

## MEDICAL INFORMATION SYSTEMS IN THE HEALTH SERVICES

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### *Disease, Data and Confidentiality*

The changing social habits and conditions of life in a congested urban community, together with changes in industrial processes, continually create new health hazards, such as the toxic hazards of food additives, combustion of fuels on a new scale and of a new type, and environmental pollution. Advances in the production of new powerful therapeutic and prophylactic agents have created a need, not only to assess their effectiveness in comparison with existing drugs or forms of treatment, but also to maintain a continued watch for the development of adverse reactions.

These problems have necessitated new research techniques which in turn have led to new methods for the protection of the community's health. Studies involving comparison of characteristics, ways of life and environmental circumstances of affected or unaffected individuals have helped to isolate casual agents and personal factors associated with especial risk. Such studies have uncovered important determinants of disease such as cigarette smoking, air pollution due to the inefficient combustion of coal and the characteristics of environmental factors and personal physique that portend serious heart disease. The collection of personal medical data was also of critical value in special investigations of maternal deaths, perinatal mortality and child health; while cancer registration has provided essential information on the natural history of malignant disease. The use of similar methods holds promise for the future prevention of congenital malformations and inborn metabolic diseases, for the development of new methods of monitoring and pre-symptomatic screening, for the creation of more effective methods of controlling and alleviating the disabilities that accompany the ageing process.

In much of this work it is essential for the data to relate to identified individuals so that information recorded at different times and places can be collected.

It is this collection and handling of medical information relating to identified individuals by those other than their personal doctors that makes it imperative for research workers to respect confidentiality. The British Medical Research Council considers that, subject to certain safeguards, medical information obtained about identified individual patients should continue to be made available without their explicit consent for the purpose of medical research.

The situation in Ireland is such that it is impossible for a research worker to gain access to the names of the patients when he or she is examining their medical data contained in the Hospital In-Patients Enquiry Scheme<sup>1</sup>, administered by the Medico-Social Research Board.

### *I The HIPE Scheme in Ireland and Related Schemes Abroad*

The Hospital In-Patient Enquiry Scheme in Ireland is broadly identical to the one which has been operating in Scotland since 1961. The Irish scheme however, commenced in 1969, shortly after the Medico-Social Research Board commenced operations under its Medical Director - Geoffrey Dean.

The basic outline of the Scheme is as follows: hospitals complete summaries for each in-patient discharged and send them to the Medico-Social Research Board where they are checked, coded and prepared for processing by computer. At regular intervals statistical tabulations are prepared and the current production consists of:-

- i) A diagnostic index for each participating hospital and each participating Consultant quarterly.
- ii) A surgical index for each hospital quarterly
- iii) A diagnostic summary index for each hospital quarterly.

In addition at the end of each calendar year national statistical tables drawing average durations of stay per diagnosis, sources of admission, age distribution of patients, etc., are prepared as are tabulations showing each hospital's performance as compared with the national performance. This latter group of statistics has obvious limitations at this point in time, since the Hospital In-Patient Enquiry Scheme has as yet not achieved full national coverage. Nevertheless useful information has already been accumulated for the more common medical conditions.

The circulation of statistical information on the work load and procedure of individual hospitals is still the subject of debate but the Medico-Social Research Board is of the opinion that in order that the Enquiry Scheme achieve its maximum potential such information should be made generally available to those concerned with the administration of our health services.

The data collected under the Hospital In-Patient Enquiry Scheme have enormous potential for epidemiological research and for administration and planning of the health services. Some examples of its uses are:-

- i) The establishment of national morbidity statistics based on hospital in-patient treatment. Thus the particular health problems in our community will be identified and the basic data will be available, on which allocation of obtainable funds in order of priority can be decided. The establishment of national morbidity statistics will also

obviously influence the trend of medical and nursing education.

- ii) Detection of changes in national morbidity patterns.
- iii) Provision of information on duration of stay for difficult medical conditions and age groups.
- iv) Establishment of the incidence of re-admissions and calculation of the success rate of various surgical procedures.

In addition, at hospital level the diagnostic and surgical indices will be of considerable value in Medical Record Departments and will facilitate research by individual consultants.

As has already been mentioned the Irish scheme is broadly similar to the one operating in Scotland since 1961. In England and Wales an Enquiry Scheme has been in operation since 1951 with the General Hospitals participating on a 10 percent sample basis and the Psychiatric Hospitals on a 100 percent basis with fully identified patient treatment summaries. Similar Enquiry Schemes are in operation in Northern Ireland, Holland, the United States, Canada and Sweden. The Scheme in Ireland and the other aforementioned countries has received an enlightened and co-operative response from the Medical profession.

## *II Inputs and Outputs of the HIPE Information System*

The basic procedures of the Information System are quite simple. Each participating hospital completes a summary sheet (Fig. 1) except those parts of it referring to the MSRB Code, Area of Residence and Marital Status whenever a patient is first registered. In due course the hospitals send the forms to the Medico-Social Research Board who complete the coding, and check that the hospitals' codes are error free. Every quarter commencing January, the forms without the patient's name and address, are then sent from the MSRB to the computing centre at Kilmainham who translate the information contained in Fig. 1 into computer input format. The data are then analysed by specially written computer programs, printed in an agreed format for each hospital, and finally aggregated into the form of National tables. The National tables however are only produced on a yearly basis. Fig. 2 depicts the information flow from the hospitals whilst Tables 1 and 2 show the format of some of the output information from the National computer centre.

As has been mentioned, each hospital receives quarterly a diagnostic and surgical index which are in the format illustrated in Tables 1 and 2. In addition, the consultants in each hospital receive *on request* similar information pertaining to their own patients.

The National tables are sent exclusively to the Medico-Social Research Board and contain information on:-

- i) Number of discharges by diagnosis, sex and age showing mean duration of stay.
- ii) Number of discharges by diagnosis, sex and source of admission showing mean waiting time.
- iii) Number of discharges by diagnosis, sex and duration of stay. The discharge code indicates whether a patient was sent home, to another hospital, to a convalescent home, or died.
- iv) Number of discharges by diagnosis, sex, marital status and age showing mean duration of stay.
- v) Number of discharges by diagnosis, sex and health board areas showing bed days, mean duration of stay and discharges per million population.

