maxillo-facial injuries and overall inadequacy and inaccessibility of dental services have no corresponding final outcome indicators. Measurement of progress in the implementation of strategies to deal with these problems have only been made through the intermediate outcome indicators. However, an attempt should have been made to measure the final outcome of these problems.

The rate of utilization of dental service (Indicator 6.2.1.) has been included to measure improvement of coverage of the population in the public sector. The pattern of demand by ethnic group, category of patient and treatment is measured by Indicator 6.2.2. All the variables mentioned have been defined in the 'Definition of Terms' used for the Dental Subsystem (see Annex 9). All the data required are captured in the formats designed.

Some indicators measure workload by category of staff (Indicators 1.3.1. - 1.3.4.) In the case of the Dental Officer and Dental Nurse these have included the two most common items of care: fillings and extractions. An increase in the restorative component of filling: extraction ratio when compared over a period of time, may indicate conformity to the current philosophy or policy of dental service delivery, that more restorative work be done. However, with expansion of dental services and subsequent increase in manpower and facilities (described in Chapter 3), this may merely indicate that more staff is available to render conservative treatment.

For the orthodontist and dental specialist, the workload has been measured by the number of patients seen per year (Indicators 4.1. and 5.1. respectively).

An attempt has been made to include some indicators that measure to a limited extent the quality of dental care. For example, indicators 1.2.1. and 1.2.2. measure the percentage of patients given completed 'conservative' and 'all required treatment' respectively. The terms 'conservative' and 'all required treatment' have also been defined in the Definition of Terms. Indicator 5.3. also measures, to a certain extent, quality of care in the percentage of patients referred for further treatment after being treated for maxillo-facial injuries.

Some indicators relate to health policy. For example, Indicators 6.1.1. - 6.1.5. measure allocation of resources (manpower and facilities) and equity of distribution by district and state.

A few indicators require supplementary data to be provided by sample surveys (stated as 'special studies') for computation. For example, the numerator of Indicator 3.3. (Number of patients completed periodontal treatment) and the numerator of Indicator 5.3. (Number of maxillo-facial cases referred for further treatment) have merited special consideration in the 'special studies' planned to provide the required data not captured in the routine service records.

No indicator has been developed to measure continuity of care, for example, defaulter rate of orthodontic patients, although a continuous care register for the orthodontist (PG 102) has been included in the Dental Subsystem.

Emphasis has been given to assessing the School Dental Programme. Indicators 6.3.1. and 6.3.2. have been developed to measure improvement in coverage of schools. In the Fourth Malaysia Plan the preschool component has been included with the establishment of the Preschool Service Units. The terms 'coverage' and 'completion' have been defined for the programme subsystem.

It can be seen that an attempt has been made to develop indicators that conform to the stated objective of the Personal Dental Care Programme. Indicators to measure

coverage have been developed to serve the phrase 'to provide maximum coverage of population', some quality of care indicators have been included to measure 'highest possible quality of personal dental care'. No attempt, however, has been made to develop a comprehensive list of indicators. It should be noted that in this context, the policy-makers have perhaps been wise to requalify the statement of objective by adding in the phrase 'within available resources'.

CONCLUSION

In this chapter, the writer has attempted to describe the continued development of dental health indicators. Theoretical aspects of indicators have been discussed in the first section. The approach utilized in the indicator exercise and actual indicators have been described in the second section. A discussion on the indicators has been included: it can be seen that the indicators have conformed to the stated objective of the programme sub-subsystem, and most of the data required for computation are available in the information subsystem.

However, it appears that the indicators have been developed to fit into the format designed (problem-intervention-intermediate and final outcome indicators). In this context, some of the indicators have been developed first and the corresponding problem and intervention stated retrospectively to conform to the problems and strategies mentioned in the Fourth Malaysia Plan, as described in Chapter 3.

Some of the final outcome indicators developed are questionable since certain components in the intermediate outcome indicators have not been developed or do not logically follow the problem and intervention stated. A few indicators do not have final outcomes; effort should perhaps be made to develop them.

The indicators developed are by no means complete. In conclusion, after considering the information requirements and practical problems involved in determining and using indicators, the following statement made in the WHO's guidelines for indicator development (WHO, 1981g) seem apt "... selectivity must be the keynote. More will be gained by selecting a small number of relevant indicators for which a country can obtain the information within its resources than by aiming at comprehensiveness".

6. PENANG STATE ANNUAL REPORT 1981:

A MODEL OF SYSTEM UTILIZATION

INTRODUCTION

The Dental Health Information System was first implemented in the State of Penang (Pulau Pinang) in January, 1981. Since then, monthly returns recorded in the new forms have been regularly submitted to the Central Unit of the Information and Documentation System. The Dental Officer attached to the Unit has been involved in checking and compiling the monthly reports.

An annual report for the State was prepared in March, 1982. (Ministry of Health, Malaysia, 1982) based on the returns for the period of January - December, 1981. In this chapter, it is the writer's intention to use this annual report as a model to portray the utilization of the information subsystem.

In the first section, the writer has described the functions of the Dental Officer in the IDS Unit during the period of submission of the monthly reports, the problems encountered in the communication system, and the tasks involved in the preparation of the annual report.

The second section has dealt with the content of the report, i.e. the types and combinations of information derived from the service records, and how they have been displayed.

A discussion has followed in the final section, touching on the following aspects: the quality and availability of data recorded, the information presented, and further combinations or permutations of data that can be used to derive other types of information. The possible uses of the information and how they may best be displayed, have also been included in the discussion. The writer has also discussed the extent to which the information presented can be related to the indicators developed and described in Chapter 5. In this way, the writer intends to measure the effectiveness of service records as a major source of data for the indicators. This in turn measures the degree of usefulness of the information subsystem in terms of availability of information provided, thus measuring, to a certain extent, achievement of systems objectives. Finally, the writer has discussed the future problems envisaged at the IDS Unit in terms of workload when the information subsystem becomes fully functional throughout the whole country. Recommendations on how the workload problem may be solved have also been included in the discussion.

6.1. PREPARATION OF ANNUAL REPORT

The reports received monthly at the IDS Unit are as follows:

1. PG 206 - State Report on Workload of Dental Nurse;
2. PG 207 - State Report on Workload of Dental Officer;
3. PG 208 - State Report on Workload of Orthodontist;
4. PG 209 - State Report on Workload at the Dental Specialist Clinic;

[The Dental Specialist Clinic is a hospital dental clinic headed by a Dental Specialist (Oral Surgeon). One Dental Officer and an average of two Trainee Dental Officers also work in this clinic under the supervision of the specialist. The trainee officers comprise dental graduates from unscheduled universities who are required to undergo further training for a period of two years prior to registration. The workload recorded in form PG 209 is that of the total staff.]

5. PG 210 - State Report on Workload of Dental Technician;
6. PG 203 - Individual Workload of Orthodontist, and
7. PG 204 - Individual Workload of Dental Specialist

(Two separate reports of PG 204, corresponding to the number of Dental Specialists in Penang, are submitted).

Previously, District Reports, recorded on the same forms PG 206-210 were submitted but this practice has been discontinued since they were not required at the national level.

The reports listed above were received promptly and regularly. This may reflect either the ease with which the data were recorded in the new forms, or the efficiency of the Senior Dental Officer in compiling the returns at the state level, and the simple design of the information flow.

The Dental Officer at the IDS Unit checked all data entries in the reports. No analysis was carried out at this stage. The most common mistakes found in the recording of data are as follows:

1. Recording of data into the wrong columns, especially in the 'Items of Care' section of the forms;
2. Errors in cumulative totals of attendances. The source of error was usually in the addition of 'new' and 'total' attendances. Errors in the cumulative totals often resulted in cumulative mistakes for each subsequent monthly return. This, in fact, affected four monthly reports (January - April). The Senior Dental Officer in Penang was informed of the errors, who then rectified the mistakes and promptly submitted amended copies to the IDS UNit.

Each monthly report was submitted in two copies. After the data had been checked, a copy of each report was sent to the Director of Dental Services, Dental Division. Previously, all reports were sent directly to the Director. The latter also monitors the individual workloads of the Orthodontist and Dental Specialist.

In the preparation of the annual report, the monthly returns were further compiled and condensed into four summaries, corresponding to the types of operating personnel. They are:

1. Summary of State Report on Workload of Dental Nurse;
2. Summary of State Report on Workload of Dental Officer;
3. Summary of State Report on Workload of Orthodontist, and
4. Summary of State Report on Workload at the Dental Specialist Clinic.

9. Number of patients issued with full/partial dentures per year.
10. Ratio of fillings to extractions per Dental Nurse/Dental Officer;
11. Ratio by types of fillings;
12. Ratio by types, of maxillo-facial injuries;
13. Average number of teeth extracted and fillings done per patient by category of patient;
14. Average performance by category of personnel:
 - (a) average number of fillings/month/officer
 - (b) average number of extractions/month/officer
 - (c) average attendance/month/year/officer
 - (d) average number of denture units completed by
Dental Technician
15. Attendance ratio at Dental Specialist Clinic; and
16. Order of frequency of occurrence of oral surgery cases (for first fifteen cases).

The total text of the Annual Report is not shown in this treatise. However, the following examples are given to illustrate the method of presentation:

(from Summary of State Report on Workload of Dental Nurse)

1.4 % distribution of attendance:

1.4.1. By ethnic group $\left[\frac{\text{Total no. of attendances of a specific ethnic group}}{\text{Total Attendance}} \right]$

Malay	..	31.0%
Chinese	..	58.4%
Indian	..	10.3%
Others	..	0.3%
		100.0%

(from Summary of State Report on Workload of Dental Officer)

7. Average performance:

7.1. Average number of extractions per Dental Officer:

Per Year	..	2,686
Per Month	..	224

7.2. Average number of fillings done per Dental Officer:

Per Year	..	1,610
Per Month	..	134

7.3. Average attendances per Dental Officer:

Per Year	..	4,438
Per Month	..	370

(from Summary of State Report on Workload of Orthodontist)

2. Completion:

2.1. % of patients completed active treatment

$$\left[\frac{\text{No. of patients completed active treatment}}{\text{Total no. of patients}} \right]$$

= 12.5%

2.1.1. By category of patient:*

$$\left[\frac{\text{No. of patients of a specific category completed active treatment}}{\text{Total no. of new attendances of same category}} \right]$$

Primary School	..	5.3%
Secondary School	..	14.3%
Adults	..	17.9%

* Note that 'by category of patient' can be calculated in two ways.

2.1.2. By category of patient:

$\frac{\text{No. of patients of a specific category completed active treatment}}{\text{Total No. of patients completed active treatment}}$	
Primary School	.. 12.3%
Secondary School	.. 55.4%
Adults	.. <u>22.3%</u>
	<u>100.0%</u>

6.3. DISCUSSION6.3.1. Quality and Availability of Data

From the summaries shown in Annexes 10-14, it can be seen that the data recorded are complete. As noted in Section 6.1., this reflects the quality of data in the monthly reports, which in turn indicates that all the data are available from the source documents. Furthermore, the fact that the summaries have been recorded on the same forms as the monthly returns (PG 206-209) indicates the versatility of usage of the forms designed.

However, certain data used for calculation are not captured in the formats. This is illustrated by the following:

1. The state population figure for calculating the percentage coverage of population is taken from the National Census Bureau, using the projected population for 1981. This calculation is based on the 1980 census with an annual increase of 1.9 per cent.
2. In the calculation for the percentage coverage of schools, the source of data for the total number of schools in the state is the State Education Department.

6.3.2. Presentation of Information

The various types of information derived from the service records have been presented in terms of percentages and ratios. They have been linearly presented in the annual report according to categories of personnel, patients, ethnic group and treatment. It is commendable that most of the corresponding numerators and denominators used in the calculations have been included in the text. This provides the reader or user easier reference to the relevant data columns in the forms to check the accuracy of the calculations. However, instead of enumerating the percentages as presented in the annual report, certain information could have been displayed in table form. For instance, the percentage distribution of total attendance by category of patient, ethnic group and category of treatment for the Dental Officer could have been presented as follows:

TABLE X : % DISTRIBUTION OF TOTAL ATTENDANCE

Category of Patient		Ethnic Group		Category of Treatment	
Preschool	1.1	Malay	37.3	Oral Surgery	3.2
Primary School	13.3	Chinese	50.1	Orthodontic	-
Secondary School	20.9	Indian	12.2	Periodontal	0.3
Ante-natal	3.1	Others	0.4	Prosthetic	4.2
Adult	52.7	-	-	General	92.3
TOTAL	100.0%		100.0%		100.0%

From the types of information listed in Section 6.2. and the data displayed in Annexes 10-13, it can be seen that further combinations or permutations of data are possible to derive other types of information. For example, the average number of visits per patient can also be calculated by ethnic group from the attendance section of Annex 11. In the item of care section of all the data summaries, only selected items have been presented. The percentage of patients given prophylaxis or endodontic treatment, percentage of patients issued with partial/full dentures, number of extra/intra oral X-ray films used, can also be calculated for all categories of patient. Various other types of information can be presented, just for information sake. However, it should be borne in mind that information selected for presentation should have relevance to usage, which in this case is for subscribed users at the national level. Hence, although data for deriving more information are available, additional information have not been presented in the report.

6.3.3. Uses of the Information

The information presented in the report may be used in three ways:

6.3.3.1. Planning

According to one authority (Litsios, 1971), planning is basically 'a process of projecting and selecting from alternatives for the future.' In a report released by a WHO Working Group on Planning and Evaluating Dental Health Services (WHO, 1972a), the aim of planning is to obtain maximum effectiveness of a given amount of resources in terms of the stated goals of a programme.

According to a report on health operational research (WHO, Bucharest, 1971), the planning process can be translated in a sequence of steps as follows:

1. the establishment of goals and objectives;
2. the synthesis of alternative strategies for achieving goals, programme planning;
3. the choice of an optimal strategy or programme;
4. the expression of the optimal programme as a plan - a schedule of events in time; and
5. implementation and evaluation.

For the purpose of this treatise, the programme in question is the Personal Dental Care Programme which is already well established in the delivery of dental services in Malaysia. The programme objective and strategies have already been described (refer to chapters 3 and 5). The planning referred to is therefore continued planning. In this section, the types and sources of information required for planning, and how the information derived from the annual report may prove useful for this purpose, are the subjects for discussion.

