

A STUDY OF DATA-PROCESSING REQUIREMENTS  
IN THE  
TRAINING RESOURCES DIVISION

by

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## INTRODUCTION

This report studies information processing activities of the staff in Professional Risk Management of California's Training Resources Division (TRD). Information processing comprises such tasks as computerized literature searching, text and image processing, storage of bibliographic and other information, analysis of statistical data, information dissemination, and use of electronic mail. This report presents a proposal for rationalizing the use of software and hardware to improve TRD's information processing capabilities.

## ORGANIZATIONAL STRUCTURE

### General

Professional Risk Management of California (PRMC) administers the University of California's systemwide self-insurance program for hospital and professional medical liability. PRMC has two systemwide administrative offices and five regional offices. At each regional office, there are Account Executives who request assistance from PRMC's Training Resources Division in providing background information for claims handling. Similarly, TRD assists PRMC Account Executives and Hospital Risk Coordinators at affiliated hospitals in providing training materials and programs for physicians and hospital staff. TRD also performs educational and research activities to support loss-control and prevention programs.

PRMC is allied with Applied Risk Management (ARM), which has a contract with the University of California to provide financial and computer services for workers' compensation and claims management. ARM's Computer Resources Division (CRD) has developed online systems for reporting and processing workers' compensation and medical malpractice claims. These systems run on a Tandem computer. PRMC staff have some access to the Medical Malpractice system and to other programs on the Tandem machine.

### Organization of TRD

TRD's staff consists of the Director, Orley Lindgren; two full-time researchers, one administrative assistant, and several part-time consultants. The full-time researchers are Ann Persson and Diane Douglas; Mary Lewis is the administrative assistant. Terry Richards, a part-time consultant to TRD, is also a Librarian in the Office of the General Counsel of the Regents of the University of California. In addition to performing research activities, Diane Douglas functions as coordinator of TRD's information activities.

## CURRENT OPERATIONS IN TRD

### General

The primary activity of Training Resources Division staff is information gathering and dissemination. This activity is accomplished in five basic ways:

1. Staff respond to clients requesting information for claims settlement, litigation support, workers' compensation, and environmental health and safety issues. Clients include PRMC Account Executives, ARM management, Hospital Risk Coordinators, and other U.C. risk management staff.
2. Staff perform research on selected current topics and disseminate information on these topics to clients through several channels. They assemble and distribute notebooks of materials (e.g., a recent notebook contained brochures from California residential care facilities for head-injured and brain-damaged persons). They perform monthly mailings of news clippings (e.g., product and device alerts); and they compile written reports with statistics, bibliographic references, and a synthesis of the literature.
3. Staff maintain a collection of materials relevant to the legal aspects of medicine and health care risk-management and safety issues.
4. TRD serves as a clearinghouse for information on legal, ethical, medical, and administrative aspects of health care, occupational injury and disease, and other areas of liability.
5. Staff provide training seminars and presentations to hospitals and health care maintenance organizations on risk and claims management issues and techniques pertinent to the University's self-insurance programs.

A large proportion of TRD staff time is spent researching and responding to direct requests for information. Such requests are categorized into one of three levels, then prioritized, and logged.

Level 1 requests are generally very specific and require relatively little time to fill; a telephone call or two is occasionally sufficient. More commonly, the end product for such a request is a bibliography with abstracts, and some full-text articles. These requests take from one to two weeks to fill.

Level 2 requests are usually on broader topics which involve multiple factors. The end product for this type of request is usually a brief synthesis of the information found, in addition to a more comprehensive package of selected citations, texts of relevant articles, and other information appropriate to the request, e.g., lists of experts or contacts, pamphlets, or audio-visual materials. Level 2 requests take from two to four weeks to fill.

Level 3 requests necessitate in-depth study of the topic, and, often, a comprehensive search of the literature. Such requests may be for data to support litigation of high-loss claims. The end product of a level 3 request is usually a notebook containing a collection of materials (such as that described above), or the organization of a presentation or educational meeting. Completion time for such requests is three to four weeks.

There is an established method for logging search requests and for tracking time and costs associated with the research process. Each request for information is translated into a brief written description, and placed in a file folder which is indexed by the requestor's name, the date, and the topic. A copy of the final report, along with its accompanying material, is included in this file folder.

#### Hardware configuration

Three COMPAQ personal computers (a COMPAQ Portable III, a COMPAQ Portable II, and a COMPAQ Deskpro 286) comprise the core hardware for the TRD system. A number of data files, which are accessed by the entire staff, occupy the approximately 70MB of hard disks on the three COMPAQ machines. The COMPAQs are also used for searching external systems, as well as for storing and manipulating temporary, working files. PRMC management has a Macintosh SE and a LaserWriter Plus, which are occasionally used by TRD staff to obtain high-quality graphics prints. TRD has a shared dot-matrix printer and two Tandem terminals. The Tandem terminals, the only machines having the ability to communicate with each other, are utilized less frequently than the COMPAQ's to access the Medical Malpractice and electronic mail systems. TRD staff have three major complaints about the Tandem system: it has limited accessibility (8:00 a.m. - 5:00 p.m. only), response time is slow, and there is no capability for uploading and downloading files via microcomputer.

