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TOCRS—The therapy-oriented computer record system

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A computerized system has been developed to provide treatment records for patients in the Duke Psychiatric Outpatient Clinic. Demographic, diagnostic, and therapeutic data are incorporated into a concise summary provided to the therapist for each patient visit. Variables were carefully chosen to capture essential therapeutic information while minimizing the burden of data entry on the therapist. Suggestions by the users have led to a number of modifications in the system, including the addition of special data-keeping functions for therapy groups and record generations of summary reports for clinicians and administrators. Essential information is gathered in a format well suited to analysis by standard computerized statistical techniques. Record keeping, in this fashion, provides an information base that describes the process of psychiatric treatment.

Medicine, as one of the scientific disciplines, has long relied on the mathematical abilities of the computer to facilitate basic research. Moreover, as a service discipline, medicine has found increasing use for the computer in the maintenance of the extensive clinical records upon which it relies. Psychiatry is unique among the medical disciplines in that there are no universally accepted theories of pathology. Until quite recently, there has not even been a widely accepted diagnostic system based on explicit criteria. Psychiatric data, therefore, are often subjective and may be formulated in a number of different ways. On the other hand, computers are well suited to handle binary (yes-no) sorts of data, so they have made few inroads in psychiatry.

Computers have been shown to be useful in only a small number of psychiatric settings and have still unexplored potential (Klein, Greist, & VanCura, 1978). These applications fall, widely, into four groups: (1) personality simulation, (2) patient interviewing, (3) diagnostic assistance, and (4) record keeping. Detailed summaries of these uses have been collected by Crawford, Morgan, and Gianturco (1974) and Kline and Laska (1968) and in a recent volume by Sidowski, Johnson, and Williams (1980).

Beginning in about 1965, Colby (1975) began the development of computer simulators of personality. With support from the disciplines of transformational grammar, problem solving theory, and pattern recognition, his research groups developed clinically convincing simulators of neurotic and paranoid psychotic thought process. Simultaneous efforts by Weizenbaum (1966) at the Massachusetts Institute of Technology led to the development of a computer model of therapy. The interactions of this therapist-patient duo are presented in an intriguing article by Cerf (1973). The likeness to "real" clinical interaction is striking. Such simulations are well suited to teaching settings. Furthermore, modeling will aid the understanding of the programs of human thought process and will clarify the rationale and the language of therapeutic intervention (Loehlin, 1972).

Greist (Greist & Klein, 1980; Greist, Klein, & Erdman, 1976; Greist, Klein, & VanCura, 1973) and others at the University of Wisconsin have developed a quite facile patient interviewing system. This has been used to assist clinicians in data gathering for diagnosis, measurement of progress, and suicide risk prediction. Both therapist and patient acceptance of these computerized interactions has been good. Computerization has increased data yield per therapist-patient contact hour. Reports generated from data stored provide feedback to the therapists.

Spitzer and Endicott (1974) developed a computer routine, DIAGNO, that successfully made diagnoses consistent with the classifications in use by the American Psychiatric Association. DIAGNO relied on data gathered by skilled interviewers using standard protocols. The program was built around a decision-tree format and relied on heuristic criteria to render its diagnoses. The correlations between diagnoses by the therapist, the computer, and a second clinician were high. In cases in which there was disagreement, the ensuing discussions often led to clarification of the nature of the patient's problems.

Investigators at the Rockland Research Center (Laska & Kline, 1968; Laska, Logemann, & Weinstein, 1971) have developed a comprehensive psychiatric data base, the Multi-State Information System (MSIS). This system provides users at many remote sites with services ranging from routine billing to the generation of narrative reports (Craig, Golenzer, & Laska, 1968). These researchers have chosen to overcome the difficulties of data extraction from narrative entries by restricting such entries and providing, as an alternative, an extremely large number of defined variables. A large computer is

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dedicated to the sole purpose of maintaining the MSIS. This increases efficiency, aids confidentiality, and speeds data transfer. This system will certainly be a model for the development of other large data bases (see Laska, Siegel, & Banks, 1980).

In summary, computers have found homes in psychiatry in the simulation of personality, in conducting patient interviews, in assisting diagnostic decisions, and in the maintenance of data bases. As aptly put by Klein et al. (1978), computers have many "promises to keep" in psychiatry. Their potential has just begun to be realized.