FIG. 1: Ireland - Hospital In-patient Records Summary Sheet

**MEDICAL—IN CONFIDENCE**

SURNAME \_\_\_\_\_

FIRST NAMES \_\_\_\_\_

HOME ADDRESS \_\_\_\_\_

M S R B CODE \_\_\_\_\_

Code No of Hospital <sup>1-3</sup> \_\_\_\_\_ Hospital Case Reference No. <sup>4-9</sup> \_\_\_\_\_

SKIP COLUMNS 10-21 INCLUSIVE

Area of residence <sup>22-25</sup> \_\_\_\_\_

Date of Birth <sup>28-31</sup> Day \_\_\_\_\_ Month \_\_\_\_\_ Year \_\_\_\_\_

Sex  32

Consultant/G P on discharge <sup>34-37</sup> \_\_\_\_\_

For Official use <sup>38-40</sup> \_\_\_\_\_

Mental State  33

Occupation in full (Specify) \_\_\_\_\_

Date placed on Waiting List			Source of Admission	Date of Admission			Date of discharge or death			Hosp Div or Unit on Discharge	Type of bed on discharge	Discharge Code
Day	Month	Year		Day	Month	Year	Day	Month	Year			
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
41-46			47	48-53			54-59			60	61	62
Principal Diagnosis (1) _____										63-66		_____
Others { (2) _____										10-13		_____
(3) _____										14-17		_____
Principal Operation (1) _____										Day	Month	71-73
Other (2) _____										67-70		74-76

FIG. 2: Information Flows

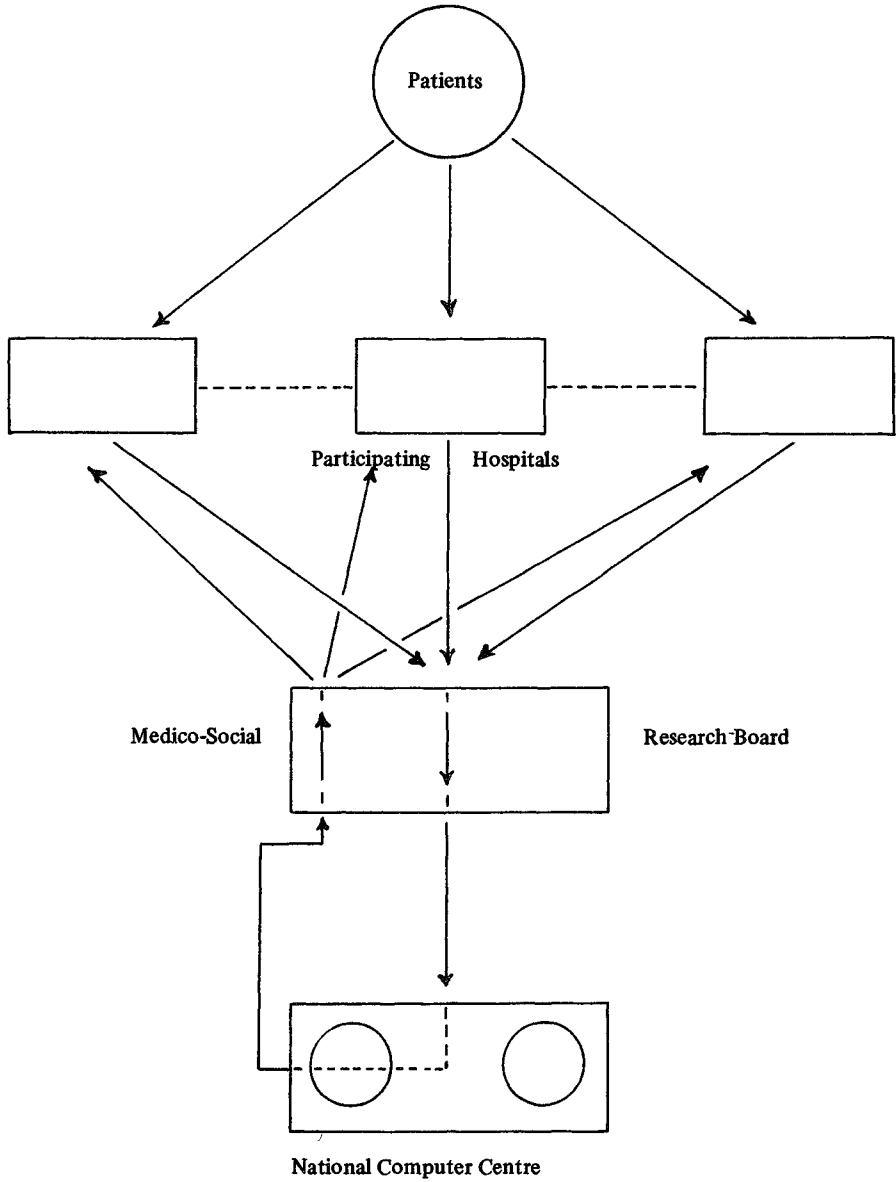


TABLE 1: *Index Diagnoses for Hospital No xxx (1973)*

Name	Date of birth	Sex	Mar status	Occn	Area of res	Admin date	Source	Days waiting	Consults
xxx Diagnosis xxxx xxxx	003.0 18.2.59	F	S	188	422	June 70	5	0	0008
xxx Diagnosis xxxx xxxx xxxx	003.9								
xxx Diagnosis xxxx xxxx	999.4								
xxx Diagnosis xxxx xxxx xxxx	Y34.9 17.5.63	M	S	197	028	July 63	6	98	0010

TABLE 2: Number of Discharges by Diagnosis, Sex and Age showing Mean Stay and National Mean Stay, Hospital Number xxx (1973)

Diagnosis	Sex		Age							Total male	Total female
			Under 1	1-14	15-24	25-44	45-64	65-74	75 & over		
006 Enteritis and other diarrhoeal diseases	Male	Discharges	4.0	5.0	4.0	2.0	4.0	1.0		20.0	
		hosp. mean stay	1.3	3.6	3.3	3.5	7.0	5.0		3.8	
		Nat. mean stay	23.2	10.6	7.6	12.3	11.1	9.0		16.9	
	Female	Discharges	1.0	4.0	1.0	5.0	2.0	1.0	4.0		18.0
		hosp. mean stay	5.0	2.3	1.0	8.2	5.0	3.0	6.8		5.3
		Nat. mean stay	25.2	12.0	5.9	9.3	13.6	13.0	22.8		17.8
300 Other effects of external	Male	Discharges			1.0	4.0				5.0	
		hosp. mean stay									
		Nat. mean stay									
	Female	Discharges									
		hosp. mean stay									
		Nat. mean stay									
TOTAL	Male	Discharges	69.0	613.0	389.0	442.0	554.0	323.0	182.0	2572.0	
		hosp. mean stay	6.6	6.3	7.1	10.3	12.9	20.2	20.0	11.3	
		Nat. mean stay	15.6	8.6	9.1	10.8	16.8	21.4	27.8	14.1	
	Female	Discharges	42.0	455.0	247.0	300.0	395.0	254.0	216.0		1909.0
		hosp. mean stay	5.9	6.2	42.7	9.4	15.1	19.6	25.5		17.2
		Nat. mean stay	17.5	8.9	9.6	9.6	15.9	26.4	45.5		15.9

These tables therefore are yearly statements concerning the health of the Nation as reported by the participating hospitals and contain a wealth of information on this topical issue.