#### External data sources

When bibliographic references are required in response to a request, TRD staff search a variety of commercially available, computerized databases. Frequently accessed files include those available on the DIALOG, BMEDSS, MEDLINE (through MELVYL), and

LEXIS/NEXIS systems. Between 40 and 50 such searches are performed each month. Other external data sources include printed journals, which the researchers review regularly to identify articles for addition to the library collections or to gather data for addition to an INMAGIC file.

#### Internal data sources

Current operations in the TRD involve the use of numerous internal, machine-readable data files, some of which are permanent and some of which are temporary in nature. These files are stored, not only in various formats, but also in different physical locations: on the COMPAQ hard disks, on Tandem disk packs, and on a collection of 5 1/4 inch, indexed, floppy disks.

Temporary data files used by TRD staff are generally needed for a short time, while analysis is performed on the data they contain. These files are then archived to floppy disks, from which they may later be retrieved if needed. Files of this type include downloaded search results, files of statistical data, and WordPerfect files of reports which have been printed and distributed.

There are numerous, permanent data files maintained by TRD staff. Most of these files are maintained and accessed using INMAGIC software. INMAGIC is a database management software package which includes a powerful report-writing utility. INMAGIC allows the existence of a number of separate databases, having either shared or differently described record structures and report formats. There is considerable variety in the permanent INMAGIC files maintained by TRD; a list of these files give some sense of the scope and complexity of TRD operations:

1. Library materials: this file contains references for materials, mostly reprints, contained in the TRD library, and serves as a catalog for the collection. Materials are indexed using a subject thesaurus, developed in-house, and the records contain abstracts written by TRD part-time staff. This file currently contains approximately 1200 references, and grows at the rate of 50 - 100 references per month. There is a large backlog of records waiting to be added to the file; about half of the library collection is now represented in this database. Articles distributed as part of the monthly news clippings mailing, or identified through external database searches, are added to the Library's collection.
2. AIDS collection: this contains bibliographic references for materials contained in the TRD library section on the medico-legal aspects of AIDS. Only a portion of the documents in this collection have been

added to the INMAGIC database. The collection is updated by a regular SDI current awareness search.

3. OB/GYN collection: this collection of bibliographic references represents materials contained in the TRD library section on the medico-legal aspects of perinatology. Here, too, only a portion of the physical collection is reflected in the INMAGIC database. The collection is updated by a regular SDI search.
4. Cerebral palsy collection: this file, too, is a subset of the TRD library collection, and has been only partially represented in an INMAGIC database. These articles are indexed according to the way in which they define and measure cerebral palsy.
5. Jury verdicts and settlements database: this file contains records for jury verdicts relating to health care malpractice, especially in California. The records are based on information gleaned from the Medical Malpractice Verdicts, Settlements, and Experts and Jury Verdicts Weekly journals, and other jury verdict reports. There are currently about 450 records in this database.
6. Database of depositions and experts: this file provides subject access to the names of experts on various medical topics. This is a new INMAGIC file and currently contains about 50 records of expert witnesses from whom a deposition has been received and filed in the library. TRD plans to expand this database to include the names of experts identified through online searches, especially of the NEXIS forensics database, who might be useful resources in the future.
7. Names and organizations file: this directory contains names of people and organizations who have been contacted in the course of TRD's investigations. There are currently about 500 entries in this file.
8. SRC file of search requests: this contains about 200 indexed entries for completed search requests. Each completed request is stored in a file folder with the requestor's name, the date, and a subject descriptor; file folders are kept in a cabinet in the TRD Library.

Other types of permanent files maintained by TRD staff include:

9. Oxford Database of Perinatal Trials: TRD is a beta site for this data package, which comes with its own access software. The package is stored on one of the

COMPAQ machines. The database, which continues to be updated on a regular basis, contains published and unpublished data on clinical trials which have been conducted over the last 20 years.

10. Database of bicycle injuries and accidents: this data file was compiled by the Consumer Product Safety Commission.
11. In-house publications: this collection consists of the compiled notebooks (described above), reports prepared in response to requests, and monthly mailings. These materials are indexed in a printed list.
12. Claims database: this is stored on the Tandem machine as part of the Medical Malpractice system. (See above.)

### Software

In the course of their daily work, TRD staff use a variety of software:

1. WordPerfect programs have several uses: they provide word processing capabilities for compiling reports; they are used to edit downloaded bibliographic citations; and they provide rudimentary, desktop publishing functions.
2. LOTUS 1-2-3 and SYMPHONY are used for spreadsheet functions and graphing.
3. MICROSOFT CHART is used for graphics functions.
4. DIALOGLINK provides terminal emulation and communications software for accessing the DIALOG online information retrieval system and most other online services. Additionally, this software provides a logging system, recording time, costs, requestor's name, and subjects for all DIALOG searches.
5. INMAGIC is used for database management of bibliographic, directory, and data files.
6. INCASE is a set of "canned" record structures and report formats for use with INMAGIC when indexing depositions and other documents in support of litigation. These structures and formats are also used as guides for the design of additional structures and formats.
7. Electronic mail is available on the Tandem machine, and

requests are often received from Account Executives via Tandem terminals. There is, however, no current link between the COMPAQs and the Tandem, and reports cannot be returned to the Account Executives via electronic mail.