According to the WHO report on planning and evaluating dental health services (WHO, 1972b) the types and corresponding sources of information needed for planning are as follows:

1. Characteristics of the population

The characteristics should include composition by age, sex and other attributes such as standard of education, social and economic characteristics, and comparative rates of increase of the total population and the groups concerned. The main source of information about the population covered usually comes from censuses. This has already been cited as the source in the calculation of the percentage of population covered in the annual report.

2. Needs

This is expressed in terms of prevalence and incidence of those diseases or conditions that the programme may encompass. For Malaysia, information on needs have been estimated by identification of the types and extent of dental problems, as shown by the dental epidemiological surveys carried out in 1971 and 1974. Estimates of treatment requirements may be expressed in terms of types of care, e.g. conservative treatment, periodontal treatment, orthodontic care. In the annual report, the percentage distribution of patients by category of treatment or percentage of patients given treatment by selected items of care may be used to plan for incremental needs.

3. Information on demand

This is usually based on past experience on effective demand or past utilization of services. Effective demand will depend on limitation of supply and accessibility of service. If expansion of a service is contemplated, the measurement of potential demand has

to be based on behavioural information and knowledge of obstacles in the way of obtaining dental care. Potential demand however, is not equivalent to need. Some people will not avail themselves of services even if they are offered free or are easily accessible.

Information on effective demand may be obtained from service records. In the annual report, this has been measured by the percentage of population by age group given treatment in the given year. However, information from interview surveys about those obviously in need but have not sought treatment is more useful than information on simple utilization rates. In the Dental Subsystem, information on accessibility of services are not available. Information on this may also be obtained through the interview survey mentioned.

4. Resources

Information should be available on both manpower and material resources. On manpower, it should include not only dentists but all members of the dental team: auxiliaries, technicians and so on. It is also useful to know the age structure of the available manpower, sex ratio, geographical distribution, and the utilization of their time. On material resources, the distribution and capacity of the dental health services network, equipment available and supplies utilized should be ascertained through past experience.

Information on dental manpower output can be obtained from dental schools and schools for training auxiliary personnel. The present number of dentists available may be obtained from licensing and registration boards. Before the introduction of the HMIS, information on dental manpower and material resources were obtained from the Dental Division, Training and Manpower Division, Supplies Division and Services Division. In future, information on resources will be obtained from the Resources Subsystem, which as noted in Chapter 4, comprises the Supplies, Training, Personnel and Facilities subsystems. In the annual report, the number of operating personnel for the state is stated in the summaries. Continued demand for supplies may be determined by the number of patients treated for a particular item of care.

5. Finance and cost

Information will be required on actual expenditures in recent years expressed, if possible, as indices corrected for inflation and in terms of related cost (per patient visit, per patient with treatment completed). The information should not only include public resources as given in official (state and local) budgets, but also private expenditure. This can be measured by household expenditure studies, studies of dentists incomes, private consumption and so on. No data on finance and costs are captured in the formats for the Dental Subsystem. The main source of information on these will be the Finance Subsystem of the HMIS. It has been stated in chapter 4 (Section 4.1.2.2.1 system boundary) that sectorally, the Ministry of Health is responsible for

health services performance in both public and private sectors. Although initial efforts in the HMIS development have been directed to satisfy the Ministry's requirements for the public sector only, inclusion of the private sector in the future may provide the necessary information on finance and costs in this sector.

6. Standards and norms

On the basis of past experience or through operational research and time-motion studies, the planner should obtain information on the following aspects from the utilization of resources:

- (a) Time: total time, lost time and effective chair-time of a dentist on a daily, weekly or yearly basis;
- (b) Productivity: expressed in terms of work done per unit time, this may vary considerably, depending on professional practice, equipment used and utilization of auxiliary personnel;
- (c) Average number of patients per hour, half-day or day : averages of time spent per patient treated comprehensively or for certain services may be useful in certain cases. Rigid norms should be avoided but averages obtained in the service are most useful.
- (d) Population per dentist : some services have norms allocated for dentists, based on past experience of the utilization of services (in programmes where services are based on spontaneous demand) and on incremental needs (school dental programme).

From the monthly reports submitted to the IDS Unit, data on time lost is captured in the formats by the number of days of leave taken per operating personnel. But apparently the data have not been used to derive the relevant information in the annual report. Productivity has been measured by the average performance (average number of fillings, extractions and attendance per operating personnel per month) but this has not been related to the average time spent per patient. The dentist to population ratio in Malaysia at present is 1:18,000. (Refer to Fig. 18, Chapter 3, p.71). The desired ratio is 1:5,000. Planning for manpower requirements should be directed towards this goal.

7. Cost-effectiveness of alternative methods and procedures

This is of crucial importance to planning if it is not to be a mere extrapolation of the present into the future.

What is being done and achieved must be compared with what might otherwise be achieved if some other methods and procedures were adopted. The best studied measures are water fluoridation for primary prevention and incremental dental care as a means of secondary prevention.

Information on cost-effectiveness comes from field trials, pilot demonstration projects, cost-effectiveness studies, applied research, and time and motion studies involving different compositions of the dental health team and expanded utilization of auxiliaries. Since cost is often not directly measurable, alternative ways may have to be found to measure cost-effectiveness. For instance, the number of working hours per personnel may be related

to the cost expended in their training. Although service records cannot be the sole source for measuring cost-effectiveness, this source may still be valuable for providing some data (eg. the workload for personnel) in determining cost-effectiveness.

6.3.3.2. Evaluation

According to the WHO Report on planning and evaluating dental health services (WHO, 1972c), evaluation aims to assess how far the objectives of a plan or programme have been attained, and whether the cost was the minimum possible. In the evaluative process, checks are made on four factors: effectiveness, efficiency, appropriateness and adequacy.

1. Evaluation of effectiveness

The effectiveness of a measure or activity is measured by the degree to which it attains stated objectives. It is measured by comparing the status of the subject of activity before and after it. For example, a programme activity for the application of topical fluorides in school children can only be evaluated if the status of the group before and after the procedure was introduced is known. The first measurement is made through a baseline survey, the second through an evaluative survey.

The development of indices and indicators is useful in evaluating dental services. The DMF (T) index, for instance, can be used as follows:

- (a) changes in the index at two different points in time may reflect the effectiveness of a preventive programme; and
 - (b) changes in the percentage composition of the index at two different points in time may reflect the effectiveness of treatment in reducing tooth loss
- $$\left[\frac{M}{DMF(T)} \text{ decreases} \right] \text{ and in restoring decayed teeth } \left[\frac{F}{DMF(T)} \text{ increases} \right].$$

The WHO Report mentioned above also recommended the use of the following ratios and proportions in determining effectiveness of a programme:

- (a) ratio of extractions to fillings after pulp treatment per 100 fillings;
- (b) proportion of one-surface fillings per 100 fillings;
- (c) proportion of anterior teeth with pulp involvement per 100 teeth with pulp involvement; and
- (d) number of children with extractions by age group, and frequency distribution of the number of extractions per child.

The indicators described in Chapter 5 have been developed to evaluate the Personal Dental Care Programme. The DMF (T) index has already been stated as a means of measuring the final outcome of the activity in combating the problem of dental caries with priority given to treatment of schoolchildren. As noted, the indicator on the preventive of treatment, i.e. the percentage of schoolchildren given topical fluoride has not been

developed; the proportion, however, has been calculated and presented in the annual report. In relation to the ratios and proportions recommended by the WHO Report, the ratio of fillings to extractions and ratios by types of fillings have been calculated, but they have not been related to the specific age groups of schoolchildren or related to teeth with pulp involvement. Proper evaluation of the effectiveness of the programme is not solely dependent on the service records as a source of information, but as already stated, from evaluative surveys.

In relation to effectiveness, an important aspect to be considered is quality. With regard to fillings, quality is reflected by the percentage of deficient fillings, number of fillings with recurrent caries and fillings requiring replacements. In the Personal Dental Care Programme, quality is measured to a certain extent by the percentage of cases with conservative and all required treatment completed. Longitudinal studies need to be carried out to determine the quality of specific items of care.

2. Evaluation of efficiency

In efficiency analysis there are three basic variables: time, work done, and costs. Efficiency has an economic connotation and assumes that a value is attached by the dental health services to attaining the maximum results with the minimum possible resources. The simplest measurement used to evaluate efficiency is that of work done. This is expressed in the total number of

units of work done by type (examinations, X-rays, extractions, fillings, dentures, etc.). The productivity of a dentist or dental clinic may be reflected in the relationship of work done per unit time (fillings per hour, hours for a full denture, etc.). The output of clinics has to be expressed uniformly for purposes of inter-clinic comparison. In the Personal Dental Programme, the output of the Dental Specialist Clinic is easily measured and compared since the work ~~done~~ is already based on the clinic and not on individual work done by its staff members. In the services of children, the mixture of service items is limited (as for the Dental Nurse report). The composition of the work done in a clinical hour gives a good summary of productivity.

The third variable, as mentioned, is cost. The cost of a clinical hour may be partially assessed, even using incomplete information, such as the composition and salaries of the dental team involved, and the number of hours the clinic remains open. If monetary cost cannot be assessed it should be possible to use manpower hours multiplied by years of training as an alternative measurement for the input of manpower resources. Economic efficiency will be reflected in the relation of productivity to costs. During a clinical hour that costs so much, a specific amount of work will be done. In this way the three variables of efficiency - time, work done and costs - can be finally summarized.

3. Evaluation of appropriateness

In evaluating appropriateness, the programme strategy is reviewed and the choice of strategies and decisions actually taken are re-examined. To find out if a programme is appropriate, the alternative uses of resources, employing different treatment or preventive methods, would have to be reviewed to ascertain if more objectives could be attained by using a different resource mix within the same ceiling of expenditure. For instance, a programme including fillings and extractions might sometimes achieve more in the long run if some resources were devoted to preventive activities that would decrease the need for them. Indeed, the best method studied, from the cost-effectiveness standpoint, is the combination of water fluoridation with regular dental care programme, which has been proved more economical than the provision of regular dental care programme only.

In the Malaysian government dental services, the strategy of combining water fluoridation with regular dental care is already well established (Refer to Chapter 3, Section 3.2.2.). No studies, however, have been conducted to determine the effects of water fluoridation, in terms of total cost of dental treatment. Data captured from the school dental service, for instance, can be used to determine this. The percentage less fillings per year and average number less fillings per child are some indicators that can be used to measure the cost-effectiveness of the programme.

Briefly, cost-effectiveness analysis, which really results from assessment of efficiency and effectiveness, can be used in evaluating appropriateness.

4. Evaluation of adequacy

Adequacy usually concerns coverage in relation to the population to be covered. According to the WHO Report on planning and evaluating dental health services (WHO, 1972d), the following series of percentages should give a picture of the situation:-

- (a) % of the population group examined;
- (b) % of the population group needing treatment;
- (c) % of the population treated; and
- (d) % of the population with treatment completed.

In the annual report the percentage of population covered and the percentage coverage (plus completion) of schools have been calculated. These may be related to the predetermined targets of the programme for each age group to determine the adequacy of the programme.

6.3.3.3. Research

Data recorded in the formats in the Dental Subsystem can be used for research. Some potential areas of research may include the following:

1. Study of the collection, analysis and use of the service statistical data for planning and evaluation of the dental services;
2. Periodic analysis of the dental manpower distribution;
3. Studies on cost-effectiveness, for example, the use of different combinations of personnel;

4. Studies on trends on demand for dental services by age group, ethnic group and treatment;
5. Utilization of dental services and the pattern of regular attendances in the community as related to the availability and accessibility of the service, waiting time, etc.; and
6. Quality of treatment given including extent of referral services, quality of fillings done and dentures issued, etc.

When it becomes fully functional, the Health Services Research Section of the IDS Unit will be responsible for determining the specific areas of research to be conducted and the methods to be employed.

6.3.3.4. Workload increase at the IDS Unit (Dental)

So far reports are only forthcoming from the State of Penang. It is envisaged that there will be a substantial increase in workload, in terms of analysing, checking, validating, compiling and presenting data for all reports when the information subsystem becomes fully functional in all states of Malaysia. The use of microcomputers would be valuable in combating the additional workload problem. Furthermore, the introduction of computers at the IDS Unit will certainly reduce the amount of space required for all the records.

CONCLUSION

An annual report for the State of Penang has been prepared, based on the 1981 data captured on the new formats designed for the Dental Subsystem. The report has been used as a model to illustrate the utilization of the information subsystem.

It can be seen that information derived from service records alone are by no means sufficient for the management of the dental services in general and the Personal Dental Care Programme in particular. However, certain data from the service records do provide valuable information required for continued planning and evaluation of the programme. The figures calculated for Penang may be compared to the national average or to other states. Comparison can also be made on a year-to-year basis. Some data from the formats can also be used as potential material for conducting further research.

It remains to be seen whether the data from the service records will actually be utilized for planning, especially in the expansion of services. By analysing some of the data, the planner can determine the quantity and types of manpower to be trained and how they should be deployed; the number of new clinics to be built, including those for specialized treatment can also be determined by studying the pattern of treatment and overall utilization of the services by age group and ethnic group. The use of different mix of personnel may be attempted to determine the relative efficiency or cost-effectiveness.

In order to function optimally, the Dental Subsystem has to interact and interface with other subsystems of the HMIS, but certain data still have to be obtained from sources outside of the total information system. When linkages are formed amongst subsystems, the dental formats may have to be redesigned for EDP compatibility. As it is, increased workload is envisaged at the IDS Unit (Dental), which may necessitate the use of microcomputers to solve the problem stated.

The Dental Subsystem has been utilized only in the sense that all data for the formats are being captured and recorded properly, and that the resulting reports are being submitted to the IDS Unit on time and in the right manner. The State of Penang has been selected to illustrate system utilization only because it is the one state so far with a full complement of data available for preparing an annual report. The types of information presented and the method of display may be used in the preparation of annual reports for other states when the subsystem becomes fully functional throughout Malaysia. The State of Penang, though, is not typical of States in Malaysia. It is relatively small and has a comparatively large urban population. As far as system utilization is concerned, the Penang experience does not reflect conditions that will prevail in other states.

7. DISCUSSION

Rapid developments are taking place in Malaysia within and outside the health sector. The Ministry of Health is functioning under a complexity of goals in the changing environment with limited resources at a time when technology has thrown open remarkable possibilities in the delivery of health care services. With a view to assist in overall planning and management, the Ministry has also been increasingly using modern management techniques to improve its performance at all levels. This has led to a growing need for a valid and supportive information base, provided by a new management information system, which, in its planning and development stages, has utilized concepts in management science that have only been in existence for the last twenty years or so.