THE THERAPY-ORIENTED COMPUTER RECORD SYSTEM

Since computers have special ability to perform tasks that are narrow in scope and repetitive in nature, their application in situations that demand flexibility and the selection of small bodies of relevant information from larger wholes is difficult. This difficulty is a reflection of the relative complexity of the information extraction processes performed by the human mind. A task cannot be programmed that cannot first be explicitly defined in human language. For this reason, the definition of a comprehensive psychiatric data base and the maintenance of a clinically meaningful psychiatric record by computer have proved difficult. Attempts at the implementation of such systems have been troubled by both overcomplexity and marked restriction in the nature of the data collected.

As will be detailed below, a therapy-oriented computerized record system (TOCRS) has been developed and implemented in the Duke Psychiatric Outpatient Clinic. Operation was begun in 1975. Modifications have been made and capabilities extended at the request of the therapists using the system. At the same time, a data base has been amassed that can be used to evaluate the treatment process. Each patient's record can yield meaningful scientific data.

DESIGN CONSIDERATIONS

The need of the therapist for a brief, clearly organized summary of relevant clinical information for each patient encounter was the foremost consideration in the design of the TOCRS. In such a system, the therapist logically serves as the primary data gatherer. Available time and willingness to complete the necessary form, then, are important factors. For this reason, a decision was made to collect data in a variety of formats, rather than attempt to record all information with a cumbersome (and tiresome) list of "yes-no" questions. Provision was made to accept information of three types: (1) checklist (e.g., attendance), (2) fixed format (e.g., prescriptions), and (3) free text (e.g., progress notes). This design permitted a broad range of information restricted in depth to be recorded in a highly flexible way. The needs of the clinic for administrative, demographic, and appointment information were incorporated. A core of information to meet several sets of needs was so derived.

IMPLEMENTATION

The TOCRS has been developed within the framework of existing facilities, personnel, and funds. The project was the collective effort of psychiatric and computer science faculty and students. Programs were written in Programming Language One (PL/I) (Gallie and Ramm, 1976). Data are collected in the clinic on printed forms, coded and keypunched by data technicians, and entered into the computer at a local terminal. Phone lines connect this terminal to the IBM 370/165 central processing units at the Triangle Universities Computation Center. The master files are kept on an IBM 2314 disk at that location. The flow of the data through the system is shown in Figure 1.

Routine file maintenance is performed by a series of logically distinct program modules that run sequentially (Figure 2). Modularization allows recovery of partially processed data in the event of abnormal job termination, aids error localization and correction, and facilitates modification of the system. Ancillary programs have been written to generate discharge summaries and medication summaries, to correct errors in the master file, and to extract data for statistical analysis.

NATURE OF THE DATA BASE

The data base is organized in a sequential fashion The "record" for each patient consists of a set of trans actions (e.g., attendance, medication change) and i variable in length. New transactions are added by merg ing them with the "old" record. Although a good bit o

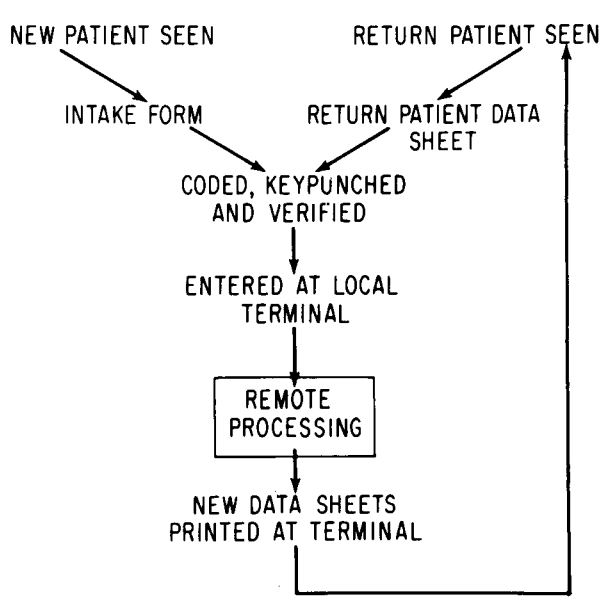

Figure 1. Data flow through the TOCRS.

