PROPS SYSTEM: PROGRAMS FOR RESIDENTS
OPERATIVE PERFORMANCE
IN SURGERY

by

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ABSTRACT

The education of a general surgeon requires 5 to 6 years after the completion of medical school. The training is unique in that it consists of training in both cognitive and technical skills. A Surgery Residency Program must provide an adequate and balanced exposure to the full variety of operative procedures that comprise General Surgery. A computer program has been developed to help the Residency Program Director accurately and efficiently track the operative experience of residents. This program will facilitate scheduling so that each resident will have an adequate operative experience and so that balance within the program among the residents can be achieved.

Programs for Residents' Operative Performance in Surgery (PROPS) is an efficient, accurate, inexpensive and easy-to-use personal computer based software system that will capture and store resident's operative data by case, automatically tabulate statistical data relative to the operative experiences of residents, provide management reports for use by the Residency Program Director, facilitate the transfer of the Chief Resident data electronically to the Residency Review Committee for General Surgery, and prepare a report to the Board of Surgery for each Chief Resident. In addition, the PROPS system provides an intelligent consulting function to fulfill an even case distribution. This consulting function will help the

director to quickly and easily obtain the needed information to make decisions regarding resident assignment.

The PROPS system has proven to satisfy the Department of Surgery's need for resident operative experience record keeping and report making. After completion of these tasks, a comprehensive tabulation of residents' operative experience at each level of their training program will be developed.

This experience with the PROPS system using a relational Data Base Management System (DBMS) is being extended to a larger environment where information is gathered from multiple sources. Specifically, the PROPS system has potential to help with operating room decisions such as scheduling, supplies, room utilization, and reporting.

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CHAPTER I

INTRODUCTION

The Problem

The education of a general surgeon requires 5 to 6 years after the completion of medical school. The training is unique in that it consists of training in both cognitive and technical skills [1]. A Surgery Residency Program must provide an adequate and balanced exposure to the full variety of operative procedures that comprise General Surgery. Managing the operative experience of the resident has been difficult; the techniques available for doing so remain underdeveloped. Performance assessment is now easier to do. This is a consequence of improvements in data management technology. Computers have made it easier to collect and work with data on performance involving many different cases [2,3]. A computer program was developed and is herein described that will accurately and efficiently maintain the operative experience of residents, and at the same time optimize the balance of operative experience among the residents.

There are many reasons to concurrently track residents operative experience. To list some of them:

Educational.

1. To insure that the resident is exposed to the appropriate number and type of cases.

2. To identify areas of deficient operative experience.

<u>Administrative</u>.

    1. To make accreditation records.

    2. To make Residency Review Committee (RRC) reports.

    3. To adjust faculty composition on a rotation.

    4. To make resident operative experience as part of a performance profile.

<u>Credentialling process</u>.

    1. For advancement within the residency.

    2. For specialty boards.

    3. For hospital privileges.

    4. For responsibility to the public.

    5. For decisions on retention and promotion.

<u>Costs</u>.

    1. To reduce the maintenance cost.

    2. To reduce the managing cost.

    3. To reduce the processing time.

Programs for Residents' Operative Performance in Surgery (PROPS) is an efficient, accurate, inexpensive and easy-to-use personal computer based software system that will capture and store residents' operative data by case, automatically tabulate statistical data relative to the operative experiences of residents, provide management reports for use by the Residency Program Director, facilitate the transfer of the Chief Resident data electronically to the RRC for General Surgery, and prepare a report to the American Board of Surgery (ABS) for each Chief Resident. In addition, the PROPS

system provides an intelligent consulting function to help the director solve the following problems specifically about operative experience for residents:

1. Do they do enough of the correct cases?
2. Do all the residents in the program get the same experience?

In the other word, the PROPS system will help the director fulfill an even case distribution.

Background: Database Management Systems

A database is a collection of files that contains related information about an organization. The simplified view of a database system looks something like Figure 1. The advantages that accrue from having a database are [4]:

1. The amount of redundancy in the stored data can be reduced.
2. The problem of inconsistency in the stored data can be avoided (to a certain extent).
3. The stored data can be shared.
4. Standards can be enforced. This simplifies problems of maintenance and data interchange between installations.
5. Security restrictions can be applied.
6. Data integrity can be maintained.
7. Conflicting requirements can be balanced.
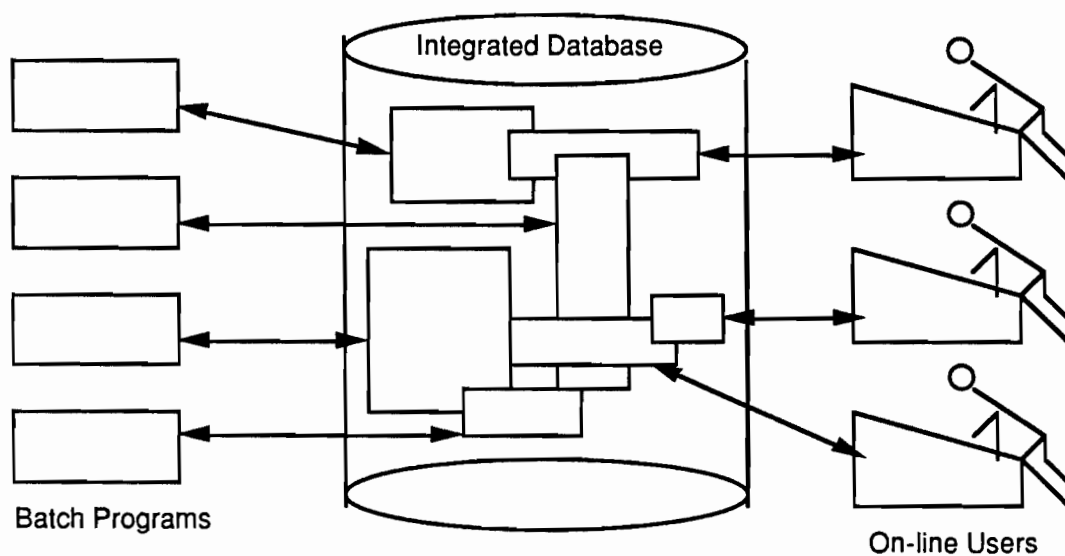
Figure 1. Simplified view of a database system

In the PROPS system the database contains files describing the attendants, residents, procedure code, operative cases, and so on. There are also many different files used to describe the patient, staff, operating room schedule and so forth. In order to handle all access to the database, a database management system (DBMS) is developed for this purpose. DBMS is a program designed to control and manage these complicated collection of data so it is immediately accessible and easy to manipulate.

There are three types of DBMS: network, hierarchical, and relational model. They differ in the way in which they structure the data; yet each shares a common organization. Every DBMS provides three views of the database [5]:

1. The system (or global) view considers the entire database from a system perspective. All data elements are defined in the context of natural groupings (records) and relationships among groupings. This definition is generally called the schema.

2. The application (or external) view considers the database only from the perspective of a specific application. Only the data required by the application are presented; relationship outside the application are hidden. This definition is general called the subschema. In the Hospital Information System (HIS) example, the nursing station order entry and clinical laboratory internal management applications may share the same files but will use different subschemas to reflect their different data needs.

3. The physical (or storage) view considers how and where the files are stored. All files used by a DBMS must be managed using an access method provided by the support system. The DBMS provides a tool to relieve the application programmer of having to know about the physical storage. Moreover, since the application can be written using only the subschema definitions, changes can be made in the physical organization without altering the application programs. (This is called physical data independence.)

The definition of schema, the subschemas, and the physical storage assignments is the responsibility of the Data Base Administrator (DBA). Figure 2 illustrates how these definitions are used by the DBMS. At the application level, each application has its own subschema. The programmer uses this subschema in the Data Division (for COBOL programs) and all references to the physical files
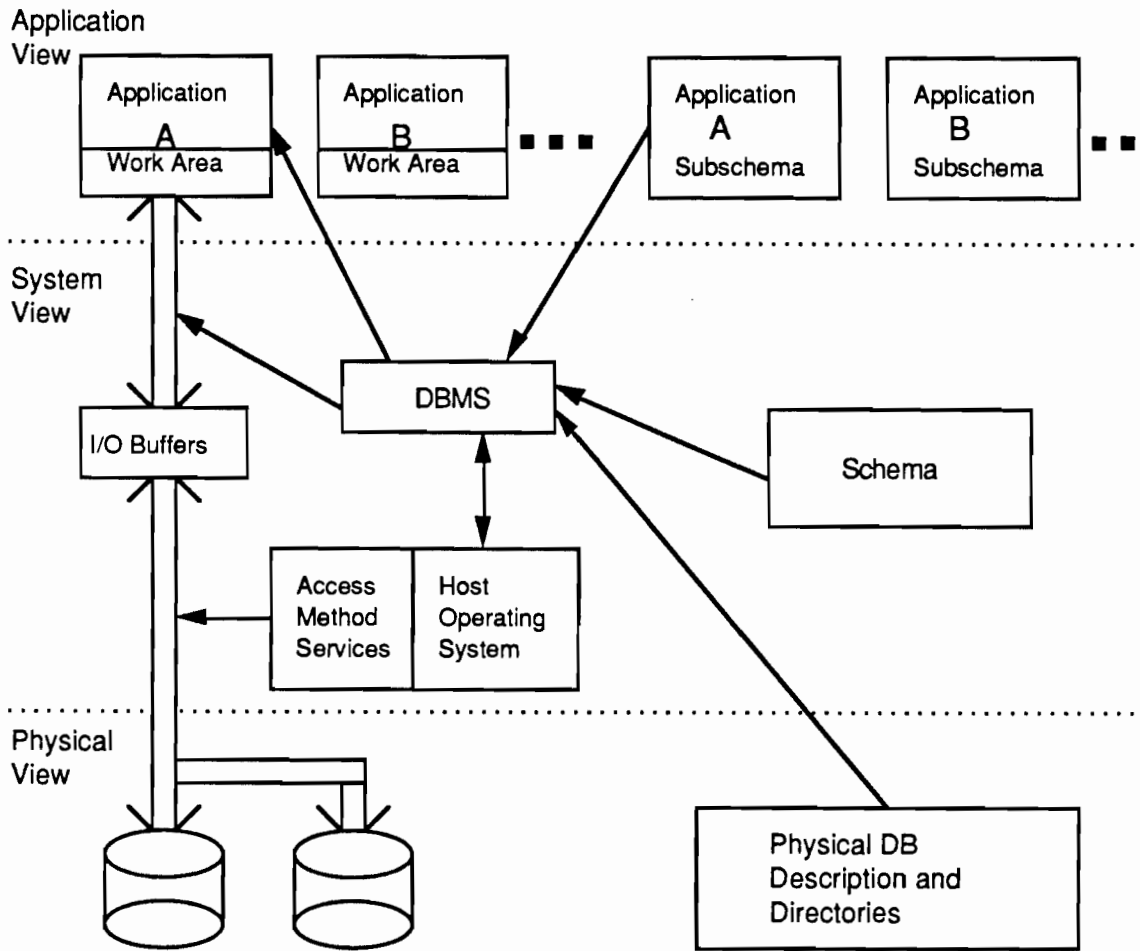
Figure 2. A database management system

and their data are managed through this subschema. As shown, each compiled program generally has a work area. Data from the database are moved to and from this work area and then moved to and from the storage assigned to variables for processing.

At the system level, the DBMS interfaces with the host computer's operating system. It uses the operating system and its access method services to move blocks of data to and from I/O buffers. The DBMS also has services to move data to and from application working areas. The DBMS has access to the application subschema plus the system schema. This allows the DBMS to map the application view into the global view for the system. From this view, the logical groupings can be translated into physical files and their locations; the physical database descriptions and directories support this function.

In general, most DBMSs operate in this manner. Some, such as that illustrated here, support application development; others are fully self-contained and simply provide access to the DBMS functions of query and file management. All DBMSs, however, are complete systems: they offer more than a file access service. Each provides tools to define the database; access the data and files by the given names (called symbolic referencing); and support system level functions such as security, concurrency management, backup and recovery, and tuning. A DBMS is normally classified by the model used to define the database: network, hierarchy or relation. This affects only the schema and subschema. Physically, the storage of the data need not reflect the logical view of the schema. In fact, relational database system normally do not store their data as

relations; retrieval time would be too great to justify such an organization.

A very important function of DBMS is to separate the application view of data from the physical view of data. Separating the two allows each to exist independently. If for some reason the method of physically storing data is changed, the application program remains unaffected. Conversely, if one application program is altered, other programs using the same data need not be changed. This is made possible because the DBMS acts as a mediator between the application programs and the physical data.

Relational DBMS

Although there are three types of DBMS, the relational model has become increasingly popular since it was introduced by E. F. Codd in 1970 [6]. The relational model is based on predicate calculus and significantly formalizes database theory. With the relational model, data may be described without imposing the arbitrary structure necessary for representation at the physical level. This make it especially effective in yielding program-data independence.