8. SPSS software resident on the Tandem machine is used for statistical analysis. On occasion, data from the malpractice claims and incidents database is downloaded, or typed by hand, into LOTUS 1-2-3 or SYMPHONY, where charts and graphs may be generated on a laser printer.
9. TRD is a beta site for 'Baby Benefits', a software package which aids in the analysis of medical records, and in tracking clinical procedures. This program runs on one of the COMPAQ machines.

#### WORKFLOW AND ACCESS PROCEDURES IN TRD

##### Use of internal systems

Researchers initiate research on a new query by consulting the TRD library collections, their own personal files, and the internal databases. They often consult with each other to determine whether anyone else has had a similar, previous query. The library collection and the internal databases are new and relatively small, but, even now, provide a good starting point for an increasing number of search requests. Due to the unique nature of each new request, few searches can conclude with the internal systems; usually they must be pursued through external sources. Use of the internal sources, however, often significantly reduces the time spent searching external systems. (See Figure 1 for a flow chart of the process to complete a client request.)

##### Use of external systems

Researchers routinely search commercial, computerized, bibliographic databases and download the references retrieved. When it is legal to keep these references in machine-readable form, they are stored on floppy disks, often along with the search strategy used to retrieve them; each researcher indexes her own floppies, usually with the name of the requestor or a subject term. When copyright protection makes it illegal to keep downloaded files, the file is deleted after use. Relevant references from these external searches are identified, retrieved from local libraries, and reviewed. The focus of the retrieved articles is summarized in a report, the text of which is saved on a floppy disk. (See Figure 2 for a diagram of this procedure.) Sometimes, researchers must use the resources of a local library



for materials and information not available online; TRD has a collaborative agreement with a number of libraries, and often draws from these sources.

#### Use of the Tandem

TRD staff analyse data on incidents and claims from the Tandem Medical Malpractice system. They examine recent claims to find trends in litigation topics, to obtain average costs for various types of claims, and to collect claims data on specific types of injuries. Sometimes, the Tandem's SPSS software is used for analysis of this data, as well as data from other sources. Output from Tandem processes (either SPSS or ENFORM reports on Medical Malpractice data) is received by TRD staff on either floppy disks or printed paper. If the Tandem output is on a floppy disk, the data is loaded into a LOTUS 1-2-3 or SYMPHONY program, where it may be graphed or charted and printed. If the Tandem output is on printed paper, the data is keyed into a LOTUS 1-2-3 or SYMPHONY program, again, to be graphed or charted and printed. Statistical data from sources external to the Tandem is generally given to Tandem programmers on floppy disks for loading into Tandem files. TRD researchers write their own SPSS and ENFORM programs, but must have Tandem programmers submit these programs for execution. This procedure is outlined in Figure 3.

#### Document addition to the Library's Catalog

Documents which have been identified as relevant to a client's request are retrieved for both the requestor and the TRD library collection. If the document is a photocopy, a record of this is made for reporting to the Copyright Clearance Center. Bibliographic information for each document is coded on worksheets, abstracted, and assigned indexing terms from the internally-developed subject thesaurus. Information from the worksheets is entered directly into the INMAGIC database if the appropriate microcomputer is available for use; otherwise, a file is prepared in WordPerfect for batch loading into INMAGIC.