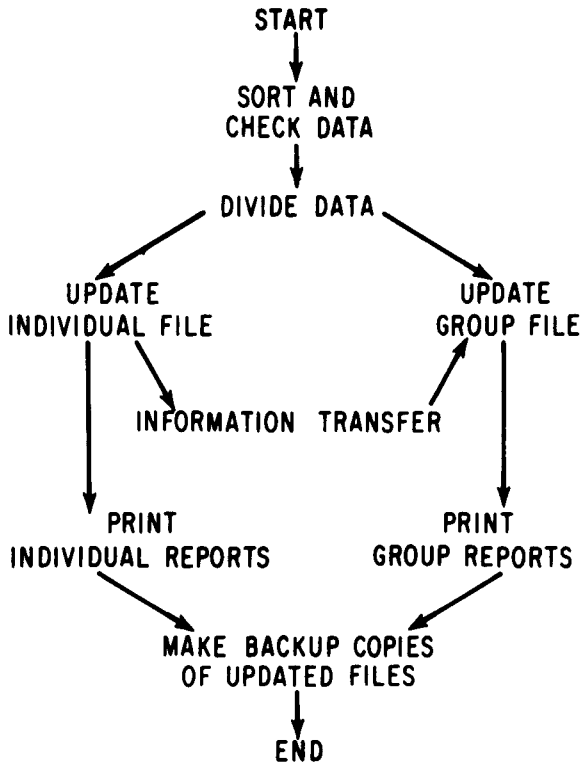

Figure 2. Data processing modules.

storage space is devoted to identifying information (patient identification number, date) for each transaction, the problems inherent in a fixed-length direct-access patient record are avoided. Data are periodically extracted from these master files to generate a second data base of fixed-length records, which are used in statistical analysis and report generation (see discussion below).

Patient confidentiality (Laska & Bank, 1975) is protected in a number of ways. The clinic maintains a record of the patient's name and Duke history number and assigns a unique code number to each patient. Only the first name, last initial, and this code number are entered into the system. Data cards are stored in a locked file, work forms are destroyed after use, and clinic forms are returned to the therapists for their records. A password known only to the system manager and selected programming staff is necessary to access the master computer files.

THE CORE RECORD

For every patient, presenting problems, treatment goals, psychiatric diagnoses, and treatment modality are stored, as well as the usual demographic, billing, and appointment information. A summary of medications is kept, and space is provided for process notes and reminders. From these data, summaries of the therapeutic encounter are generated and provided to the therapist well before the next scheduled meeting. This "return patient data sheet" also serves as data input area for the subsequent visit (Figure 3). Periodic summaries of treatment and discharge notes are generated to allow disposal of data sheets accumulated in the patient's record.

The use of the computer-generated form is not mandatory for data entry. A general clinic note is complete and sufficient, since the logical data for a given patient's visit consist of a record of attendance, a progress note, a record of medication changes, and an appointment date and time. This is useful in the entry of data from unexpected or emergency visits. In these situations, the note from the previous visit may be used for reference even if computer processing is not complete, for these are kept in a temporary file in the clinic.

SPECIAL APPLICATION

In addition to keeping standard data for all patients, it is possible to record special data for different therapy settings. The definition of these data depends on the development of a model for each particular treatment modality. (The return patient data sheet, for example, reflects a psychobiological model.)

Because many clinic patients are in group therapy, a special set of tools was developed to capture data about the group process. The model on which the system was based is sketched in Figure 4. Therapist and patient rosters, attendance records, meeting dates, and process notes are the core of the record defined. A variety of rating instruments that quantify group process, individual behavior, therapist behavior, and outcome are available (Hawkins, Norton, Eisdorfer, Gianturco, 1973; Liebeman, Yalom, & Miles, 1973). A "group encounter summary," serving functions similar to the return patient data sheet, is generated for each meeting.

DATA EXTRACTION AND REPORT GENERATION

In the process of keeping a computerized psychiatric treatment record, a large amount of data about the process of therapy is accumulated. The files in which these data are stored are necessarily organized in a fashion that lends itself to the generation of reports about each patient from variable amounts of information. Furthermore, parameters may be defined in ways that are understood clearly in the context of an individual patient's treatment but are difficult to compare from patient to patient. Before statistical analysis may proceed, steps must be taken to isolate a subset of the data that is of interest and to reorganize the subset into a file that is easily sorted and searched (Rosati, McNeer, Starmer, Mittler, Morris, & Wallace, 1975). This conditioning process is accomplished by an "extractor" program, as shown in Figure 5.