It is fortunate that at the time of planning and development of the information system, there were no political, financial and technological constraints so that the best of scientific expertise could be used in the development process. It is also fortunate that as far as scientific expertise is concerned, the Ministry has had the benefit of consulting the WHO in the planning and development of the HMIS Development Project. It has been noted in this thesis (chapter 2) that the formation of a health information system at the national level is not feasible in certain countries, namely the U.S.A., where political constraints and the system of health care delivery do not permit the development of such a system. This, evidently, has not been the case in Malaysia: the

government plays a major role in the delivery of health care services, and it has recognised the need for such a system that can be organized at the central level.

The principles utilized in the overall development of the HMIS are well established and, like the concepts applied, systematic. In the development process, the project for the HMIS Development has had to pass through several different phases. The protocol for development has listed the phases as the conceptual phase, systems analysis phase, systems design phase, systems development phase, and the test run and evaluation. In the protocol, the systems objectives have been clearly defined, the system boundary identified, and the methodology (planning and procedures), project schedules, outputs and requirements systematically worked out.

With regard to system boundary, this has been identified sectorally to include the private sector. It is difficult to envisage at this stage, the information requirements for this sector, since efforts in the HMIS Development Project have initially been directed toward the public sector only. It would be interesting to gauge the reaction of private practitioners when the government decides to encroach upon the premises of private enterprise, especially if information on the practitioners' approach in service management is to be included. As it is, the private sector's involvement with the government is limited to registration, declaration of income, the reporting of specified diseases that require government intervention and control, and conforming to required standards in the

setting up of practice. The government has no say in the day-to-day running of practice in the private sector.

However, information on the utilization of health services in the private sector would be useful. Efforts should be directed to acquiring all the information required for planning, of which the types and sources have been described in chapter 6. Specific information should at least include coverage, demand and needs of the population by ethnic group and age group for this sector. The information would provide planners in the Health Ministry an overall perspective of the health situation in the country. To date, no survey has yet been carried out to determine the extent, types, quality, costs and acceptability of health services supplied by the private sector. As mentioned in the brief description of overall health services in Malaysia (chapter 3), the government is expanding its services to meet the needs of the expanding population. Since service expansion has been decided on, it would be useful to have the extent of incremental needs determined more accurately for the public sector. It would certainly be a waste of valuable resources if more health facilities are built and more manpower trained and deployed, when planners still remain ignorant as to whether the expanding population will utilize the services or not.

It remains to be seen what the Ministry's policy will be regarding the private sector. There may even be a need to introduce new legislation to facilitate government involvement in new, specific areas in this sector. As

mentioned in chapter 1, there are three major influences acting on the model of an (oral) health system. Apart from the political institution and the population, the categories of personnel delivering the services also play a part in influencing the function of the health care system. As also noted, the views of these personnel are aired through their own professional organizations. For the Ministry, co operation and co ordination between public and private sectors can be promoted through the Malaysian Medical Association, the Malaysian Dental Association and other related health organizations.

In planning the HMIS, the principles involved have conformed closely to the systems concept of developing a new sub-organization (the HMIS) within an already established parent organization (the Ministry of Health). The systems model with top level management (chapter 1, Fig. 3), includes a 'master planning council' which, in this case, may be said to be the Steering Committee. The latter has provided guidance and supervision for the overall development of the information system. The 'operations committee' from the same model, can be said to be the Information System Development Group (ISDG), which has been delegated the task of providing technical input to the planning and development Processes. The functions and terms of reference of both Steering Committee and ISDG have been suitably specified in the protocol for development.

In the conceptual phase, the principles underlying the Information System Development process have been clearly defined, and the framework has included guidelines for identifying the various subsystems within the HMIS. The process of identification has been further facilitated by relating the subsystem names to those functional divisions already established within the Ministry. Similarly, the naming of the sub-subsystems correspond to those programmes already operational within each functional division. This certainly conforms to the first principle formulated in the conceptual phase, that the information system be developed to suit Malaysia's specific needs, and that no model external to the country situation be imposed.

In the systems analysis phase, a review of the Ministry's organization has been made. Such a study has never been carried out before. This phase has given the system designers an insight into the Ministry's functions, decision-making activities and information support at the time of study. This has in turn facilitated data development, in the sense that designers and potential users alike now know what information should be retained (information available and needed); what information should be included (information not available but needed); and what information should be weeded out (information available but not needed).

In the systems design phase, development of the communication system has been carried out by considering different networks of information flows and selecting the most suitable one for each subsystem. Consideration has been

given to integration of all subsystem communication networks, so that the HMIS will function as a whole in order to serve the Ministry's overall objectives. In designing the formats, attention has been paid to reducing delivery staff time in generating and transmission of data.

The framework for development has also, for the first time, formally defined for the health managers the relation between information, decision and action. The framework has specifically identified the level, functions, areas of concern, information required, the individual requiring the information, and the frequency at which it is required. All personnel involved in the exercise of filling the form for the framework for development (see Fig. 30, chapter 4.) have had to meet for this purpose. The constant interaction at this stage may have recreated awareness and instilled greater consciousness amongst some personnel on what their roles are within their own areas of concern and how they relate to one another at different or similar levels and divisions within the Ministry. In this context, those involved may recognize the importance of serving the Ministry as a whole and not to function in isolation.

According to the framework, decisions are to be made for the purposes of strategic planning, management control and operational control. It has been assumed that there should be no overlapping of decisions in the areas of concern mentioned above. If they do overlap, different aspects of those areas should be distinct and in themselves, non-overlapping. In practice, overlapping does occur. For

example, decisions made at the district level may not only be related to operational output from service delivery, but also to performance aspects, which is the area of concern assumed for the state level. One of the major factors to be considered in system design is flexibility: lower level decisions may be input to higher level decisions and vice versa, but too rigid a system may lead to lack of integration, with overspecificity of data use from one functional level to another.

Good planning procedures require that anything new to be introduced (technology or strategy) into an established parent organization, be first tested and evaluated prior to implementation. For the HMIS, the test run and evaluation phase has been carried out to avoid premature institutionalization of the project. Accordingly, evaluation criteria have been agreed upon, resources mobilized and procedures for the test run established. As noted in chapter 4, this phase has also been called the 'system debugging' phase: as the term implies, all 'bugs' in the system should first be removed. Redesigning of forms and modifications to instructions, procedures and information flows have been made during this phase. In Penang state where the test run was carried out, the health staff have been subjected to a great deal of inconvenience because of the constant changes made. Problems have been identified related to data capture and recording, and learning new procedures for submission of the resulting reports. The main causes of problems were identified as additional workload incurred in filling the forms, and effort on part of the staff in

adapting to the new system. The solution to these problems was mainly to stress the importance of training the staff, especially at the peripheral level, to appreciate the importance of the HMIS in the management of services, in the hope of improving the quality of data recorded. The test run has proved the overall feasibility of the information system. It has also highlighted the importance of the human factor in determining the success or failure of the system.

It has been mentioned in the introductory section of this thesis, that the writer has been personally involved in the implementation of the Dental Subsystem. It is the writer's opinion that this process has been fairly smooth, and that the Dental Subsystem has fared better than the other major subsystems. This may be attributed to several factors. The Dental Subsystem, as noted in chapter 4, is basically simple in design. The formats developed are not unlike those used in the old system. So far, only one programme sub-subsystem has been developed. This, as also noted, means that less data is being generated compared to the other subsystems. In turn, less training of staff is required; only one instruction manual needs to be referred to. The fact that the Dental Subsystem is not as yet computer based has also facilitated system adaptation on the part of the staff. Complaints, no doubt, have been made, but this, in the writer's opinion, is due more to problem of system adjustment than to mere additional workload. However, redesigning of the forms for compatibility with EDP need to be considered in the future, when the question of system linkages is raised. This may, in turn, necessitate retraining of the staff.

For the Dental ISDG member, the implementation of the Dental Sub system in the three states indicated for the first phase (Kedah, Perlis and Perak) has been a fairly easy task. The master plan developed for overall implementation has helped define the schedule of tasks to be fulfilled. The implementation has been facilitated by the total co operation and compliance on the part of the states, and the use of trained personnel from Penang to assist in the training. For the rest of the states in Malaysia, it has been noted that there was a request from the National Dental Director to speed up the process. This decision has been supported by the other State Dental Directors who were anxious to have the new system introduced as soon as possible. As also noted, a change in training strategy was made: the states were trained in two regional centres instead of being trained state by state. During this period, no trained staff from Penang was utilized to assist in the training process. The writer (the dental ISDG member at that time) fears that this too rapid implementation process may give rise to problems in terms of inadequate training: this may lead to subsystem dysfunction later on. However, the least of the best thing that has happened, is that the dental services now have a standardized reporting system. The same method of record keeping can facilitate adaptation for staff indicated for interstate transfer. Chairside assistants, dental nurses and dental technicians are the personnel who actually fill in the forms. Since the latter have been standardized, procedures for recording of data can now be included as part of the curriculum for training these auxiliaries at the Dental Training School in Penang.

For the other major subsystems (Medical, Health and Resource Subsystems), the situation is more complex. Each subsystem comprise several programme sub-subsystems and the forms have been designed for EDP compatibility. The implementation process for these subsystems could have been carried out subsystem by subsystem or programme by programme instead of all at once. In assessing the final outcome for these subsystems, it may be a case of introducing something too new, too much, too soon.

Institutionalization of the HMIS has been carried out by terminating the HMIS Development Project and establishing the Central Unit of Information and Documentation System at the Planning and Development Division. This conforms to the systems concept of providing a structure for administrative control at the central level. The components of the central unit have been identified as the Development Section, Information and EDP Section, Documentation Section, and the Health Services Research Section. Top priority has been given to developing the Development Section. Categories of staff required and posts that have been established and filled for the IDS UNit are shown in Annex 6.2. It is evident that there is still a shortage of staff at the Development Section - the posts for a Statistical Officer, a Systems Analyst, Medical Record Officers and a Translator are still not filled. As it is, the former ISDG members absorbed into the Development Section (the Statistician, Medical Officer of Health, Medical Officer, Dental Officer and Public Health Sister) have to perform tasks delegated

to absent staff in the same section and other sections.

For example, the former ISDG personnel mentioned have had to translate all forms and instruction manuals into Bahasa Malaysia, since it is required that ultimately all data be recorded in the translated forms. As the staff were not overly proficient in the scientific usage of the national language, there have been difficulties in identification and standardization of terms to be used.

The Information and EDP Section and the Documentation Section are to be developed proportionately to the rate of expansion of the Central Unit. However, uneven speed or delay in developing these sections may lead to static dysfunction of the information system, since it has to function as a whole to achieve system objectives.

The formation of the Health Services Research Section should prove useful for the Ministry. A structure now exists which, when fully developed, can provide expertise in conducting research namely, epidemiological surveys, longitudinal and cross-sectional studies on service utilization and evaluative surveys as and when indicated. Special studies may also be directed toward the private sector.

A factor not elaborated on in the development and implementation of the HMIS is the question of automation and the problems associated with it. The use of automation first started with punch card tabulation systems, later with computers, and most recently for health care delivery,

with automated standard equipment for diagnostic and treatment purposes. The incredible speed, capacity and diversity of tasks that can be performed by computers capture everyone's imagination and has formed a means to an end. The end is seen as the computerization of data capture, storage and manipulation. The true end, however, is using the technology to deliver services to consumers. This is often overlooked.

Automation has been most frequently used with the greatest success in the administrative aspect of health care facilities rather than the direct delivery of health care services. Administrative forms and practices, being arbitrarily adopted may easily be adapted to the automated devices. The actual delivery of health care services requires that the devices be tailored to the needs of people and this requirement is often overlooked.

The data development efforts of the HMIS have been directed to the population as the basic unit, with primary consideration given to patients and service concerns. However, the data captured are to be used, as stated in the system objectives, for providing the necessary information for purposes of strategic planning, management control and operational control - in other words, to improve service management and administration. The use of computers for most subsystems in the HMIS are not as yet to be used in improving direct delivery of health care services. This matter, though, should be looked into in the continued development of the HMIS.

It has been mentioned at the beginning of this thesis that the HMIS has now reached the stage of system management, and that a management consultant firm has been employed to specify EDP requirements for those subsystems indicated for computerization. Data security is a matter to be considered by the consultants in designing the necessary software and hardware for the relevant subsystems. This factor may not be considered as crucial if the system objectives include computerization of the HMIS to improve direct delivery of patient care. However, certain documents, directives, reports and minutes of meetings may contain some confidential information related to policy and political matters, and service assessment of certain personnel indicated for change in administrative positions.

The HMIS in Malaysia is not fully developed yet. Therefore, it would be unrealistic at this stage to make a complete assessment of the effectiveness and efficiency of the system. This can only be done at the stage of system review. However, should problems associated with system dysfunction arise, the causes may be attributed to three major areas of weakness. During review, solutions may be directed to dealing with these areas.

The first area of weakness is in data capture. There may be broad duplication of capture, poor communication and lack of definitions on usage still. High error rates for computer based subsystems may be due to excessive emphasis on automation and lack of recognition of the human role. Too much time may still be spent on data capture leading to chronic backlogging and also the use of static measures

for dynamic processes. Staff at the peripheral level usually do not understand the significance of the data captured. Due to lack of feedback of the data captured to the data sources, problems in motivation and training of personnel may persist.

The second area of weakness is in data communication. In spite of the information flows designed specifically for each subsystem, there may still exist lack of integration and multiplication of routes. For example, the National Dental Director may still bypass the IDS Unit for information available at the state or district levels by asking direct; this may happen despite the new communication system established for the Dental Subsystem. Another aspect of weakness in data communication is poor flexibility from lack of understanding of the role of communication, and excessive specificity to single cases. There may also be inappropriate speeds and times of communication, as illustrated by the following situation: the Dental Subsystem, unlike the other subsystems, is not computer supported. So far, the first seems to be functioning well as far as data capture and submission of reports are concerned. However, the slower rate of data manipulation and transmission in the Dental Subsystem may cause lack of integration in overall system linkages when the total HMIS becomes fully functional.

Data use is the third major area of weakness, and this, in the writer's opinion, may constitute the main cause of system dysfunction. Weakness in data use could be due to excessive volume from poor needs analysis and definition.