Figure 1

Diagram of the process to complete a client request

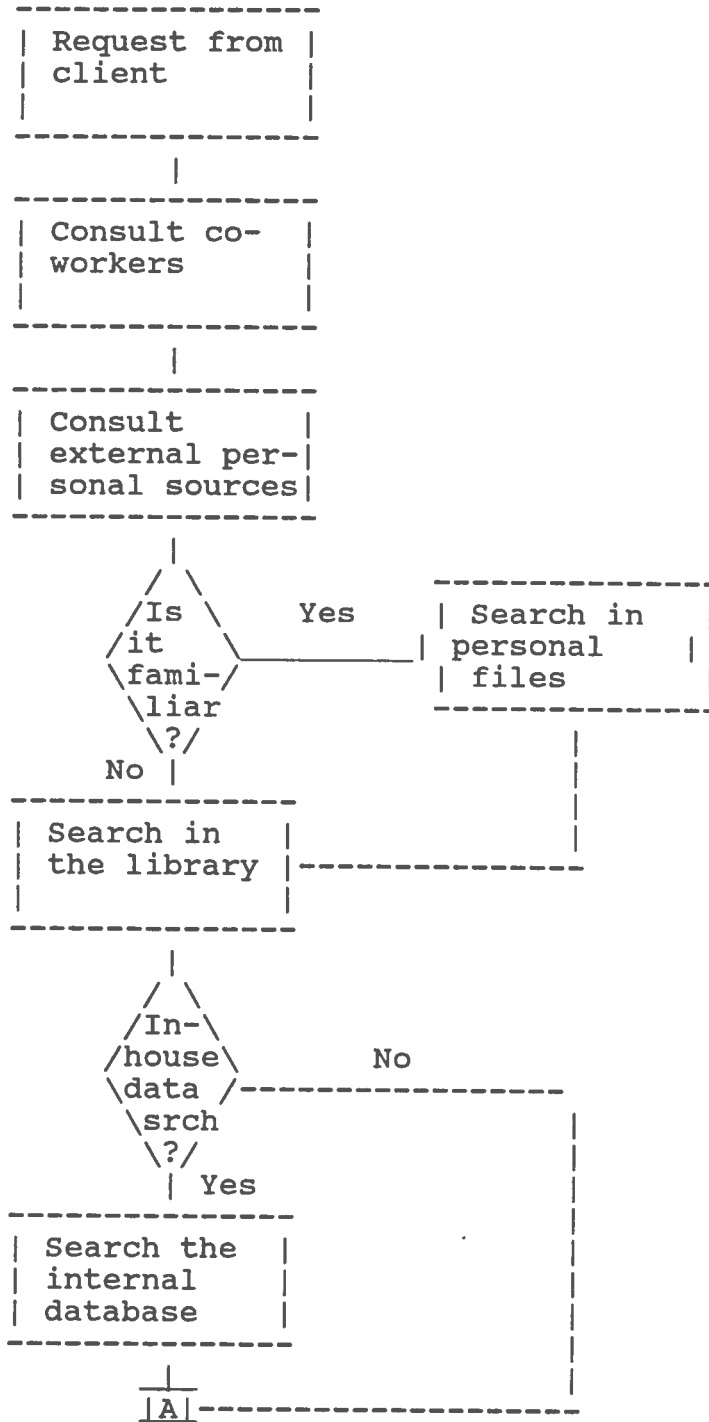


Diagram of the process to complete a client request - continued

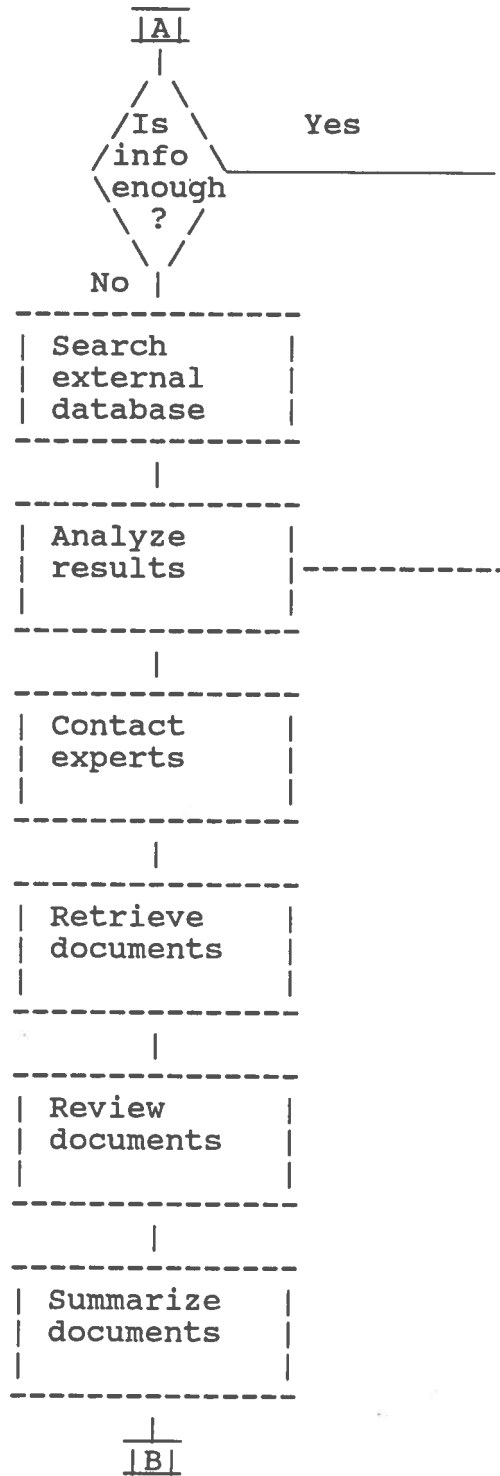


Diagram of the process to complete a client request - continued

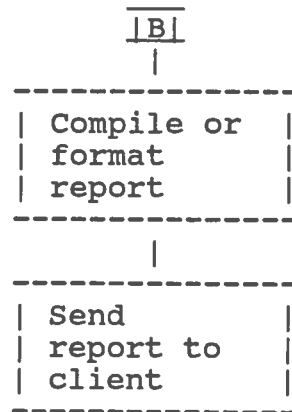


Figure 2

Diagram of the commercial database search process

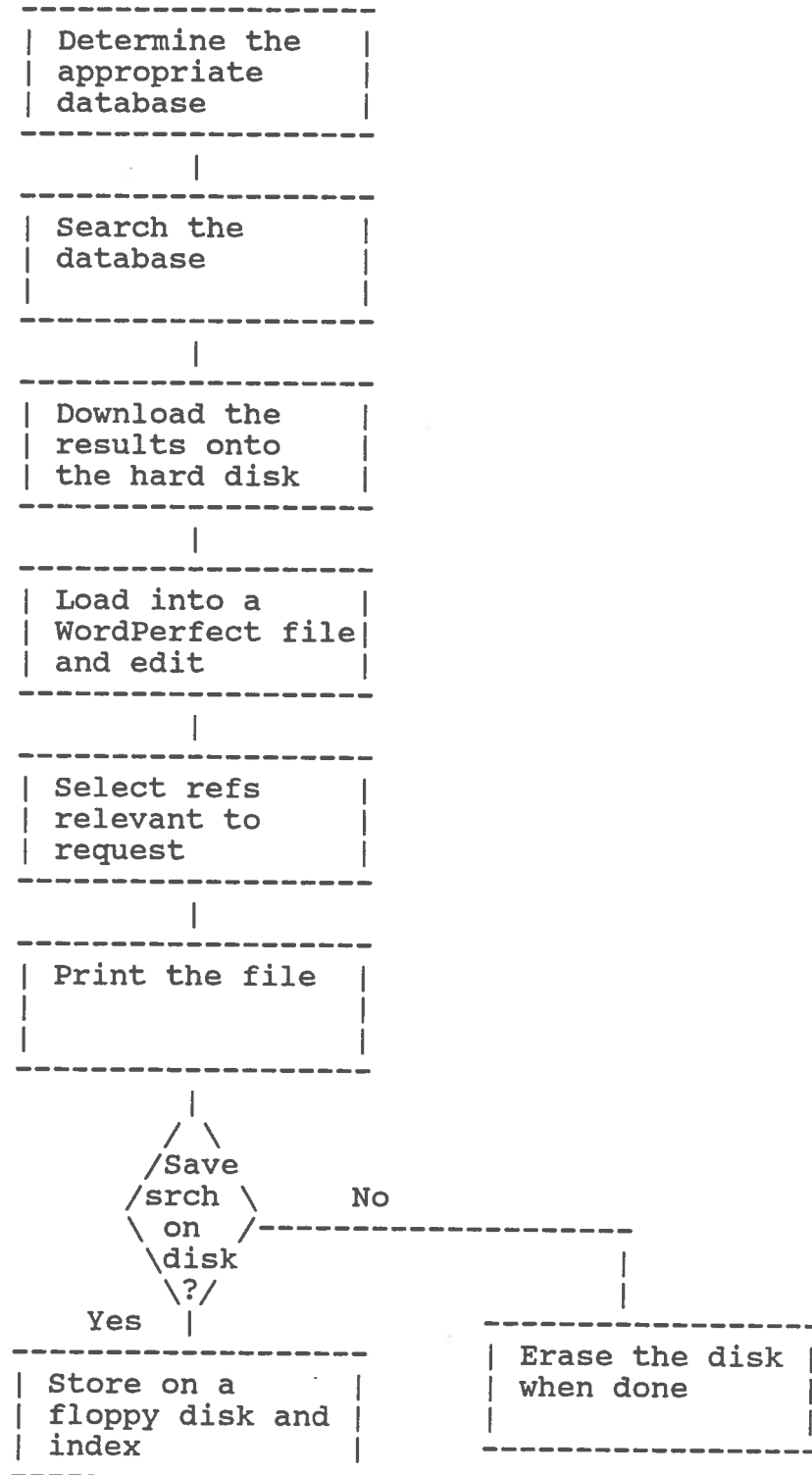


Figure 3

Diagram of Mainframe use patterns

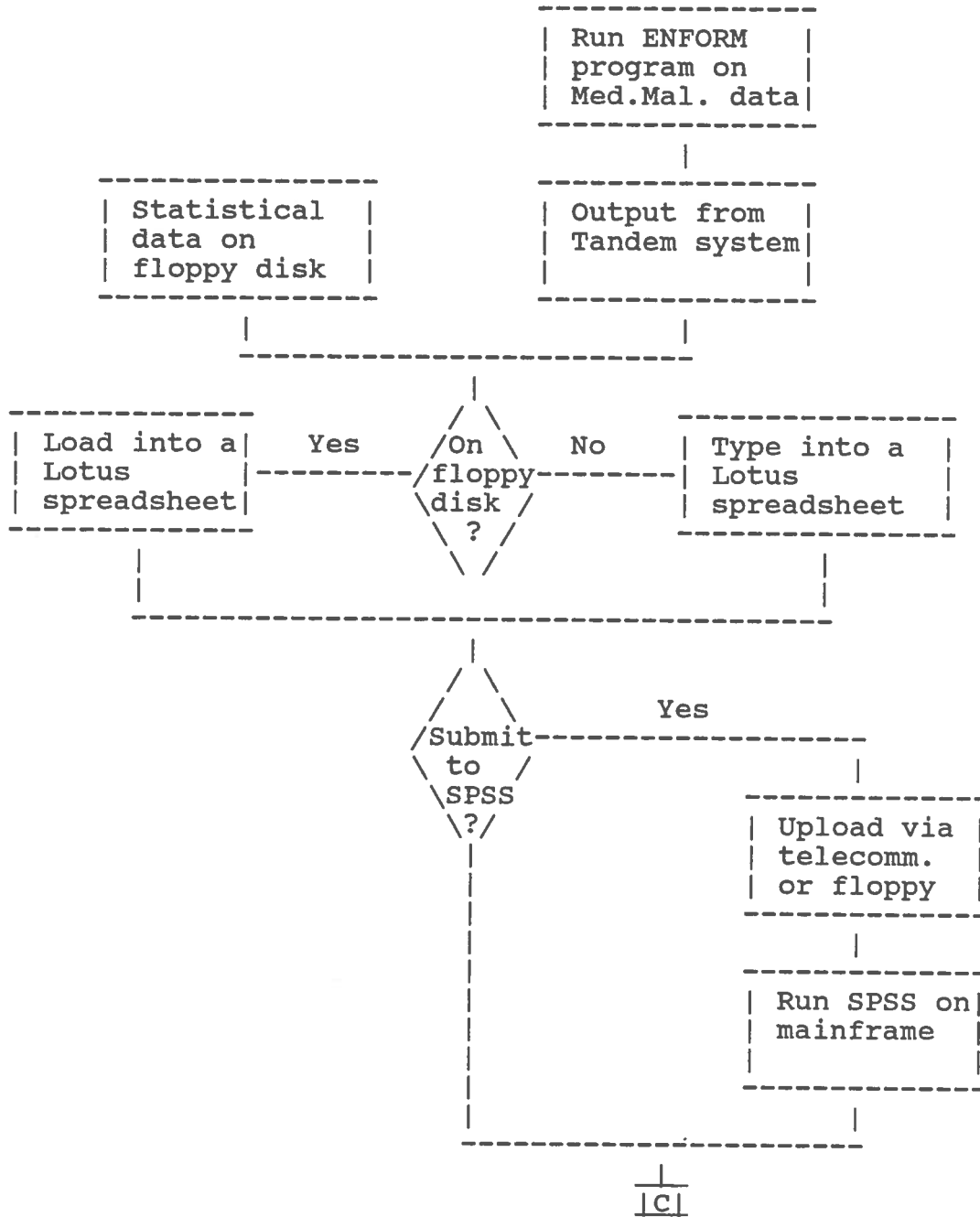
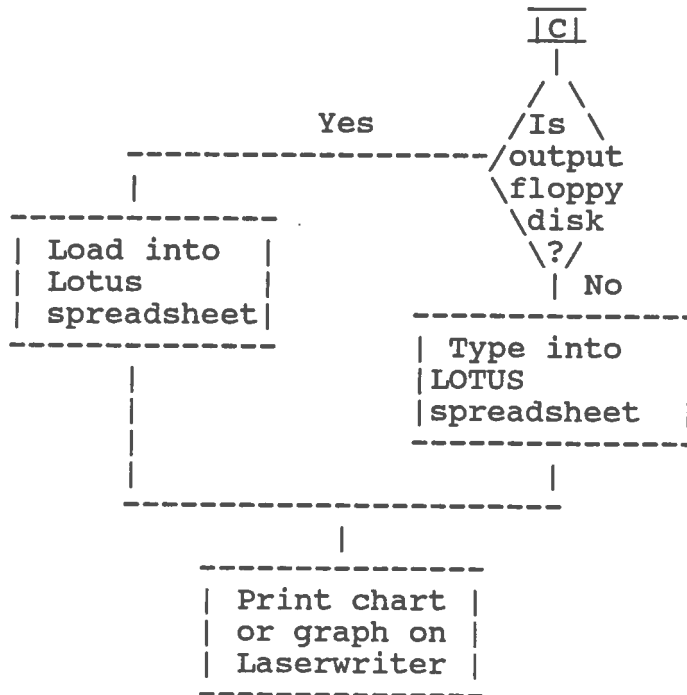


Diagram of Mainframe Use Patterns - continued



## PROBLEMS WITH THE CURRENT SYSTEM

The previous sections of this report have reviewed the hardware and software used, the files consulted and generated, and the staffing of TRD. This section summarizes problems in the existing system.

