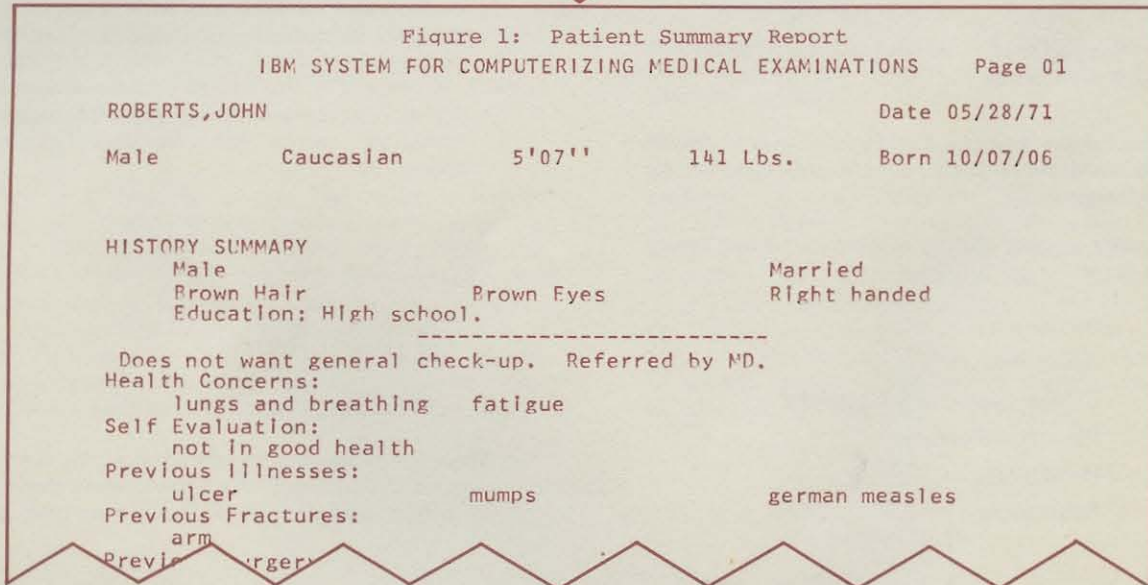
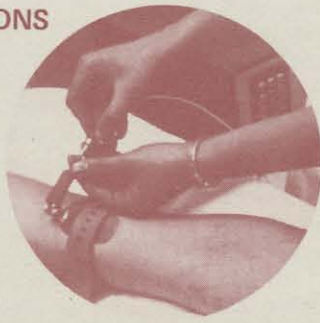




**SYSTEM FOR
COMPUTERIZING
MEDICAL
EXAMINATIONS**



SEE INSIDE FOR COMPLETE PATIENT SUMMARY REPORT

CME (System for Computerizing Medical Examinations) is a system to facilitate the collection and reporting of multiphasic medical data, including medical history and the results of various on-line and off-line test procedures.

Computerizing Medical Examinations is designed to provide efficient history taking, laboratory testing, and physical measurement elements of a medical examination. It provides a standardized and professional summary of the data while permitting more efficient use of professional and para-professional personnel.

The system takes full advantage of the multi-programming capabilities of the IBM 1800 Data Acquisition and Control System and the MPX Operating System to collect data and compare it with a previously entered file of normal values. Depending on the test, these values may be based on age, sex, height, weight, and/or race.

The system utilizes an IBM 1800 Computer with IBM 2760 Optical Image Units for recording the patient's history; IBM 1001 Data Transmission Terminals for identification of the patient for various tests; IBM 2956 Mark-Sense Card Readers for input of off-line test results, and standard medical instruments for on-line collection of chemistry, hematology, audiometry, spirometry, and ECG data.

At the completion of (or at any time during) the test series, a Patient Summary Report using medical terms can be printed, and is available to the examining physician prior to his examination of the patient.

