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REPORT BY

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DEPUTY ADMINISTRATOR AND SECRETARY

OF

UNIVERSITY COLLEGE HOSPITAL

ON HIS VISIT TO HOSPITALS IN THE

UNITED STATES OF AMERICA AND CANADA

FROM THE 1st TO 21st JUNE 1963.

INDEX.

	Paras
Admissions office central	27
Accounting	53
Associations	66
Acknowledgements	67
Computers	2 & 3
Experimental & use of	4, 5 & 6
For medical histories	8
In Pathology	7
In X-Ray Departments	9
In Out-patient Departments	10
Allocation of Nursing Staff	11
Statistics	12
Other	13
Discussion	14
Chutes rubbish	48
linen	51
Catering	60
" automatic	62
Canteen lay-out	61
Dictation central	25
Disease index	26
Drugs issue	33
H.I.P.O.	34
Brewer	35
Narcotic counters	36
Domestic services	45
Strip & clean teams	47
Sinks	46
Equipment cleaning	43
Paint gun	44
Folding trolley	52
Slide access storage	52
Glass washing central	32
Hospitals visited	1
Linen chutes	51
Lifts	57
Medical records on computer	3
Microfilming	15
Retrieval of	16, 17, 18
Utilisation of	19
Filing systems	20
Abstraction	21
Issue of	24
Central dictation of notes	25
Maintenance	42
Cleaning equipment	43
Paint gun	44
Medical education post-graduate	54
Nursing - progressive patient care	40
Studies	41
Operating theatres utilisation	63
Patients index equipment	22
Computer	23
Pathology	
Automatic equipment	28
Computer use	29
Request procedures	31
Report procedures	30
Pneumatic tubes	38
Patients' property	55
Patients monitoring	64
Publications	65
Rubbish disposal	48 & 49
Statistics central admission office	27
Security	56
Sterile supply	39
Vacuum cleaning central	50
Ventilation	58
X-Ray Departments	37

The major and possibly the most difficult part of the history yet to be programmed is that part which is difficult to codify, the results of clinical examination and findings. Because of the volume of variable input the translation of these parts of the record would involve, it is hoped to agree and establish a clinical vocabulary which would simplify coding into computer language and avoid alphabetic input.
The experiments are at present based on four patients. It is planned to extend them to 40 patients in January 1964.

Already the programming has extended to 1,000 pages.

The practical achievements are very impressive. In the administration of drugs, for example, the computer prints out at the due administration time the dose to be administered, will communicate cautions as to legality of dose, method of administration, physical contra-indications, which require coded input clearance and requires coded report whether drug administered or not.

4. Similar experiments, not seen, were reported by "Systems Development Corporation, Santa Monica, California" upon which John A. Vallance published 24/5/1962 a report "Development of a Simulated Ward Operation".

5. and by Veterans Administration Centre General Medical and Surgical Hospital, Los Angeles,
Director, L.C. Like, 1928 Wilshire and Sawtelle Boulevard,
Los Angeles, Zone 25, California.

6. Experiments at the planning stage were seen at
Union Memorial Hospital, Baltimore,
at present limited to medical statistics, results of diagnostic tests and drug administration, and at
University Hospital, Chicago.

7. More specialised experiments were seen as follows:-

National Institutes of Health Medical Centre, Bethesda.
Automatic recording on computer of results of autoanalysed and other automatic testing equipment. Requests for and results of tests at present recorded on punched cards for processing on Hollerith machines. The procedures are described in more detail under the heading of Pathology.

8. University Hospital (Western Region), Cleveland.
A very sophisticated experiment on recording of complete medical history of diabetic patients processing some 20 pages of coded information with plain language results of clinical findings and history.

9. University of California Department of Radiology (not seen)
Retrieval by computer of video tape recordings of X-ray films.

10. University Hospital, Chicago.
Programming (in planning stage only) of second attendance of a patient at the Out-patients Department. This experiment is based upon the air lines booking procedures and is int[illegible]

11. Children's Hospital, Akron, Ohio (not seen).
Calculation of patients' nursing needs, and
Allocation of Nursing Staff.
The patient's needs and even nursing staff preferences are programmed.

12. Of the practical work seen on the computers the most striking examples were at
Professional Activity Study Centre, Ann Arbor, where the professional activities of the medical staff of 284 hospitals were analysed and summarised, 150 codes being employed in respect of each patient, the results being sent to each hospital the day after receipt.