Data are arranged into two-dimensional tables in the relational model. A horizontal line of entries in a table is called a tuple. A tuple in similar to a record in a conventional file system. Vertically, the table consists of domains. A domain is similar to a field in a conventional file system. The table itself is called a relation. A relation always has a fixed number of domains. One or more of the domains form the primary key for the relation. Each tuple must have

a unique primary key. The rest of the domains consists of attributes describing the primary key [7,8,9]. The components of a relation look like Figure 3.

Relational Databases are usually accessed by high level query languages that free the user from navigating through the database to locate information.

To aid in designing a database with the relational model, normal forms are used to limit each relation to one entity. An entity is some object or concept that can be perceived as being distinct and independent. When a relation is limited to just one entity, each domain of the relation describes some attribute of the entity. Normalization of data reduces redundancy in the database and reduces the potential number of inconsistencies arising from updates, deletions, and additions. There are five major levels of normalization and each level is increasingly strict in minimizing redundancy of data. These normal forms are shown by examples in the Figure 4 and briefly described as follow:

First normal form: A relation must have a fixed number of domains to be in first normal form. Variable length records and repeating groups are illegal.

Second normal form: Second normal form applies to relations with composite keys. The relation must be in first normal form and all domains that are not in the key must pertain to all domains within the key, not just a subset of them.

Third normal form: To be in third normal form a relation must be in second normal form. In addition to the requirement that all

Relation: Patient Address

Name	Address	State	Zip	Phone

**Relation
Intension**

**Relation
Extension**

Domain   Domain   Domain   Domain   Domain

←·············─·············**Tuple**·············─·············→

ATTRIBUTES

Figure 3. The components of a relation

Nth NF	Examples
1st NF	PATIENT_INFO(<u>PATIENT,MEDICATION</u>,DOSAGE,DOCTOR,BEEPER)
2nd NF	PATIENT_DOCTOR(<u>PATIENT</u>,DOCTOR,BEEPER) and PATIENT_MEDICATIONS(<u>PATIENT,MEDICATION</u>,DOSAGE)
3rd NF	DOCTOR_CALLED_AT(<u>DOCTOR</u>,BEEPER), PATIENT_OF(<u>PATIENT</u>,DOCTOR) and MEDICATION_TAKEN(<u>PATIENT,MEDICATION</u>,DOSAGE)
3rd NF	DOCTOR_HISTORY(DOCTOR,SCHOOL,SPECIALITY)
4th NF 5th NF	DOCTOR_ATTENDED(DOCTOR,SCHOOL) and DOCTOR_SPECIALIZES(DOCTOR,SPECIALITY)

* The underlined field indicates key field

In 1st NF if the key is (PATIENT,MEDICATION), it is not 2nd NF because DOCTOR and BEEPER do not pertain to the medication part of the key. In 2nd NF, BEEPER is not a fact about the key, PATIENT. It is a fact about the patient's doctor. Therefore, further decomposition brings the PATIENT_INFO relation into 3rd NF.

To keep track of a doctor's specialities and schooling one may express the relation in 3rd NF. However, if the doctor has attended several schools or has several specialities, exactly what is contained in each tuple of the relation becomes ambiguous. In the 4th NF, multiple specialities or schools may be represented by simply adding tuples as need.

Figure 4. Normal forms and normalization

domains be facts about the key, it is also required that nonkey domains be facts about the key only. Nonkey domains may not be facts about other nonkey domains.

Fourth and fifth normal form: Fourth and fifth normal form apply to relations with domains that may have multiple values. A fourth normal form relation must be in third normal form. Additionally, each tuple may contain only one independent multivalued fact about the key. Fifth normal form covers sources of redundancy not mentioned above. If a relation fulfills all the normal form requirements listed so far and can still be divided into smaller relations without losing information content or producing duplicate keys, it must be so decomposed in order to be in fifth normal form. Unless a relation contains domains allowing multiple values, third normal form is the highest normal form to which the relation may be decomposed [7,10].

The relational model provides a significant advantage by allowing the user to manipulate data without knowing the physical storage structure of those data. The freedom from navigating through the physical database is not without cost. Although free from needing to know the manner in which the data are physically stored, the user must still be aware of the logical connections between relations. The relational model considers only the relationships of data within a relation; other kinds of relationships are usually not represented by the database but are instead found in the programs that manipulate the data. If information to be represented does not follow rather definite patterns, well structured database systems, in general, are of little use in trying to represent that information [11,12,13].

Tool: FoxBASE+/Mac

One of the main purposes of the relational database is to accommodate the retrieval of data. Retrieval is essentially creating another table, relation, or report, according to the stipulations the user. This may be accomplished by a variety of relational query languages. These languages are simpler to use than typical general purpose programming languages [14].

The FoxBASE+/Mac, a product of Fox Software, is a relational DBMS and a fully compatible to the Ashton-Tate's dBASE family [15]. FoxBASE+/Mac was selected to implement this project because it is not only the fastest, but the best database management program available today for the Apple Macintosh. FoxBASE+/Mac also offers a network multiuser capability and a user-friendly interface to make it easily to use its powerful tools. The comparison among different database management systems is shown in the Tables 1 and 2. FoxBASE+/Mac was chosen for the PROPS system based on the top grading in the Table 1.

Thesis Objectives

The objective of this thesis is to establish a computer software system called PROPS that will provide the Residency Program Director with the following functions:

1. Make an intelligent editing screen to enable the user to enter and retrieve surgical case information easily and accurately.

Table 1. A comparison of features among different DBMSs

	4th Dim	HyperC	Omnis	dBase	MacMax	FoxBASE
Multiple-field key & index	-	-	+	+	+	+
Relationship	++	+	++	++	++	++
Drawing tool	++	++	-	++	+	++
Programming language	++	++	+	-	++	++
Documentation	++	++	+	+	++	++
Multiuser	+	-	+	+	-	+
Graphic	+	+++	-	+	-	+
Performance	-	-	-	-	+	+++
Import/Export data	+	+	+	+	+	+
Report	+	-	+	++	+	+
Price	+	+++	+++	+++	+++	+++
Grading	11	10	8	12	12	**18**

Table 2. Performance comparison between FoxBASE+ and 4th
Dimension

	FoxBASE+/Mac	4th Dimension	Ratio
Import	21 sec.	27 min. 11 sec.	77.6
Export	15 sec.	4 min. 23 sec.	17.5
Delete	7 sec.	20 min. 15 sec.	173.5
Process	4 min.	29 min. 27 sec.	7

* Use Iliad Data Dictionary 1714 records (77 kbytes)

2. Track and monitor the operative experience of general
surgery residents, so that the rotation schedule can be changed
during the year to optimize resident operative experience.

3. Make up to 20 additional reports to help manage residency
program more effectively.

4. Create the electronic Chief Resident operative experience
report in the exact format required annually by the RRC for general
surgery.

5. Provide an assurance that each resident will fulfill the
minimal requirements as defined by the RRC.

6. Create customized dictionaries of patients, residents, attending physicians, procedures and Current Procedural Terminology (CPT) codes.

7. Provide a database for quality assurance activities.

CHAPTER II

METHODS

System Development Life Cycle

Information systems of all types go through a predictable series of phases from birth to death. This process is referred to as the system development life cycle (SDLC) [14]. The following are the seven stages of SDLC:

1. Problem recognition
2. Feasibility study
3. Analysis
4. Design
5. Construction
6. Conversion
7. Maintenance.

In Figure 5, each of these phases appears within a circle, and arrows show the inputs and outputs for each phase. The functions of these phases, with emphasis on the design and construction stages, will be briefly described.

Phase 1, 2, and 3

Simply, the major function of problem recognition is to establish that a problem exists and the major function of feasibility
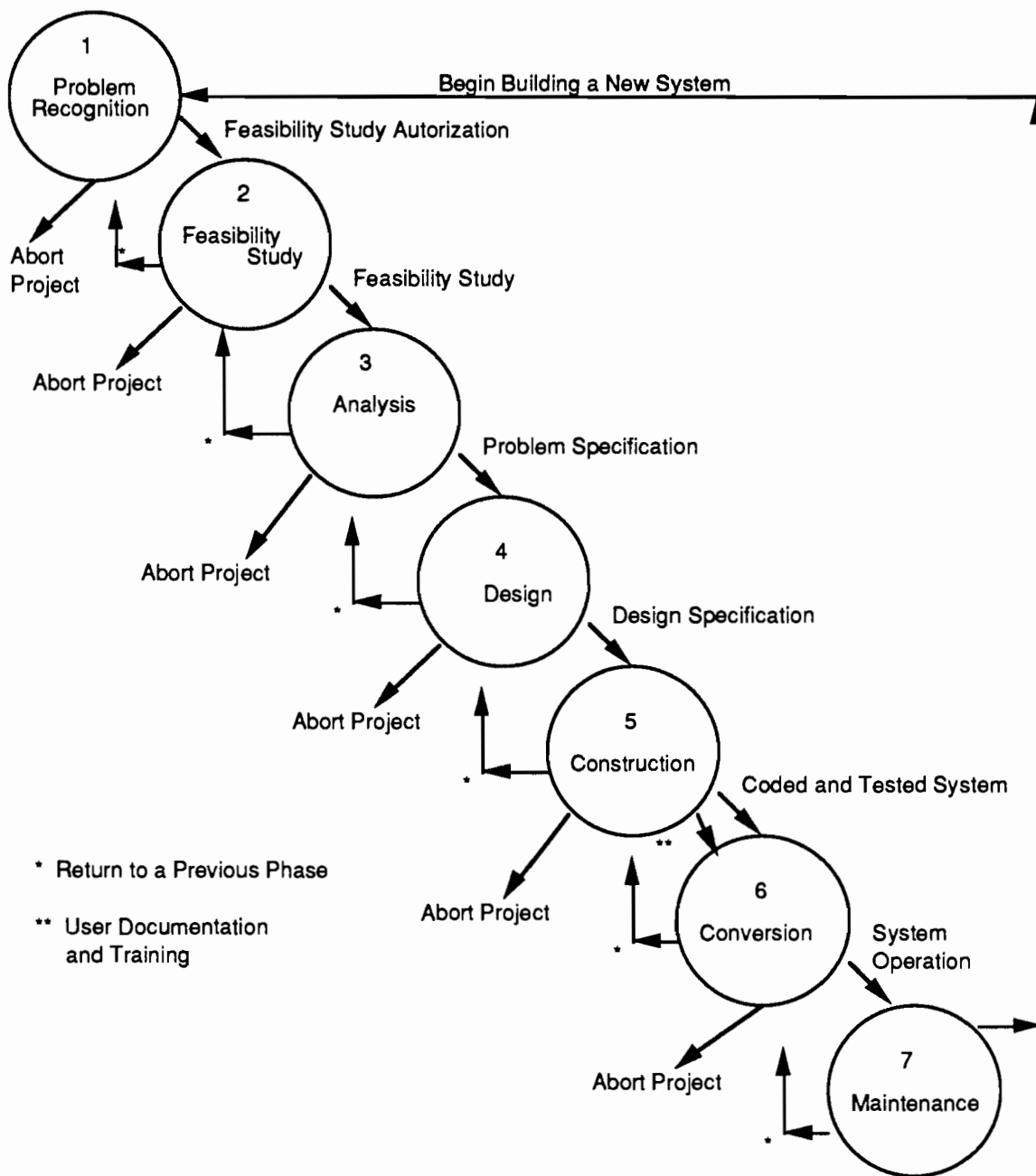
Figure 5. System development life cycle

study is to define the problem and determine whether or not a new system is feasible. The analysis phase involves the investigation of the problem in order to determine the requirements of a proposed new system. The final result of the analysis phase is a set of requirements or specification for the new system. The requirements for the PROPS system have been described as thesis objectives in the previous chapter.

In addition to the requirements, a complete technical specification of the PROPS system is expected and detailed as follows:

1. Since the PROPS system will run on the Macintosh, full Macintosh features such as menu bar with menu options, windows, and dialog box should be implemented. In other words, the program should be menu-driven, with clear, concise options prompting the user for a response.

2. The programs should be user-friendly. User should not need to keep referring to the manual. Instead, user should be instructed simply by requesting the on-line helps.

3. The program will check the validation of data input from the user before they are stored into the databases.

4. The program will provide an error-handling function. When errors are encountered, the program should automatically handle these errors and display an error message to warn the user for correcting.

5. The program should be interactive to make it easier to use.

6. The program should provide a user-verification function to prevent invalid users from accessing the information stored in the databases.