Loss of long term and planning value of data may result from constant change and ignorance in its utilization. There may be lack of co-ordination between related uses, coming from poor organizational definition of the relationships. Economizing on data presentation by increasing data volume but decreasing the frequency may lead to inefficient use. For the HMIS, levels of use have been identified, but lack of integration stemming from overspecificity and compartmentalization of data usage may still exist.

The health indicator exercise has been carried out as a continuing development process of the HMIS. The indicators developed have shown how some of the information from service records may be utilized to assess service performance. The Penang State Annual Report has been used as a model to portray system utilization (for the Dental Subsystem). However, there is no guarantee that the indicators developed and the information presented in the annual report may be used by its subscribed users in the management of services. In-service courses may have to be conducted for health executives in the Ministry to ensure proper use of the information system. The management consultant firm employed may be useful in determining the scope, method and content of training involved. It remains to be seen what the final outcome of total system usage will be.

Finally, it is evident that the overall development and implementation of the HMIS has not been an easy task. This is evident in the delay of the project schedule by two years. The first extra year has been devoted to establishing the

framework for development which has been one of the more complicated elements of the information system development. However, it has been the foundation on which project requirements were defined in order to fulfil the stated objectives of the system. The second additional year has been used to extend the period of test run and evaluation. This extension is justified to allow more time for system adjustment. and to improve the system design, in order that premature institutionalization of the system may be avoided. The true outcome of the system, however, can only be determined when the total HMIS becomes fully functional throughout the nation.

CONCLUSIONS

The Ministry of Health in Malaysia is moving towards more sophisticated means in the management of its services. A new Health Management Information System (HMIS) has been introduced to improve the bases of decision-making at all levels in the Ministry, by making available accurate and timely information.

The organization of a health information system at the national level is not feasible in certain countries. The feasibility of developing such a system depends on the nature of health care services delivery, and the availability of funds and technological expertise. In considering all these factors, conditions were favourable in Malaysia for developing such a system.

The process associated with the development and implementation of the HMIS has been systematic. Systems thinking, a concept recently established in the school of management science, has been applied in the development process.

The HMIS Development Project has a protocol in which distinct development phases have been identified. The project has its overall objectives clearly defined, the system boundary identified, the methodology worked out, and the project requirements, schedule and outputs clearly stated. It has top level management provided by a Steering Committee. A divisional task force was also formed to provide technical input to the project development process. Expert advice was sought through consultation with the World Health Organization.

The project is ambitious. The private sector has been included in the identification of the system boundary. The Ministry, however, has yet to establish its policy regarding this sector: the extent and nature of involvement have yet to be determined.

Health information from the private sector is useful in providing planners in the Ministry a total picture of the country's health situation. Such information may ensure that additional resources expended in service expansion will actually be utilized by the expanding population. Incremental needs for the public sector can also be determined more accurately.

Co operation and co ordination between private and public sectors in information system management may be promoted through established professional organizations in the country, namely, the Malaysian Medical Association and Malaysian Dental Association.

The information system has been developed to suit Malaysia's needs in particular; no system foreign to the country situation has been adopted. This is evident in the guiding principles used for identifying the subsystems and sub-subsystems of the HMIS.

The project has necessitated a review of the Ministry's organization during the systems analysis phase. Such a review may never have been initiated in the absence of this project. The review has not only enabled system designers to define the Ministry's functions, decision-making activities and information support at the time of study, but may have given policy-makers and other health managers a new insight to short-comings in the overall organization of the Ministry and its administrative procedures.

The process of identifying specific information required in the exercise of determining the framework for development of the information system, may have constituted a refresher course on management for the health personnel involved. The role of information in the management of health services has been stressed. The relationship between information, decision and action has been formally defined for the first time.

During the systems design phase, the communication network for each subsystem has been determined only after considering all possible alternatives. System integration has been considered in the selection process. System flexibility has been included in the utilization of information at different levels and areas of concern. The human role has been considered in the data development process: attention has been paid to cutting down delivery staff time in generation and transmission of data.

The test run and evaluation phase has been a trying period for the health staff in Penang state. The process, however, has been systematically carried out, with evaluation criteria having been predetermined and the relevant procedures established. Constant modifications to instructions, procedures and information flows were made, and they have proved the overall feasibility of the information system.

The Dental Subsystem has fared better than the other subsystems during the test run and implementation phase. To all intents and purposes, although 'new', this subsystem has remained a conventional information subsystem, meaning that all data are still manually manipulated. Nationwide implementation of the Dental Subsystem

has been facilitated by the total co operation and compliance of all states.

The period of test run may still have been insufficient for the other subsystems. The latter are more complex in terms of design, scope, functions and tasks to be fulfilled. These subsystems are computer based. The success in adoption of automation in improving service management for the Health Ministry depends on these computer supported subsystems. They may, however, have been prematurely implemented. The situation could have been made less complicated by implementing them subsystem by subsystem.

The information system has control at the central level. The Central Unit of Information and Documentation System (IDS Unit) has distinct sections set up to deal with specific tasks in information management at the national level. The Health Services Research Section, in particular, is an added boon to the Ministry: a suitable structure now exists to facilitate research in the provision and utilization of data for planning, evaluation and improvement of health services.

The overall development and implementation of the HMIS has not been an easy task. The project has, in the writer's opinion, probably caused a major upheaval in the Ministry's organization. It may have subjected all health personnel, especially those involved in decision-making, to a period of soul-searching as far as their positions, roles and functions are concerned.

The information provided by the system is based mainly on health service records. With regard to this source, the information system does not provide all information required for purposes of strategic planning and management of services. This is evident in the data required for computation of certain health indicators developed, and the types of information that can be presented in an annual report. No matter how adequately designed the system may be, information still needs to be obtained from sources outside of the system.

The phase of system management is in sight. Management consultants are now available to determine the EDP requirements of the computerized subsystems, and to ensure proper usage of the information processed, to meet the HMIS overall objective. Provision of data security is a factor to be considered in the design of the necessary software and hardware for the relevant subsystems.

Service management and the direct delivery of patient care are two separate though related issues. Improvement of the one through automated data processing (part of the present HMIS objective) need not necessarily lead to improvement in the other.

The use of automation in the direct delivery of patient care is a factor to be considered in the continued development of the HMIS.

The Dental Subsystem may also require EDP in the future: a standardized method of data processing may help improve integration and co ordination of the total HMIS.

The human role in the computerized subsystems of the HMIS cannot be overemphasized. It is easier to change the system to suit the people than vice versa. Consideration has been given to the human role in the system design, but proper system utilization needs to be ensured. It would be an oversight on the part of system designers if time and money have been spent and energy expended in development without attention paid to detailed aspects of proper usage of the system. Some managers may not relish the idea of changing their management style just to suit the system., Furthermore, staff at the operational level may resent excessive time spent in form-filling when their main concern is patient management.

In-service courses need to be conducted within the Ministry to facilitate proper system utilization. Consideration should be given to providing sufficient feedback of data captured to the data sources. Proper usage is crucial in determining the ultimate success or failure of the HMIS.

The information system is not yet fully functional. Many components are still not developed, and linkages still have to be established among subsystems. Any attempt, therefore, on the part of the writer to make a total assessment of the HMIS at this time would not only be unfair, but unrealistic.

At this stage, the only definitive statement that can be made regarding the HMIS is that, it has been introduced to assist managers in the Ministry of Health, Malaysia to improve the bases of decision-making at all levels, by making available accurate, relevant, and timely information. Whether the information system will really lead to changes for the better as far as service management is concerned, still remains to be seen.

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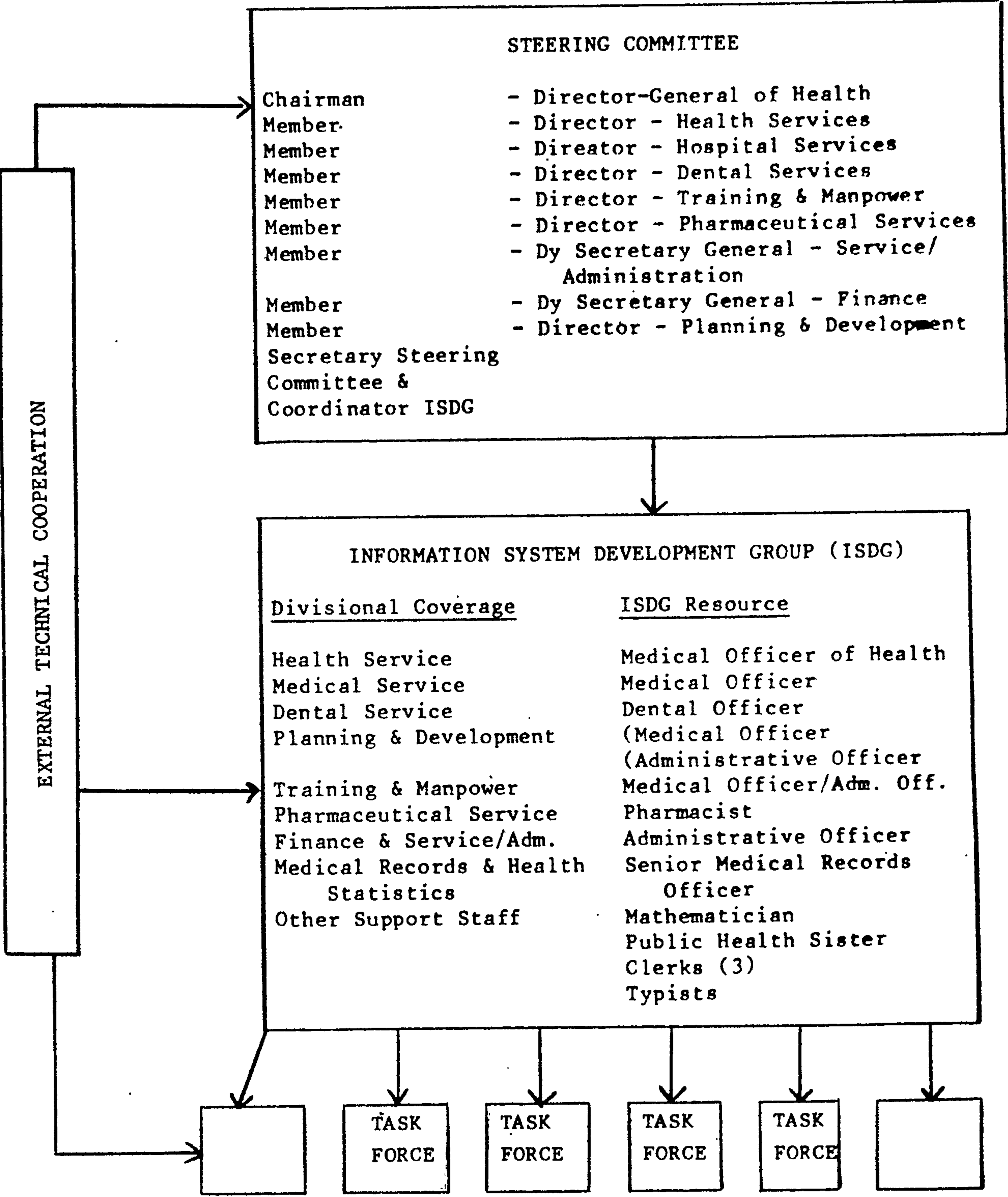
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ANNEX 1

HEALTH MANAGEMENT INFORMATION SYSTEM DEVELOPMENT PROJECT
ORGANIZATION STRUCTURE



ANNEX 2

HEALTH MANAGEMENT INFORMATION SYSTEM DEVELOPMENT PROJECT

FUNCTIONS & RESPONSIBILITIES
OF THE STEERING COMMITTEE

The Steering Committee is responsible for development of a Health Management Information System. Its functions will be as follows:

(1) To provide collectively top management support for the Health Management Information System Development effort and creating an environment within the Ministry and Divisions for carrying out different studies that may be needed.

(2) To establish a Health Management Information Systems Development Group (ISDG) that would assume responsibilities for technical aspects of the systems development effort.

(3) To ensure provision of resources needed for the Health Management Information System Development effort by allocating available resources from among competing user demands to both the ISDG and Divisional Task Forces (DTF).

(4) To direct and guide the Health Management Information Systems Development Group in the development efforts and review periodically its progress.

(5) To critically review the recommendations of ISDG and, if approved, establish a schedule for a phased implementation.

ANNEX 3.1

HEALTH MANAGEMENT INFORMATION SYSTEM DEVELOPMENT PROJECT

1. TERMS OF REFERENCE FOR
INFORMATION SYSTEMS DEVELOPMENT GROUP - ISDG

Under the overall direction of the Steering Committee the ISDG will:

- (1) Develop a framework of the health management information system including identification of different subsystems.
- (2) Identify the information needs of the Ministry and its Division and their possible uses in planning, management and operational control of their services and its supporting units at various levels.
- (3) Design an effective and efficient HMIS to cater to their data-based information needs.
- (4) Test run and evaluate the designed system.

ANNEX 3.2

HEALTH MANAGEMENT INFORMATION SYSTEM DEVELOPMENT PROJECT

2. FUNCTIONS OF ISDG MEMBERS

- (1) To participate in the development of a framework for the Health Management Information System.
- (2) To act as a technical link between the ISDG, as the Working Group of the Steering Committee, and the assigned Division and assist the Divisional Heads -
 - (a) to organize the Divisional Task Force that may be established;
 - (b) to provide necessary guidance and direction to the Divisional Task Force by interpreting, in the context of the Division, the directives of the Steering Committee;
 - (c) to be responsible for the technical content of Divisional outputs.
- (3) To be collectively responsible to ensure that the terms of reference of ISDG are carried out effectively and efficiently.