TRD's primary product is information; specific problems have developed in the methods by which they derive that product. When TRD operations began, staff developed an information processing system which met their initial needs. The increased volume and complexity of TRD's work are placing demands which this processing system will soon be unable to meet. The current system cannot integrate the variety of data from numerous external sources into reports, internal data files, and bibliographies which can be easily accessed by TRD's clients and utilized by TRD staff in future research projects.

Specific problems include:

1. There is a continuing shortage of disk space in the COMPAQ machines on which to store data files.
2. Researchers have no direct, electronic mail access via their PC's to the Account Executives.
3. Researchers cannot efficiently share data files amongst themselves. The current method of informal access suffices for the existing staff, but will not serve under an increased work load, increased staffing, or an increase in the number of electronic files.
4. There is no systematic method for storing reports in such a way that they can be accessed online by other researchers, by management, or by clients.
5. There is no systematic organization and management of the report and data files to both provide and assure future access.
6. The process of extracting data from the Medical Malpractice System is awkward and inefficient. Direct access to the Tandem machine is limited, slow, and often not directly available to TRD staff. Although at least one of the researchers can write her own ENFORM reports to pull data from the claims database, she cannot run them herself, but must have a CRD programmer submit them. TRD staff do not have direct subject search capabilities for the claims portion of the Medical Malpractice system, but feel that such a function could benefit them greatly by providing quick and frequent analysis of current trends.