HIGHLIGHTS

- . On-line registration of the patient i.e., directly to the computerized file
- . Automated history taking via visual display terminals—utilizing simple question/answer techniques
- . Collection and editing of automated test results such as:
 - Audiometry
 - Blood Pressure
 - Clinical Laboratory Chemistry
 - Electrocardiograms
 - Hematology
 - Spirometry
- . Collection and editing of non-automated test results
 - Chest X-Ray
 - Differential Blood Cell Counts
 - Height, Weight
 - Urinalysis
 - Vision
- . Computer comparison of test results with normal values stored in the system for population groups
- . Results available for statistical analysis
- . Patient Summary Report provided for the physician
- . Systems design flexibility in meeting specific requirements for patient history and data acquisition

These HIGHLIGHTS translate into the following ADVANTAGES to the user:

- . Reduces clerical workload for admission/registration, report compilation, report typing—patient's file is immediately stored in the computer.
- . Improves quality control and standardization—all on-line tests are read directly by the computer. Transcription errors are eliminated. Uniform, accurate readings are assured.
- . Minimizes involvement in paper work by professional staff—maximizes time with patient.
- . Incorporates all pertinent patient data into one standard document—eliminates duplication and filing errors.
- . Allows complete control by the physician—any computer results may be modified at his discretion.

SYSTEM DESCRIPTION

Input/Processing/Output Description

When the patient is registered into the system, he receives a Test Booklet of mark-sense cards which are prepunched and printed with a six-digit patient

identification number, and a two-digit test number—one card to identify each test of the entire battery of tests he is to take.

The Registration Card has space for descriptive information about the patient, an indication of which tests he is to take, and what form of Patient Summary Report is desired. Patient Summary Reports may be printed in either of two user-chosen formats and may include only positive replies to history questions (i.e., the patient has had measles), or both positive and negative replies (i.e., the patient has had measles, he has not had mumps). The reporting of negative replies indicates to the physician that the question has been asked.

As the patient progresses through the testing areas, a separate card is removed from the booklet and entered into the system for each test. If the test is on-line, for example spirometry, the card is read by the IBM 1001 Data Transmission Terminal. This enters the patient and test identification data and signals the System to activate the appropriate testing station and execute the associated computer data acquisition routines. If an off-line test is requested, such as urinalysis, the IBM 2956 Mark-Sense Card Reader is used to transmit the test request and test results.

The provision for entering mark-sense data also provides back-up for all on-line tests. It also allows for "overriding" of data previously entered automatically. For example, the Cardiologist can override the computer by marking his evaluation of the ECG on the "Electrocardiogram" card and entering it via the 2956 Mark-Sense Unit.

The medical history questionnaire is presented to the patient on an IBM 2760 Optical Image Unit. He responds to the questions by touching the screen with an electrical probe. Coded responses are stored in the computer. The 2760 will branch, under computer control, to minimize the number of questions asked. For example, if the patient answers that he has not had headaches, he is not asked if they are severe.

At the completion of the test series, a Patient Summary Report is automatically generated on the IBM 1053 Typewriter or the IBM 1443 printer. This report, which is concise, standardized, and professionally formatted, becomes an important portion of information in the patient's permanent file. It is made available to the physician before he begins the physical examination of the patient. (See Figure 1, Patient Summary Report)

PROGRAMMING CONSIDERATIONS

All programs are written in 1800 Fortran IV and 1800 Assembler Language and operate under the control of MPX (Multiprogramming Executive, 1800-OS-010 OPT 2, Version 3).

SYSTEMS CONSIDERATIONS

Minimum configuration for hardware is an IBM 1800 Computing System with three disk drives (1810's), and 32,767 words of memory, a 1442 Card Reader/Punch and a 1443 Printer. Input attachments are IBM 1816 typewriters; IBM 1001 Data transmission Units and medical devices for test results.

The complete specifications for a recommended system can be obtained from your IBM Marketing Representative.

Installation license does not apply.