Table D

INFORMATION REQUIREMENTS FOR PERSONAL DENTAL CARE SUB-SYSTEM/SUB-SUB-SYSTEM

LEVEL OF GENERATION		Dental clinic in Sub health C.		Dental Clinic in Main Health C.		School Dental Clinic		School Dental Centre		Main D. Clinic		DC Polyclinic		Mobile DC		Mobile D Squad		D.C. Hospital		
		F Gen		By		F Gen		By		F Gen		By		F Gen		By		F Gen		
		No.	DESCRIPTION																	
DATA ELEMENTS	1	A	DN	DN	DO	A	DN	DN	A	Ortho	A	DS DO DN	A	DO DN	A	DO DN	A	DO DN	A	DS DO
	2	"	-	-	DO	-	-	-	-	DO DN	-	Ortho	-	-	-	-	-	-	-	DS DO
	3	"	-	-	DO	-	-	-	-	DO Ortho	-	Ortho	-	-	-	-	-	-	-	DS DO
	4	"	DN	DN	DO DN	-	DN	DN	-	Ortho DO	Ortho	DS DO	Ortho	DO DN	DO DN	DO DN	DO DN	DO DN	DO DN	DS DO
	5	"	-	-	DO	-	-	-	-	Ortho DO	Ortho	DS DO	Ortho	-	-	-	-	-	-	DS DO
	6	"	DN	DN	DO DN	-	DN	DN	-	Ortho	Ortho	DS DO	Ortho	DO DN	DO DN	DO DN	DO DN	DO DN	DO DN	DS DO
	7	"	DN	DN	DO DN	-	DN	DN	-	Ortho	Ortho	DS DO	Ortho	DO DN	DO DN	DO DN	DO DN	DO DN	DO DN	DS DO
	8	"	-	-	DO	-	-	-	-	Ortho DO	Ortho	DS DO	Ortho	-	-	-	-	-	-	DS DO
	9	"	-	-	DO	-	-	-	-	Ortho DO	Ortho	DS DO	Ortho	DO	DO	DO	DO	DO	DO	DS DO
	10	"	-	-	DO	-	-	-	-	Ortho DO	Ortho	DS DO	Ortho	DO	DO	DO	DO	DO	DO	DS DO
	11	"	-	-	-	-	-	-	-	-	-	DS	DS	-	-	-	-	-	-	DS DO
	12	"	-	-	-	-	-	-	-	-	-	DS	DS	-	-	-	-	-	-	DS DO
	13	"	-	-	DO	-	-	-	-	Ortho DO	Ortho	Ortho DS	Ortho DS	-	-	-	-	-	-	DS DO
	14	"	-	-	DO	-	-	-	-	Ortho DO	Ortho	Ortho DS	Ortho DS	-	-	-	-	-	-	DS DO

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INFORMATION REQUIREMENTS FOR PERSONAL DENTAL CARE SUB-SYSTEM/SUB-SUB-SYSTEM

LEVEL OF GENERATION		Dental clinic in Sub health C.		Dental Clinic in Main Health C.		School Dental Clinic		School Dental Centre		Main D. Clinic		DC Polyclinic		Mobile DC		Mobile D Squad		P.C. Hospital	
		By		By		By		By		By		By		By		By		By	
		F Gen		F Gen		F Gen		F Gen		F Gen		F Gen		F Gen		F Gen		F Gen	
DATA ELEMENTS																			
No.	DESCRIPTION																		
16	No. of 1st attendances for fillings	A	DN		DN DO	A	DN	A	DN	A	Ortho DO DN	A	Ortho DS DO DN	A	DO DN	A	DO DN		DS DO
17	No. of 1st attendances for crowns	"	-		DO		-		-		Ortho DO		Ortho DS DO		-		-		DS DO
18	No. of 1st attendances for dentures	"	-		DO		-		-		Ortho DO		Ortho DS DO		-		-		DS DO
19	No. of 1st attendances for scaling	"	DN		DO DN		DN		DN		Ortho DO DN		Ortho DS DO DN		DO DN		DO DN		DS DO
20	No. of 1st attendances for endodontic	"	-		DO		-		-		Ortho DO		Ortho DS DO		-		-		DS DO
21	No. of 1st attendances for extraction	"	DN		DO DN		DN		DN		Ortho DO DN		Ortho DS DO DN		DO DN		DO DN		DS DO
22	No. of 1st attendances for abscess	"	DN		DO DN		DN		DN		Ortho DO DN		Ortho DS DO DN		DO DN		DO DN		DS DO
23	No. of 1st attendances for removal of impacted teeth	"	-		DO		-		-		Ortho DO		Ortho DS DO		-		-		DS DO
24	No. of 1st attendances for dry socket/infected teeth	"	-		DO		-		-		Ortho DO		Ortho DS DO		DO		DO		DS DO
25	No. of 1st attendances for treatment of periodontal disease	"	-		DO		-		-		Ortho DO		Ortho DS DO		DO		DO		DS DO
26	No. of 1st attendances for biopsies	A	-		-	A	-	A	-	A	-	A	DS	A	-	A	-	A	DS
27	No. of 1st attendances for treatment of oral pathology	"	-		-	"	-	"	-	"	-	"	DS	"	-	A	-	A	DS
28	No. of 1st attendances for fracture	"	-		DN	"	-	"	-	"	DO	A	DS DO	"	-	"	-	A	DS DO
29	No. of 1st attendances for orthod. III	"	-		DO	"	-	"	-	"	Ortho DO	"	Ortho DS DO	"	-	"	-	A	DS DO

Table D

INFORMATION REQUIREMENTS FOR PERSONAL DENTAL CARE SUB-SYSTEM/SUB-SUB-SYSTEM

LEVEL OF GENERATION		Dental clinic in health.C.		Dental Clinic in Main Health C.		School Dental Clinic		School Dental Centre		Main D. Clinic		DC Polyclinic		Mobile DC		Mobile D Squad		D.C. Hospita	
		F Gen.	By	F Gen.	By	F Gen.	By	F Gen.	By	F Gen.	By	F Gen.	By	F Gen.	By	F Gen.	By	F Gen.	By
DATA ELEMENTS																			
No.	DESCRIPTION																		
30	No. of fillings done (completed)	M	DN	M	DN DO	M	DN	M	DN	M	Ortho DO DN	M	Ortho DS DO DN	M	DO DN	M	DO DN	Mo.	DS DO
31	No. of . . . crowns done (completed)		-		DO DT		-		-		Ortho DO DT		DT Ortho DS DO		-		-		DS DO DT
32	No. of dentures done (completed)		-		DO DT		-		-		Ortho DO DT		Ortho DT DS DO		DO DN		-		DS DO DT
33	No. of scaling done (completed)		DN		DO DN		DN		DN		Ortho DO DN		DS Ortho DO DN		DO DN		DO DN		DS DO
34	No. of endodontic treatment done (Completed)		-		DO		-		-		Ortho DO		Ortho DS DO		-		-		DS DO
35	No. of extraction done		DN		DO DN		DN		DN		Ortho DO DN		Ortho DN DS DO		DO DN		DO DN		DS DO
36	No. of abscesss treated (completed)		DN		DO DN		DN		DN		Ortho DO DN		Ortho DS DO DN		DO DN		DO DN		DS DO
37	No. of impacted teeth removed		-		DO		-		-		Ortho DO		Ortho DS DO		-		DO		DS DO
38	No. of dry socket/infected socket treated (completed)		-		DO		-		-		Ortho DO		Ortho DS DO		DO DN		DO		DS DO
39	No. of periodontal diseases treated (completed)		-		DO		-		-		Ortho DO		Ortho DS DO		DO		-		DS DO
40	No. of biopsies done.		-		-		-		-		-		DS		-		-		DS
41	No. of oral pathology cases treated		-		-		-		-		-		DS		-		-		DS
42	No. of fractures treated (completed)		-		DO		-		-		Ortho DO		Ortho DS DO		-		-	M	DS DO
43	No. of orthodontic cases under treatment	"	-	"	DO	"	-	"	-	"	Ortho DO	"	Ortho DS DO	"	-	"	-	"	DS DO

INFORMATION REQUIREMENTS FOR PERSONAL DENTAL CARE SUB-SYSTEM/SUB-SUB-SYSTEM

LEVEL OF GENERATION		Dental clinic in health C.		Dental Clinic in Main Health C.		School Dental Centre		Main D. Clinic		DC Polyclinic		Mobile DC		Mobile D Squad		D.C. Hospital	
		F Gen	By	F Gen	By	F Gen	By	F Gen	By	F Gen	By	F Gen	By	F Gen	By	F Gen	By
DATA ELEMENTS	DESCRIPTION																
44	Total no. of attendances of (0-6) age group	6mo	DN	6mo	DO DN	6mo	DN	6mo	Ortho DO DN	6mo	DS Ortho DO DN	6mo	DO DN	6mo	DO DN	M	DS DO
45	Total no. of attendances of (6-18) age group	"	DN	"	DO DN	"	DN	"	Ortho DO DN	"	DS Ortho DO DN	"	DO DN	"	DO DN	"	DS DO
46	Total no. of attendances of (above 18) age group	-	-	-	DO	-	-	-	Ortho DO	-	Ortho DS DO	-	DO	-	-	-	DS DO
47	Total no. of attendances of females (15-45)	"	-	"	DO	-	-	"	Ortho DO	"	Ortho DS DO	"	DO	"	-	-	DS DO
48	Total no. of attendances of schoolchildren																
49	No. of 1st attendances of (0-6) age group	A	DN	A	DO DN	A	DN	A	Ortho DO DN	A	DS Ortho DO DN	A	DO DN	A	-	A	DS DO
50	No. of 1st attendances of (6-18) age group	A	DN	A	DO DN	A	DN	A	Ortho DO DN	A	DS Ortho DO DN	A	DO DN	A	DO DN	A	DS DO
51	No. of 1st attendances of (above 18) age group	-	-	-	DO	-	DN	A	Ortho DO DN	A	Ortho DS DO	A	DO DS	-	-	A	DS DO
52	No. of 1st attendances of females (15-45 years) age group	-	-	-	DO	-	-	A	Ortho DO	A	Ortho DS DO	A	DO	-	-	A	DS DO
53	No. of 1st attendances among primary schoolchildren	A	DN	A	DN	A	DN	A	Ortho DO DN	A	DS Ortho DO DN	A	DO DN	A	DO DN	A	DS DO
54	No. of 1st attendances among secondary schoolchildren	-	-	-	DO	-	-	A	Ortho DO	A	Ortho DS DO	A	DO	-	-	A	DS DO
55	Total no. of 1st attendances among farmers, fishermen, felda workers, gov't servants, estate workers	A	DO	A	DO	-	-	A	Ortho DO	A	Ortho DO DS	A	DO	-	-	A	DS DO

Table D

INFORMATION REQUIREMENTS FOR PERSONAL DENTAL CARE SUB-SYSTEM/SUB-SUB-SYSTEM

LEVEL OF GENERATION		Dental clinic in health C.		Dental Clinic in Main Health C.		School Dental Clinic		School Dental Centre		Main D. Clinic		DC Polyclinic		Mobile DC		Mobile D Squad		D.C. Hospital	
		Sub health C.		Main Health C.		F Gen		F Gen		F Gen		F Gen		F Gen		F Gen		F Gen	
		By	F Gen	By	F Gen	By	F Gen	By	F Gen	By	F Gen	By	F Gen	By	F Gen	By	F Gen	By	F Gen
DATA ELEMENTS																			
No.	DESCRIPTION																		
56	Population by age groups (0-6; 6-18; 18 and above, females 15-45)																		
57	Urban population																		
58	Rural population																		
59	Population densities																		
60	Projected population year by year fees coming 5 years																		
61	Population of farmers, fishermen, felda workers, gov't servants, estate workers																		
62	List of primary schools																		
63	List of secondary schools																		
64	List of primary schools covered																		
65	List of secondary schools covered																		
66	No. of primary schoolchildren																		
67	No. of secondary schoolchildren																		
68	No. and locations of schools with enrollments (0-500)																		
69	No. and locations of schools with enrolments (500-1000)																		
70	No. and locations of schools with enrollments (1000 & above)																		

Table C

INFORMATION REQUIREMENTS FOR PERSONAL DENTAL CARE SUB-SYSTEM/SUB-SUB-SYSTEM

LEVEL OF GENERATION DATA ELEMENTS		Dental clinic in health C.		Dental Clinic in Main Health C.		School Dental Clinic		School Dental Centre		Main D. Clinic		DC Polyclinic		Mobile DC		Mobile D Squad		D.C. Hospital	
		F	By	F	By	F	By	F	By	F	By	F	By	F	By	F	By	F	By
		Gen		Gen		Gen		Gen		Gen		Gen		Gen		Gen		Gen	
No.	DESCRIPTION																		
71	Total primary school enrollment																		
72	No. and locations of schools with visiting services																		
73	No. of locations of schools with dental clinics																		
74	No. of dental chairs																		
75	No. of private dentists																		
76	No. of dental practices (excluding registered dentists)																		
77	Location of dental practices (address, administrative district)																		
78	No of DO																		
79	No of DN																		
80	No of DT																		
81	No of completed cases per month	mo																	
82	No of recall cases per month	A	DN	mo	DO DN	mo	DO DN	DN	mo	DO DN	Ortho	mo	DO DN	DO DN	DO DN	DO DN	DO DN		
83	No of defaulters per month	A	DO DN	A	DO DN	A	DO DN	DN	A	DO DN	Ortho	A	DO DN	DO DN	DO DN	DO DN	DO DN		
84	No of complaints received																		
85	No of complaints investigated																		
86	No of complaints finalized																		
87	Per capita income																		
88	Total no. of registered dentists premises	A	DO	A	DO	-	DO	-	A	DO	DO	A	DO	-	-	-	-	-	-
89	Total no of registered dentist premises inspected	A	DO	A	DO	-	DO	-	A	DO	DO	A	DO	-	-	-	-	-	-
90	List of existing std/norms for manpower (as directed by planning committee)																		
91	List of schools completed	mo.	DN	mo.	DN DO	mo.	DN DO	DN	mo.	DO DN	DO DN	mo.	DO DN	DO DN	DO DN	DO DN	DO DN		
92	No of days each dental clinic functions in the year	A	DO DN	A	DO DN	A	DO DN	DN	A	DO DN	DO DN	A	DO DN	DO DN	DO DN	DO DN	DO DN		

Information output for Personal Dental Care sub-system/sub-sub-system

ANNEX 4.2.

