Development of an on-line management information system for community mental health centers

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An on-line computerized management information system has been developed at the Salt Lake City VA Hospital and is currently being implemented at Salt Lake Community Mental Health Center. An introduction to this system, including systems design and procedures for development, are presented. The advantages of on-line technology as compared to batch processing technology are also discussed.

The degree of success attained by an organization is directly related to the decision making acumen of its administrators. An advantageous decision is more probable when an administrator has ready access to that information which relates both directly and indirectly to that decision. The multiplicity of decisions which face any administrator requires that a wide variety of data be collected and maintained by the various operations within an organization. Furthermore, the data must be readily accessible and easily aggregated into appropriate formats, so that the possible implications of alternative decisions can be examined.

Management information systems (MIS) have been widely implemented in business settings as a systematic approach to collecting and reporting the information necessary for decision making. In recent years, attempts have been made to apply these concepts to mental health care delivery systems. In several ways, the components of a community mental health center (CMHC) are analogous to the components of a business structure, so that a cross-fertilization of techniques may take place. Both seek effective utilization of resources. Both must achieve effective resource utilization to continue to exist. And finally, both must meet the needs of consumers and stockholders (taxpayers). However, there are also differences between a CMHC and a business. For example, in a CMHC, information needs are very broad and include both administrators and researchers. Thus, a direct application of corporate management techniques to a mental health delivery system is not feasible.

In recent years, various management information systems have been developed and implemented by mental health centers. Many of these systems are constructed from a combination of transaction processing and data base management techniques. A few systems (Elpers & Chapman, 1973; Kaplan & Smith, 1974; Kurke & Van Houdnos, 1974; Broskowski, Note 1) have been automated by means of electronic data-processing equipment. Several fundamentals for

systems design have been learned in the process. First, the methods of data collection must be uncomplicated. All data-collection documents should be designed with the user in mind. Forms design should be simple, yet it should allow for the collection of all necessary data and be susceptible to modification. Routine data gathering should be maximized for clerical staff and minimized for clinical staff. Report generation should be timely and relevant to the needs of the individual mental health center. Reports should meet the needs of management, research, clinical activities, and funding agencies. Finally, the system must insure confidentiality of patient records. An awareness of these fundamentals is a necessary precursor for the appropriate systems design of an MIS.

A comprehensive, on-line computerized MIS has been designed and is currently being implemented at the Salt Lake Community Mental Health Center. This MIS is a functional subset of the on-line psychiatric assessment system developed in cooperation between the College of Medicine of the University of Utah and the Salt Lake City VA Hospital (Johnson, Giannetti, & Williams, 1975; Johnson & Williams, 1975; Williams, Johnson, & Bliss, 1975). Thus, the Utah system now provides a management information system as well as psychiatric assessment services. The purpose of this paper is to describe the systems design and development of this on-line management information system.

FUNCTIONAL DESIGN

While the majority of clinical services rendered by the center are on an outpatient basis, the center also maintains several other service units including inpatient, partial hospitalization, children's behavior therapy, and crisis intervention. Other functions of the center include consultation, training, and research. With this wide variety of services, the first step in systems design was to determine the needs of each functional unit. The analysis of how to fulfill these various needs

provided the functional specifications for data collection.

One of our initial design tasks was the development of a uniform method of data collection. This required a synthesis of data-collection specifications for each of several functions within the center. Out of this analysis, three basic documents and several ancillary forms were developed to collect all necessary input data. The first basic document is the admissions form, which is completed by an intake worker when a prospective client applies for services. This form is used to collect demographic, historical, and billing information. Once a client has been admitted for treatment, the admission form is used to change or update information about the patient. The second basic document is the termination form. A therapist completes this form when a client exits from treatment. Data for outcome and follow-up studies are provided by this document. The final basic document is the day activity record. This form is completed by staff members to record services performed and to act as a record of time deployment. The day activity record form is shown in Figure 1 as an example of input document design.

The Salt Lake Community Mental Health Center has a cathode-ray tube terminal (CRT) and an electrostatic printer which are connected via telephone lines to the computer at the VA Hospital. Data from all of the documents are typed directly into the CRT by the clerical staff.

Report generation is accomplished using a flexible process. Reports may be produced at any time during normal business hours and report content may be comprised of any of the variables in the data base. Certain reports, including mandatory reports for federal, state, and county agencies, are automatically generated at fixed intervals. Management reports about caseload, services rendered, costs of services, number of contacts, and patient characteristics are produced periodically in three levels. The first level is a cumulative report based on the entire mental health center. Level 2 reports describe the individual service units which comprise the center. The last level consists of individual staff reports. Any staff member may select additional reports of his own design to supplement all other output received. The individual staff report is shown in Figure 2, as an example of the kind of reports generated.

The MIS will also reduce much of the burden placed on clerical staff. Monthly patient billing statements, staff payroll listings, financial reports, and other time-consuming processes are basic to this system. Certain information, such as budgetary and caseload data, is updated and remains on-line for constant monitoring.