PSYCHIATRY OUTPATIENT DEPARTMENT 089123 WSM 30
JERRY D.
RETURN PATIENT DATA SHEET LAST VISIT 01/25/78

APPT: 02/01/78 09:00 VISIT # 5 KEPT: YES ( ) NO ( ) CANCELLED ( )
THERAPIST: DR. JONES SUPERVISOR: SMITH
CLINIC CODE: I/C AMT. $90.00 COLLECTED ( ) CHARGED ( ) SPONSORED ( )

PRESENTING PROBLEM: 01/04/78
"Been feeling real bad."
DIAGNOSTIC IMPRESSION: 01/04/78
1) 300.4 Reactive Depression (unresolved grief reaction.)
GOALS: 01/25/78
(1) Attempt to help him work through his grief.
(2) Identify and treat (if needed) any neurotic or characterologic problems which have blocked normal resolution.
(3) Help structure relationships with women in a more adaptive way via cognitive approach.
TREATMENT PLAN: 01/04/78
Short term individual therapy.
NOTES: 01/25/78
Client discussed today, for the first time, his relationships with women. Seems to have generalized his fear of rejection to them. Has engaged in several "self-destruct" relationships. Is very frustrated about this.
LAB WORK: RESULTS: NT + AT level 150 ug/ml (ther 110-180).
MEDICINES:
1) 01/11/78 Elavil 25mg tid and 100mg hs.

NEW TREATMENT PLAN (if changed, circle items) WAITING LIST

Team Patient	Group Rx: ST LT	Individ. Rx: ST LT	Ind. Group
Conjoint Rx: ST LT	Behav. Mod: ST LT	Family Rx: ST LT	Conj. B.Mod.
Couples Rx: ST LT	Biofeedback: ST LT	Medical Rx	Fam. Coup.
Other: _____			Biof.

CHANGES IN MEDICATIONS: RX DOSE DISP INSTRUCTIONS REFILL
1) _____ _____ _____ _____
2) _____ _____ _____ _____
3) _____ _____ _____ _____

NOTES, REMINDERS, changes in DIAGNOSIS, PROBLEMS, GOALS: (specify!)
_____
_____
_____

NEXT APPT:__/__/__ TIME __:__ LAB WORK _____ DATE__/__/__
TRANSFERRED TO:_____
TERMINATED: ( ) DATE:__/__/__ REFERRED TO:_____ CODE:___
INFORMATION ON BACK ( ) FORM CA7507790107

Figure 3. Return patient data sheet.

In general, an extraction program may be designed to select a small subset of data to test a specific hypothesis, or it may capture a more general subset that may be of interest to several researchers. The variables to be extracted must be chosen carefully, with a knowledge of the data coding idiosyncrasies inherent in the system. A review of the extracted data "by hand" will often reveal a few unexpected events that were coded improperly and will aid the detection of missing or incomplete data.

If information in the extracted file is organized properly, commercially available statistical packages (Barr, Goodnight, Sall, & Helwig, 1976) may be used to manipulate and analyze the data. Currently, this capability is used to generate monthly summaries of clinic experience for both therapists and clinic administrators. These are used for clerical purposes, such as the verification of billing sheets and the generation of lists of new patients and recently discharged patients. In addition, these monthly reports provide the therapist and his/her supervisors with a cumulative summary of patient care experience. These data include the number of patients, diagnoses, duration of treatment, and prescribing practices. A brief summary of the characteristics of the patients in the current active file, obtained through these, appears in Table 1.

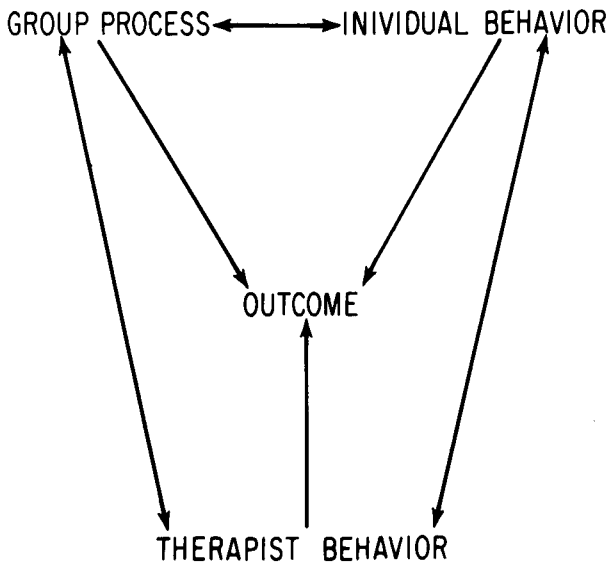

Figure 4. Active factors in group therapy—A model.