Table 3

I.R. Information output		Data Combination	Level requiring information										Remarks
			District		State			National					
			By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency			
No	Description		By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	
5	Total attendances by Type of treatment (statewise) (in the district)	1-14	-	-	-	-	-	-	-	-	-	-	-
			SDO	Annual	-	-	-	-	-	-	-	-	-
			D/O	Y/M	-	-	-	-	-	-	-	-	-
5	Total attendances by specified age groups (statewise) (in the district)	44-47	-	-	-	-	-	-	-	-	-	-	-
			SDO	Annual	-	-	-	-	-	-	-	-	-
			D/O	Y/M	-	-	-	-	-	-	-	-	-
5	No of 1st attendances by type of treatment (statewise) (in the district)	16-29	-	-	-	-	-	-	-	-	-	-	-
			SDO	Annual	-	-	-	-	-	-	-	-	-
			D/O	Y/M	-	-	-	-	-	-	-	-	-
6	No of 1st attendances by specified age groups (statewise) (in the district)	49-52	-	-	-	-	-	-	-	-	-	-	-
			SDO	Annual	-	-	-	-	-	-	-	-	-
			D/O	Y/M	-	-	-	-	-	-	-	-	-
43	Work done, type of treatment, quantity of treatment given for each type (statewise) (in the country) (in the state)	30-43	-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
62	Quality (% of each item of care of total output	30-43	-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
45	Total attendance/DO (statewise) (for state)	1-14,77	-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-

Table E

I.R. Information output		Data Combination	Level requiring information												Remarks
			District			State			National						
			By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	
No	Description		By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	
46	Total attendance/DN (statewise) (for state)	1, 4, 6, 7, 78	-	-	-	-	-	-	-	-	-	-	-	-	-
81	Output of work DO/DN (for state)	30-43, 77, 78	-	-	-	-	-	-	-	-	-	-	-	-	-
136	Output of work DO/DN/DT (for district)	30-43, 78, 8DO DO Y/M monthly 79, 80	-	-	-	-	-	-	-	-	-	-	-	-	-
82	Total no of 1st attendance 18, 79 for dentures per DT (for state)		-	-	-	-	-	-	-	-	-	-	-	-	-
86	Workload for various categories of staff (by dental clinics) 30-43 (does not include DS ortho)		-	-	-	-	-	-	-	-	-	-	-	-	-
49	Average no of fillings per year/DO/DN (statewise)	30, 77, 78	-	-	-	-	-	-	-	-	-	-	-	-	-
50	Average no of dentures (full/partial) per year/DO (statewise)	32, 77	-	-	-	-	-	-	-	-	-	-	-	-	-
51	Average no of extractions per year DO/DN (statewise)	35, 77, 78	-	-	-	-	-	-	-	-	-	-	-	-	-
52	Average no of scalings per year/DO/DN (statewise)	33, 77, 78	-	-	-	-	-	-	-	-	-	-	-	-	-
42	Coverage eligible population by age no. covered (by age) (statewise)	49, 50, 51 52, 56	-	-	-	-	-	-	-	-	-	-	-	-	-

Information output for Personal Dental Care sub-system/sub-sub-system

Table E:

I.R. Information output		Data Combina- tion	Level requiring information										Remarks
No		Description	District		State		National						
			By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	
47	Coverage of priority groups - total eligible population of priority group - total eligible no. treated of priority groups	55,61	-	-	-	-	-	-	p(PPM)	Annual	-	-	
62	Target achievement - coverage of primary school children (statewise) (in the state)	66,53	-	-	P(PPN)	Annual Quarterly	-	-	p(PPN)	2 1/2 years	-	-	
62	Target Achievement -coverage of secondary school children	67,54	-	-	P(PPN)	Annual Quarterly	-	-	-	-	-	-	
137	List of schools covered/completed	64 65 91	-	monthly	-	-	-	-	-	-	-	-	
110	Coverage achieved - No. of schools covered	64,65,62, 63	-	-	P(PPN)	Quarterly annually	-	-	-	-	-	-	
128	Location and no. of schools - by categories by availability of service (by districts)	68 69 70 72 73	-	-	-	-	-	-	-	-	-	-	
11	Coverage by existing facilities - Chair-population ratio - Annual average attendance by chair	74, 56 74, 1-14	-	-	P(PPN)	Once every 5 yrs	-	-	-	-	-	-	

Table 2

I.R. Information output		Data Combina- tion	Level requiring information										Remarks
			District		State		National						
			By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	
No	Description		By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	
134	No and location of dental practices (excluding registered dentists) in the district	76 77	SDO DO	Y/M Annual	-	-	-	-	-	-	-	-	-
10	No of private dentists (by districts)		-	-	-	-	-	-	P (PPM)	5 yrs	-	-	-
41	% of registered dentists 88,89 premises inspected annually (by states)	-	-	-	-	-	-	-	P (PPM)	Annual	-	-	-
111	No of completed cases per DO per month	81, 78	SDO DO	Y/M mo	-	-	-	-	P (PPN)	Annual	-	-	-
111	No of completed cases per DN per month	81 79	SDO DO	Y/M mo	-	-	-	-	P (PPN)	Annual	-	-	-
112	No of recall cases per DO per month	82 78	-	-	-	-	-	-	P (PPN)	Annual	-	-	-
112	No of recall cases per DN per month	82 79	-	-	-	-	-	-	P (PPN)	Annual	-	-	-
113	No of defaulters (not defaulted visits) per DO per month	83 78	-	-	-	-	-	-	P (PPN)	Annual	-	-	-
	No of defaulters (not defaulted visits) per DN per month	83 79	-	-	-	-	-	-	P (PPN)	Annual	-	-	-
36	Public dissatisfaction with services provided (statewise) (by district breakdown)	84 85 86	-	-	-	-	-	-	-	-	-	-	-
15	Per capita income by district (for the state)	87	-	-	-	-	-	-	P (PPN)	Quarterly	-	-	-
			-	-	-	-	-	-	P (PPM)	5 yrs	-	-	-

Table E

I.R. Information output		Data Combina- tion	Level requiring information										Remarks
			District		State		National						
No	Description		By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	By whom	Frequency	
24	Std/Norms for manpower computations	90	-	-	-	-	-	-	-	-	-	-	
	Daily average no. of attendances at each dental clinic	44-46 92 MCH MS MOIC	-	-	-	-	-	-	-	-	-	-	
	Total no. of attendances per year of adults/schoolchildren	46 15	-	-	-	-	-	-	-	-	-	-	
	by state		-	-	-	-	-	-	-	-	-	-	
	by districts (for the state)		-	-	CMHO	-	-	-	-	-	-	-	At time of preparation of 5 yr plan At time of mid-term review.
	Total attendances	E49-51	-	-	-	-	-	-	-	-	-	-	
	- 1st attendances	E44-46	-	-	-	-	-	-	-	-	-	-	
	- repeat attendances (by districts) (in the state)		-	-	CMHO	Annual	-	-	-	-	-	-	
	% of schoolchildren covered by mobile dental service for the past 5 years (by district)		-	-	-	-	-	-	-	-	-	-	
			-	-	CMHO	At time of prep. of 5 yr plan At time of mid-term review							

ANNEX 5

[illegible]

[illegible]

SCHOOL OF SCHOOL CHILDREN, IN ORDER TO BE ADEQUATE FOR THE MONTH YEAR
 CHILDREN OF THE AND THE OF THE FOR THE MONTH YEAR
 CHILDREN OF THE AND THE OF THE FOR THE MONTH YEAR

[illegible]

[illegible]

[illegible]

REPORT OF WORKLOAD OF DENTAL NURSE

PC 201

1. State	District		4. Unit	6. Sub-Unit	8. Name of Dental Nurse	
	2. Health	3. Administrative				
5. Location			7. Location			

Category of Patient	Ethnic Group					Items of Care										Completion	
	Attendance	Malay	Chinese	Indian	Others	Total	Primary Extraction	Restoration				Temporary Filling	Prophylaxis	Topical Fluoride	Conservative		
								Simple Amalgam	Compound Amalgam	Silicate/Composite	Total						
9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Pre-School	New																
	Total																
Primary School	New																
	Total																
Secondary School	New																
	Total																
Grand Total	New																
	Total																

Total number of days of: vacation leave
sick leave
maternity leave
unrecorded leave

Signature of Dental Nurse

1. State	District		4. Unit	6. Sub-Unit	8. Name of Dental Officer
	2. Health	3. Administrative			

Category of Patient	Attendance		Ethnic Group				Category of treatment					Items of Care																	X-Ray									
	New	Total	Malay	Chinese	Indian	Others	Total	Oral Surgery	Orthodontic	Periodontal	Prophylaxis	Endodontic Treatment	Temporary Filling	Extraction	Restoration					Oral Surgery						Prosthesis					Comple-tion							
															Primary	Permanent	Simple Amalgam	Compound Amalgam	Silicate/Composite	Inlay/Crown	Total	Abscess	Fracture	Infected Socket	Surgical Extraction	Miscellaneous Surgical Cases	Full	Partial			Others	Conservative	Case					
9	10		11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	Intra Oral	Extra Oral
Pre-School	New																																					
	Total																																					
Primary School	New																																					
	Total																																					
Secondary School	New																																					
	Total																																					
Ante-Natal	New																																					
	Total																																					
Adults	New																																					
	Total																																					
Grand Total	New																																					
	Total																																					

Signature of Dental Officer

Total number of days of vacation leave

sick leave

maternity leave

unrecorded leave

Revenue collected (to be recorded only by the officer in charge) for the clinic

1. State	District		4. Date	6. Name of Orthodontist
	2. Health	3. Administrative		

PG 203

Category of Patients		Items of Care													Signature of Orthodontist																				
		Ethnic Group				Category of Treatment				X-ray		Restoration								Oral Surgery				Prosthesis											
		Malay	Chinese	Indie	Others	Total	Orthodontic	Pericoronitis	Fracture	General	Extra Oral	Intra Oral	Impression	Removable Appliance			Fixed Appliance	Adjustment of Appliance	Active Treatment Completed	Review Retention Cases	Primary	Permanent	Simple Bridges	Compound Bridges	Silicate/Composite	Inlay/Crown	Total	Temporary Filling	Endodontic Treatment	Prophylaxis	Abscess	Surgical Extraction	Miscellaneous Surgical Cases	Full	Partial
Grand Total	Total																																		
	New																																		
Adults	Total																																		
	New																																		
Secondary School	Total																																		
	New																																		
Primary School	Total																																		
	New																																		
Others	Total																																		
	New																																		

Total number of days vacation leave
Sick leave
maternity leave
unrecorded leave

1. State		District		4. Unit		6. Name Dental Specialist/ Dental Officer	
2. Health		3. Administrative		5. Location			

PG 204

Category of Patient	Attendance	Ethnic Group				Category of Treatment					Items of Care																															Year																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		Malay	Chinese	Indian	Others	Total	Oral Surgery	Orthodontic	Periodontal	Prosthetic	General	Tumour	Cyst	Oral Medicine Cases	Biopsy	Alveolotomy	Apicoectomy	Miscellaneous Surgical Cases	Treatment of Soft Tissue Injury	Treatment of Injuries to Teeth	Fracture	TMJ Disorder	Infected Socket	Oro-facial Fistula	Arrest of Haemorrhage	Surgical Extraction	Extraction	Restoration	Periodontal Treatment	Prosthesis	Examination/Review																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Grand Total	Sex											Benign	Malignant	Osteomyelitis	Abscess	Long	Soft Tissue	Oral Medicine Cases	Biopsy	Alveolotomy	Apicoectomy	Miscellaneous Surgical Cases	Treatment of Soft Tissue Injury	Treatment of Injuries to Teeth	Mandible	Facial Bone	TMJ Disorder	Infected Socket	Oro-facial Fistula	Arrest of Haemorrhage	Surgical Extraction	Primary	Permanent	Simple Amalgam	Compound Amalgam	Silicate/Composite	Inlay/Crown	Total	Temporary Fillings	Endodontic Treatment	Prophylaxis	Full	Partial	Others	Denturist/Approval	Examination/Review																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				</

Signature of Dental Specialist/Dental Officer

Total number of days of vacation leave Total number of days of maternity leave
sick leave unrecorded leave
Revenue collected (to be recorded by officer in charge only)

REPORT OF WORKLOAD OF DENTAL TECHNICIAN FOR THE MONTH YEAR

1. State	District		4. Unit	6. Sub-Unit
	2. Health	3. Administrative		
			5. Location	7. Location

PG 205

Name of Dental Technician	No. of Patients		TYPE OF WORK												No. of Hours				
			Denture				Orthodontics				Inlay/Crown								Splint
	Full Denture	Partial Denture	Full	Partial	Rebase/ Reline	Repair	Study Model	Appliance	Others	Gold	Acrylic	Porcelain Jacket	Silver	Acrylic	Other Prostheses	Dental Health Education	Repair and Maintenance	Indent and Store Work	
8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Total number of days on vacation leave sick leave maternity leave unrecorded leave																			
Total number of days on vacation leave sick leave maternity leave unrecorded leave																			

DISTRICT/STATE REPORT ON WORKLOAD OF DENTAL NURSE FOR
THE MONTH YEAR

1. State	District		4. No. of Dental Nurse
	2. Health	3. Administrative	

PG 206

	Attendance	Ethnic Group					Items of Care										Completion	
		Malay	Chinese	Indian	Others	Total	Primary Extraction	Restoration			Temporary Filling	Prophy- laxis	Topical Fluoride	Conser- vative	Case			
								Simple Amalgam	Compound Amalgam	Silicate/ Composite						Total		
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	249	
Pre-School	New																	
	Total																	
Primary School	New																	
	Total																	
Secondary School	New																	
	Total																	
Total	New																	
	Total																	
Cumulative Total From Previous Month	New																	
	Total																	
Cumulative Total This Month	New																	
	Total																	

Signature of Senior Dental Officer/State Dental Director

1. State	District		4. No. of Dental Officer
	2. Health	3. Administrative	

Category of Patient	Attendance	Ethnic Group				Category of Treatment					Items of Care															X-Ray										
		Malay	Chinese	Indian	Others	Total	Oral Surgery	Orthodontic	Periodontal	Prosthetic	General	Extraction	Restoration					Temporary Filling	Endodontic Treatment	Prephylaxis	Periodontal Treatment	Orthodontic Treatment	Oral Surgery					Prosthesis				Completion				
													Primary	Permanent	Simple Amalgam	Compound Amalgam	Silicate/Composite						Inlay/Crown	Total	Abscess	Fracture	Infected Socket	Surgical Extraction	Miscellaneous Surgical Cases	Full	Partial	Others	Conservative	Case	Intra Oral	Extra Oral
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	32	33	34	35	36	37	38	39	40	
Pre-School	New																																			
	Total																																			
Primary School	New																																			
	Total																																			
Secondary School	New																																			
	Total																																			
Ante-Natal	New																																			
	Total																																			
Adults	New																																			
	Total																																			
Total	New																																			
	Total																																			
Cumulative Total From Previous Month	New																																			
	Total																																			
Cumulative Total This Month	New																																			
	Total																																			