Phase 4: Design

Design is the most important development phase. It lays the foundation for the coding, testing, and maintenance activities. The principal purpose of this phase is to decide how to build the proposed PROPS system and let it fulfill the requirements and specifications defined above. The principal technique used in this phase is the top-down design method; that is, describing the system from the top to the bottom, starting from an overall perspective and working down through levels in increasing detail. In other words, the modules subsidiary to a given module M divide among themselves the responsibility for performing module M's function. For example from Figure 6, the PROPS system's main task can be decomposed into six tasks and then the "update" module can further be decomposed into six smaller functional modules.

Decomposition and modular design technique make the design, construction, and maintenance phases more effective, usable, reliable, and easily, and can help the developer cope with any change in the requirement of the system implementation [15,16].

Phase 5 and 6: Construction and Conversion

These two phases concern coding and debugging the computer programs. The task is to convert the design into a working system. At the construction phase the top-down coding and integration of
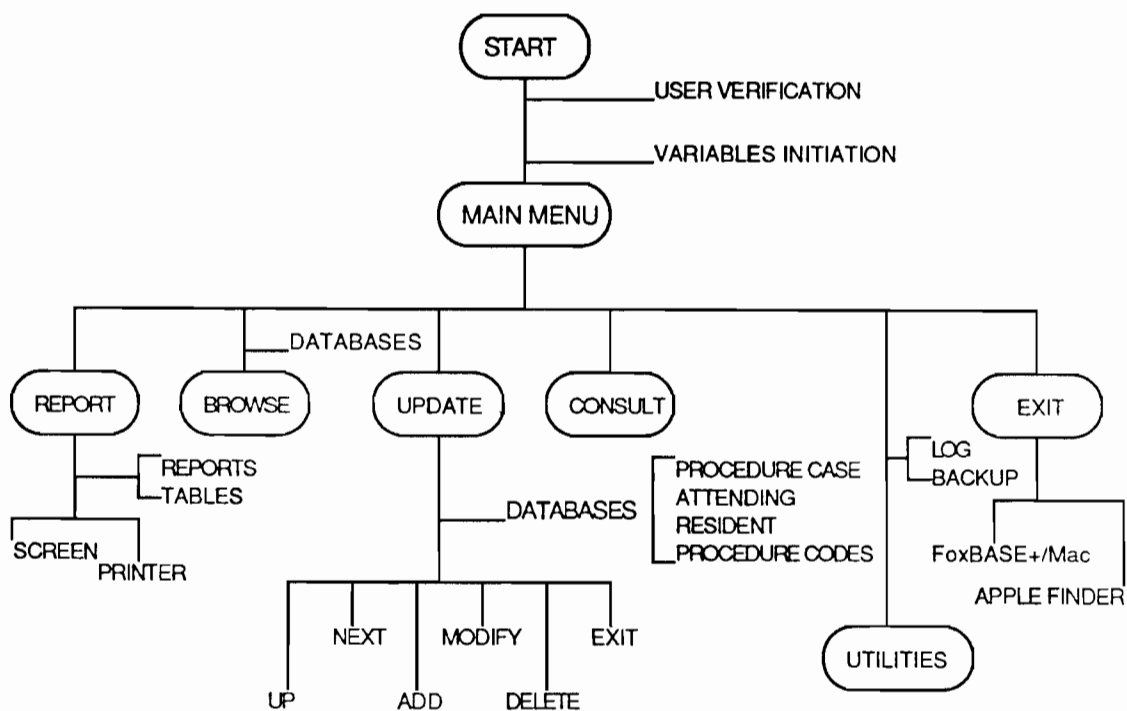
Figure 6. PROPS system's program flowchart

modules developed in the design phase are still used. Also during this phase, more and smaller modules represented by routines were derived from decomposing the bigger ones, more detailed algorithm and small data structures for databases were created. The methods used for coding are modular design and structured programming.

The PROPS system is simply a computer software; therefore, it has to be coded in a programming language. The programming language provided by the FoxBASE+/Mac is fully compatible with dBASE III Plus, a structured high-level programming language. The design methods will be described in detail later.

Phase 7: Maintenance

This is another important phase in any application software development project. The main function of maintenance is to verify and upgrade the operational system as necessary. The PROPS system is currently under evaluation. The results will be described in more detail in the following chapter.

Hardware Requirements

The Apple Macintosh computer was chosen for use with this project because it is a user-friendly tool. A hard disk of 20 megabytes is used to store data and programs. The minimum memory to run this program is one megabyte of RAM. The computer is also connected, through the Appletalk network, to a printer, the work station where the program is developed.

Software Design

FoxBASE+/Mac stores fields and records in a database. Fields and records are the building blocks of any database, from a patient's address book to the whole hospital records. A field is a single piece of information. Thus, in an address book, the area where one person's name appears is a field. A record comprises the fields for one entry. In an address book, one patient's name, address, and phone number are a record. A collection of records forms a database. A database holds information about each field, such as the kind of data it stores (character, numeric, date, logical, memo and picture), as well as the records themselves. The relation among fields, records, and database is shown in Figure 7.

Field Names

Data File:

Address List

Name

Address

City_____State _____Zip _____

Phone
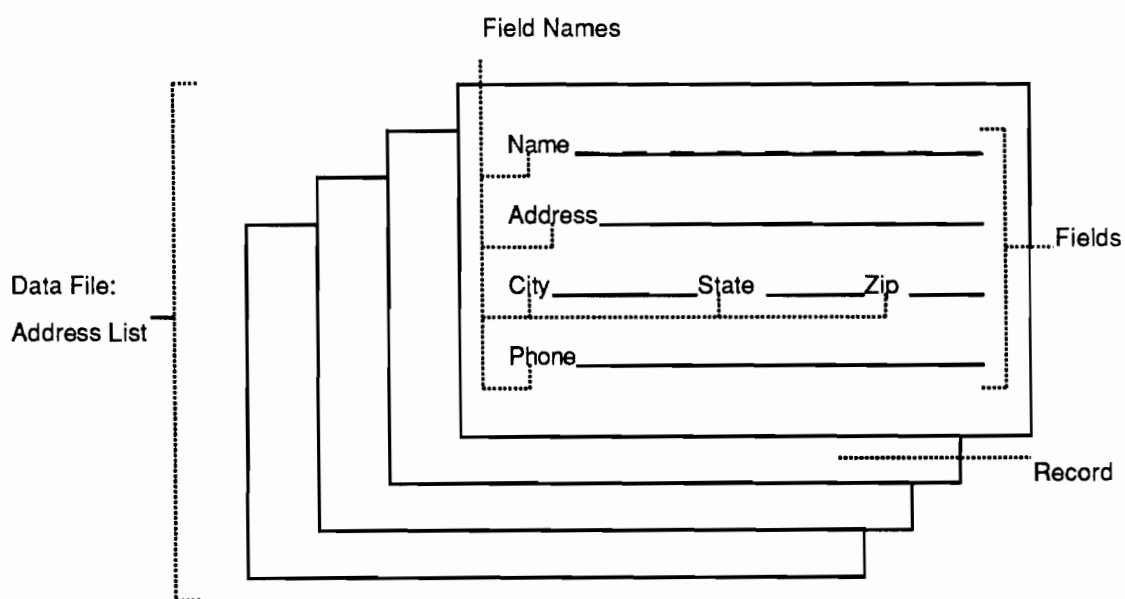
Fields

Record

Figure 7. The relation among fields, records, and database

A database file can hold a lot of varied information. However, if the user thinks of database files as groups of information on specific subjects, the user can see the advantage of linking groups together to serve special purposes. The difference between single files and using related files is a matter of convenience and accuracy. A single file must attempt to solve every need and may not be tailored to a particular task. A related file need only do one job well because it can be linked to other files that suit other jobs.

The relations among different database files can be linked together through the common key in the database. A relation between two files allows them to work in a synchronized way, so they can be maintained and used together. A change in one is reflected in the other, and information can come from both [17,18]. A relational database management system provides the capability to cross-reference between relations. Figure 8 provides an illustration of the relational concept. Cases and patients can be related based on the contents of the patient identification number (PATID field). The patient name for case number 04231 (William Baker) is found by cross-referencing the two tables on the patient number identification.

A computerized database management system lets the users easily control the information stored in their databases. The users can create database structures, enter data into records, keep their records up-to-date and retrieve their data - or information about their data - in any form that they want. The users can even modify the structure of their existing databases as their needs changed.

	CASENO	DATE	PATID	ATTID
001	01234	01/23/89	587-37-5050	0034
002	05455	03/22/89	456-34-0988	0023
003	03200	04/01/88	345-12-4567	0012
004	04231	12/22/88	123-45-6789	0044
005				
006				

	PATID	NAME	SEX	DOB
001	587-37-5050	Steve Allen	M	06/15/56
002	456-34-0988	Mary Adams	F	09/05/45
003	345-12-4567	Francis Frog	M	12/05/47
004	123-45-6789	William Baker	M	06/23/81

Figure 8. The relation between two databases

FoxBASE+/Mac is an exceptionally full-featured database management system. It allows the user to perform all the above tasks very quickly and easily; it is far easier to use than any compatible database product, anywhere. In order to implement the PROPS system, FoxBASE+/Mac is used to create following database files:

CASE.DBF file: a main database file to store the procedure cases information.

CODE.DBF file: a database file to store procedure codes.

ATTENDANT.DBF file: a database file to store attendants' data.

RESIDENT.DBF file: a database file to store residents' data.

SERVICE.DBF file: a database file to store service names.

USER.DBF file: a database file to store authorized users' data.

CODEHELP.DBF file: a database file to store procedure codes for help.

MYHELP.DBF file: a database file to store user manual for help.

TEMP.DBF file: a temporary database file to store the sorted database.

MAJORCODE.DBF file: a database file to store the procedure categories.

The database file structures are listed in the Appendix A.

Once the database structure has been created, the fields can be used in any data entry form. FoxBASE+/Mac allows the simultaneous use of up to 10 database files (allows a maximum of 48 files to be open at once). Each of these can be used independently, as if it were the only file in use. While working on one file, the current record in any of the other files can be read, but not changed. Separated work areas are provided for each database file to be used. These areas are identified as 1 through 10, or alternately, A through J. When FoxBASE+/Mac is entered, the work area is 1. To work with multiple database files, a separate work area must be identified as each database file is opened (USEd). Work areas are selected by means of the SELECT command. Work areas do not have to be selected in order.

The data entry is made independently in each database file. Data entry screens can be drawn in a manner natural and logical to the user. A built-in excellent, full-featured programming language can be used to design intelligent and interactive screens, enabling the user to perform the functions provided by the PROPS system more easily and more accurately. The following program files have been written to support the PROPS system:

MAIN.PRG file: show main menu to control the whole system.

INIT.PRG file: initialize the variables and arrays for the programs.

CASEUPDATE.PRG file: show submenu to update the procedure cases.

CASEADD.PRG file: add a new procedure case into database.

CASEDEL.PRG file: delete an old procedure case from database.

CASEMOD.PRG file: modify an old procedure case in database.

CASEFIND.PRG file: search a procedure case in database.

CODE.PRG file: browse the procedure code.

CODEUPDATE.PRG file: show submenu to update the procedure codes.

CODEADD.PRG file: add a new procedure code into database.

CODEDEL.PRG file: delete an old procedure code from database.

CODEMOD.PRG file: modify an old procedure code in database.

CODEFIND.PRG file: search a procedure code in database.

ATTENDANT.PRG file: browse the attendant data.

ATTUPDATE.PRG file: show submenu to update the attendants' data.

ATTADD.PRG file: add new attendant data into database.

ATTDEL.PRG file: delete old attendant data from database.

ATTMOD.PRG file: modify old attendant data in database.

ATTFIND.PRG file: search attendant data in database.

RESIDENT.PRG file: browse the resident data.

RESUPDATE.PRG file: show submenu to update the residents' data.

RESADD.PRG file: add new resident data into database.

RESDEL.PRG file: delete old resident data from database.

RESMOD.PRG file: modify old resident data in database.

RESFIND.PRG file: search resident data in database.

USERUPDATE.PRG file: show submenu to update the users' data

USERADD.PRG file: add new user data into database.

USERDEL.PRG file: delete old user data from database.

USERMOD.PRG file: modify old user data in database.

REPORT.PRG file: show submenu to select one of the reports.

REPORT0.PRG file: \

REPORT1.PRG file: \

    *   show the different reports selected by user.

    *   /

    *   /

REPORTn.PRG file:

CONSULT.PRG file: show submenu to select one of the consultings.

CONSULT0.PRG file: \

CONSULT1.PRG file: \

    *   show the selected consulting information.

    *   /

    *   /

CONSULTn.PRG file:

BACKUP.PRG file: back up the database for other softwares uses.

LOG.PRG file: create log disk required by RRC.

The program codes for the MAIN.PRG are listed in the Appendix B.