7. Integration of graphics with text requires the use of a separate machine for that purpose. When high-resolution graphics output is required, the appropriate data must be manually input to the Macintosh machine. As TRD staff become more involved in presentations and training, the need for integration of high-resolution graphics with text is increasing. The current necessity of both generating and printing these files on the Macintosh results in an unnecessarily high demand for this machine.
8. Formal guidelines do not appear to have been established for the types of information that should be stored in TRD's files, as opposed to information that should be discarded at the conclusion of a research project. Such decisions are made independently by each researcher, according to her own standards. The staff is currently small, and there is close but informal concensus; as the work load and the staff increase, such concensus will be difficult to maintain.

#### PLANNING PREMISE

In developing a plan for the future configuration of TRD's data processing system, the future role of TRD within PRMC and ARM must be examined. Assuming that ARM and PRMC will continue to grow at an increasing rate, TRD will be called upon to provide a greater level of its current services, as well as additional services, in the next five years. TRD is beginning to extend its client base beyond the University of California and the Los Angeles County hospitals and medical centers, into health maintenance organizations. They would also like to expand their services; an immediate goal is expansion of the monthly mailings into a monthly newsletter. Another goal is development of the in-house databases to create a marketable source of medico-legal information, or, at least, to provide direct, online search capabilities for TRD clients. As the client base increases, the staff of TRD will, of necessity, increase. We did not conduct a staffing analysis of TRD, but it seems apparent that the current staff is nearing, if it has not already reached, the limit of its capacity.

TRD's goals for strengthening its internal resources and for serving a larger community of healthcare professionals, will create a need for additional automated support. Staff will need rapid access to permanent files; such a need implies a network or a single, multi-user machine. Sales presentations (already being made at selected meetings of medical professionals), training seminars, and the planned monthly newsletter, will increase the need for such enhanced graphics functions as a large selection of textual fonts and the capability for outputting high resolution graphics to paper, slide, and video formats. Provision of online access for clients, as well as for ARM and PRMC management, to

TRD reports and databases will require the installation of telecommunications facilities.

#### INTERNAL PROCEDURES AND ORGANIZATION

If TRD is going to expand its client base and its services, as well as build a central database from which to provide these services, TRD must examine carefully their internal procedures and operations. They must begin now to develop a plan and a policy for their databases. Such planning must include centralized access to permanent files. Plans for such access imply not only a hardware and software solution, but an overall coordination of data management. Currently, much creative energy and resourceful activity is applied to data collection, but the development of internal resources lacks a long-range, organizational plan. A collective, cooperative standard must be developed to provide guidelines on such matters as what material is to be kept and indexed, where material is to be indexed, and how material is to be indexed. Such a standard requires the development and consistent application to all files of a single, integrated subject thesaurus. (This integrated thesaurus should also be applied to the claims indexing in the Medical Malpractice system.)

Central database storage and software for TRD's permanent, multiple-user files would both improve accessibility and help achieve overall coordination. The many current files which have been created and maintained by different researchers are organized by different methods and indexed using different subject vocabularies. Separation of unlike data is helpful and necessary, as different types of data have different requirements for structure and retrieval; but files which share common access points should be merged to improve the accessibility of the data they contain.

Another implication of the centralized access concept is the sharing of individual resources. Each researcher manages work records according to her own personal methods, and much information is stored in the mind of each independent researcher. There is now frequent interpersonal consultation between researchers, but, as the work load and staff increase, it will be more difficult for researchers to obtain a truly global view of a problem without ready access not only to their own previous work, but also to that of their fellow researchers.

Another internal procedure which needs analysis is the procedure by which records for library materials are entered into the database. In order for the database to be current and useful, the time-lag for the database update process must be minimal. Combining similar files wherever possible is another way to improve the efficiency of this process. Likewise, record-

keeping, especially case and database search logs, should be centralized. Other processes which might benefit from centralization include accounting for on-line searches of commercial databases (with access to client names and subjects), the billing process, and record-keeping for photocopies.

### STAFFING

It is apparent that TRD staff are at the limits of their ability to absorb work-load increases. Most staff time is now spent in research central to TRD's primary activities. Currently, the functions of collection management and database administration are peripheral to TRD's primary activities; these functions must be made more central if TRD is to successfully meet its goals for expansion. These functions are essential to the system that we are proposing. At least one additional full-time equivalent staff person will be needed to develop and maintain the type of database that TRD requires to support expanded information services. This position could be divided into two half-time positions, one a Librarian to organize and manage the physical library collection, and the other a Database Administrator to coordinate, manage, and implement database policy. Both of these functions should be performed by someone with a background in medical or legal information handling.

### PROPOSED SYSTEM DESIGN

#### Goals of the design

The overall design of a future system to meet both TRD's needs and the needs of its clients, must make integration its highest priority.

1. The data processing system must allow TRD's researchers to communicate electronically with each other and with the clients.
2. The system must allow data to be quickly and easily shared between researchers and between TRD and its clients.
3. The system must allow TRD's products to be both easily disseminated to its clients electronically and accessible to each researcher electronically. The Tandem T-mail is already an established electronic mail system, used by most of the Account Executives; it would be more efficient to utilize T-mail rather than attempt to establish another system.
4. The system must provide an efficient method for extracting data from the Tandem system and integrating that data into

TRD's internal data files and reports.