13. and at the Data Processing Centre at the National Institutes of Health at Bethesda, who in addition to undertaking accounting, payroll and inventory work, were undertaking:-
1) Analysis of laboratory research.
2) Large data processing, e.g. world wide cancer survival analysis of 500,000 cases for International Meeting at Oslo.
3) Mathematical calculations from information recorded on tapes of heart function, with details of blood flow, blood pressure, size of heart and other instrument recorded date.
This centre occupied a floor area of 30,000 square feet and employed a staff of 125.

14. The economics and practicability of the computer work being done was discussed at every opportunity. My impression of the many views expressed is that for statistical and calculation work computers are ideal, but that for the complete medical history the practical limitations of vocabulary are not acceptable at the present time - while language can be put into a computer, a large hospital's medical records in their present form would require an immense input unless a vocabulary restriction were imposed. I had the opportunity of discussing this particular problem with a management consultant of Remington Rand Inc. who informed me that they had programmed into a computer a complete medical dictionary and a limited range of non-medical vocabulary. It was claimed that each word of a medical history written in long hand could be sensed and stored on tape in the computer and could be retrieved by random selection in 3 seconds and printed out. I did not see this equipment and with the equipment I saw in operation the uncoded part of a medical history appeared to me to present an uneconomic storage problem for the computer, although variable information can unquestionably be put into a computer.

The major doubt I had on the full medical history studies I saw was, however, the economics of the computer for this work. At the Massachusetts General Hospital I was told by the Director of Nursing, an enthusiastic supporter of the experiment, that she would ask for a clerical staff of 100 plus to undertake the input at ward level covering 16 hours a day for the 40 wards, leaving 8 hours a day (at night) to be covered by the Nursing Staff.

<u>Medical Records.</u>
<u>Microfilming and Retrieval of Record.</u>

15. Microfilming is seen by a number of hospitals visited as a possible alternative to, or as a interim step to, putting medical records into a computer. Approaches varied from the extremes of

16. Some interesting proposals for the retrieval of a microfilmed medical record were seen. At Johns Hopkins Hospital, Baltimore, a film covering 36 pages of record was mounted on a Hollerith punched card. It was claimed the card could be retrieved in 4 seconds and reproduced in 1 minute. It was possible to select a group of cards by desired classification punched on card, e.g. age, sex, disease. A film reader would be installed at each location necessary. Films were mounted on the cards by a "Xerox Mounter". Provision was made for adding history of subsequent treatment by leaving space in card holders.

17. The National Institutes of Health considered the retrieval rate above to be too slow and that in fact it could not be achieved by the punch cards system except by eliminating the older punched cards. They favoured a microfilm system with magnetic identification code similar to that used on cheques, although they had considered a system in which sensing slots were cut in the film.

18. Massachusetts General Hospital, Boston, had investigated a system called Media Magnavox Electronic Data Image Apparatus (of which the cost was $110,000). In this system the film is taken on perforated rolls, cut from the rolls on to cards and placed in capsules which in turn are placed in files. A seven digit number is photographed on to the film. When required the capsule bearing the first 5 digits of the number is placed on a Medica Selector Reproducer and keys depressed for the last 2 digits. Then the operator presses a start button and the cards are removed from the capsule one by one and transported by a belt under a photo cell read head which selects the required films. Retrieval time is estimated at 31 seconds.

19. The Johns Hopkins Hospital, Baltimore, had carried out an interesting study of the utilisation of medical records, showing that referral dropped from 48% of records after 1 year to 8% after 7 years.

Filing Systems

20. Terminal digit filing was in use at each hospital visited.

21. The National Institutes of Health stuck a coloured tab, a different colour for each year to facilitate abstraction of non-current files. If a patient re-attends before the file is due for abstraction, a tab of the colour of the current year is stuck over the earlier tab.

22. Index of Patients.

Except at the Henry Ford Hospital, where a mechanically operated strip index file was in use, a rotary elevator index file was used, with phonetic or alphabetical mechanical positioning of file. Equipment used included the Diebold and Remington Rand, with a capacity of 250,000 index cards.

23. University Hospital, Chicago, had the patient index on a computer. This will print out patients of similar description if requested patient description not available, so that patient can be questioned further.