CPT Codes

Current Procedural Terminology is a systematic listing and coding of procedures and services performed by surgeons. Each procedure or service is identified with a five digit code. The use of CPT codes simplifies the reporting of service. With this coding and recording system, the procedure or service rendered by the physician is accurately identified. The CPT codes assigned for the procedures are categorized as follows:

MEDICINE(except Anesthesiology)	90000 to 99999
ANESTHESIOLOGY	00100 to 01999
	99100 to 99140
SURGERY	10000 to 69999
RADIOLOGY (including Nuclear Medicine and Diagnostic Ultrasound)	70000 to 79999
PATHOLOGY and LABORATORY	80000 to 89999

CPT descriptive terms and identifying codes currently serve a wide variety of important functions in the field of medical nomenclature. This system of terminology is the most widely accepted nomenclature for the reporting of physician procedures and services under government and private health insurance programs. CPT is also useful for administrative management purposes such as claims processing and for the development of guidelines for medical care review. The uniform language is likewise applicable to medical education and research by providing a useful basis for local, regional, and national utilization comparisons.

Medical nomenclature and procedural coding is a rapidly changing field as new procedures are developed, old procedures become obsolete, and existing procedures are modified to reflect changes in medical practice. In an effort to keep up with the most current "state-of-the-art," the American Medical Association (AMA) revises and publishes CPT on an annual basis [19].

In order to make the PROPS system calculate and tabulate the reports quickly, other codes just for the procedures in general surgery are assigned to match the CPT codes. The major codes are alphabetically assigned to the following category:

A	SKIN AND SOFT TISSUE	A001	-	A004
B	HEAD AND NECK	B001	-	B009
C	BREAST	C001	-	C007
D	ALIMENTARY TRACT	D101	-	D508
E	ABDOMEN	E101	-	E603
F	VASCULAR	F001	-	F906
G	ENDOCRINE	G101	-	G105
H	HAND	H101	-	H106
I	THORACIC	I101	-	I112
J	PEDIATRIC	J101	-	J116
K	GENITO-URINARY	K101	-	K112
L	GYNECOLOGY	L101	-	L104
M	PLASTIC	M101	-	M107
N	NERVOUS SYSTEM	N101	-	N106
O	ORTHOPAEDICS	O101	-	O105
P	TRAUMA AND EMERGENCY SURGERY	P101	-	P132
Q	ENDOSCOPIC PROCEDURES	Q101	-	Q112
R	OTHER PROCEDURES	R101	-	R107

The detailed codes are listed in the Appendix C. When the users

want to enter the procedure case information into the PROPS system's database, they can choose the assigned codes from the help menu and then the matched CPT codes will be entered automatically.

User Manual

The user can operate the PROPS system based on the system flow shown in the following figure:
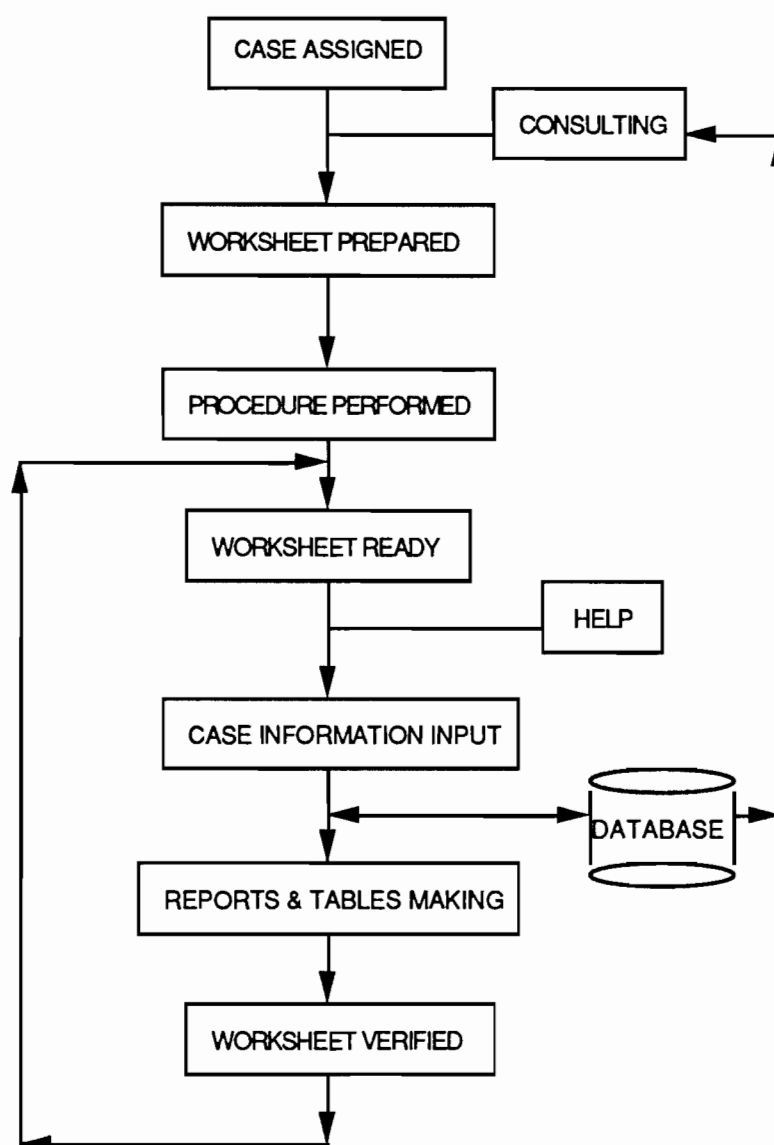
Figure 9. PROPS system's operational flowchart

Like any Macintosh application the PROPS system is a menu driven program and easy to use. It provides the user with nine pull-down menus on the main screen: Apple, File, Edit, Update, Browse, Report, Consult, Utilities, and Exit. The user can drag the pull-down menu from the top of main screen or use the command-key option directly to perform the functions supported by PROPS system. Figure 10 shows the PROPS system's main screen for use to select the option from the menu bar.
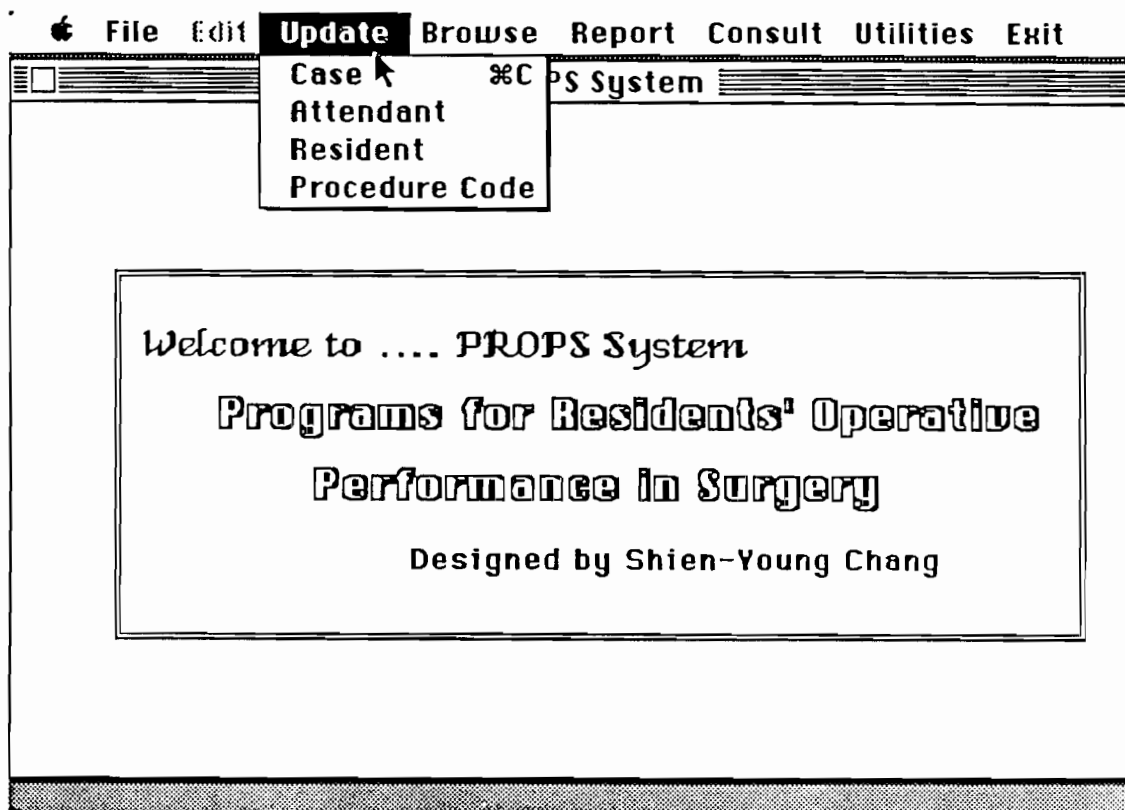
Figure 10. PROPS system's main screen

Before entering the PROPS system, the users will be prompted to enter their social security number (SSN) and password for verification. The users have three chances to key in their SSN and password. The program director can use the "Utilities" menu to add the authorized users' SSN and password into the PROPS system and make them eligible to use this system.

The "Apple" menu contains the commands that allow users to bring forward the on-line help window for help and call additional desktop programs that they installed. The "File" menu contains the commands that allow the user to set up the page and print out the contents shown on the screen. The commands provided by "Edit" menu will be dimmed and none of the commands is available in the PROPS system.

The "Update" menu allows the user to update (add, modify, search, and delete) the databases for procedure case, attendant, resident, and procedure codes. Figure 11 shows the "Update" screen for updating a procedure case.

The "Browse" menu provides the browsing function to allow the users to look up the particular information they want from the databases for procedure code, attendant, resident, and CPT codes. Figure 12 shows the procedure codes for "Vascular," one of the buttons chosen from the category screen shown in Figure 13.

The "Report" menu is the most important part of the PROPS system. It provides report-making function and allows the user to display the reports either on the screen or the printer. Figure 14 shows the report for "Shared Case Analysis" chosen from category screen shown in Figure 15.

```
 ·
  ❦  File  Edit  Update  Browse  Report  Consult  Utilities  Exit
╔══════════════════════════════════════════════════════════════════╗
║                         PROPS System                               ║
╠══════════════════════════════════════════════════════════════════╣
║▓□══════════════════════ Update Case ═══════════════════════════════║
║                                                                    ║
║  CASE/OR #: 12345                    Date of Surgery: 01/01/89      ║
║                                                                    ║
║  Service Code: cardi-thor            Hospital: UUMC                ║
║                                                                    ║
║  Patient Last Name: LASTNAME         First Name: FIRSTNAME         ║
║                                  �                          ║
║  Date of Birth: 01/01/55         ▶    Sex: F                      ║
║                                                                    ║
║  Surgery Type: Emergency             Patient Status: In-Patient    ║
║                                                                    ║
║  Pre-Op Visit: 01/12/88              Location: Dr. Office          ║
║                                                                    ║
║  Attending Surgeon: Edwin C. McGough                              ║
║                                                                    ║
║  Procedures Performed: D021   ____   ____   ____   ____           ║
║                                                                    ║
║  Residents in OR: Alan Muskett_____   RR Code: CS          ║
║                   Steve Merrel_____             SJ          ║
║                   Alan Muskett_____             TA          ║
║                   Ed Raines_____             FA          ║
║                                                                    ║
║   ( Next )  ( Upper )  ( Search )  ( Add )  (Modify)  (Delete)  ( Exit )║
║▓                                                                   ║
╚══════════════════════════════════════════════════════════════════╝
```