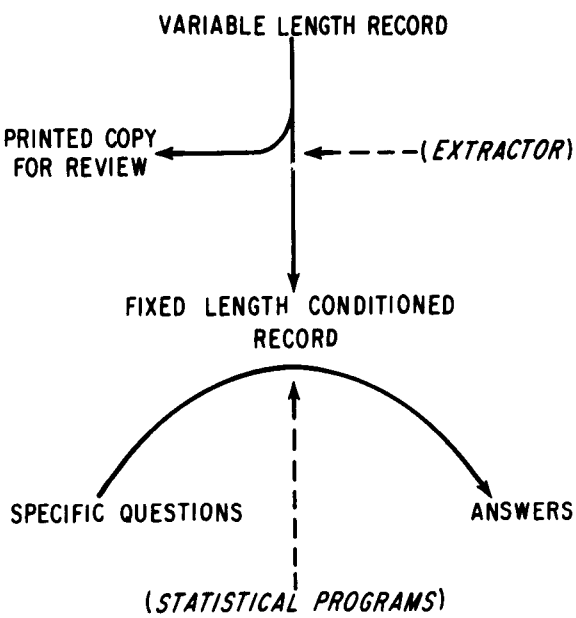

Figure 5. Data extraction and analysis.

CLINICAL EXPERIENCE

The core of the TOCRS was put into production in 1975 and has been in constant use since that time. In the past, therapist participation in the system has been largely on an elective basis. Modifications have been added as requested by clinicians, or as needed for increased efficiency or clarity. Report generation capability has been expanded in keeping with system growth and utilization.

At present, the computer system is used by all the psychiatry residents in the clinic and a number of social workers and interns in clinical psychology. The active patient file has reached equilibrium at about 240 patients.

Considerable resistance to use of the system has been encountered. The therapists have expressed resentment at being "told what to do" and have voiced concern that the system would "take too much time." They have been hesitant to entrust a computer with confidential information. This defensiveness is probably a reflection of fear of the unknown, fear of loss of control, and a reluctance to examine critically a diagnostic and therapeutic process that is highly individualized and a bit ambiguous. A formalized record system, especially one that facilitates review of the treatment process by others, may be seen as a threat.

To counter this resistance, attention is paid to orienting new users to the operation of the system. They may be reassured, and their cooperation may be elicited. Information links between computer room and clinic have been kept open to insure responsiveness of the system to the users' needs.

Clinical experience has allayed many of the early fears, and quite a number of therapists have become enthusiastic users of the system. Flexibility and feedback have been the winning features. A record-keeping process that demands little of the clinician and yet returns concise information summaries is well met. The therapist chooses which facilities he/she will use in

Table 1
Characterization of Patients in the Active File

	All Patients	> 2 Visits
Number of Patients	131	78
Age*		
Average	29.6	29.6
Range	14-58	14-58
Diagnostic Category (DSM-II)**		
Neurotic	58.0	55.1
Character Disorder	11.5	17.9
Psychosomatic	3.1	2.6
Psychotic, Major Affective	6.9	6.4
Organic Brain Syndrome	.8	1.3
Deferred	19.8	16.7
Number of Clinic Visits		
Median	3	10
Duration of Treatment†		
Median	29.5	91.5
Average Interval Between Visits†		
Median	7.0	9.9
Frequency of Use of Medications**		
Benzodiazepines	9.2	14.1
Tricyclic Antidepressants	16.8	21.8
Phenothiazines	12.2	16.7
Other Major Tranquilizers	3.1	3.9
Lithium	3.1	3.9
Number of Types of Medications Used**		
0	67.2	59.0
1	23.7	25.6
2	7.6	12.8
3	.8	1.3
4	.8	1.3

**In years. **Percentages. †In days.*

the maintenance of records and is not hindered by "irrelevant" data.

Return patient data sheets provide a quick review of the course of treatment before the hour starts and encourage prompt entry of progress notes. The four visit summaries for each patient are often used as the primary source of information for third-party payers and serve as the core of termination summaries. Cumulative patient care reports not only provide a chance for review and introspection but also foster a sense of direction and a feeling of accomplishment.

Changeover of programming personnel and lack of system documentation have been the major impediments to improvement of the system. In part, this lack of continuity is a necessary consequence of the choice to develop the system within the limits of available personnel and facilities.

CONCLUSION

A concise computerized record of outpatient psychiatric treatment has been developed. The data collected at each patient visit may be used in a number of different ways; the system serves different functions for different people. To the therapist, the TOCRS provides a summary of pertinent clinical information for each patient encounter. For purposes of supervision, it provides a summary of clinical experience. To the administrator, the data base is an important source of billing and utilization information. Finally, the TOCRS may provide the researcher with key information in the quest for a better understanding of the nature of psychiatric treatment.

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