Table 3 gives an overall view of the National Health situation as reported by the hospitals contributing to the HIPE Scheme during the period 1970-73. Some points of interest arising from this table are:-

- a) In 1970 only 11 hospitals were supplying information whilst in 1973 the figure had risen to 47.
- b) By 1973 information pertaining to 179,757 discharges was being processed through the system - an increase of 449 percent when compared to 1970.

These two observations underline the rapid acceptance by the medical community of the value, to them, of the Hospitals In-Patient Enquiry Scheme. The number of participating Hospitals has now risen to 54, a figure which represents 70 percent of all the hospitals' admissions in the country, and whilst 100 percent coverage may not be achievable it is to be hoped that the majority of the remaining 30 percent of admissions will eventually be included in the Scheme.

### *III The Use of the Information System for Research Purposes*

Apart from supplying useable information to individual hospitals' consultants and the Medico-Social Research Board, a data base like the HIPE Scheme has great potentialities for research. Indeed the information system contains such a wealth of useable data that the research worker has, at times, difficulty in seeing the wood from the trees!

More than 30 interesting research studies have been completed using the data base of the HIPE Scheme.

TABLE 3: *An Overall View of the National Health Situation as Reported by the Federated Hospitals*

Classification	1970	1971	1972	1973
<i>Male</i>				
Discharges	17,472	47,118	74,714	92,571
Bed-days	225,749	699,424	1,046,760	1,305,374
Mean stay	12.92	14.84	14.01	14.10
Discharges per million population	12,058	31,573	50,064	62,029
<i>Female</i>				
Discharges	15,248	43,521	71,550	87,186
Bed-days	198,510	635,370	995,177	1,389,248
Mean stay	13.02	14.60	13.91	15.93
Discharges per million population	10,626	29,429	48,382	58,955
<i>Total</i>				
Discharges	32,720	90,639	146,264	179,757
Bed-days	424,259	1,334,794	2,041,937	2,694,622
Mean stay	12.97	14.73	13.96	14.99
Discharges per million population	11,345	30,506	49,227	60,499
% Increase in total discharges		177%	61.4%	22.9%



Since the author is only completely familiar with two of the aforementioned research topics <sup>2,3</sup> a brief description of each will be given to illustrate the uses of the data base for research purposes.

#### *Changing Patterns of Length of Stay in an Irish Hospital, 1961-73*

The purposes of the research was broadly to examine the discharge statistics of Our Lady's Hospital for Sick Children, Crumlin, for the years 1961 and 1973 and if possible isolate those conditions whose length of stay had been significantly reduced during this period. It was hoped that this information would give guidelines to the future medical development of the hospital.

The research disclosed that in 1961 Our Lady's Hospital accommodated 5,828 patients who, collectively, accounted for 100,564 bed-days representing an average length of stay of 17.27 days. In 1973 the hospital treated 10,173 patients who accounted for 104,396 bed-days, or an average length of stay of 10.26 days. Statistical analysis showed the 40.6 percent reduction in average length of stay could be attributed to 67 morbidity conditions classified according to list D of the World Health Organisation.

A similar analysis was carried out for Surgical Operations where it was shown that 14 classes of operation demonstrated significant reductions in mean stay and contributed substantially to an overall reduction in average length of stay for Operations from 13.60 days in 1961 to 9.70 days in 1973.

This research study concluded by pointing out, that had not these reductions in mean stay occurred, an additional 200 beds would have been required by 1973. No increase had, in fact, taken place over the period 1961-73.

#### *How Long Patients Stay in Irish Hospitals*

Data from 38 hospitals (18 teaching and 20 non-teaching) extracted from the HIPE information system pertaining to six common conditions; hypertrophy of tonsils and adenoids, acute appendicitis without mention of peritonitis, appendicitis unqualified, inguinal hernia without mention of obstruction and hyperplasia of the prostate. The age and sex (male) of the patients was carefully defined in order to eliminate, as far as possible, all other causes of variation in mean stay except the personal aspects of the practice of medical staff in some of our hospitals - for instance, differing practices with regard to treatment.

This research conclusively showed that differences in mean stay existed for the treatment of hypertrophy of tonsils and adenoids and for inguinal hernia without mention of obstruction for male children between 5-14 years in the teaching hospitals as opposed to the non-teaching hospitals which provided information. A further finding of the research was that a great variation exists in length of stay in Irish hospitals and that the range in length of stay in Ireland is longer than in Scotland.

#### *IV Some Limitations of the Information System*

The HIPE information system has in the opinion of the writer, three basic limitations:

##### *Limitation I:*

Whilst the information sent to hospitals, contains valuable statistics concerning the diseases affecting *each* patient, the *quantity and type* of information produced is such as to

inhibit the Medical Practitioner and Administrator from drawing without excessive effort, *general* conclusions concerning admissions, bed-stay and length of stay.

*Presenting some of the Data of the Information System more Concisely*

The HIPE Scheme classifies diseases according to WHO list D, that is, 300 causes of hospital morbidity. As is readily realised, not all of these conditions contribute equally to the utilisation of beds within any hospital. For instance, in one of our leading Children's Hospitals hypertrophy of tonsils and adenoids (D162) accounted for 3,131 bed-days in 1972, whilst inguinal hernia without mention of obstruction (D181) accounted for only 895 bed-days, out of a total of approximately 99,000 for the entire hospital. If one takes, however, those 30 conditions which account for the greatest useage of bed-days in Children's Hospitals participating in the HIPE Scheme, the following picture emerges:-

Hospital	1972		1973	
	No. of bed-days	% of total bed-days	No. of bed-days	% of total bed-days
A	64615	65%	73474	72%
B	17247	69%	16812	75%
C	No analysis available		39169	73%

Thus based on this information for the years 1972 and 1973 (data for 1971 and 1974 are not available) it can be seen that 30 causes of morbidity (10 percent of the total) account for approximately 70 percent of the total number of bed-days of the hospitals. It is the writer's contention that whenever information for 1974 and 1975 is available, these 30 causes of morbidity will probably account for between 70 percent and 75 percent of the total bed-days of the hospitals. This simple fact could be extremely useful to hospital administrators.

The first limitation of the information system postulated in this section was concerned with the difficulty of drawing general conclusions from such a wealth of data. One of the major questions any hospital wishes to have an answer to is "Have we achieved significant reductions in length-of-stay (without, of course, lowering standards) in the hospital, when last year is compared with previous years?"

Comparing 300 morbidity conditions on a yearly basis is a daunting task even if EDP equipment is available. However, the previous observation that 10 percent of the conditions account for 70 percent of the bed-days (in children's hospitals) means in effect that the scale of the comparisons can be substantially reduced.