Figure 11. The "Update" screen for updating a procedure case

🍎 **File   Edit   Update   Browse   Report   Consult   Utilities   Exit**

```
                        PROPS System
▤□═══════════════════ Browse Code ════════════════════


   Title: VASCULAR


   ┌──────────────────────────────────────────────────┐
   │            Aneurysms                               │
   │   F079      Suprarental aorta                      │
   │   F080      Infrarental aorta                      │
   │   F081      Iliac                                  │
   │   F082      Femoral                                │
   │   F083      Popliteral                     ᕙ        │
   │   F084      Other Major(Specify)                   │
   │             Cerebrovascular                        │
   │   F085      Carotid                                │
   │   F086      Vertebral                              │
   │   F087      Arch branches, direct                  │
   │   F088      Arch branches, cervical bypass         │
   │◁            Peripheral Obstructive                 ▷│
   └──────────────────────────────────────────────────┘
```
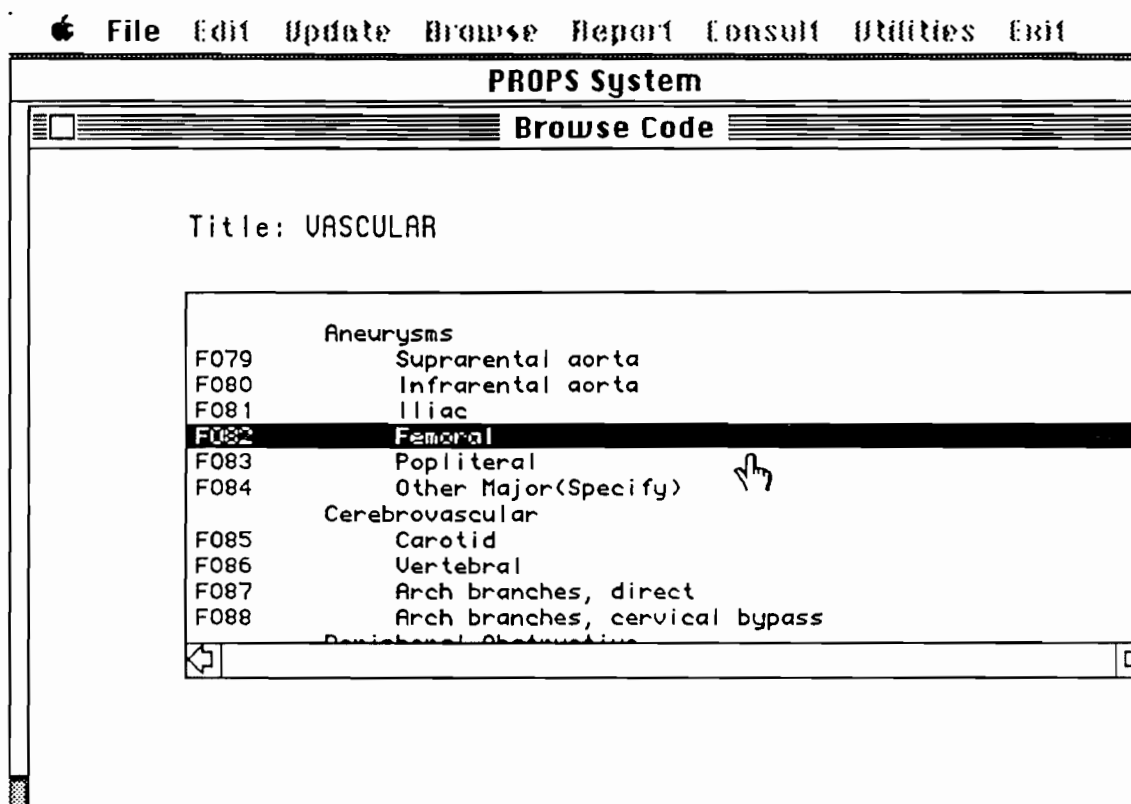
Figure 12. The "Browse" screen shows the procedure codes for "Vascular"

⌘ File Edit Update Browse Report Consult Utilities Exit

PROPS System

Browse Code

Choose one of the following categories

○ SKIN AND SOFT TISSUE   ○ PEDIATRIC

○ HEAD AND NECK   ○ GENITO-UNINARY

○ BREAST   ○ GYNECOLOGY

○ ALIMENTARY TRACT   ○ PLASTIC

○ ABDOMEN   ○ NERVOUS SYSTEM

○ VASCULAR   ○ ORTHOPAEDICS

○ ENDOCRINE   ○ TRAUMA AND EMERGENCY SURGER

○ HAND   ○ ENDOSCOPIC PROCEDURES

○ THORACIC   ○ OTHER PROCEDURES
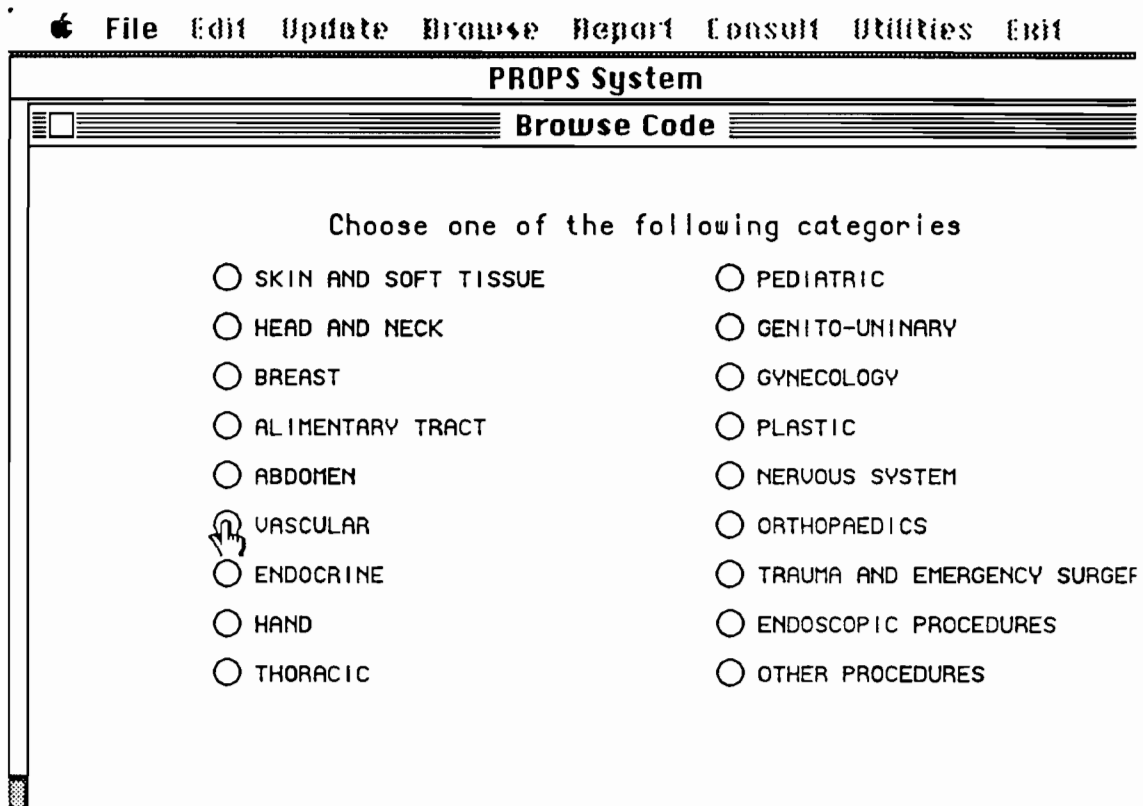
Figure 13. The category screen for the user to select the main procedure

Residency Program Name

Shared Case Analysis

06/01/89 to 07/31/89

Hospital: UUMC

ATTENDING	TTL	MAJ	MIN	INP	OUTP	RES	% RES
Edward W. Nelson	27	27	0	20	7	27	100.00
James M. McGreevy	8	8	0	6	2	8	100.00
Jeffrey R. Saffle	39	35	4	32	7	39	100.00
John Hunter	1	1	0	1	0	1	100.00
John M. Holman	8	7	1	5	3	8	100.00
Kent Thorne	1	1	0	1	0	1	100.00
Merril T. Dayton	3	3	0	3	0	3	100.00
Merril L. Wilson	1	1	0	1	0	1	100.00
Peter F. Lawrence	1	1	0	1	0	1	100.00
William A. Gay, Jr	2	2	0	1	1	2	100.00
TOTALS:	91	86	5	71	20	91	100.00

Figure 14. The report for "Shared Case Analysis"

 File   Edit   Update   Browse   Report   Consult   Utilities   Exit

```
╔══════════════════════════════════════════════════════════════╗
║                       PROPS System                           ║
╠══════════════════════════════════════════════════════════════╣
║ ▤□══════════════════ Show Report ══════════════════════      ║
║                                                              ║
║                   Report Categories                          ║
║                                                              ║
║        0.  Institution Case Summary by Service               ║
║                                                              ║
║        1.  Institution Case Summary by Category              ║
║                                                              ║
║        2.  Shared Case Analysis                              ║
║                                                              ║
║        3.  PGY Level Case Experience as Surgeon by Category   ║
║                                                              ║
║        4.  PGY Level Case Experience as Surgeon by Service    ║
║                                                              ║
║        5.  Resident Rotation Schedule Analysis               ║
║                                                              ║
║        6.  Resident Record                                   ║
║                                                              ║
║        7.  Case Worksheet by Resident                        ║
║                                                              ║
║        8.  Role Discrepancy Summary                          ║
║                                                              ║
║        9.  Institution Case List                             ║
║                                                              ║
║        10. Other Reports     11. Exit to main menu           ║
║     Choose one of the categories (0 - 11) => [ 0 ] ▶          ║
╚══════════════════════════════════════════════════════════════╝
```

Figure 15. The category screen for the user to select the report

The "Consult" menu is the intelligent part of the PROPS system. It provides a consulting function based on the information queried by the user and the data stored in the databases. It allows the user to ask for the priority in scheduling residents to an operation and other analysis results, such as an even case distribution in certain service. This consulting function allows the program director to quickly and easily get the useful information from the PROPS system that helps the director to make a decision more efficiently in order to assign a procedure to a suitable resident.

The "Utilities" menu will provide the Surgical Operative Log disks that must be sent to the RRC annually along with the Chief Resident operative experience reports. The Utilities options will also save procedure case information into a file format that is compatible with other softwares like Excel, allowing user to perform additional analysis above and beyond the scope of that provided by PROPS system.

The "Exit" menu allows the user to exit from the PROPS system to either FoxBASE+/Mac prompt or Apple Finder screen.

Help Window

The PROPS system incorporates a very general, sophisticated help facility designed to provide an on-line reference manual for user. Help may be invoked by pressing Command-H. Two kinds of help windows will be displayed according to the user's activities at that moment. The help window is entered with the topics panel foremost. The users can scroll through the list to find the topic they

want help on, or just type a letter to make the pointer move to the first topic starting with that letter.

In any case, after the users have selected the topic they are interested in, they can either click the "Help" button or double-click the topic to see the help text from that topic. Figure 16 shows the help window for the user to look up the procedure code when he is entering the case information for a procedure performed.

Data Validation

The PROPS system provides not only an intelligent and interactive user interface to avoid input mistakes, but also data validation throughout the system to warn the user and allow for appropriate corrections. The PROPS system uses a variety of screen I/O mechanisms such as menu bar, window, scrollable lists, text edit regions, text buttons, picture buttons, radio buttons, check boxes, and popups, which are provided by the Macintosh.

Figure 17 shows the "Modify" screen for modifying the procedure case information. From the scrollable box, which contains a list of attendants, the user can select one of the attendants. The list can be scrolled with the standard scroll bars (if needed), both vertically and horizontally. Using the star symbol (*), the user can access items in the popup, click and drag through the list displayed over the popup until the item to be selected is highlighted. Release the mouse button and the highlighted item will be displayed on the popup.

Figure 16. The help window for the user to look up the procedure codes
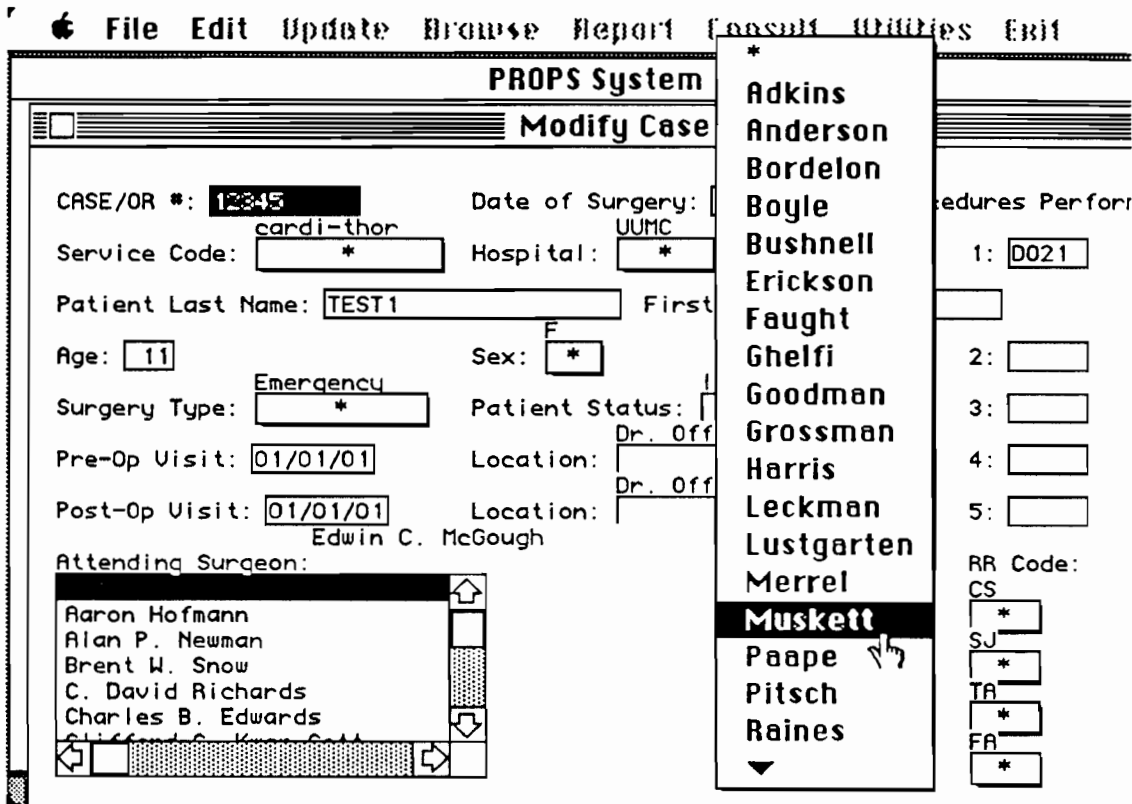
Figure 17. The "Modify" screen for modifying the procedure case information

CHAPTER   III

RESULTS

Summary

There have been problems with the documentation of resident operative experience. Residents have often waited until the final year of residency to begin a tally of their operative experience. With this large degree of procrastination, there is no way to verify whether the operative experience reports turned in by the residents are truly accurate or not. More and more agencies are after these data including the RRC, the AMA and the ABS. Without an accurate picture of the operative activity on each service in each hospital, it is difficult to make hard decisions about resident distribution and modification of rotation.