24. Issue of Medical Records.

All the hospitals visited had a system of requisitioning the

25. Dictating Machines.

Apart from the National Institutes of Health, who had reverted to individual dictating machines because of peaks of demand, all the hospitals had central dictating facilities with 4 to 7 machines in the medical typing pool. The National Institutes of Health sent the discs from the individual machines through the pneumatic tube to a central typing pool.

26. Diseases Index.

Generally the hospitals were, or were planning to, prepare the disease index by Hollerith or computer processing. The Toronto General Hospital filed the disease index cards in a Robot Kardex file. By pressing numbered keys the card for a disease classification would be produced mechanically.

27. Central Admission and Statistics Office (C.A.S.O.)

The Massachusetts General Hospital have mechanised the recording of all admissions and discharges on punched cards processed on Hollerith machines.

All statistics are produced mechanically and lists of patients admitted, transferred and discharged printed out for communication to all concerned. On the same equipment the operating lists are prepared for communication to wards, central supply, etc.

In the same department addressograph plates are embossed and standard documents for medical records are prepared.

The cost of the C.A.S.O. equipment was approximately $30,000.

28 Pathology Department.

Automatic testing equipment was in general use at the Pathology Departments visited. Of particular interest, however, were the plans at the National Institutes of Health to record automatically the results of tests undertaken by the autoanalysers and other automatic equipment. At the National Institutes of Health at the present time requests for pathological tests are made on punch cards, appropriate squares being ticked, using a special pencil, an addressograph plate indicating the patient's name, number, etc. On arrival at the laboratory office the request card is punched by mark sensing and a second punch card is prepared for the results of the tests. The results are printed out with three copies, one for the ward or clinic, one filed under patient's name and one in date order. When further tests are done, the print out will automatically include all previous tests done for the same patient. The up to date cumulative summary of test results is then sent to the ward or clinic, who are requested to destroy the previous test report or summary. The results of urgent tests are communicated to the operating theatres and heart recovery rooms by means of a scanning device, quix Fax, made by the Telephone Autograph Corporation of California.

29. I was informed that an analogue graphical convertor would be used to record the strength of electrical impulses at exact intervals and thus convert the graphs produced by an autoanalyser for a series of sample curves into digital form. The results would be fed into a computer programmed to sense magnitude and value of peaks by rejecting false or noise peaks.

It is intended that when perfected the method should replace the present punch card system.

31. Other departments had more familiar procedures, with request forms in duplicate or triplicate, but all forms had a gummed section to be detached and stuck on the specimen for identification. The Henry Ford Hospital had request forms in a variety of colours to assist in sorting the request to the appropriate laboratory. It was usual for the laboratory central office to be connected by inter-comm. to the individual laboratories to enable information about urgent tests to be obtained.

The Toronto General Hospital had particularly attractive laboratories with benches at 11' centres at right angles to the windows, with a good working corridor between the ends of the benches and the main corridor wall.

32. All the hospitals visited had extensive contralised glass washing and sterilising facilities. At the National Institutes of Health Hospital Centre the department occupied an area of 4,000 square feet.

Drug Issue.

33. All the hospitals visited had given considerable thought to the arrangements for the issue of drugs. At the Johns Hopkins Hospital, Baltimore, a study had shown that up to 20% of a nurse's time could be taken up by paper work in connection with drugs, apart from the administration. This high percentage no doubt is partly accounted for by charging for patients' drugs. Another study showed that 90% of the errors in the administration of drugs fell into 5 categories. These studies pointed to the need for a safer and more efficient system of drug issue.

34. Although there are more complicated and expensive systems such as the electronic HIPO (Hospital Indicator for Physicians Orders) the trend was best exemplified by the system at the Massachusetts General Hospital, MOSAICS (Medication Supply and Individual Charge Systems). The Chief Pharmacist claimed that out of 4,000 or so drugs in stock only 40 were commonly used on any one ward, and in the case of paediatrics the number frequently used dropped to 20. The principle was therefore to issue drugs to ward by pharmacist without requisition.. The size of packet of commonly used and inexpensive drugs had been increased, simplifying issues, but the packets contained pre-packed unit doses for ease and safety of administration. It was claimed by the Chief Pharmacist that the output of his pharmacists had increased by 40%. The ratio of pharmacists to in-patients was 1 - 200.