A statistical sub-routine specially designed to test for significant differences in mean length of stay of these dominant conditions would, I believe, be an extremely useful addition to the present information system. The attention of hospitals and other interested parties could then be focused on the favourable or unfavourable trends of those conditions which, in effect, absorb the majority of a hospital's resources.

Although these remarks have used children's hospitals as an example, it is thought that General Hospitals will also display similar characteristics with regard to bed-stay.

**Limitation II:**

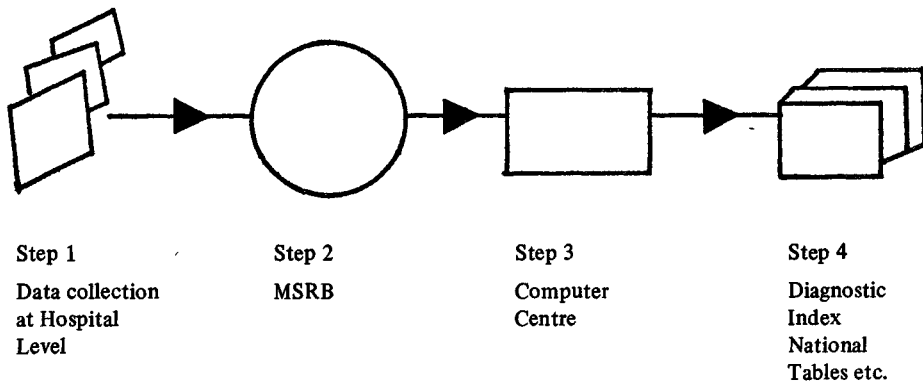
The format in which the basic data concerning illnesses is collected and prepared for analysis at the Central Data Processing Service (PSD) is wasteful of material and human resources.

**Limitation III:**

The basic data concerning illnesses are manually prepared by individual hospitals and in the format of Fig. 1, normally at the time of *discharge*. The preparation of this data at both admission and discharge, together with the introduction of simple Electronic Data Processing systems could have tangible benefits to both hospitals and the HIPE scheme.

**An Information System Based on the Hospital In-Patient Enquiry Scheme**

As has been indicated the information contained in Fig. 1 is the basis of the HIPE Information System. The steps involved from the initial capture of the data at hospital level to the production of a Diagnostic Index and National Tables etc., by the State Computer Centre are as illustrated:-



and as Fig. 2 indicates the output from Step 3 finds its way back to the Medico-Social Research Board and then to the individual hospitals. That this Information System works efficiently and plays an important role in socio-medical planning and research is unquestioned. However, as has been indicated in the previous section of this paper, further areas for improvement exist which would have beneficial effects at both hospital, regional and ultimately national level. I would now like to describe what I consider to be the next level of development of this Information System.

#### *V A Hospital Integrated Data Processing System - A Simple EDP System*

A Hospital Information System is confronted with two basically contradictory requirements: -

- i) It is important to supply the necessary data quickly to all who need it (this may sometimes even be of vital importance viz. in car accidents, etc.).
- ii) Part of the medical data are of a rather confidential nature, in today's health care system, even to the patient himself.

Any Hospital Information System therefore, must be so designed as to allow (i) to function efficiently without violating (ii). This can be easily achieved by modern EDP systems and equipment.

Within any hospital the following tasks have been historically carried out by manual methods: -

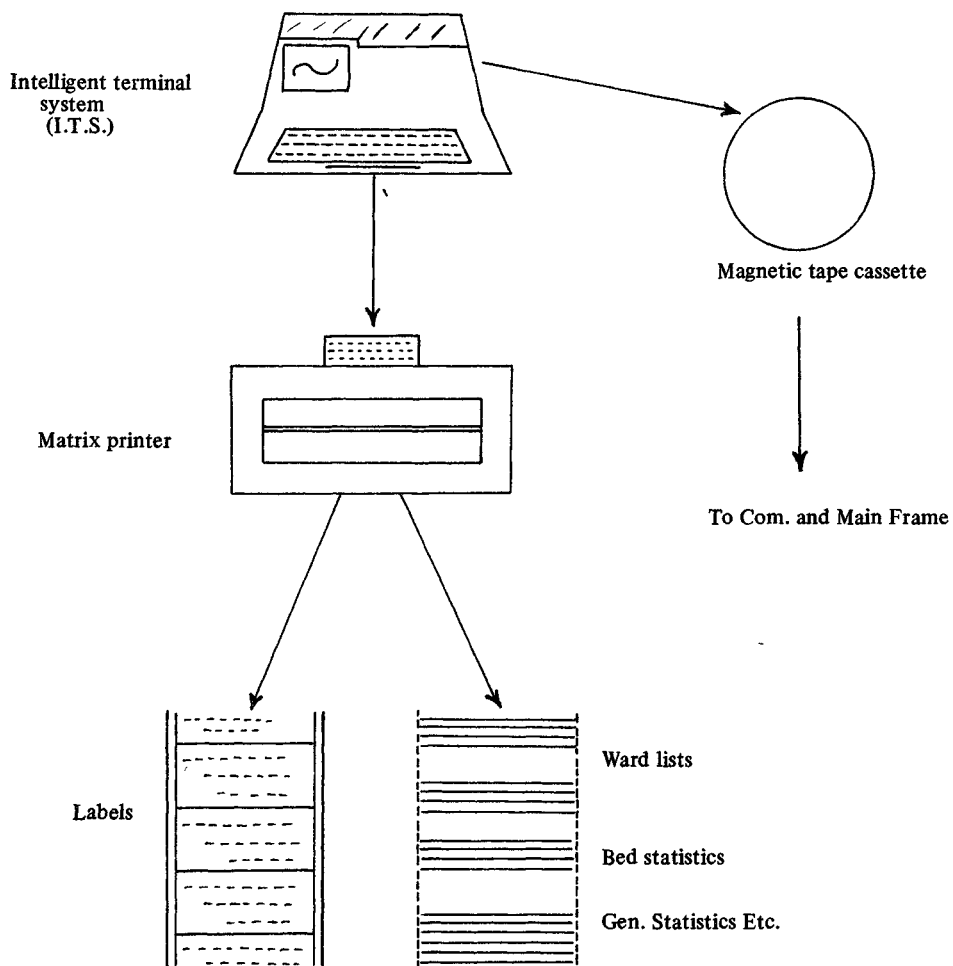
- Patient admission/registration
- Out-patient appointments
- Waiting list production
- Master index
- Statistics (Inventory control, average bed occupancy, etc.)
- Personnel (wages and statistics)
- Supplies ordering and accounting
- General accounting
- Recording of diagnoses
- Clinical chemistry data acquisition
- Clinical bacteriology data acquisition, etc.