In order to answer these problems, the PROPS system has been developed to track resident operative experience. This is a data base program that is written in the Macintosh format and is, therefore, very friendly. The program is designed to keep track of all resident activity in the operating room. The program will also generate reports of this operative experience according to resident, service or attending. Specifically of interest to residents, this program will generate the report that residents need to send in to the ABS at the end of the residency. It will also allow the program director and residents to keep track of the resident's educational experience so

that it can be modified if there is a deficiency in that experience. The implementation of this program would greatly enhance the educational aspects of the program. The program will improve the balance of operative experience among the residents and will allow for an objective evaluation of the scheduled rotations.

The success and usefulness of PROPS system depend upon the quality of the data contained within the program. This program has been tested and there is a problem with data entry. Since there are five hospitals and so many services, the best way to ensure accuracy and completeness is to have the residents enter the data. Therefore, we proposed to use the program during the month of June, 1989 as a trial run. This also allowed the residents to evaluate the program.

The PROPS system is installed on a Macintosh computer, which is located in the Chief Resident's office near the Surgical Intensive Care Unit. The program is almost completely self-explanatory and once the residents turn on the program it will help them enter the data with prompt and menu driven instructions. There is a short course to demonstrate the program and instruct all residents to use it. There is also a concise booklet of instructions (see Appendix E) beside the computer for those who are completely unfamiliar with the operation of the Macintosh. For the month of June the residents were required to fill out a worksheet for every operation. At the end of each week or at the end of June, the residents took their worksheets and entered them into the computer. In July the program was tested to see how effective it was at generating the necessary summary reports. A resident evaluation questionnaire was also

distributed. Based upon the recommendations, the program can be adopted and modified.

This is a very important project to the residency program. Not only will it provide objective data to improve the residency experience, but it will also perform a vital service for each resident.

Program Correctness

Based on the users' experience with the PROPS system, the senior-most resident in the operating room is responsible for recording case data on a form similar to the one in the Appendix D and delivering the completed case forms to the residency program coordinator for subsequent entry into the computer.

The residents, by the way, seem to agree that recording cases at the detail level and reviewing the computer entries monthly improve greatly the accuracy of resident operative experience tracking and RRC reporting.

The computer produces a monthly worksheet report, organized by resident, listing each operation the resident attended, the procedures performed at the surgery, and the role the resident was credited with. The residents indicate on the worksheet the procedure they wish to receive RRC credit for, and verify role assignment. The corrected worksheet forms are returned to the residency program coordinator, who makes the required changes in the computer.

The worksheet, then, provides a means by which all residents may audit what has been reported to the computer system on a timely basis and provide feedback to the system.

In all cases, the PROPS system attempts to enforce the RRC rules that dictate the number of residents who can be credited on a case, the acceptable mixture of roles that can be credited and the number of procedures in a case for which a resident may receive RRC credit.

The PROPS system evaluates resident reporting to identify missing data and discrepancies. For example, if the residents have not selected the procedure for which they want RRC credit, or have claimed RRC credit for more than one procedure in a case, or two residents are claiming the role of surgeon (CS or SJ) for the same case, those discrepancies will be included on the monthly Discrepancy Report used by the residency program coordinator and on subsequent monthly worksheet reports that will be distributed to residents.

All the reports and tables produced from the PROPS system are listed and explained in the following section. Note that some of the data shown in the reports and tables is just test data.

Reports

PROPS System Sample Report A

Report A is shown in Table 3. This report includes only cases in which residents participated. Totals shown in the RES column reflect operations where a resident received credit as surgeon in the chief (CS) or junior years (SJ). A separated page is provided for each hospital affiliated with the program. From this report the Residency Program Director can easily summarize the institution cases by service.

Table 3. Institution case summary by service

Residency Program Name
Institution Case Summary By Service
06/01/89 to 07/31/89

Hospital: UUMC

SERVICE	TTL	RES	MAJ	MIN	EMG	ELEC	INP	OUTP*
Cardio-Thoracic Surgery	2	2	2	0	0	2	1	1
Gynecology	0	0	0	0	0	0	0	0
Neurologic Surgery	0	0	0	0	0	0	0	0
Orthopaedic Surgery	0	0	0	0	0	0	0	0
Pediatric Surgery	0	0	0	0	0	0	0	0
Plastic Surgery	0	0	0	0	0	0	0	0
Urology	0	0	0	0	0	0	0	0
Vascular Surgery	1	1	0	1	1	0	1	0
Transplant	24	24	24	0	10	14	16	8
Burn	38	38	34	4	2	36	31	7
Trauma/Emergency	0	0	0	0	0	0	0	0
Head and Neck	0	0	0	0	0	0	0	0
Anesthesia	0	0	0	0	0	0	0	0
General Surgery	26	26	26	0	4	22	22	4
Other	0	0	0	0	0	0	0	0
TOTALS:	91	91	86	5	17	74	71	20

*TTL: Total Cases, RES: Resident, MAJ: Major Procedures, MIN: Minor Procedures
EMG: Emergency, ELEC: Elective, INP: In-Patient, OUTP: Out-Patient

PROPS System Sample Report B

Report B is shown in Table 4. This report includes only cases in which residents participated. Totals shown in RES column reflect operations where a resident received credit as surgeon (CS) or junior years (SJ). A separate page is provided for each hospital affiliated with the program. From this report the Residency Program Director can easily summarize the institution cases by category.

Table 4. Institution case summary by category

Residency Program Name
Institution Case Summary By Category
06/01/89 to 07/31/89

Hospital: PCMC

CATEGORY	TTL	INP	OUTP	ATT	RES	% RES
Skin and Soft Tissue	0	0	0	0	0	0
Head and Neck	1	1	0	0	1	100
Breast	0	0	0	0	0	0
Alimentary Tract	23	19	4	4	19	83
Abdomen	5	5	0	0	5	100
Vascular	3	3	0	0	3	100
Endocrine	0	0	0	0	0	0
Hand	0	0	0	0	0	0
Thoracic	2	2	0	0	2	100
Pediatric	64	63	1	1	63	98
Genito-Urinary	5	5	0	0	5	100
Gynecology	0	0	0	0	0	0
Plastic	0	0	0	0	0	0
Nervous System	0	0	0	0	0	0
Orthopaedics	0	0	0	0	0	0
Trauma and Emergency Surgery	3	2	1	1	2	67
Endoscopic Procedures	1	1	0	0	1	100
Other Procedures	3	3	0	0	3	100
TOTALS:	110	104	6	6	104	94.6

PROPS System Sample Report C

Report C is shown in Table 5. This report includes only cases in which residents participated. Totals shown in RES column reflect operations where a resident received credit as surgeon in the chief (CS) or junior years (SJ). From this report the Residency Program Director can easily understand the percentage of case shared by the residents for any range of dates.

Table 5. Shared case analysis

Residency Program Name

Shared Case Analysis

06/01/89 to 07/31/89

Hospital: UUMC

ATTENDING	TTL	MAJ	MIN	INP	OUTP	RES	% RES
Edward W. Nelson	27	27	0	20	7	27	100.00
James M. McGreevy	8	8	0	6	2	8	100.00
Jeffrey R. Saffle	39	35	4	32	7	39	100.00
John Hunter	1	1	0	1	0	1	100.00
John M. Holman	8	7	1	5	3	8	100.00
Kent Thorne	1	1	0	1	0	1	100.00
Merril T. Dayton	3	3	0	3	0	3	100.00
Merril L. Wilson	1	1	0	1	0	1	100.00
Peter F. Lawrence	1	1	0	1	0	1	100.00
William A. Gay, Jr	2	2	0	1	1	2	100.00
TOTALS:	91	86	5	71	20	91	100.00

PROPS System Sample Report D

Report D is shown in Table 6. This report compares operative experience by category among residents at the same PGY (Post Graduate Year) level. The number shown on the first line for each category is the number of cases in which the resident received credit as surgeon in the chief (CS) or junior years (SJ) within the date range specified.

The second line of data (per category) consists of the total number of cases in which the resident received credit as surgeon (CS) or junior years (SJ) to date.

In the example shown, Dr. Ghelfi performed 29 pediatric cases as surgeon in the period from 06/01/89 thru 07/31/89, and was surgeon for a total of 31 breast cases throughout his entire residency experience. By reviewing all residents at the same PGY level side by side, the Residency Program Director can easily identify uneven case distributions in certain categories or unsatisfactory quantitative performance on the part of residents.

PROPS System Sample Report E

Report E is shown in Table 7. This report compares operative experience by service among residents at the same PGY level. The number shown on the first line for each service is the number of cases in which the resident received credit as surgeon in the chief (CS) or junior years (SJ) within the date range specified.

The second line of data (per service) consists of the total number of cases in which the resident received credit as surgeon (CS) or junior years (SJ) to date.

In the example shown, Dr. Ghelfi performed 41 cases in the pediatric surgery service as surgeon in the period from 06/01/89 thru 07/31/89, and was surgeon for a total of 49 cases in the pediatric surgery service throughout his entire residency experience. By reviewing all residents at the same PGY level side by side, the Residency Program Director can easily identify uneven case distribution in certain services or unsatisfactory quantitative performance on the part of residents.

Table 6. PGY-3 experience as surgeon by category

Residency Program Name
PGY-3 Case Experience as Surgeon by Category
06/01/89 to 07/31/89

CATEGORY	RESIDENT: 1	2	3	4	5	6
Skin and Soft Tissue	0	1	0	0	0	3
	0	1	1	0	0	3
Head and Neck	1	0	0	0	0	0
	1	0	0	0	0	0
Breast	0	0	0	0	0	2
	0	0	0	0	0	2
Alimentary Tract	0	0	0	0	0	3
	0	0	0	0	0	3
Abdomen	0	0	0	0	0	6
	0	0	0	0	0	6
Vascular	0	0	0	0	0	13
	0	0	0	0	0	13
Endocrine	0	0	0	0	0	0
	0	0	0	0	0	0
Hand	0	1	0	0	0	0
	0	1	0	0	0	0
Thoracic	3	0	1	0	0	0
	3	0	1	0	0	0
Pediatric	0	0	29	0	0	0
	0	0	31	0	0	0
Genito-Uninary	0	0	3	0	0	8
	0	0	4	0	0	8
Gynecology	0	0	0	0	0	0
	0	0	0	0	0	0
Plastic	0	6	0	0	0	0
	0	6	0	0	0	0
Nervous System	0	0	0	0	0	0
	0	0	0	0	0	0
Orthopaedics	0	0	0	0	0	0
	0	0	0	0	0	0
Trauma and Emergency Surgery	0	26	1	0	0	0
	0	26	1	0	0	0
TOTAL MAJOR	4	34	46	0	0	35
	4	34	55	0	0	35
Endoscopic Procedures	0	0	0	0	0	0
	0	0	0	0	0	0
Other Procedures	0	1	1	0	0	1
	0	1	1	0	0	1
TOTAL MINOR	0	1	1	0	0	1
	0	1	1	0	0	1

RESIDENT NAME: 1: ADKINS 2: ERICKSON 3: GHELFI 4: PAAPE 5: WHITE 6: WIECHMANN

Table 7. PGY-3 case experience as surgeon by service

Residency Program Name
PGY-3 Case Experience as Surgeon by Service

06/01/89 to 07/31/89

SERVICE	RESIDENT: 1	2	3	4	5	6
Cardio-Thoracic Surgery	5	0	0	0	0	0
	5	0	0	0	0	0
Gynecology	0	0	0	0	0	0
	0	0	0	0	0	0
Neurologic Surgery	0	0	0	0	0	0
	0	0	0	0	0	0
Orthopaedic Surgery	0	0	1	0	0	0
	0	0	1	0	0	0
Pediatric Surgery	0	0	41	0	0	0
	0	0	49	0	0	0
Plastic Surgery	0	0	0	0	0	0
	0	0	0	0	0	0
Urology	0	0	0	0	0	0
	0	0	0	0	0	0
Vascular Surgery	0	0	0	0	0	1
	0	0	0	0	0	1
Transplant	0	0	0	0	0	24
	0	0	0	0	0	24
Burn	0	38	0	0	0	0
	0	38	0	0	0	0
Trauma/Emergency	0	0	0	0	0	0
	0	0	0	0	0	0
Head and Neck	0	0	0	0	0	0
	0	0	0	0	0	0
Anesthesia	0	0	0	0	0	0
	0	0	0	0	0	0
General Surgery	0	0	0	0	0	11
	0	0	0	0	0	11
Other	0	0	0	0	0	0
	0	0	0	0	0	0
Totals	5	38	42	0	0	36
	5	38	50	0	0	36

RESIDENT NAME: 1: ADKINS 2: ERICKSON 3: GHELFI 4: PAAPE 5: WHITE 6: WIECHMANN

PROPS System Sample Report F

The Residency Program Director will be able to enter each resident's rotation schedule into the PROPS system and revise it when necessary.