A user is not authorized to access any of the MIS programs until a set of security codes, which are changed periodically, are entered correctly into the terminal. These codes are compared internally to a set of codes stored for the terminal being used. Thus, the appropriate

codes must be submitted on a specific terminal before the user may proceed. All patient data are stored off-line on magnetic tapes which must be mounted by the computer operator. Therefore, access to patient data is only possible during normal business hours.

BASIC SYSTEM

The software configuration consists of a terminal control program which is resident in the foreground (real-time) partition of memory and has the capability of controlling 32 terminals in a time-sharing environment. The average response time on each terminal is less than 1 sec. The terminal control program is comprised of several different modules, including a file manager, report generator (Johnson, Cole, & Williams, 1975), an on-line editor, and a NORDIC interpreter (Hansen, Note 2). NORDIC is a user-oriented language in which all the data-collection programs are written. For a detailed hardware configuration of the system, see Cole, Johnson, and Williams (1975).

All data collected through the terminal control program are stored sequentially on disk files until data is completed for the day. At this point, an update program is initiated in batch mode which produces a trailing audit and summary of the day's transactions. The data are then sorted and merged into a master tape file which is stored off-line with backup. The master file is segmented into the patient file, staff file, and financial file, each of which contains a series of records in a linked allocation structure (Knuth, 1973). This type of record structure is advantageous for editing, since it eliminates all searches for specific items. Thus, addition or deletion of items is simplified. Upon completion of the master file merge, the report preparation program determines if any reports were requested. The update/merge processes are always completed before report generation proceeds, to insure that the data base is current. If a report has been requested, the report preparation program initiates the transfer of the master file to on-line status on direct-access disk storage. Master file data are then stored in an inverted file structure for rapid and efficient cross-tabulation of variables. The report generator then produces the specified reports.

The system is designed around the user. CRT operators do not need knowledge of programming or computers. Menus of input options and possible reports are presented on the CRT and all steps in between are completely transparent to the user. All programs were designed and written utilizing techniques of structured programming accompanied with detailed documentation for ease of installation, operation, and maintenance.

The overall philosophy of the software development was to create a system that was inherently flexible and susceptible to change. The major emphasis was placed on methodology rather than initial content. This design

SALT LAKE MENTAL HEALTH

day activity
record

STAFF NAME: _____

STAFF I.D. NUMBER:

DAY: _____

UNIT I.D. NUMBER DATE:

	CLIENT'S NAME OR EVENT CLIENT SOCIAL SECURITY NO.	APPT. TIME	MODALITY	ACTIVITY	SPECIAL AREAS OF CONCERN	APPT. STATUS	TIME SPENT hr. min.	NUMBER PEOPLE SERVED
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								

FUNCTION	MODALITY	ACTIVITY	SPECIAL AREAS OF CONCERN
DIRECT PATIENT CARE	11- Inpatient 12- Partial Hospitalization 13- Residential 14- Outpatient 15- Community Treatment Contact 16- Nursing Home 17- Emergency	A- Individual B- Group C- Family D- Couple E- Milieu, Recreation, Soc. Therapy F- Patient Planning G- Medical Maintenance H- Collateral I- Records and Clinical Report J- Education/Training-Rehab. K- Psychological Testing L- Psychiatric Evaluation M- Intake X- Telephone Contact Y- Field Visit	A00- Agencies for the Aged C00- Non-School Childrens Agencies D00- Drug Abuse Agencies F00- Family Planning Agencies G00- General Public: Groups H00- Health Delivery Systems L00- Law Enforcem./Correctional Agencies M00- Non-Center Mental Health Facilities N00- Nursing Homes P00- General Public: Individual R00- Religious Groups S00- Primary Schools S40- Secondary Schools S60- Other Schools V00- V A Facilities W00- Public Welfare Agencies X00- Alcohol Agencies Y00- Other Social Service Agencies Z00- Other
CONSULTATION AND EDUCATION (External)	21- Case Consultation 22- Program Consultation 23- Public Information 24- Staff Development 25- Referral of Non-Client	N- Delivery P- Preparation	
TRAINING (Internal)	31- Inservice 32- Student 33- Volunteer	A- Individual B- Group P- Preparation R- Class or Workshop	APPOINTMENT STATUS 1- Cancelled 2- Failed (Leave Blank if Appointment Was Kept)
ADMINISTRATIVE AND ALLIED	40- Reports 41- Research and Evaluation 42- Community Affairs 43- Organizational Maintenance 44- Clerical 45- Physical Maintenance 46- Vacation 47- Sick Leave 48- Comp. Time 49- LWOP	S- Federal T- State U- County W- Internal	

Figure 1. An example of data-collection forms: Day activity record.