All of these tasks can now be efficiently completed by relatively low cost, modern, small to medium sized data processing equipment.

In the aforementioned list the first task is the basic ingredient of the HIPE scheme. Currently and traditionally, this is expedited manually with the production of much paper a number of incorrectly coded forms. Fig. 3 illustrates an alternative Data Processing System for carrying out patient admission/registration. As can be seen this simple system's design cannot only supply (in magnetic tape format) the basic information for the HIPE Information System, but also additional control data for the Hospital. A further point of interest (and importance) is that during peak hours the Visual Display Unit is used only for reception work; at quieter times out-patient data can be entered. After completion of this work the various lists and statistics can then be printed.

It is possible to extend this basic concept much further and in doing so I would like to review some developments in the USA, the Netherlands and Sweden.

FIG. 3: Admission System I: Up to 300 bed local hospital



## *VI Integrated Hospital Information Systems*

Denver General Hospital<sup>4</sup> (Colorado, USA) and Leyden University Hospital<sup>5,6</sup> (Holland) are amongst many hospitals which, over the last few years, have installed computer-based information systems. They have installed these systems in the belief that significant improvements (both operational and financial) will result. Denver General Hospital report the following improvement in operational efficiency:

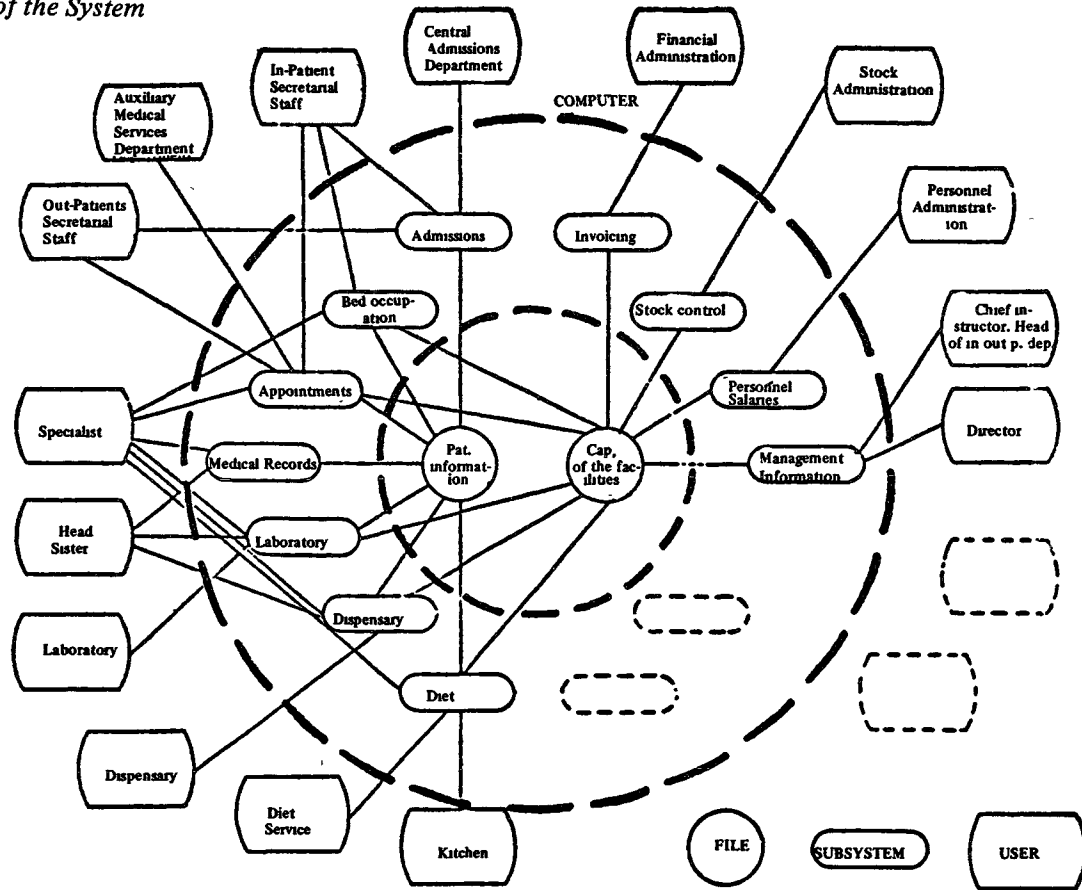
- i) A reduction in inventory from the industry average of 150 days supply to an average of 30 days supply. Inventory shortages practically eliminated.
- ii) A significant decrease in the volume of paperwork required for internal control operations.
- iii) A significant reduction in the total number of personnel involved in internal control.
- iv) The automated system is saving approximately £220,000 annually compared to the operating costs under the previous (manual) system.
- v) Increased revenue through the ability of the control system to accurately identify and report the costs of operation by floor, by department, and by cost centres throughout the hospital.

Denver General Hospital contains 350 in-patients beds and 250,000 out-patients per year. Leyden University Hospital enumerate the objectives of their integrated Hospital Information System as: -

- i) More efficient utilisation of the limited resources available for health care, to be realised by: -
  - more effective communication by increased accessibility of information and faster reporting,
  - relieving staff from administrative humdrum and interminable form filling,
  - more efficient utilisation of the treatment capacity by means of an integrated reservations system,
  - providing the supervising authorities with a clearer and more up-to-date overall picture, thus benefiting management.
- ii) Qualitative improvement of the services to the patients, to be achieved by -
  - more rapid observations of the patient, and thus an earlier start of the treatment,
  - closer supervision of the performance of the treatment, and better follow up,
  - support of various kinds of medical decisions by the application of decision schemes composed by the physicians concerned (e.g., A Real-Time Information System for Thrombosis Centres)<sup>6</sup>.
- iii) Providing assistance for research projects, in the form of -
  - information on the course of disease,
  - information on the result of treatments,
  - the discovery of hitherto unknown correlations, which may provide new directions for medical research.

Leyden University Hospital's computer-based information system has been designed to achieve a system availability of over 99 percent, with the possibility of servicing up to 120 terminals simultaneously. The total cost of the system, including operating, maintenance, equipment and material charges, should not exceed £3,000 per annum per terminal for 100 terminals connected. Fig. 4 describes the structure of the system. The Leyden University Hospital has about 900 beds and 260,000 out-patient visits per year.

FIG. 4: Structure of the System



### *A Regional Integrated Medical Information System*

Stockholm County<sup>7</sup> (Sweden) has a population of approximately 1.5 million people, 71 hospitals with a total of 20,700 beds and 1,500 county employed physicians who treat 3.7 million out-patients per year.