Report F is shown in Table 8. The rotations are listed in date sequence. A separated line will print on this report for each rotation in the same specialty. Future rotations, if scheduled, will print also.

If a period of time is unaccounted for between two specified rotations, the system will print "***" to alert the Residency Program

Table 8. Resident rotation schedule analysis

Residency Program Name
Resident Rotation Schedule Analysis
R. Little - PGY 3

FROM	THRU	ROTATION	MOS	SRG	TA	HOSPITAL
07/01/84 - 12/31/84		General Surgery	6	68	0	UUMC
01/01/85 - 03/31/85		Gynecology	3	46	0	VAMC
04/01/85 - 06/30/85		Anesthesia	3	52	0	VAMC
07/01/85 - 08/31/85		Vascular Surgery	2	17	0	VAMC
09/01/85 - 12/31/85		Gynecology	3	82	0	VAMC
01/01/86 - 03/31/86		Urology	3	13	0	UUMC
04/01/86 - 06/30/86		Thoracic Surgery	3	24	0	UUMC
07/01/86 - 12/31/86		Plastic Surgery	6	12	0	UUMC
01/01/87 - 06/30/87		Neurologic Surgery	6	0	0	LDSH
07/01/87 - 09/30/87		Transplant	3	0	0	LDSH
10/01/87 - 01/31/88		***				
02/01/88 - 02/28/88		Trauma/Emergency	1	0	0	HCH
03/01/88 - 03/31/88		Orthopaedic Surgery	1	0	0	HCH
04/01/88 - 09/30/88		General Surgery	6	0	0	HCH
10/01/88 - 12/31/88		Burn	3	0	0	HCH
01/01/89 - 03/31/89		Pediatric Surgery	3	0	0	PCMC
04/01/89 - 06/30/89		Other	3	0	0	PCMC

Director to this condition. This report will also list the number of cases for which the resident received credit as surgeon (CS) or as teaching assistant (TA) during each rotation.

The number under SRG represents the total cases in which the resident was credited as surgeon (CS or SJ) during the period covered by the rotation. The number under TA represents the total number of cases in which the resident was credited as a teaching assistant during the period covered by the rotation.

PROPS System Sample Report G

Report G is shown in Figure 18. This report is identical in format to the one normally sent to the RRC each year for all chief surgeons, reflecting their full residency experience.

However, this report can be run on demand of any resident, showing the detail of their RRC operative experience to date.

As an option when running this report, the PROPS system will prepare the surgical operative log diskette that must be sent to the RRC annually along with the resident record report.

PROPS System Sample Report H

A worksheet is to be distributed to each resident monthly. The resident indicates the procedure he or she would like to receive RRC credit for, and returns the form to the residency program coordinator so the computer system can be updated. Report H is shown in Table 9. This report includes only cases in which residents participated. The four columns under the heading --RES RECORD-- represent the total number of procedures performed in each role in the residency

```
04/25/88                    RESIDENT'S RECORD                    Page  2
16:42:33            Residency Review Committee for Surgery

                         Resident SSN: 456-23-8977
                           Mitchell, Jennifer A.
```

	*	SC	SJ	TA	FA
SKIN AND SOFT TISSUES					
Major lymphadenectomies:					
Axillary/groin					
Major excision and repair/graft for skin neoplasms					
Radical excision of soft part tumor					
HEAD AND NECK					
Resections of lesions of:					
Lips					
Tongue					
Floor of mouth/buccal mucosa					
Other major					
Parotidectomy					
Other salivary glands					
Radical neck dissection					
Resection mandible or maxilla					
Tracheostomy					
Other major					
BREAST					
Biopsy					
Simple mastectomy					
Modified radical mastectomy					
Radical mastectomy					
Excisional biopsy or quadrant excision					
with axillary sampling					
Breast reconstruction					
Other major					
ALIMENTARY TRACT					
Esophagus:					
Esophagectomy					
Esophago-gastrectomy					
Antireflux procedure					
Esophageal bypass procedure					
Other operations for esophageal stenosis					
Esophageal diverticulectomy					
Other major					

```
NOTE:  Each operation can be tabulated as only one procedure.  Choose the most
significant component.  Each operation can have only one primary surgeon;
teaching assistants and first assistants can be counted concurrently.

*SC-Surgeon, Chief Yr. SJ-Surgeon, Juniors Yrs. TA-Teaching Asst. FA-First Asst.
```

(Please note that this is just part of the record and the resident will fill out this record based on the report shown in the Figure 19)

Figure 18. Resident record

```
08/22/89                    Residency Program Name
18:21:52                       Resident Record


Resident:   Gordon Tagge

                                                      CS   SJ   TA   FA
-------------------------------------------------------------------------
B003 Floor of mouth/buccal mucosa                      1    0    0    0
D103 Antireflux procedure                              3    0    0    0
D201 Gastrostomy(All Types)                            2    0    0    0
D301 Enterolysis                                       3    0    0    0
D307 Other Major(Specify)                              1    0    0    0
D402 Colostomy(All types)                              2    0    0    0
E302 Cholecystostomy with or without operative cholangi 0   0    0    1
E304 Choledochoenteric anastomosis                     0    0    0    1
E602 Ventral                                           0    0    0    1
F804 Insertion of peritoneo-venous or indwelling venous 3   0    0    0
I105 Lobectomy or segmental resection of lung          1    0    0    0
J101 Herniorraphy, inguinal and umbilical             12    0    0    2
J102 Repair branchial cleft anomalies/thyroglossal duct 1   0    0    1
J103 Repair deformity in chest wall                    1    0    0    0
J104 Repair diaphragmatic hernia                       1    0    0    0
J105 Repair esophageal atresia/TEF                     0    0    0    2
J107 Repair pyloric stenosis                           1    0    0    0
J109 Procedures for meconium ileus/NEC                 1    0    0    0
J110 Difinitive operation for Hirschsprung's/imperforat 1   0    0    3
J111 Excision Wilm's tumor/neuroblastoma               1    0    0    1
J115 Orchiopexy                                        0    0    0    2
K102 Circumcision                                      1    0    0    1
R101 Removal of skin moles, small tumors, etc.         2    0    0    0
-------------------------------------------------------------------------
```

Figure 19:   Resident record generated by PROPS

Table 9. Case worksheet by resident

Residency Program Name
Case Worksheet by Resident

Resident: Chris Tsoi

DATE	PATIENT	CASE NO	RRC	CREDIT?	CS	SJ	TA	FA
06/02/89	TREDENICK, W	060289CT	SJ	___				
Lobectomy or segmental resection of lung					0	1	0	0
06/02/89	MAYNE, K.	060289CT2	SJ	___				
Removal of skin moles, small tumors, etc.					0	1	0	0
06/04/89	WILLIAMS, B.	060489CT	SJ	___				
Gastrostomy (All Types)					0	2	0	0
Choledochoenteric anastomosis					0	1	0	0
Exploratory laporotomy exclusive of trauma					0	1	0	0
06/05/89	LITTLEDYKE, F.	060589CT	SJ	___				
Gastrostomy (All Types)					0	2	0	0
06/06/89	FRANSON, F.	060689CT	SJ	___				
Inguinal-femoral (all types)					0	1	0	0

(--- RES RECORD --- spans CS SJ TA FA)

program to date by that resident. It is intended to assist the residents with the selection process by advising the residents of their current RRC totals for each procedure that was performed in the case.

PROPS System Sample Report I

Report I is shown in Table 10. This report includes only cases in which residents participated. The role abbreviations signify the following: CS - Surgeon, Chief Year, SJ - Surgeon, Junior Year, TA - Teaching Assistant, FA - First Assistant.

For example, if two residents claim the role of surgeon (CS or SJ) for the same case, the case and specified role will be printed.

Table 10. Role discrepancy summary

| | Residency Program Name | | | |
| | Role Discrepancy Summary | | | |
DATE	PATIENT	ATTENDING	RESIDENT	R R CODE
06/03/89	Phillips, D.	McMann, J.	James, A.	CS
			Waller, F.	SJ
06/03/89	Johnston, A.	Harris, A.	Peter, B.	TA
			Waller, F.	TA
06/12/89	Farmer, C.	Agrams, A.	Norman, A.	SJ
			Marx, G.	SJ
06/15/89	Semerdjian, L.	Smith, D.	Ruttan, M.	CS
			Hardy, T.	TA

Role discrepancies that can exist are:

1. Two residents claim the role of surgeon (CS or SJ) in the same case.

2. Two residents claim the role of teaching assistant (TA) in the same case.

3. One resident claims the role of chief surgeon (CS) and one resident claims the role of teaching assistant in the same case.

PROPS System Sample Report J

Report J is shown in Figure 20. This report includes only cases in which residents participated. It lists the attending surgeon, the residents who were present and their roles, and the procedures performed. Extra space is provided for writing in related information or complications. This report can be run for any range of dates, and for one or more institutions.

```
                    Residency Program Name
                    Institution Case List
                    06/01/89 TO 07/31/89


Hospital:  HCH

        DATE      PATIENT        CASE #        ATTENDING      RESIDENT
    --------------------------------------------------------------------
    06/02/89    MAYNE, K.          0602CT2   Maunsel B. Pearce
                                                          Chris Tsoi
    Removal of skin moles, small tumors, etc._____

    06/02/89    TREDENICK, W.      060289CT  Maunsel B. Pearce
                                                          Chris Tsoi
    Lobectomy or segmental resection of lung_____

    06/04/89    WILLIAMS, B.       060489CT
                                                          Chris Tsoi
    Gastrostomy(All Types)_____
    Choledochoenteric anastomosis_____
    Exploratory laparotomy exclusive of trauma_____

    06/05/89    LITTLEDYKE, F.     060589CT  Maunsel B. Pearce
                                                          Chris Tsoi
    Gastrostomy(All Types)_____

    06/06/89    FRANSON, F.        060689CT  E. Douglas Slawson
                                                          Chris Tsoi
    Inguinal-femoral(all types)_____

    --------------------------------------------------------------------
```

Figure 20. Institution case list

CHAPTER IV

DISCUSSION

User Questionnaire Analysis

All users that participated in the residency program during the one-month study period received questionnaires regarding the utility, helpfulness, and ease of use of the PROPS system. All residents, staff and office personnel that used the system were requested to complete questionnaires. There are 13 questions in all (see Appendix F). A continuous scale was employed for scoring most questions in order to facilitate the approximation of the average impression of the entire group of system users.

A total of 16 questionnaires was collected from all the registered users. Of the 16 questionnaires, 12 were completed by residents, 1 by attending, 1 by a research associate, and 2 by programmers (see Table 11.)

Answers to 8 of the 13 questions were scaled so that they could take any value between 1 and 9, where an answer of 1 indicated a low or negative response, and 9 implied a high or positive response. Three subsequent questions were left blank to fill the answer, and the last was a request for open comment. An average of all users' scores to questions with scaled answers was used to determine the mean response of the entire user group.

Table 11. Reviews of questionable appropriateness

User Questionnaires Results				(June 1989)
Question	Score			N
	Average	Max	Min	
1. What is the user professional status?				
Attending				1
Resident				1 2
Programmer				2
Research Associate				1
2. How many cases performed?				4 0 4
3. How many cases input into PROPS?				2 3 7
4. How often did you use PROPS?	2.07	1	1 0	1 5
5. How easy to use PROPS?	7.06	2	0	1 6
6. How is the performance of PROPS?	6.31	1	0	1 6
7. How is the accuracy of results provided in PROPS?	7.67	3	0	1 2
8. How useful or informative are the results provided in PROPS?	6.87	2	0	1 5
9. How useful is PROPS?	5.77	2	0	1 3
10. How often is PROPS available?	6.67	0	0	6
11. How has PROPS affected productivity?	5.7	0	0	1 0
12. Do you like to use PROPS during residency program?		1 0	3	13

Max = Number of users giving response to Score 9
Min = Number of users giving response to Score 1
N = Number of users giving particular response

Most respondents considered themselves to be infrequent users of the program because they were allowed to input all the procedure cases performed in June at one time. However, all the residents still like to use this program. Only the Residency Program Director will use this program frequently to keep track of the operative experience of residents.