5. The system must provide a foundation to which future capabilities or technologies can be easily added. An example of such a future addition is the capability to transmit and display graphics image files from one machine to another; there is currently no technological standard for such transmission, but this capability will probably be developed within the next five years. Other future additions might include such devices as video-disk or CD-ROM devices, or the addition of a bulletin board system.

#### Software Configuration--INMAGIC

INMAGIC is a powerful software package that can facilitate system integration. It is a database management system specifically designed to manage textual data. It allows the user to create varying-length data fields; in establishing the characteristics of records in a database, the user need only specify the name of each data field, not the maximum number of characters in each field.

Another useful feature of INMAGIC for bibliographic applications is its ability to handle repeating fields. The maximum number of field occurrences that may be associated with a single record are not predefined. If, for example, a field has been defined in the database for the author of an article, and in the course of entering data a second author is encountered for a particular article, the system will enable the creation of a second author field for that record.

INMAGIC is menu-driven, and allows the existence within a single system of multiple databases which may or may not share record and report definitions. The software, when combined with Flash-up Windows, permits the use of controlled vocabulary lists, as well as the creation of a cross-referencing structure within each controlled vocabulary list. A variety of different indexes may be created for a single database. Retrieval may be accomplished with complex, boolean search statements. In addition to easy, flexible methods of data entry, retrieval, and maintenance, INMAGIC provides a powerful report-writing capability which allows the use of fixed text, user-supplied text, and database text fields. Planned future enhancements to the system include, for example, the ability to accomplish global database changes. This is a very flexible and easy-to-use software package. There are no limitations on database size (other than that of the hard disk INMAGIC accesses), and response time for searching indexed fields is purported to remain essentially the same regardless of the size of the database or the number of system users.

The INMAGIC system is already in use by TRD, and the staff

have invested considerable time in becoming proficient with it. The system will be released in a network version this summer. This version, installed on the hardware configuration described below, would provide adequate software support for the shared as well as the individual data files of each staff member.

The system runs under MS-DOS, and on various sizes of Digital Equipment's VAX machines. If the TRD databases outgrow the file server that INMAGIC is installed on, a new version of the software could be acquired to run on a more powerful machine. Thus, a future migration path is available if one becomes necessary.

### Hardware Configuration

The use of INMAGIC, together with an appropriate hardware configuration, will solve the major problem of providing centralized access by facilitating the development of an integrated data processing environment. This environment, however, must support electronic communication between the TRD staff and between TRD and its clients, as well as Tandem access. Two hardware configurations can meet these requirements: a local area network, or a large microcomputer system running a multi-user operating system. Because most of the software currently used by TRD runs under MS-DOS, the latter option is not a feasible one. (As of this date, Microsoft's OS/2 with multi-tasking has not been released, and XENIX will not run most of the software that TRD uses.)

The proposed configuration for TRD, then, is a local area network having a large microcomputer system as file-server and network gateway, with either the existing COMPAQ machines or other, moderate-sized personal computers as researcher workstations. This network should have a gateway to the Tandem machine (it is possible that several Tandem ports will be needed), providing staff with the ability to access the Tandem through their workstations. The PRMC laser printer should be connected to the file-server, allowing researchers to route their printing to it. Each workstation would continue to have its own modem with a direct dial telephone line attached, to facilitate searching external systems such as DIALOG, MEDLINE, and LEXIS. The machine chosen to act as file-server and network gateway should be capable of handling the largest Winchester hard-disk currently available (314MB); this will provide adequate space for database growth over the next two to three years.

A means of archiving unneeded data files and creating database backups should also be included as part of the network. This equipment might be an 8-track tape drive, a 1/4 inch cartridge drive, or a 5 1/4 or 3 1/2 inch floppy disk drive. The last option would be the cheapest, but the slowest and least efficient.

We do not plan to make a recommendation on the specific hardware, software, or wiring that should be installed for the network, since we do not have any direct comparative experience with LAN network system performance.

#### TRD Network to Tandem Communications and Message Processing Software

In order for the network to provide an integrated work environment with the Tandem system, several software enhancements will be necessary. A user on the TRD network must be able to perform work on the Tandem machine; specifically, to initiate a session on the Tandem system to perform a statistical analysis run or a subject search of claims, and to have the output spooled onto the researcher's machine when the process is finished. One of these enhancements is the addition to workstations of terminal emulation software (such as Dante, PCLink, or Microlink), and the establishment of the TRD system as a port on the Tandem to allow TRD initiation of jobs. Locations will need to be established in the Tandem spooler to route completed TRD jobs to the TRD network.

The Tandem system will soon be upgraded, which should improve the sluggish response time observed by TRD staff.

If Tandem's T-mail is accepted as the electronic mail system for the network, no other electronic mail software should be required.

#### CONCLUSION

Throughout this report we have emphasized the importance of centralized access to information. The system we are proposing lays a good, basic foundation for providing such access at a moderate cost. We have not focused on elaborate technology which, though impressive, would prove expensive to acquire, would demand an expensive migration path, and would not be easily expanded. We have, instead, proposed a system which will provide a flexible foundation for expansion and growth, as well as an easy migration path, both from the present system and to any future system. The system we are proposing is both expandable and adaptable, and provides a capability for the addition of new technologies which might be found desirable, such as the use and transmission of high-resolution graphics images or the use of CD-ROM devices.