Signature of Senior Dental Officer

PG 208

1. State	District		4. No. of Orthodontist
	2. Health.	3. Administrative	

Category of Patients	Ethnic Group				Category of Treatment							X-ray		Items of Core																						
	Attendance	Malay	Chinese	Indian	Others	Total	Oral Surgery	Orthodontic	Periodontal	Prosthetic	General	Extra-Oral	Intra-Oral	Impression	Removable Appliance	Fixed Appliance	Adjustment of Appliance	Active Treatment Completed	Review Retention Cases	Extraction		Restoration					Temporary Filling	Endodontic Treatment	Trophy/toxis	Oral Surgery			Prosthetic			
																				Primary	Permanent	Simple Amalgam	Silicate/Composite	Inlay/Crown	Total	Surfical				Extraction	Miscellaneous	Surfical Cases	Full	Partial	Others	
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	32	33	34	35	36	37	38	39	40	
Primary School	New																																			
	Total																																			
Secondary School	New																																			
	Total																																			
Adults	New																																			
	Total																																			
Total	New																																			
	Total																																			
Cumulative Total from Previous Month	New																																			
	Total																																			
Cumulative Total this Month	New																																			
	Total																																			

Signature of Senior Officer/State Dental Director

Ministry of Health Malaysia
Health Management Information System

STATE/DISTRICT REPORT ON WORKLOAD OF DENTAL TECHNICIAN FOR THE

MONTH YEAR

1. State	District		4. No. of Dental Technician
	2. Health	3. Administrative	

PG 210

	No. of Patient Receiving		TYPE OF WORK															Repair and Maintenance	DHE aids	Other Prostheses	Indent and Store Work
			Denture				Orthodontic			Inlay/Crown			Splint								
			Full	Partial	Rebase/ Reline	Repair	Study Model	Appliance	Others	Gold	Acolyte	Porcelain Jacket Crown	Silver	Acrylic							
5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23			
Total																					
Cumulative Total From Previous Month																					
Cumulative Total This Month																					

Signature of Senior Dental Officer

ANNUAL REPORT ON POPULATION COVERAGE, SCHOOL COVERAGE AND AVERAGE PERFORMANCE

1. State

POPULATION COVERAGE	PRE SCHOOL	No. of New Patient	2	
		Estimated Population	3	
		% covered	4	
	PRIMARY SCHOOL	No. of New Patient	5	
		Estimated Population	6	
		% covered	7	
	SCHOOL FOR THE BLIND	No. of New Patient	8	
		Estimated Population	9	
		% covered	10	
	ANTENATAL	No. of New Patient	11	
		Estimated Population	12	
		% covered	13	
	ADULTS	No. of New Patient	14	
		Estimated Population	15	
		% covered	16	

COMMENTS

SCHOOL COVERAGE	PRIMARY SCHOOL	No. of School Covered	17	
		Total no. of Schools	18	
		% Covered	19	
	SECONDARY SCHOOL	No. of School Completed	20	
		No. of Covered	21	
		Total no. of Schools	22	
AVERAGE PERFORMANCE	ATTENDING	% covered	23	
		No. of School Completed	24	
	FILLING	Dental Officer	25	
		Dental Nurse	26	
	EXTRACTION	Dental Officer	27	
		Dental Nurse	28	
	Denture	Dental Officer	29	
		Dental Nurse	30	
		Dental Technician	31	
No. of Dental Patients	Full		32	
	Partial		33	

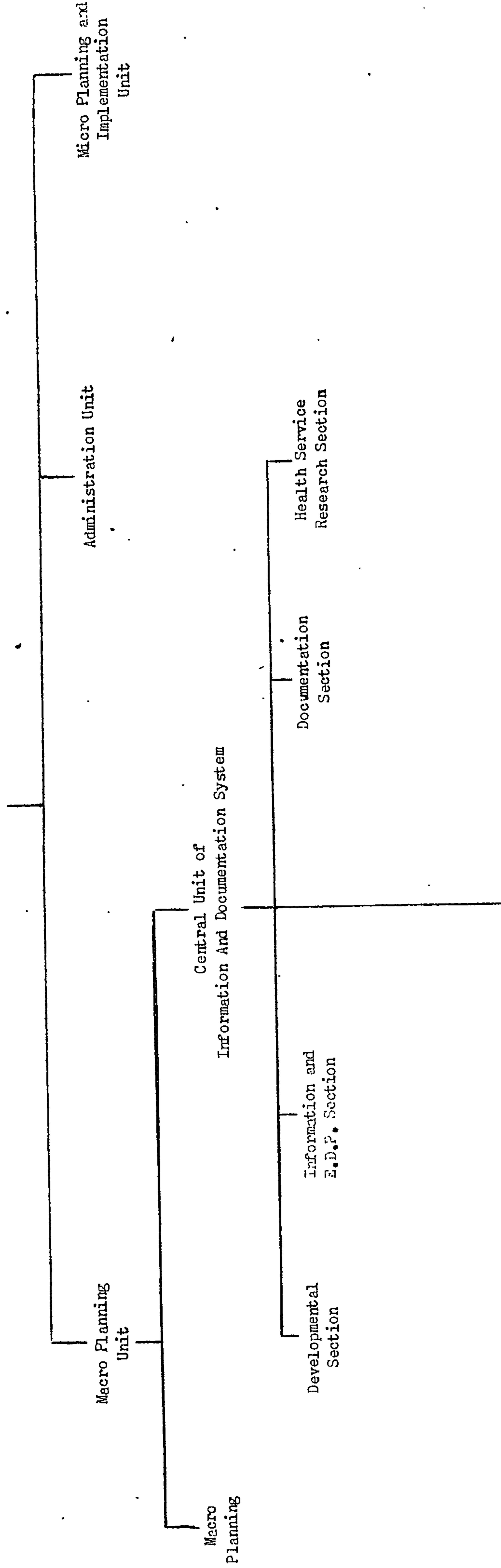
SIGNATURE OF STATE DENTAL DIRECTOR

'INFORMATION AND DOCUMENTATION SYSTEM'

ORGANIZATION AND STRUCTURE

ANNEX 6.1.

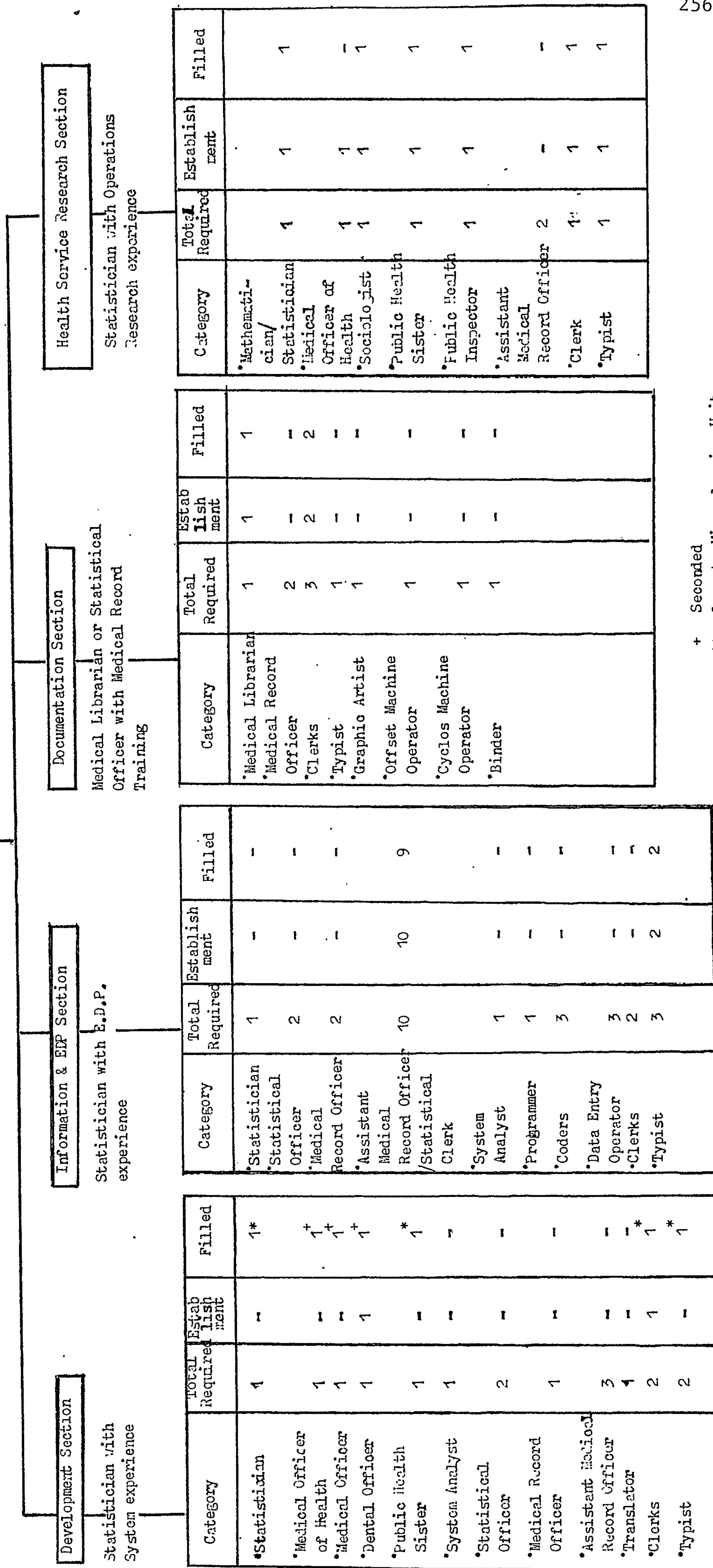
Planning And Development Division



Peripheral units of IDS in MOH Division/
State/institutions.

Category	Total Required	Establishment	Filled
Medical Officer (Super Scale G)	1	1	** 1

Information and Documentation System Unit



+ Seconded

** Loan to Microplanning Unit

* Loan from H.S. Research Section

[illegible]

Targeted States for 1984: Kedah, Perlis, Perak

W : for 1982: 7 remaining States

KE: Kedah F: 1st part of the month

PE: Perils
S: 2nd Part of the month

PK: Perak

Operation :

---: Subject to variation

xxx : Repeated Activities in other States for 1982

F.M.P. Objectives: To provide maximum coverage of population with highest possible quality of personal dental care within available resources.

Available in HHS

ANNEX 8.

PROBLEM	INTERVENTION	INTERMEDIATE OUTCOME INDICATORS	By Staff (DO/DN) Ethnic Group, Category of Patient, District, State, Year	FINAL OUTCOME INDICATORS
1. High Incidence of Dental Caries.	1. Provide adequate treatment for dental caries for all categories of patients with priority given to school children.	*1.1. % of patients given conservative treatment and/or extraction No. of new attendances recorded under general category of treatment Total population requiring conservative treatment and/or extraction as calculated from Dental Epidemiological Survey *1.2. Completion of Treatment:- 1.2.1. % of patients completed conservative treatment No. of cases recorded under item of care: conservative completion Total no. of patients given treatment 1.2.2. % of patients completed all required treatment (excluding orthodontic treatment) No. of cases recorded under item of care: case completion Total no. of patients given treatment *1.3.1. average no. of fillings per DO *1.3.2. average no. of extractions per DO *1.3.3. average no. of fillings per DN *1.3.4. average no. of extractions per DN		1. Reduction in DMF and DMEX Indices.
2. Edentulousness (partial and full) amongst school children and adults.	2. Improve rehabilitative dental treatment through dental prostheses.	*2.1. % of patients issued with partial dentures No. of patients issued with partial dentures Total population requiring partial dentures As calculated from Dental Epidemiological Survey *2.2. % of patients issued with full dentures No. of patients issued with full dentures Total population requiring full dentures as calculated from Dental Epidemiological Survey *2.3. Average no. of denture units completed by Dental Technician Total no. of denture units completed by Dental Technician Total no. of Dental Technician	By Month, State By Category of Patient, District, State, Year By type of denture unit (partial and full) month, State	2. Reduction in Incidence of Edentulousness.

PROBLEM	INTERVENTION	INTERMEDIATE OUTCOME INDICATORS	FINAL OUTCOME INDICATORS
3. High Incidence of Periodontal Disease amongst children and adults.	3. Establish centres for more intensive treatment for periodontal disease in selected main dental clinics.	3.1. Periodontal Unit/Population ratio 3.2. % of patients receiving periodontal treatment $\left[\frac{\text{No. of new attendances recorded under periodontal category of treatment}}{\text{Total population requiring periodontal treatment as calculated from Dental Epidemiological Survey}} \right]$ By category of patient, Ethnic Group, State 3.3. % of patients completed periodontal treatment $\left[\frac{\text{No. of patients completed periodontal treatment}}{\text{No. of patients given periodontal treatment}} \right]$ By category of patient 4.1. Orthodontist/Total Attendance ratio by category of patient, ethnic group per state and year $\left[\frac{\text{No. of patients completed active treatment}}{\text{No. of cases recorded under item of care: active treatment completed}} \right]$ By category of patient, state, year 4.2. % of patients completed active treatment $\left[\frac{\text{No. of cases recorded under item of care: active treatment completed}}{\text{No. of patients given orthodontic treatment}} \right]$ By category of patient, state, year 5.1. Dental Spec list/Total Attendance by category of patient, ethnic group per state per year. 5.2. % of patients given treatment for maxillo-facial injuries. $\left[\frac{\text{No. of cases recorded under items of care: fractures, injuries to soft tissue and injuries to teeth}}{\text{Total no. of patients attending Dental Specialist clinic}} \right]$ By category of patient, state, year 5.3. % of patients completed treatment for maxillo-facial injuries referred for: 5.3.1. Dental Prostheses 5.3.2. Orthodontic Treatment 5.3.3. Reconstructive Surgery (Denominator: Total no. of patients completed treatment for maxillo-facial injuries) By Special Study 6.1.1. Dental Chair/Population ratio by type of chair (static/mobile), Staff (DO/DN) and by District/State 6.1.2. Dental Officer/Population ratio 6.1.3. Dental Nurse/School children population ratio 6.1.4. Orthodontist/School children population ratio 6.1.5. Dental Specialist/Population ratio 6.1.6. Dental Technician/Dental Officer ratio By District, State	3. Reduction in Incidence of Periodontal Disease. By Special Study 4. Reduction in Incidence of Dento facial anomalies.
4. Handicapping Dento-facial anomalies.	4. Continue providing orthodontic treatment for children and adults needing treatment for dento-facial anomalies		
5. Maxillo-facial injuries and other oral conditions requiring specialist care.	5. Provide specialist treatment for maxillo-facial injuries and other oral conditions.		
6. Inadequate and inaccessible dental services	6.1. Increase number of trained staff and physical facilities to cope with increasing demand for dental services.		