To help handle the flow of information between individual physicians, medical departments and hospitals, a regional computer-based, information system for health care has been developed. It is based on the development of a data-bank, which is built up in three levels:-

- i) Main file (on-line)
- ii) Patient file (on-line)
- iii) Medical history file (off-line)

The Main File represents one of the basic functions of the information system. It contains:-

- a) Census information (official personal data, address, etc.), 1.5 million people.
- b) Critical medical information (blood groups, critical illnesses as diabetes, hypersensitivity to drugs, vaccinations, etc.), 400,000 entries.
- c) Information on previous in-patient care, 550,000 entries.
- d) Information on previous X-ray examinations, 700,000 entries.

All of the EDP work is centralised and handled by the Stockholm County Computer Centre, which serves not only the hospitals, but all County Council Departments. Fig. 5 depicts the structure of the Medical Information System, Fig. 6 shows the content of the Main File and Fig. 7 indicates the routines of the Main File.

In 1974 the Stockholm County Medical Information System had 187 visual display terminals (70 of which were connected to hard copy printers) installed in ten hospitals. In one of these hospitals, Huddinge, terminals for entry and retrieval of information are located as follows:-

- One for every two wards (40 patients)
- One for every four wards (80 patients)
- Booking centre
- Information
- Archive
- All laboratories
- X-ray department
- Operation theatres
- Anaesthesia units
- Intensive care units

As Stockholm County report<sup>7</sup> "The total planning within the whole area of health care may yet become of greater importance to the development of costs in the long run. Only with a well-developed information system will it be possible to co-ordinate the utilisation of all available resources and to achieve rational long range after planning".

### *Basic Hardware Requirements of a Computer-Based Medical Information System*

The type and quantity of EDP equipment required for computer-based medical information systems depends on the level of sophistication desired. Fig. 3 depicts a very simple EDP system consisting only of a visual display unit with storage (memory) capability and



