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A New Data Base System for Medical Records Using MUMPS, BASIC, and FORTRAN in the Department of Pediatrics

(medical record/computer/data base)

CHUZO MORI, TOSHIKAZU NISHIO, KATSUTOSHI ABE, MASAKAZU SAITO, YUTAKA TOMITA, NORIYUKI HANEDA, and YASUJI NAKAO

Department of Pediatrics, Shimane Medical University, Izumo 693, Japan

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A new system for medical record processing established in Shimane Medical University Hospital is introduced together with details of configuration of this system.

The system is designated "POS matrix" which consists of diagnoses and clinical findings arranged as a matrix. Using this sytem, complicated clinical information can be compiled in CPU systematically, and various output data can be obtained. The objective of implementation of this system is to make clinical data available for instruction of medical students, clinical research and more adequate care for the patients.

Rapid progress in the field of clinical medicine has enormously increased the quantity of data obtained from patients. Data-processing methods through the current format of clinical chart are considered to be inadequate to meet the needs of present-day medical practice. We wish to introduce a newly designed medical-record processing system which has been established in Shimane Medical University Hospital.

MATERIALS AND METHODS

Materials

A total of 103 pediatric inpatients representing forty-one diseases, were analyzed to determine the format of the clinical chart recorded with POS (Problem oriented system) and summarized by a new method which is designated "POS matrix". The details are listed in Table I. The clinical information obtained from 20 cases among the 103 described above were compiled in CPU using the method of "POS matrix".

Methods

The configuration of the system is shown in Fig. 1. The central processing unit (CPU) is Pana Facom U-1500. The main memory unit is 320 KB IC memory. The external memory units are composed of two magnetic discs of 40 MB memory capacity, and magnetic tapes. Typewriter (TW) is a

TABLE I. *Diseases Examined*

Disease	Number	%
Newborn related	18	17.4
Digestive	13	12.6
Cardiovascular	12	11.7
Blood dyscrasia	11	10.7
Urinary related	11	10.7
Metabolic disorders	8	7.8
Neuromuscular disorders	7	6.8
Respiratory disorders	6	5.8
Infection	5	4.9
Morphologic syndrome	3	2.9
Others	9	8.7
Total	103	

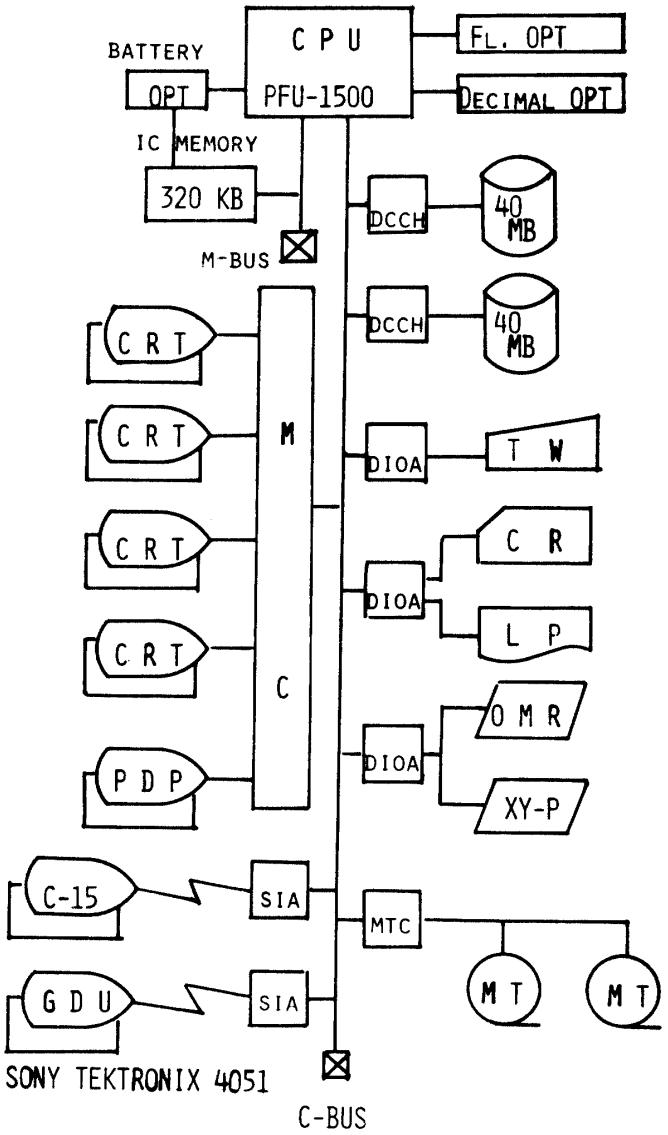

Fig. 1. Configuration of the system.

console unit which enables control of the terminal devices. These devices are four CRT display units and a set of plasma display (PDP), card reader (CR), line printer (LP), optical mark reader (OMR), and XY plotter.