INSTALLATION TASKS

Customer personnel should be experienced with 1800 hardware, MPX Operating System, Fortran IV, and Assembler Language. In addition, there must be someone who is familiar with the medical instruments to be used and able to determine and satisfy the requirements for interface between these instruments and the System. Additional installation capability can be provided by the use of IBM Systems Engineering Services to guide and assist the customer with systems planning and implementation.

The System provides the capability to perform on-line ECG data acquisitions and to run available ECG computer analysis programs such as the Mayo Clinic/IBM Vector Cardiographic Program. The ECG program is distributed by its author to qualified physicians. Your IBM representative can supply further information regarding the details of the distribution. Specific instructions are available in the Computerizing Medical Examinations documentation for integration of the ECG program. This can be done by the user or by IBM Systems Engineering Services.

MODIFICATIONS

The System architecture is modular and enables the user to modify:

- . CME programming
- . Repertoire of laboratory tests
- . Format and text of the Patient Summary Report
- . Format and content of cards found in the Test Booklet
- . Format of the medical history questionnaire film used on the IBM 2760

SPECIAL CUSTOMER RESPONSIBILITIES

The System for Computerizing Medical Examinations is a sophisticated approach to a complex application. The installation and use of such a system is not a task to be undertaken lightly. This is a versatile system which provides many facilities but there are a number of tasks and functions that must be evaluated and performed by the user to assure operational success.

In planning for the use of the System, the following should be understood:

The System, in the form it is received, supports a specific battery of tests. If it is planned to use the system as it is defined (or some subset of that system) the requirements for installation are typical of those required for any on-line computing system. A reasonable level of systems knowledge must be provided.

No particular medical significance should be attached to the test battery included in the System. The specific tasks were selected as representative of those commonly found in screening centers today. A major feature of the System is its capability to accept modifications of the test repertoire should they be required to meet user objectives.

It is strongly recommended that the user gain some operational experience with the System in its present form before planning modifications to it. Should modifications be desirable, it is a general rule that changes in off-line procedures can be accomplished without the detailed programming knowledge. However, changes in on-line procedures where direct attachment of instrumentation is involved will require experienced systems programming skills. (See section of this notice on INSTALLATION TASKS.)

The System has been designed to support high volume testing (on the order of 100 patients a day.) The various data processing functions of the System have been tested under this loading. It should be recognized, however, that in an operating environment there are factors other than systems design which influence load capacity. One factor is the precise computer configuration used e.g., the number of terminals available for simultaneous patient history taking determines the flow rate through that station. Of primary importance is the effectiveness of the operating procedures established and the proficiency of the personnel assigned to administer them. Careful overall facilities planning and management is required to achieve and maintain the given load level.

The System for Computerizing Medical Examinations will provide a valuable service if planned for properly.

SEMINARS/WORKSHOPS

Seminars and Workshops for this Field Developed Program will be conducted at IBM Corporate Medical Data Center, 75 South Broadway — First Floor, White Plains, New York 10601.

Seminars

Purpose: Overview of capabilities, features and applicability of the system to a user's environment.

Class Hours: 10:00 am - 12:00 noon (seminar)
1:30 - 3:30 pm (demonstration)

Class Dates: August 16, 1971
September 13, 1971
October 18, 1971
November 19, 1971
December 20, 1971

Tuition: No Charge

Content of Seminar:

Hardware (1800)
analog interface devices
Programming concepts
Flexibilities and modularity
Advantages and benefits
Personnel requirements

Content of Demonstration:

Registration
Automated History
On-line capability
Mark-sense capability
Patient Summary Report
Questions and Answers

ROBERTS, JOHN Date 05/28/71
Male Caucasian 5'07'' 141 Lbs. Born 10/07/06

HISTORY SUMMARY

Male Married
Brown Hair Brown Eyes Right handed
Education: High school.

Does not want general check-up. Referred by MD.
Health Concerns:

lungs and breathing fatigue

Self Evaluation:
not in good health

Previous Illnesses:
ulcer mumps german measles

Previous Fractures:
arm

Previous Surgery:
stomach

OPHTHALMOLOGY:

Eyes have itched in the past.