FIG. 5: Structure of the (Stockholm County) Medical Information System

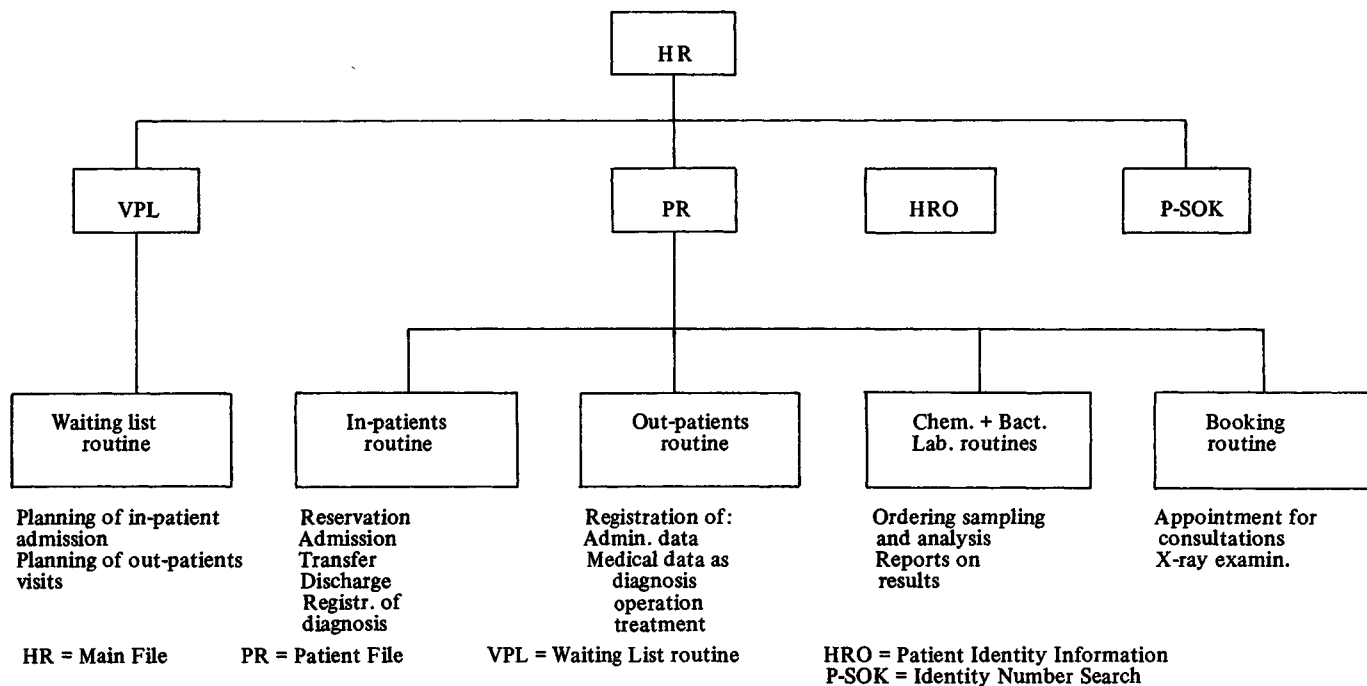


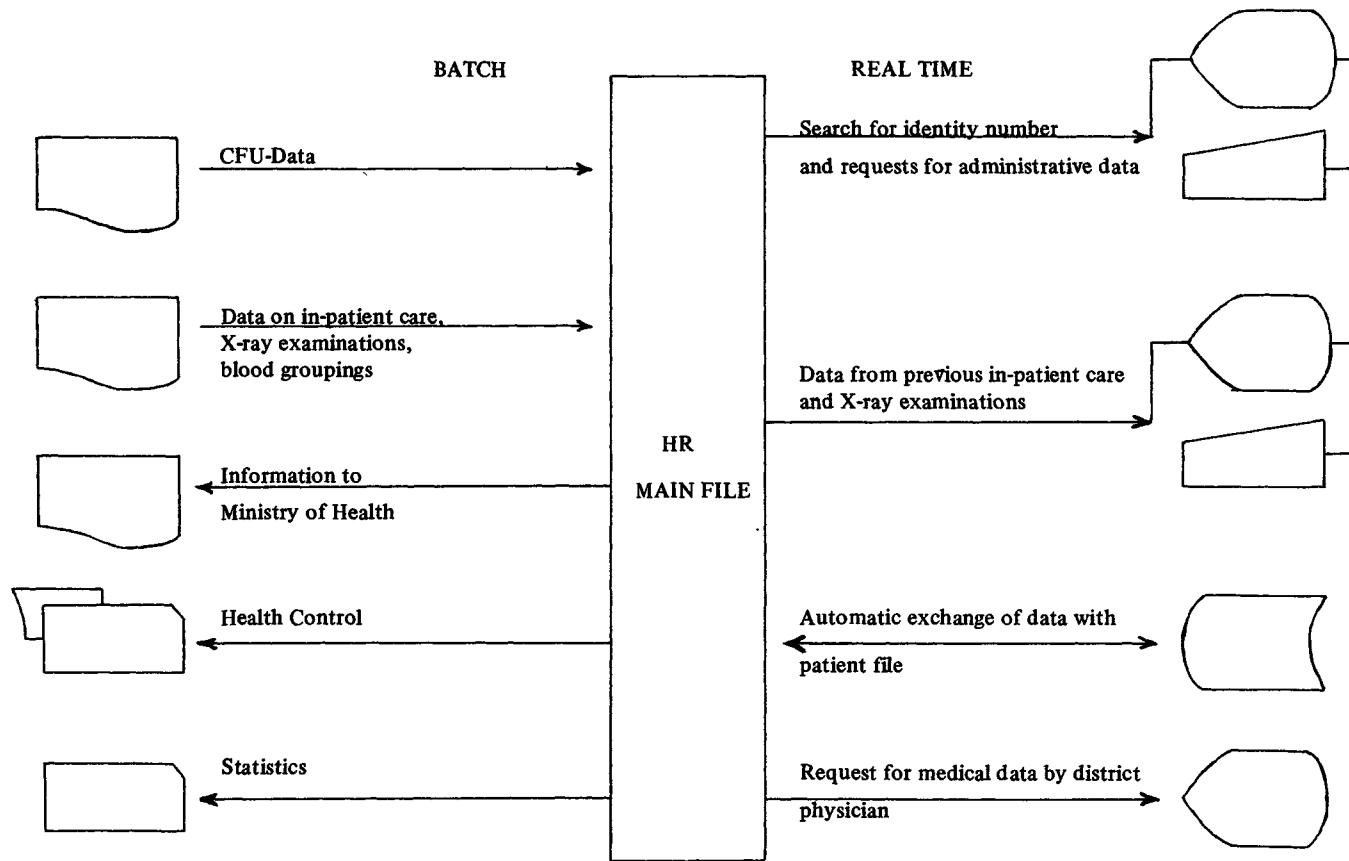
Fig. 6: *Content of Main File*

<i>CFU-Data</i>	<i>Information from previous in-patient care</i>
Identity number	Hospital (institution)
Name	Department
Address	Date of admission
Zip Code and Post Office	Terms of admission
Occupation	Date of discharge
Nationality	Terms of discharge
Civil status	Diagnosis code )
Time of latest change of civil status	Operation code )
Under age	Anaesthesia code )
Identity number of husband/wife/parents	max 10 each
Codes for	<i>Information on previous X-ray examinations</i>
County	Hospital
District	Department
Parish	Ward
<i>Critical medical data</i>	Date of examination
Telephone number (home and work)	Classification code
Blood group (group, number of groupings, observations)	Organ (part of body)
Critical illness	Examination method
Diabetes	Findings
Blood coagulation disorders	
Drug sensitivity	
Vaccinations (year, month, type, current no.)	

a Matrix Printer. Such a system could competently cope with the Admission/Registrations/Discharges of many of our hospitals and produce the basic information for the HIPE scheme in magnetic tape format for eventual processing at the Government Computer Centre (as at present) *or* on a smaller computer dedicated to that task. In addition, this simple system (Fig. 3) can produce such necessary *internal control* information as Ward Lists, Bed Statistics, General Statistics, etc., on a daily basis.

Alternatively systems could be installed which are similar to those described in the USA, Holland and Sweden. In each of these applications many visual display units are in operation and are connected to one, or in some cases two, medium sized dedicated computers. At this stage one has an integrated, computer-based medical information system of flexibility and power. Between these two limits, however, many alternative permutations and combinations of equipment are possible.

FIG. 7: Routines of the Main File



## Conclusions

The Medical Information System administered by the Medico-Social Research Board (HIPE Scheme) has achieved wide acceptance by hospitals since its inception in 1969. As has already been shown in Table 3 the growth (as measured by the number of discharges from hospitals) of the Information System has been extremely rapid - approximately 450 percent since 1970. Again using the number of discharges as the measurement, the *coverage* of the Information System is at present 70 percent. This figure is expected to show a substantial increase in the near future.

Although the information produced is extremely detailed and provides a wealth of statistics about the "medical health" of the country its actual *use* seems to be mainly limited to research investigations, data for hospital administration, and yearly reviews as to how the nation is (medically) progressing. As I have tried to show in this paper (Sections III, IV) much more use could be made of this nationally important Information System. The sheer profusion of data probably inhibits some medical administrators from examining the information in detail. A simple grouping of some 30 conditions such as suggested in Section IV, together with quarter-by-quarter and year-by-year comparisons would quickly indicate to medical administrators any sudden changes in trends. The isolation of the contributor(s) to the changes in trend could then be a relatively simple matter. These suggested changes could easily be incorporated into the existing analysis stage of the HIPE Scheme.

As Section VI has shown, the basic inputs of the Information System could be expeditely handled by modern EDP Systems. Putting the data into magnetic tape would reduce much paperwork and provide a means of directly accessing the information to a main frame computer for analysis. In addition I have shown how this basic information could be further processed by the EDP System to provide important *internal control* data for individual hospitals. Examples drawn from the USA, Holland and Sweden show how EDP Systems can be developed to provide Medical Information Systems of considerable flexibility and power. At the very least, we in Ireland should be examining and debating the merits of such systems for our own use. It would appear that this is being done on only a very limited scale at present.

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## DISCUSSION

*P. G. McQuillan:* First, I would like to thank the Society for the invitation to speak on the paper and the opportunity which it gives me to contribute to a discussion on Medical Information Systems in the Health Service. I would like to thank Mr. Harrison for having taken the interest in this particular topic and having gone to all the trouble, which he so obviously did, to pursue the matter and compliment him on the paper which he has presented this evening to the Society's members.

Much of Mr. Harrison's paper dealt in specific terms with the hospital in-patient enquiry scheme of the Medico-Social Research Board. This has been, as he correctly points out, a most valuable undertaking by the Board and has been of great assistance to hospital administration and consultant medical staff throughout the country. The Board deserves the compliments of all of us in the "business" for the work which has been put into development of the scheme and I know from personal experience it has not been easy for those of the Board's staff who have been responsible for encouraging and cajoling hospital staffs to participate and to the necessary groundwork to enable the scheme to be operational. I know that many Irish hospitals, particularly in the provinces, are very thinly staffed on the clerical and administrative side and those of us who study and have regard to the produce of the scheme must be indebted to the busy consultants and their clerical staffs who have taken the trouble to provide the input in the form required by the Board.

I would like to refer to Mr. Harrison's conclusions which he sets out commencing on page 115 of this paper as circulated. I must say immediately that they are conclusions with which I could readily find myself in agreement. It is not with the conclusions relating to the scheme itself that I intend to contribute this evening. I would like to take the final sentences of Mr. Harrison's paper,

"At the very least, we in Ireland should be examining and debating the merits of such systems for our own use. It would appear that this is being done only on a very limited scale at present",

and use the time which is available to me this evening to say something about the wider subject raised by Mr. Harrison - which was for me the most valuable part of his commendable paper - i.e., the consideration of the role of EDP in health care, planning and delivery in Ireland.