35. I did not see the Brewer Medication Cart in use, though I heard the Greater Baltimore Medical Centre were using one. The one adverse comment I heard was that the drugs deteriorated owing to the unsuitable type of packet used to suit the automatic machine.

36. Toronto General Hospital had two types of narcotic counters in use - one a patent one made by the American Hospital Supply Association of Evanston, Illinois. It was a shallow drum in clear plastic. The base has 25 numbered compartments for the doses. The lid has one hole so that only one dose can be taken out at a time, and that serially numbered. The counter simplifies the checking of unused doses. It is filled by the pharmacy and cannot be tampered with. The second counter was a home-made rectangular one working on similar principles.

41. Other studies of nursing interest were the Out-patient Clinic Nursing Utilisation Study carried out at the Michael Reese Hospital, Chicago, and Clinics in four other Chicago hospitals. The other study of interest, mentioned under the heading of drugs, was the analysis of the nature and causes of errors in the administration of drugs by nurses carried out at the Johns Hopkins Hospital, of which I have a summary of the results.

42. Maintenance.

A good deal of thought had been given to the organisation of maintenance by some of the hospitals. For example, at the Massachusetts General Hospital to save nurses time in writing out requisitions, the buildings had been divided into areas, each of which was visited by a maintenance foreman once a week, to note defects and organise single visits from each trade concerned. The foremen of the various trades took responsibility for an area in rotation.

43. At the National Institutes of Health each piece of cleaning equipment bore a card on which maintenance was recorded.

44. The Massachusetts General Hospital were using a De Vilbiss paint gun which sprayed paint undiluted by air on wall surfaces and ceilings. The compressor operates at 2,000 lbs. per square inch, and the paint was ejected from a 10 gallon drum at 90 lbs. per square inch. I was told that a room could be stripped, masked where necessary, painted, dry, free from smell and ready for re-use while a patient was in an operating theatre - some 2½ hours. The paint, with an evaporating chemical, dried in 19 minutes. I used the gun in a lounge suit without a mask - there was no objectionable spray.

Domestic Services.

Domestic service features noted were -

45. National Institutes of Health.

5 Detachable mop heads issued to each worker each day - all handed in for laundering daily and 5 more issued.

Detachable light and tube shades were taken off and dipped into a specially designed cleaning tank in two sections, one filled with detergent solution and the second with rinsing water. The tank had a deep and shallow end to simplify the cleaning operation.

A Wallmaster wall and ceiling washing and rinsing machine was in use.

To enable the areas under desks, tables, etc. to be cleaned, a desk lift on wheels was used, which lifted the desk by a single action jack, when the desk could be wheeled away.

Mops were 3 ft. wide, 32 oz. weight, the end strands bound with tape and were 50% cotton and 50% synthetic fibre to prevent matting.

A most detailed analysis of the cleaning tasks had been made, listing every area to be cleaned, the items in the area to be cleaned - washbasins, desks, tables, etc. etc. and the frequency and cleaning time allotted. The domestic was given a cleaning schedule, of which the area supervisor had a copy.

47. A number of hospitals were using domestic bed and room stripping and cleaning teams. It was claimed that the splitting of these tasks between nursing and domestic staffs caused frustrating time wasting.

48. Rubbish chutes and handling.

An elaborate system of rubbish chutes was installed at the National Institutes of Health, but were not in use. I gathered that the chutes had a considerable ' chimney' effect and that rubbish tipped into the chute at the 9th floor might be expelled at the 17th if the door were opened at the same time. In any event the doors were not air-tight. It was thought that automatically interlocking doors might overcome the misdirection of rubbish, but it was decided that the fire hazard was too great.

49. Rubbish was being collected in two bins, one for burnable material and one for unburnable, the former being taken to a central automatic incinerator. When the bin was placed on a moving belt its contents would be tipped into the incinerator and the bin moved on to a steam cleaning section and then sterilised. 3,000 bins a day were handled in an area of 3,000 square feet.

50. Central Vacuum Cleaning.

I saw this at the National Institutes of Health and the Montreal General Hospital. At both its use had been discontinued, except at the latter for emptying electric vacuum cleaners.

I was told that they were very noisy "like an express train when the vacuum pipe flaps were lifted", that dentures, rings and other articles would be sucked into the tubes, and that the pipes across corridors meant that trolleys of all kinds could not pass. The cleaning of the central dust collecting container was described as a most objectionable task.