PROBLEM	INTERVENTION	INTERMEDIATE OUTCOME INDICATORS	FINAL OUTCOME INDICATORS
	6.2. Improve coverage of population.	*6.2.1. Rate of utilization of dental service [$\frac{\text{No. of new patients registered for dental care in this year}}{\text{Total estimated population}}$]	By category of patient, ethnic group, state, year
		*6.2.2. Total Attendances to Total number by ethnic group, category of patient, category of treatment per state per year.	
	6.3. Improve coverage of schools and kindergartens.	*6.3.1. % of schools covered ($\frac{\text{No. of schools covered}}{\text{Total no. of schools}}$)	By type of school, facility, District, State, Year
		*6.3.2. % of schools completed treatment ($\frac{\text{No. of schools completed treatment}}{\text{No. of schools covered}}$)	

ANNEX 9.

1. Category of Patients
 - 1.1. Pre-School
 - Any child up to 6 years of age who has not yet entered school.
 - 1.2. Primary School
 - Any child attending a school designated, by the Education Department as 'primary' (standard I - standard VI)
 - 1.3. Secondary School
 - Any student attending a school designated, by the Education Department as 'secondary' (Form I - Form VI)
 - 1.4. Ante-Natal
 - Any patient referred to the dental clinic by ante-natal clinics/hospitals as an ante-natal case. Any patient who, in the opinion of the Dental Officer, is obviously an ante-natal case also falls into this classification.
 - 1.5. Adult
 - Any other patient who does not fall into the categories of Primary, Secondary, Ante-Natal and Pre-School belong to this classification.
2. Category of Treatment
 - In the Personal Dental Care Programme, there are 5 classified categories of treatment:
 - a) Oral Surgery
 - b) Orthodontic
 - c) Periodontal
 - d) Prosthetic
 - e) General
3. General Category of Treatment
 - 3.1. Extraction
 - 3.1.1. Primary
 - Removal of a deciduous tooth.
 - 3.1.2. Permanent
 - Removal of a permanent tooth.
 - 3.2. Conservative Treatment
 - A form of dental treatment where by a decayed or carious tooth is restored to its functional and aesthetic level. The restoration may be in the form of a filling, inlay or crown (capping) or a bridge using dental materials like amalgam, acrylic, silver or gold depending on the case. A temporary filling is also included as a conservative treatment where by a filling of a temporary nature is done. Zinc oxide dressing is usually used.
4. Completion
 - 4.1. Conservative completion
 - Where all carious tooth indicated for restoration have been filled the case is classified as a conservative completion case.
 - 4.2. Case completion
 - For Dental Officer
 - Where all teeth indicated for restoration or extraction have been treated, and any prosthetic work is required have been provided. Even when orthodontic treatment is indicated, where conservative and prosthetic treatment have been completed the case is still regarded as 'completed'.
 - For Dental Nurse
 - Where all teeth indicated for restoration or extraction of deciduous teeth only have been treated. If a case has permanent teeth indicated for extraction and/or prosthetic treatment the Dental Nurse may refer the case to a Dental Officer. After the permanent extractions and/or dentures have been completed by the Dental Officer, the case is to be referred back to the Dental Nurse to be recorded by her as case completion.

5. Dental Prostheses - In the category of treatment 'prosthetic', cases of partial edentulousness and full edentulousness are usually treated with partial dentures and full dentures respectively. An obturator is also classified as a dental prosthesis which may be used to treat in oral surgery case e.g. cleft palate.
6. Periodontal Unit - A dental unit situated in a selected Main Dental Clinic, equipped with the usual complement of dental equipment plus special equipment (e.g. Cavitron Unit - an equipment using ultrasonic vibrations for scaling) for the intensive, comprehensive and systematic treatment of patients with periodontal disease. The Periodontal Unit will be put under the charge of a suitable Dental Officer selected for this purpose.
- 7.1. Orthodontic Treatment - Treatment mainly carried out by the Orthodontist (specialist) for cases of dento facial anomalies e.g. cleft lip, extreme overjet or overbite or open bite, using orthodontic device which may be a removable or a fixed appliance.
- 7.2. Active Treatment completed - The stage of orthodontic treatment when all desired tooth movements have been achieved.
8. Maxillo-facial Injuries
 - 8.1. Fracture
 - 8.1.1. Mandible - A fracture where the mandible is involved.
 - 8.1.2. Facial Bone - A fracture where one or more of the facial bones are involved.
 - 8.2. Injuries to Soft Tissue - Injuries sustained in the oro-facial region involving the soft tissues. These include lacerations and stripping of the mucosa and laceration of the skin.
 - 8.3. Injuries to Teeth - Traumatic injuries to the teeth including fractures, subluxations and luxations.
9. School
 - 9.1. Covered - Where the students of a school are taken regularly to a dental clinic for systematic dental treatment by Dental Officer or Dental Nurses, or where a school is visited regularly by the Dental Officer or Dental Nurses who provide treatment to the students.
 - 9.2. Completed - This term is usually employed in relation to the mobile squad system of providing treatment to rural schools. The schools may be recorded as 'completed' as a project when the squad has completed its assignment e.g. if the squad is originally assigned to treat all the students in standards V and VI of that school and has done so then the school is 'completed'.

DISTRICT/STATE REPORT ON WORKLOAD OF DENTAL NURSE FOR THE YEAR 1981

1. State PULAU PINANG	District		4. No. of Dental Nurse 61
	2. Health	3. Administrative	

PG 206

Category of Patient	Attendance	Ethnic Group					Items of Care									
		Malays	Chinese	Indians	Others	Total	Primary Extraction	Restoration				Temporary Filling	Prophylaxis	Topical Fluoride	Completion	
								Simple Amalgam	Compound Amalgam	Silicate/Composite	Total				Conservative	Case
5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Pre-School	New	1968	3119	461	16	5564	9897	1504	437	34	1975	687	513	253	54	18
	Total	3293	6376	784	20	10473										
Primary School	New	17572	27172	5185	153	50082	44703	89929	18737	20484	129150	6036	30069	27068	15048	5793
	Total	44820	82411	14706	382	142319										
Secondary School	New	252	1019	229	24	1524	45	3135	827	1488	5450	312	1294	984	304	279
	Total	723	3105	775	62	4665										
Total	New	19792	31310	5875	193	57170	54645	94568	20001	22006	136575	7035	31876	28305	13406	6090
	Total	48836	91892	16265	464	157457										
Cumulative Total From Previous Month	New															
	Total															
Cumulative Total This Month	New															
	Total															

1. State PULAU PINKING	District		4. No. of Dental Officer 20
	2. Health	3. Administrative	

PG 207

Category of Patient	Ethnic Group				Category of Treatment				Items of Care																										
	Malays	Chinese	Malays	Indians	Total	Oral Surgery	Orthodontic	Periodontal	Prosthetic	Extraction					Restoration					Temporary Filling	Endodontic Treatment	Prophylaxis	Periodontal Treatment	Orthodontic Treatment	Oral Surgery						Prosthesis			Completion	X-ray
										Primary	Permanent	Simple Amalgam	Compound Amalgam	Silicate/Composite	Inlay/Crown	Total	Abscess	Fracture	Infected Socket						Surgical Extraction	Miscellaneous Surgical Cases	Full	Partial	Others						
5	7	6	5	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Pre-School	New	217	228	99	4	548	447	-	-	-	641	27	25	18	5	1	49	17	-	-	-	-	223	4	1	-	-	-	-	-	-	-	1	-	
	Total	356	455	160	8	979	208	-	-	-	771																								
Primary School	New	1266	2202	456	12	3736	185	6	18	3727	1076	5353	2711	403	933	14	4129	81	3	244	8	267	-	21	4	62	2	35	3	454	508	17	-		
	Total	3267	7378	1109	40	11944	332	9	186	11337																									
Secondary School	New	3373	6214	992	53	10672	134	18	61	10399	258	7103	14201	2667	7551	16	24375	1477	30	1378	29	172	1	10	36	85	6	281	98	2949	150	-			
	Total	7245	16978	2104	91	26498	299	39	874	25299																									
Adults-Total	New	956	438	113	3	1510	27	2	3	1478	1	1844	593	124	192	-	909	136	-	71	3	25	-	0	3	23	-	3	5	69	116	13	-		
	Total	1660	857	209	7	2733	54	3	11	2665																									
Adults	New	10667	9101	4634	111	24353	846	87	322	23958	47	37373	1320	680	733	11	2744	743	12	400	166	780	16	212	240	638	432	311	375	116	213	8			
	Total	20571	18223	7110	229	46733	1955	176	2742	41660																									
Total	New	16679	18193	5934	163	40999	1379	113	404	39063	2023	51700	10950	3834	9480	42	32206	2454	53	2093	206	-	1476	17	260	203	808	460	690	481	1655	464	8		
	Total	33099	44511	10772	375	89757	2848	227	3760	84722																									
Cumulative Total From Previous Month	New																																		
	Total																																		
Cumulative Total This Month	New																																		
	Total																																		

PG 208

1. State PULAU PINANG	District		4. Orthodontist I
	2. Health	3. Administration	

Category of Patients	Ethnic Group				Category of Treatment					X-Ray		Items of Care																							
	Attendances	Malays	Chinese	Indians	Others	Total	Oral Surgery	Orthodontic	Periodontal	Prosthetic	General	Extra-Oral	Intra-Oral	Impression	Removable Appliance	Fixed Appliance	Adjustment of Appliance	Active Treatment Completed	Retainer Retention Cases	Extraction		Restoration					Temporary Filling	Endodontic Treatment	Prophylaxis	Oral Surgery				Prosthetic	
																				Primary	Pericement	Simple Amalgam	Compound Amalgam	Silicate/Composite	Inlay/Crown	Total				Surgical	Surgical Extraction	Mucocutaneous	Full	Partial	Others
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	32	33	34	35	36	37	38	39	40
Primary School	New	36	76	26	13	151	-	151	-	-	-	-	15	101	36	7	95	9	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	76	203	73	20	325	-	325	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Secondary School	New	32	159	45	15	251	-	251	-	-	-	2	14	226	164	30	624	36	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Total	155	663	259	66	1263	-	1263	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Adults	New	26	58	29	4	117	-	117	-	-	-	1	5	137	97	22	231	21	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Total	132	279	138	24	575	-	575	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	New	94	233	100	32	519	-	519	-	-	-	3	34	524	232	67	1008	65	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	Total	363	1350	470	140	2331	-	2331	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cumulative Total From Previous Month	New																																		
	Total																																		
Cumulative Total This Month	New																																		
	Total																																		

Category of Patient	Attendance	Ethnic Group				Category of Treatment										Items of Care																				Army																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
		Malays	Chinese	Indians	Others	Total	Oral Surgery	Orthodontic	Periodontal	Prosthetic	General	Tumour		Abscess	Cyst		Soft Tissue	Oral Medicine Cases	Biopsy	Alveolodony	Apicoectomy	Miscellaneous Surgical Cases	Treatment of Soft Tissue Injury	Treatment of Injury of Teeth	Fracture		Infected Socket	Oro-antral Fistula	Arrest of Haemorrhage	Surgical Extraction	Extraction				Restoration				Temporary Filling	Endodontic Treatment	Prophylaxis	Periodontal Treatment	Prosthesis		Occlusion/Trauma	Injury/Infection																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
												Benign	Malignant		Bony	Soft Tissue									Mandible	Facial Bone					RV Disorder	Primary	Permanent	Simple Analogue	Composite/Composite			Inlay/Crown					Total																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
5	9	7	8	9	10	41	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Pre-School	Nov	356	744	182	9	1290	57	-	-	3	1230	1	1	1	53	-	3	9	1	-	-	5	-	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-	89	-	-	-	-	-	1	6	195	-	-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	Total	534	304	244	13	2092	129	-	-	14	1949	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Primary School	Nov	305	3073	243	22	1643	76	-	1	1565	3	-	65	-	1	2	2	3	1	-	-	7	3	5	-	-	1	-	5	1365	830	62	7	16	1	66	71	-	56	1	2	1	-	245	-	-	-	-	-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	Total	442	2216	307	34	2499	167	-	2	10	2320	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
Secondary School	Nov	844	1432	426	22	2730	64	1	2	4	2599	3	2	-	56	2	-	7	2	1	1	13	2	2	2	2	2	9	1	10	10	111	2098	1327	341	1007	1	2876	525	11	329	20	-	36	6	3	1071	-	-	-	-	-																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	Total	1710	3310	826	44	5890	199	7	24	102	5598	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

MINISTRY OF HEALTH MALAYSIA
HEALTH MANAGEMENT INFORMATION SYSTEM
ANNUAL REPORT ON POPULATION COVERAGE
SCHOOL COVERAGE AND AVERAGE PERFORMANCE

1. State
Pulau Pinang

POPULATION COVERAGE	PRE SCHOOL	No.of New Patients	2	7,403
		Estimated Population	3	152,526
		% Covered	4	5%
	PRIMARY SCHOOL	No.of New Patients	5	55,661
		Estimated Population	6	115,360
		% Covered	7	48%
	SECONDARY SCHOOL	No.of New Patients	8	14,866
		Estimated Population	9	81,762
		% Covered	10	18%
	ANTE NATAL	No.of New Patients	11	1,658
		Estimated Population	12	231,391
		% Covered	13	1%
	ADULTS	No.of New Patients	14	35,566
		Estimated Population	15	510,155
		% Covered	16	7%

SCHOOL COVERAGE	PRIMARY SCHOOL	No.of Schools Covered	17	197
		Total no. of Schools	18	239
		% Covered	19	82%
	SECONDARY SCHOOL	No.of Schools Completed	20	65
		No.of Schools Covered	21	30
		Total no. of Schools	22	61
	ATTENDANCES	% Covered	23	49%
		No.of Schools Completed	24	-
		Dental Officer	25	4,438
	FILLING	Dental Nurse	26	2,581
		Dental Officer	27	1,610
		Dental Nurse	28	2,239
AVERAGE PERFORMANCE	EXTRACTION	Dental Officer	29	2,686
		Dental Nurse	30	896
	Denture	Dental Technician	31	119
		Full Denture	32	385
	No.of Denture Patients	Partial Denture	33	638

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