PFU-1500 can control the Sony Tektronix 4051 type graphic display units (GFU) and the Pana Facom C-15 type personal computer (PF C-15) which are intelligent terminal units with programmable functions. We can process the data, furthermore, in MUMPS, FORTRAN, and BASIC languages by using the CPU.

A new method of summarization is designated "POS matrix" system, the explanation for which is as follows: The numerous clinical data found in medical records are separated into 5 categories (data elements), that is, symptoms, physical findings, laboratory findings, treatments, and autopsy findings. Each item has a date of onset and resolution. Symptoms (abbreviated as S) are the subjective complaints of patients. Physical findings (P) are defined as the objective data obtained by physical examination. Laboratory findings (L) are the data gained through laboratory tests. Treatments (T) mean the contents of medical treatment applied to patients. Autopsy findings (A) are pathological data obtained by autopsy after the death of patients. These 5 categories of findings are concentrated inductively to diagnoses (problems).

The clinical charts, thus, include proplems (#), clinical data (S, P, L, T, A), their duration, and description of relationship between diagnoses and clinical data. We have introduced the manner of the representation of diagnoses and clinical data as a matrix. Relations between diagnosis and clinical data are indicated by symbol (+).

The MUMPS language is used to operate the "POS matrix" system. Input items are patient's identification data, problem (diagnosis) list and clinical data summarized by "POS matrix". These data are usually input through CRT. Moreover, laboratory data of the patients can be also input with "POS matrix" through the display units, CR, and OMR.

RESULTS

It is necessary to restrict the number of items in each problem and each category (S, P, L, T, A), in order to process the numerous clinical data of patients within the limitation of CPU memory capacity. The clinical data of 103 pediatric inpatients were, therefore, analyzed statistically to decide the number of items which would adequately describe the contents of problems, symptoms, physical findings, laboratory findings, and treatments. The number of items in problem and clinical data per patient are illustrated in Table II. The number in parentheses indicates the range of these items. This result shows that, restricted to significant findings, it is satisfactory to adopt 5 items in problems, 5 items in symptoms, 10 items in physical findings, 10 items in laboratory findings, and 5 items in treatments. An example of "POS matrix", which was printed out through the line printer (LP), is shown in Fig. 2.

TABLE II. *Number of Items Obtained from Statistical Analysis*

	Number	Problem	S (Subjective complaint)	P (Physical finding)	L (Laboratory finding)	T (Treatment)
Newborn (0-1 mo.)	10	3.3 (2-6)	3.6 (1-5)	7.2 (4-10)	5.0 (1-12)	3.9 (1-9)
Infant period (1-11 mo.)	9	2.8 (1-5)	3.7 (1-6)	6.0 (2-11)	5.7 (2-12)	2.9 (1-5)
Young children period (1-5 yrs.)	9	2.0 (1-3)	5.2 (3-8)	6.9 (3-12)	7.1 (4-11)	3.8 (1-11)
School period (6-14 yrs.)	13	2.1 (1-4)	5.8 (4-9)	6.2 (2-16)	6.2 (2-15)	3.8 (1-12)
Total	41	2.5 (1-6)	4.7 (1-9)	6.5 (2-16)	6.0 (1-15)	3.6 (1-12)
SD		1.2	1.8	3.1	3.4	2.6

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                *** SUMMARY SHEET FOR COMPUTER SERVICE (1) ***  DATE 79.11.30
                                                                TIME 19.30.48

03 : PEDIATRICS
0002589 : K. K.          S41.01.12      M
                         ADMISSION ( S54.10.23 - S54.11.30 )

(PROBLEM)

#-1  2809      IRON DEFICIENCY ANEMIA
#-2  5320      DUODENAL ULCER

(SYMPTOM)                                CODE & TERM          #1  #2  #3  #4  #5

S-1  PALLOR                              79/10/02-79/11/15     +
S-2  ABDOMINAL PAIN                      79/08/10-79/09/15         +
S-3  TARRY STOOL                         79/08/30-79/09/02         +
S-4  GENERAL MALAISE                     79/10/17-79/11/05     +