DIRECT PATIENT CARE REPORT

STAFF MEMBER: 03056 JONES, NANCY

PERIOD: 03/01/76 - 04/01/76

MODALITY: OUTPATIENT

DATE ----	CLIENT NAME -----	ACTIVITY -----	TIME (HRS.) -----	PRIMARY THERAPIST -----
03/07/76	HIBBS, JAN	INDIVIDUAL	1.00	JONES
03/01/76	JACKSON, ALLEN T.	INDIVIDUAL	.75	JONES
03/12/76	JACKSON, ALLEN T.	INDIVIDUAL	.75	JONES
03/28/76	JACKSON, ALLEN T.	INDIVIDUAL	1.00	JONES
03/10/76	LARSEN, MARCIA	INDIVIDUAL	.75	JONES
03/21/76	LARSEN, MARCIA	COUPLE	1.00	JONES
03/21/76	LARSEN, MICHAEL PETER	COUPLE	1.00	JONES
03/03/76	MONTGOMERY, ALICIA	INTAKE	.50	WILSON
03/04/76	NORTON, BARBARA	FAMILY	1.00	JONES
03/04/76	NORTON, SPENCER	FAMILY	1.00	JONES
03/04/76	NORTON, WALTER	FAMILY	1.00	JONES
03/04/76	NORTON, WANDA JUNE	FAMILY	1.00	JONES
03/16/76	PETERSON, BARBARA ANN	INDIVIDUAL	.75	WYLER
03/17/76	PETERSON, BARBARA ANN	INDIVIDUAL	.75	WYLER
03/05/76	PULLMAN, ANDREW	INTAKE	.75	JONES
03/06/76	PULLMAN, ANDREW	INDIVIDUAL	1.00	JONES
03/14/76	PULLMAN, ANDREW	INDIVIDUAL	1.00	JONES
03/25/76	PULLMAN, ANDREW	INDIVIDUAL	.75	JONES
03/30/76	PULLMAN, ANDREW	INDIVIDUAL	1.00	JONES
03/04/76	ROGERSON, PHILLIP THOMAS JR.	COUPLE	1.00	JONES
03/04/76	ROGERSON, SANDRA	COUPLE	1.00	JONES
03/19/76	SANDOVAL, CHIQUITA	INDIVIDUAL	.75	JONES
03/28/76	SANDOVAL, CHIQUITA	INDIVIDUAL	.75	JONES
03/25/76	THOMPSON, LAURENCE J.	INDIVIDUAL	1.00	JONES

CLIENTS SEEN BY OTHER THERAPISTS

DATE ----	CLIENT NAME -----	ACTIVITY -----	TIME -----	THERAPIST -----
03/04/76	JACOBSEN, HOWARD JOHNSON	INDIVIDUAL	.75	MARTIN
03/21/76	LARSEN, MORONI ALMA	INDIVIDUAL	.75	OBERMYER

CLIENTS NOT SEEN THIS PERIOD

CLIENT -----	LAST SEEN -----
BALLANTINE, ARNOLD	02/30/76
SANCHEZ, LOUIS	01/20/76

Figure 2. An example of report format: Individual staff report.

facilitates the evolution of a more complete information system as users require more data from the system.

DISCUSSION

The use of management information systems in mental health care centers is still a relatively new process. Therefore, it is expected that changes to the system will occur with future experience. The inherent flexibility of the Utah system allows it to change with the changing needs of the center. The installation of this system does not impose unnecessary constraints on the treatment staff. On the contrary, the MIS supplies staff members with valuable data to aid in managing caseloads in a more effective and efficient manner.

The gradual reduction of federal funding necessitates that mental health centers generate income from a variety of new sources, and, at the same time, become more efficient in their operation. A greater amount of third-party payments, consultation payments, and education program payments thus need to be collected. With the MIS system, these collections are more likely because adequate information about services rendered is gathered automatically. Better utilization of volunteer programs is an example of how centers can operate more effectively. With the Utah MIS, staff members have the resources to write interactive training programs to be presented to volunteers by the CRT. This allows faster volunteer training, thus allowing the volunteers to become involved with the center more effectively and efficiently.

The large data base that is produced by this system will provide a great deal of data for research. Studies are possible on patient characteristics in relation to treatment processes and outcome. Evaluation of processes will become a routine activity rather than an infrequent project.

The utilization of on-line technology offers several advantages over a batch processing mode. First, it eliminates the necessity for keypunching/verification of data from forms. Second, the turnaround time for report generation is greatly reduced. Third, it increases the user's flexibility in interacting with the system to provide information for nonroutine requirements. Finally, many manual processes are eliminated, thus reducing the possibilities of human error.

On-line systems are often thought to be prohibitively

expensive. The reason for this lies in one-time hardware costs, such as terminals, direct-access storage media, and other specialized equipment. This system is designed so that the majority of data are stored off-line and transferred on-line only as needed, drastically reducing costs. An on-line system also obviates the need for data preparation; thus, additional savings are accrued. The cost of this system is less than 1% of the Salt Lake Community Mental Health Center's annual budget. This is more than justified by the benefits produced.

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