51. Linen Chutes.

These were considered useful, but need very careful control under lock and key, as they could be very dangerous. At the Montreal General Hospital an operator who had a key had committed suicide by climbing into a chute.

52. Equipment.

Items of particular interest were a patient's folding trolley, which was very practical and space saving, and slide access storage racks, on the gravity feed principle, which was very space saving and meant that articles would be used in strict rotation. It seemed that this system might have great advantages in provision stores, central sterile supply, pharmacy, etc.

53. Accounting.

The Management Accounting seen was very advanced, providing within a week full expenditure analysis, variations from budget allocations each week with cumulative figures.

54. Post-graduate Medical Education.

I was very interested to hear about the progress in organisation

55. Patients' Valuables.
The Montreal General Hospital appeared to have found a solution to this time consuming and troublesome problem by providing individual built-in strong boxes for each patient, of which the key could be kept by the patient if well enough, or by the ward sister, thus saving the work of collecting and giving receipts for valuables.

56. Miscellaneous.

Security.
I was astonished to be told that the National Institutes of Health had 90 security guards, armed with truncheons by day and revolvers by night for protection against thefts, traffic and other duties. There were also two detectives.

57. Lifts.
The hospitals visited were mainly tall buildings and there were obvious disadvantages in combining patient and staff and visitor traffic. Automatic lifts used by patients were invariably manned. The door closing mechanism was found to be too fast for patients and too slow for staff.

58. Ventilation.
Where laboratories are associated with wards I noted that the ventilation was by extraction from the laboratories, drawing air from the ward to keep animal and chemical smells from getting into the ward area.

59. Parking.
I saw parking slot machines in use. A bar across the entrance could be operated only by a plastic ticket. This had to be surrendered on leaving and a charge made according to the length of stay.

60. Catering.
The Toronto General Hospital had the best equipped and organised catering department it has been my good fortune to see. The food went to the wards in the main ward building on trays by trayveyor and hoist, dirty dishes returning by similar means. Delivery time of food was stated to be 4½ minutes maximum to furthest patient. Food is unheated en route and I was told by an ex-patient, quite by chance, that the food was always cold.

61. The canteen serveries were laid out on the scramble pattern, i.e. not a single tray line but with 4 service sections, each serving a variety of groups of dishes or drinks. Dirty dishes were placed by users on a travelling belt leading to the centralised washing-up.

62. The University Hospital (Western Region), Cleveland, were using for off-peak feeding automatic vending machines with built-in quick frozen storage and short wave cooking.

63. Operating Theatres.
Faced with increasing waiting lists for surgery, the Michael Reese Hospital, Chicago, had given special study to the utilisation

64. Patient monitoring.

It was the exception to find hospitals using or in favour of monitoring devices. University Hospital (Western Region) Cleveland had 5 four-channel mobile units in use in the operating theatres and 2 in the intensive care unit. Montreal General Hospital had one single-channel mobile machine in intensive care unit. All were operated by wires to patient.

65. Publications.

American Journal of Medical Electronics,
466 Lexington Avenue,
New York, 17.

Medical Electronic News;
Instrument Publishing Co.,
845 Ridge Avenue,
Pittsburg 12, Pennsylvania.

Newsletter of Hospital Management Systems Society,
Editor C.H. Whitston,
225 Nort Avenue N.W.,
Atlanta 13, Georgia.

66. Associations.

Hospital Management Systems Society,
(address above)
Director Dr. Harold Smalley, Ph.D.

A.H.A. Advanced Institute on Methods Improvement,
A.H.A. Headquarters Building,
840 North Lake Shore Drive,
Chicago 11, Illinois.

67. I would like to take this opportunity of expressing my sincere thanks to the Board of Governors of University College Hospital for granting me study leave to visit the United States and Canada and to the King Edward's Hospital Fund for London for making a grant from which the expenses of the visit have been met. It has been a wonderful opportunity to study developments in both countries of hospital efficiency methods.

I cannot close this report without saying how grateful I am to some 50 senior members of hospital and other staffs in the United States and Canada who have taken so much trouble to make my visit really worthwhile, have given me so much of their time and so much hospitality. It has been a most memorable experience.

O.R. CROSS,

Deputy Administrator and Secretary.

25th June 1963.