CARDIOVASCULAR:

Notes chest discomfort under the following circumstances- running, walking up a hill, walking upstairs and heavy exercise. Discomfort described as undescribable. Has taken Rx for heart within past 6 months. Notes occasional tachycardia. Past MD Dx.- abnormal ECG and thrombophlebitis. Taking (in past 6 mos.) anticoagulant Rx for vascular reasons. Has varicose veins that ache sometimes.

RESPIRATORY:

Frequent cough (due to smoking). Has to "work" at breathing occasionally. Breathing "doesn't seem to satisfy" at times. Short of breath sometimes when walking fast, sometimes when walking usual distances at average pace, sometimes when walking up a slight hill, sometimes when walking usual distances at slow pace and sometimes when walking from room to room.

GASTROINTESTINAL:

In past 3 mos. patient experienced decreased appetite and weight loss of over 5 pounds due to unknown reasons. Dyspepsia with spicy foods. Now troubled by abdominal discomfort described as heart burn and acid indigestion. Location- epigastric and umbilical. In past year had occas. constipation. Past MD Dx.- peptic ulcer. Has had x-ray of stomach and small intestine.

NEUROLOGY:

Fainted in past year. Occasionally has "dizzy spells"- e.g. light headedness.

FAMILY:

Blood relatives have died of cancer. Living blood relatives with cancer and mental illness.

OCCUPATION:

Works in laborer and tradesman activities. Daily exposure to excessive noise and dust.

HABITS:

Drinks beer (less than 3 bottles per week), wine (occ.) and liquor (occ.). Smokes cigarettes (over 2 packs per day). Has smoked more than 20 years and inhales. In past year was on following diet: ulcer. The diets were followed regularly and advised by MD.

PATIENT DIDN'T UNDERSTAND QUESTIONS:

about angina pectoris.

VISION TEST:

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VISUAL ACUITY          FAR          NEAR
      Left eye  20/40          14/42
      Right eye 20/40          14/28
      Binocular 20/40          14/28
Lateral Phoria - (Prism Diopters) 0.
Color Blindness - no. Technician - Bill Beyer.
    
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HEARING TEST:

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FREQ      LEFT EAR          RIGHT EAR
500 20dB ....          20dB ....
1000 10dB ..           10dB ..
2000 10dB ..           20dB ....
3000 20dB ....          20dB ....
4000 20dB ....          30dB .....
6000 30dB .....          40dB .....
    
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URINALYSIS

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Appearance - clear      Color - normal          pH- 7
Glucose - negative      Ketones- negative      Protein - negative
Bilirubin - negative    Hemoglobin - negative
sp. Gr. - 1.033
    
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MICROSCOPIC:

RBC's - grade 1 WBC's - negative

CHEST X-RAY:

Specific comments are lung fibrosis and a blunted costophrenic angle on the right side.

ELECTROCARDIOGRAM:

Cardiologist - Merle Mason.

ABNORMAL ELECTROCARDIOGRAM.

Heart Rate 84.
 R Duration (msecs) 86.
 T Duration (msecs) 153.
 RT Interval (msecs) 351.

Rhythm statements
 Arrythmia- atrial fibrillation.

BLOOD PRESSURE

	VALUE	LIMITS	V	V	V	V	V
Systolic (mm of Hg)	105.	132. to 172.	*****				
Diastolic (mm of Hg)	75.	74. to 96.		*****			

SPIROMETRY:

TEST	VALUE	LIMITS	V	V	V	V	V
FVC (Liters)	2.7	3.86 (69%)	*****				
FEV1.0 (Liters)	1.77	2.85 (62%)	*****				
MMEF (Liters/Sec)	2.1	3.0 (70%)	*****				

CHEMISTRY:

TEST	VALUE	LIMITS	V	V	V	V	V
Gluc (mg%)	88.	80. to 120.			****		
B.U.N. (mg%)	14.	10. to 18.			*		
Sodium (mEq/L)	139.	133. to 155.			***		
Potassium (mEq/L)	4.5	3.5 to 5.5			*		
Chloride (mEq/L)	107.	95. to 105.			*****		
CO2 (mEq/L)	25.	20. to 30.			*		

HEMATOLOGY:

TEST	VALUE	LIMITS	V	V	V	V	V
Neutrophils(%) -	79.	50. to 75.			*****		
Lymphocytes -	15.	20. to 45.		*****			
Monocytes -	2.	2. to 10.		*****			
Eosinophils -	3.	0. to 6.			*		
Basophils -	1.	0. to 1.			*****		
PBC Count (mill/cmm)	4.2	5.4 (77%)		*****			
WBC Count (thous/cc)	8.9	7.5 (118%)			***		
Hemoglobin (gms %)	15.7	15.5 (101%)			**		
Hematocrit (%)	46.0	48.0 (95%)			***		

Red cell morphology - appears normal.
 Platelets appear adequate.

* * * * * end of patient summary * * * * *

Workshops

Purpose: Detailed instruction on system capabilities and implementation procedures.

Class Hours: 9:00 am - 4:30 pm
Course Length: 3 days
Tuition: \$260/per student
Course Code: E2156
Content: CME Systems Build
Hardware Features - 1800
interrupts, configurations
2760 Film Strip Design
Mark-Sense Card Design
Patient Summary Report Design
Text Logic Generation
i.e., modifications
Timing considerations
Physical Planning Requirements
Dates: August 17-19, 1971
October 19-21, 1971

This course is a logical follow-on to the seminar to be held the day prior.

Customers should contact their local IBM Representative to register for these courses. IBM personnel should forward registrations to:

IBM Corporation
475 Northern Boulevard
Great Neck, New York 11021
Attn: CME Class Registration

ERROR CORRECTION SERVICE

Error Correction Service is provided until July 22, 1972.

Support for this Field Developed Program will be provided through Systems Engineering Services after that date.

When the user encounters a problem which his diagnosis indicates is caused by a licensed program error, documentation may be submitted to:

IBM Corporation
475 Northern Boulevard
Great Neck, New York 11021
Attn: CME Error Correction Service

IBM through the program author(s) will, without additional charge, respond to an error in the current unaltered release of the licensed program by issuing known error correction information to the Customer reporting the problem and/or issuing corrected code or notice of availability of corrected code. However, IBM does not guarantee service results or represent or warrant that all errors will be corrected. Any on-site programming services or assistance will be provided at a charge.

ORDERING INFORMATION

This FDP and its associated documentation are scheduled for availability beginning July 23, 1971.

Contact your local IBM Branch Office to order this program.

Basic Material:

Licensed Documentation: One copy of the Systems Guide, LB21-0042-0.

Unlicensed Documentation: One copy of the Program Description/Operations Manual, SB21-0041-0.

Licensed Machine Readable Material: One copy of the machine readable containing source code and sample problem.

To order the Basic Material use the following Specify Number:

Specify Number	Description	User/Volume Requirement
9058	2315 Disk	3 Disks

Charges:

Monthly charges for the licensed Field Developed Program are waived after the billing of twelve consecutive monthly charges.

Type	Program and DPOW Number	Monthly Charge
5798	AAP	\$2,400

Charges for Additional Copies of Documentation:

Licensed Documentation: For customer, order by Feature Number from PID and bill customer. For IBM internal use, request by Order Number only from Mechanicsburg.

Feature Number	Order Number	Single Charge/Copy
8014	LB21-0042-0	\$57

Unlicensed Documentation: Program Description/Operations Manual. Order from Mechanicsburg, customer will be billed by Mechanicsburg through AOC.

Order Number	Selling Price/Copy
SB21-0041-0	\$15

General Documentation: Available only from Mechanicsburg, no charge to customer.

Availability Notice	Order Number
	GB21-0040-0

*This Field Developed Program is distributed on an "as is" basis, without warranty either express or implied.