Mr. Harrison's paper gives me the opportunity of saying something about the development of Computer Services in the health business in Ireland: -

What work is being done at present?

Who is doing it and where?

How much does it cost and who pays?

What is being done elsewhere?

What *could* be done in Ireland?

What planning is being done for the development of Computers in the health field here?

Because of the time factor, what I have to say will be necessarily brief but I hope it will enable the matters raised by Mr. Harrison to be seen in perspective by the members of the Society for whom the subject matter of Mr. Harrison's paper is not one with which they are very familiar.

For the purpose of this subject, the "health area" is taken to include the Department of Health, the eight Health Boards and the major Voluntary Hospitals, and associated bodies working in the health field, e.g., Medico-Social Research Board, the General Medical Services (Payments) Board, etc. For the most part this group depends for computer services at present on the Central Data Processing Service of the Department of the Public Service in Kilmainham. That part of the CDPS operation which is dedicated to the health area is managed by a health services committee which includes the senior staff members of the CDPS, representatives of the major users and of the Department of Health. The terms of reference of this committee are -

- i) To identify what systems are necessary, to determine priorities between these systems, and to control the planning and development of all new systems.
- ii) To determine, in consultation with CDPS, the level of service to be provided in terms of a) staffing and b) hardware facilities under CDPS.
- iii) To determine, in consultation with the agencies concerned, the level of service to be provided in terms of a) staffing and b) hardware facilities under agencies which have to oversee generally the services provided in relation to health systems and to ensure that they are efficient and satisfactory.
- iv) To consider and propose arrangements for the supply of health services management of appropriate educational facilities in the area of computer development.

The total cost of computer services in 1976 is £1.026m of which £.384m is generated at the CDPS and £.642m is incurred by users who have terminal installations, users without terminal installations, the Eastern Health Board and the South Eastern Health Board who have in-house installations of their own and includes payments made to outside Companies for bureau services wherever they may be used.

As might be expected the heavy concentration of computer work is on "bread and butter" procedures e.g., payroll, expenditure analysis, cheque reconciliation, creditors' payments, etc. It is essential to have the basic systems operational before developing more sophisticated systems. The present work also includes the in-patient statistics for the MSRB, a medical card registration system for the Eastern Health Board, the system for paying doctors and chemists on behalf of the Payments Board, a monthly financial reporting system for the Department of Health, a health services staff census for the Department of Health, etc.

The number of systems which might be developed is almost endless. Staff of the CDPS and the Boards where there are computer installations have accumulated quite a library of information on systems running elsewhere in the world. They have attended at many conferences of computer users in other countries and I have studied the operation of systems in health agencies in a number of places. I have myself participated in a number of meetings of this kind. Documentation on conferences, meetings and study visits is made available to members of the Health Services Computer Committee and distributed to staff in the CDPS so that there will be a continuing awareness of developments in other places. Time will not permit the listing of the schemes which have been studied but it is sufficient to say that there is no lack of awareness amongst the people in the business of the availability of systems and the value of these systems to the planning and delivery of health care.

Cost, however, is a different kettle of fish. I noticed in Mr. Harrison's paper that the Leydon University Hospital's Computer base information system, which is the only one for which a cost figure is given, is stated to cost a maximum of £3,000 per annum per terminal for 100 terminals. This is a total of £300,000. A typical Irish provincial general hospital dealing with acute surgical, medical, obstetrical/gynaecological care and having an in-patient population in the range of 140 to 180 beds and a 90 percent plus bed occupancy has typical clerical/administrative costs of £35,000 to £40,000 per annum. Such a hospital would be run for a total cost of something under a million pounds and would have a clerical staff of about 13 to 17 people out of a total staff complement of 200 to 250. Many Irish hospitals have priorities for expenditure which would rank highly above investment in sophisticated systems and I know, from my own experience, the crying need for additional expenditure on equipment for radiology and pathology, for kitchens and laundries, for lighting, boilers and inter-communication systems which have never, in the past, been provided for by regular replacement expenditure planning. So many of our hospitals are run with a handful of clerical staff that the basic groundwork of record-keeping has not been developed even to the stage where we can be satisfied with the performance of our accounting systems and patient information systems.

A report on the use of computers for the improvement of health services was undertaken by the Department of Health and Social Security for the National Health Service in the UK in 1973. At that time there was a lot of work being done on payroll, stores accounting, etc., dental treatment records, vaccination records, school medical and child health records, hospital in-patient enquiry data, clinical laboratory applications and an experimental programme had been launched by the DHSS to determine what role computers might play in the future of the National Health Service. In Scotland the Home and Health Department were also engaged in a programme of experiments. In the report it was stated -

Although the DHSS has launched this experimental programme the process of determining just what role computing should play in health care will continue to be lengthy and probably very expensive as it has been in the majority of other environments. No one thinks that computing will revolutionise health care within the next five years. And some people think that even in ten or fifteen years computing will benefit health care only marginally. Experience to date, here and abroad, has shown a large number of failures and very few successes. Outnumbering both the failures and successes are projects on which trial must continue for a considerable time before they can be judged as successes or failures.

The adjustment to using computer based records systems can be a traumatic one, as many in the audience will know if they have gone through it themselves. Many of the agencies in the health system in Ireland have recently, or are currently, going through this period. There will soon be a lot of knowledge, experience and understanding of the merits and demerits of computer based systems and the job of harnessing this is now being firmly tackled by the health system itself through the health services computer committee. Much valuable work has already been done and the credit for much of this goes to the staff of the user organisations, and more particularly to the CDPS staff in Dublin and the staff of the organisation unit of the Department of Health in Hawkins House.

There are organisational steps of importance which now need to be taken in order to establish the system on a firm footing and a new period of growth should soon be entered upon which will in turn generate further costs and further benefits. The present period of recession will be used to the maximum for planning, organisational improvements and making of regulations etc. so that when the financial position improves the computer side of the business will be ready to avail of the improvement. It is not enough to know that if one invested £1 one could make £2 if during a period of recession the first £1 is not available to invest anyway.

I will have done Mr. Harrison's paper an injustice by not dealing with the specific matters he raised in connection with the HIPE of the MSRB. However, for me the real significance of the paper was the attention it directed on the need for, and the value of, development of computer services in health in Ireland. Mr. Harrison has done a service to the system in raising the matter and focusing attention on it and in bringing it to the notice of the members of your Society. I have great pleasure in proposing on your behalf to Mr. Harrison a sincere vote of thanks for his excellent paper on "Medical Information Systems in the Health Services".