(PHYSICAL SIGN)                          CODE & TERM          #1  #2  #3  #4  #5

P-1  PALE SKIN                           79/10/17-79/11/15     +
P-2  VENOUS HUM                          79/10/17-79/11/13     +
P-3  SYSTOLIC CARDIAC MURMUR             79/10/17-79/11/20     +

(ABNORMAL LABORATORY DATA)               CODE & TERM          #1  #2  #3  #4  #5

L-1  LOW BLOOD HEMOGLOBIN                79/10/18-79/11/20     +
L-2  LOW MCV                             79/10/18-79/11/20     +
L-3  LOW SERUM IRON                      79/10/18-79/11/20     +
L-4  HIGH ALP                            79/10/18-79/11/15     +
L-5  ERYTHROID HYPERPLASIA OF BONE
                              MARROW     79/10/19-             +
L-6  SCAR OF ULCER                       79/10/30                  +

(TREATMENT)                              CODE & TERM          #1  #2  #3  #4  #5

T-1  ORAL IRON SUPPLEMENTATION           79/11/02-             +
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Fig. 2. "POS matrix" printed out through a line printer.

The output items are "POS matrix" of individual patients (Fig. 2), graphic display of the progress notes (Fig. 3), the list of patients retrieved by each

"Problem (diagnosis)", and the patient-list of each department such as internal medicine, pediatrics, surgery, etc.

The progress notes of the patients are displayed with a trend of time series data on the CRT of Sony Tektronix 4051 type graphic display unit (GPU), under the control of PFU-1500. The table can be immediately copied by the Sony Tektronix 4631 type hard copy unit, shown in Fig. 3. The

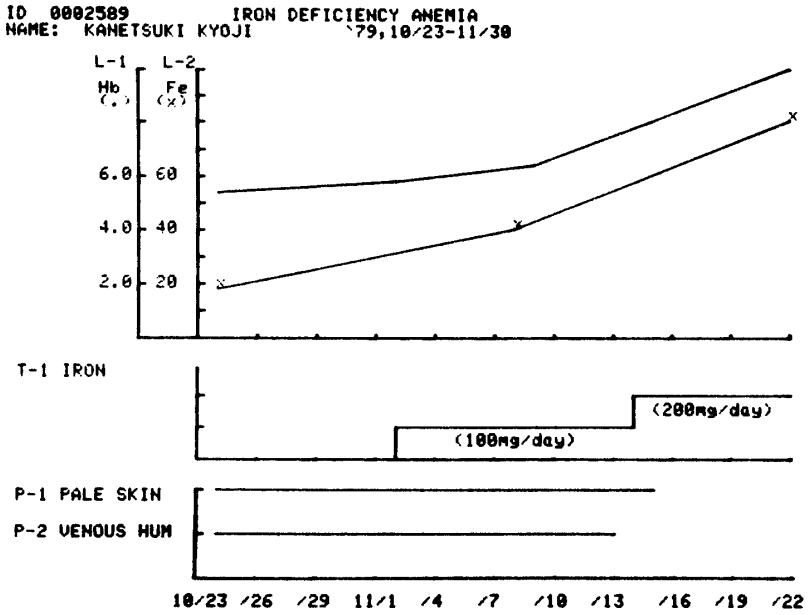

Fig. 3. Progress note and laboratory data displayed on a graphic generator under the control of CPU.

patient data of each department are also recorded on CRT of Pana Facom C-15. The data are recorded and stored on the casette magnetic tapes of C-15.

DISCUSSION

The problem-oriented system (POS) for medical records was introduced by Weed (1) to deal rationally with medical records, and to utilize a description of the medical record for the instruction of medical personnel. Anderson and Hurst enunciated the advantages of POS and promoted adoption of the system (2—4). Various formats of POS were then devised for the convenience of each bedside medical practice (5, 6) and for the application to computer-assisted systems (7—12). The "POS matrix" developed by us is quite a new type of medical recording format not hitherto described (1—6). The layout of "POS matrix" form is organic but simple enough to display graphically progress notes related to the patient, with ease and under the control of CPU (7).

Such computer-assisted medical records processing system as was established

in Shimane Medical University Hospital, has not been introduced anywhere else in the world (7—12). The system is designed to respond to MUMPS, FORTRAN, and BASIC languages. The system we devised aims at effective utilization of clinical data for the instruction of medical students, the clinical research and the care for patients.

Using the compiled "POS matrix" data, the frequency and duration of clinical findings accompanying individual disease entities can be readily retrieved even after many years.

The visual presentation of the information mainly obtained through a graphic generator will enhance the learning situations for medical students and doctors and the disease in question should be more systematically and analytically comprehensible. We will apply this sytem to the medical record management of all departments of our Hospital.

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