The respondents rated the program highly with regard to the ease of use, speed of performance, accuracy of results, usefulness, and availability.

Responses to the request for open comments tend to be of three basic types. The first comment type indicated that users considered the program to be very user-friendly. The second type of comment indicated that the program is generally helpful. The third type reflected a desire for data entry into the program by the residency program coordinator in the near future.

Limitations

Unfortunately, as with any program where compromises must be made, there are also limitations. There are limitations of the PROPS system:

1. Since each procedure is added into the PROPS system by case and not by resident, only the resident who received the highest RR code (CS > SJ > TA > FA) can add the case for the other residents who participated. The PROPS system still can not automatically detect the error if the same cases were added by a different resident, causing incorrect reports to be generated.

2. The special codes assigned to each procedure name are used as index keys in the data base. In order to avoid typing mistakes when the users type the procedure name directly, they need to find the special code for each procedure performed and record it on a worksheet before they add the procedure case. The way to find the special code is by looking at the table attached to the worksheet or from "Browse" menu on the PROPS system. An easier way is to press Command-H simultaneously to call for the Help Menu when the user is updating the procedure case.

Conclusion

The PROPS system has proven to satisfy the Department of Surgery's need for quality assurance record keeping and report making. The PROPS system will form the basis for a comprehensive evaluation system to evaluate the residents' performance at each level of progression through their training program.

There is no single technique that permits comprehensive evaluation of resident performance. Medical educators continue to be confounded by the breadth of skills to be taught and can but sample here and there in the hope of directing learning, shaping programs and certifying graduates. The evaluation should not stand in isolation but rather as one of three continuously interacting elements of a sound educational enterprise, namely: clear objectives, a curriculum or set of experiences designed to achieve those objectives, and then an evaluation process to see whether the objectives have been met [20,21].

The PROPS System in the Future

Expert System

Expert systems have been available on large machines since 1970s, but now they are moving to microcomputers. Artificial intelligence (AI) technology is being applied to create expert, or knowledge-based, systems. An expert system is one in which the knowledge of experts and the rules for applying that knowledge are stored, to be accessed later for use in decision making. Expert systems examine a problem, define and assess solutions to it, and suggest which solutions are better.

There are several expert systems in the field of medical diagnosis like HELP and ILIAD [22,23]. Given the patient's symptoms, the computer asks some intelligent questions to fill in any ill-defined areas, then presents one or more possible diagnoses. It may even suggest tests the doctor should perform in order to be sure. The point is to simplify, and perhaps make more reliable, the narrowing of a physician's choice for a diagnosis.

The cost of an expert system can usually be justified in situations where there are few experts but great demand. People trained in medical informatics will be increasingly called upon to design expert systems and to integrate them into existing systems. The PROPS system provides a base for applying AI technology to development of an expert system to advise Residency Program Directors as they manage case mix assignments in a large training program involving several hospitals.

Decision Support System

A decision support system is a management information system that specifically helps people to make better decisions. It provides existing data on request, analyzes that data, and makes predictions based on the data. It thus functions more as an analytical tool than as a mere reporting tool, and it is future-oriented rather than past-oriented. The key to a successful decision support system lies in how well it is integrated with the various databases it uses [14].

The experience with PROPS system using a relational DBMS can be extended to a larger environment where information is gathered from multiple sources and where real-time decisions need to be made. The computer center in the operating room is a good example of such an environment where different categories of individuals need and generate information and make decisions related to administration, education, research, and management. The PROPS system has the potential to expand to be a decision support system that would help the staff in the operating room to make decisions more easily about scheduling, supplying, and reporting. A project to expand the PROPS system to meet requirements of the operating room is currently being analyzed.

APPENDIX A

DATABASE STRUCTURE LIST

Structure for database:CASE.DBF
Number of data records:5
Date of last update:04/04/89

Field	Field Name	Type	Width	Dec
1	caseno	Character	10	
2	date	Date	8	
3	code	Character	10	
4	lastname	Character	15	
5	firstname	Character	15	
6	dob	Date	8	
7	sex	Character	1	
8	type	Character	10	
9	status	Character	12	
10	hospital	Character	20	
11	attendant	Character	30	
12	pre	Date	8	
13	location	Character	20	
14	proc1	Character	5	
15	proc2	Character	5	
16	proc3	Character	5	
17	proc4	Character	5	
18	proc5	Character	5	
19	resident1	Character	30	
20	rr1	Character	2	
21	resident2	Character	30	
22	rr2	Character	2	
23	resident3	Character	30	
24	rr3	Character	2	
25	resident4	Character	30	
26	rr4	Character	2	
	** Total **	321		

Structure for database:CODE.DBF
Number of data records:295
Date of last update:03/09/89

Field	Field Name	Type	Width	Dec
1	code	Character	4	
2	procedure	Character	200	
	** Total **	205		

```
Structure for database:ATTENDANT.DBF
Number  of  data  records:58
Date  of  last  update:02/03/89
        Field  Field  Name        Type        Width        Dec
        1       name            Character   3 0
        2       hospital        Character   1 0 0
        3       hospinit        Character   4
        4       major           Character   5 0
        ** Total **  1 8 5


Structure  for  database:RESIDENT.DBF
Number  of  data  records:38
Date  of  last  update:04/06/89
        Field  Field  Name        Type        Width        Dec
        1       name            Character   3 0
        2       firstname       Character   1 5
        3       lastname        Character   1 5
        4       pgy             Character   1
        ** Total **  6 2


Structure  for  database:SERVICE.DBF
Number  of  data  records:15
Date  of  last  update:01/13/89
        Field  Field  Name        Type        Width        Dec
        1       service         Character   1 0
        2       sername         Character   2 5
        ** Total **  3 6


Structure  for  database:USER.DBF
Number  of  data  records:2
Date  of  last  update:03/06/89
        Field  Field  Name        Type        Width        Dec
        1       ssn             Character   1 1
        2       password        Character   4
        ** Total **  1 6
```

Structure for database:HELP.DBF
Number of data records:19
Date of last update:03/02/89

Field	Field Name	Type	Width	Dec
1	topic	Character	30	
2	helptext	Memo	10	
3	getfield	Character	10	
4	progname	Character	10	
** Total **	61			

Structure for database:MYHELP.DBF
Number of data records:8
Date of last update:03/02/89

Field	Field Name	Type	Width	Dec
1	topic	Character	30	
2	text	Memo	10	
3	getfield	Character	10	
4	progname	Character	10	
** Total **	61			

Structure for database:TEMP.DBF
Number of data records:38
Date of last update:04/06/89

Field	Field Name	Type	Width	Dec
1	name	Character	30	
2	firstname	Character	15	
3	lastname	Character	15	
4	pgy	Character	1	
** Total **	62			

Structure for database:MAJORCODE.DBF
Number of data records:18
Date of last update:01/24/89

Field	Field Name	Type	Width	Dec
1	code	Character	4	
2	procedure	Character	30	
** Total **	35			

APPENDIX B

PROGRAM CODES FOR MAIN.PRG

```
* MAIN PROGRAM FOR PROPS PROJECT
SET TALK OFF
SET SAFETY OFF
SET DEFAULT TO "Shien-Young:Fox:PROPS"
CLOSE DATABASES
SET HELP TO MYHELP
SET PROCEDURE TO MAIN
SCREEN 0 OFF
SCREEN 1 TYPE 4 LOCK HEADING "PROPS System" FONT;
      "GENEVA",12+256 TOP
CLEAR

CLEAR ALL

SET ESCAPE OFF
MSSN = SPACE(11)
MPASSWORD = SPACE(4)
N = 1
DO WHILE N < 4
 CLEAR
 @04,05 TO 12,53 DOUBLE
 @06,10 SAY "Please key in your SSN and PASSWORD:" FONT ,16
 @08,15 SAY "SSN:" GET MSSN PICT "999-99-9999" FONT ,9 COLOR;
      "N/N"
 @08,30 say "PASSWORD:" GET MPASSWORD PICT "9999" FONT ,9;
      COLOR "N/N"
 READ
 USE USER
 SET EXACT ON
 LOCATE FOR MSSN = SSN .AND. MPASSWORD = PASSWORD
 SET EXACT OFF
 IF .NOT. FOUND()
   @06,10 CLEAR TO 08,50
   @07,10 SAY "Invalid SSN or PASSWORD, try again" FONT;
      "VENICE",16
   @09,15 SAY "Press any key to continue...." FONT "VENICE",12
  SET CONSOLE OFF
   WAIT
  SET CONSOLE ON
  N = N + 1
 ELSE
   EXIT
 ENDIF
```

```
ENDDO
IF N > 3
  @06,10 CLEAR TO 09,50
   @08,06 SAY "Invalid user, please check with coordinator";
   FONT "VENICE",16
 CLOSE PROCEDURE
 SET TALK ON
 SET SAFETY ON
 SET HELP TO
 SET TOPIC TO
 SCREEN 1 DELE
 SCREEN 2 DELE
 SCREEN 3 DELE
 SCREEN FONT "MONAGO",9
 RETURN
ENDIF
SET ESCAPE ON

CLEAR
@8,17 SAY "Initializing...Please wait" FONT "VENICE",16
DO INIT

DIMENSION BARTOP(6)
DIMENSION  BAR1(6),BAR2(6),BAR3(6),BAR4(6),BAR5(6),BAR6(6)

BARTOP(1) = "Update"
BARTOP(2) = "Browse"
BARTOP(3) = "Report"
BARTOP(4) = "Consult"
BARTOP(5) = "Utilities"
BARTOP(6) = "Exit"

BAR1(1) = "Case/C"
BAR1(2) = "Attendant"
BAR1(3) = "Resident"
BAR1(4) = "Procedure Code"

BAR2(1) = "Procedure Code"
BAR2(2) = "Attendant"
BAR2(3) = "Resident"
BAR2(4) = "CPT Code"

BAR3(1) = "To Screen/S"
```

```
BAR3(2) = "To Printer/P"

BAR4(1) = "Priority"
BAR4(2) = "Rotation"

BAR5(1) = "Log/L"
BAR5(2) = "Backup/B"
BAR5(3) = "User Password"

BAR6(1) = "To Fox System/E<O"
BAR6(2) = "To Apple Finder/Q"

MENU BAR BARTOP,6
MENU 1,BAR1,4
MENU 2,BAR2,4
MENU 3,BAR3,2
MENU 4,BAR4,2
MENU 5,BAR5,3
MENU 6,BAR6,2

ON MENU DO MENUS WITH MENU(0), MENU(1)

DO WHILE .T.
 CLEAR
 SCREEN 1 TOP
 END = 0
 @ 4,04 TO 14,55 DOUBLE
 @ 6,06 SAY "Welcome to .... PROPS System" FONT "VENICE", 16
  @ 8,10 SAY "Programs for Residents' Operative" FONT;
      "CHICAGO",16+2048
  @ 10,15 SAY "Performance in Surgery" FONT "CHICAGO",16+2048
  @12,20 SAY "Designed by Shien-Young Chang"
 SET CONSOLE OFF
  WAIT
 SET CONSOLE ON
 IF END = 1 .OR. END = 2
  CLEAR
   @06,08 SAY "Thank you for using PROPS!" FONT "VENICE",24
  @10,22 SAY "GOOD-BYE" FONT "VENICE" ,24
  IF END = 1
    EXIT
  ELSE
     ALERT CAUTION 3 "Are you sure to exit?" AT 180,90 TO T
```

```
    IF T = 1
      QUIT
    ELSE
      LOOP
    ENDIF
   ENDIF
  ENDIF
 ENDIF
ENDDO
CLOSE DATABASES
CLOSE PROCEDURE
SET TALK ON
SET SAFETY ON
SET HELP TO
SET TOPIC TO
SCREEN 1 DELE
SCREEN 2 DELE
SCREEN 3 DELE
SCREEN FONT "MONAGO",9
RETURN

PROCEDURE MENUS
PARAMETER ROW,COL
SET CONSOLE ON
MENU OFF 1
MENU OFF 2
MENU OFF 3
MENU OFF 4
MENU OFF 5
MENU OFF 6
SCREEN 2 TYPE 4 LOCK AT 60,10 TOP
DO CASE
  CASE ROW = 1 .AND. COL = 1
    SET HELP TO HELP
    DO CASEUPDATE
    SET HELP TO MYHELP
  CASE ROW = 1 .AND. COL = 2
    DO ATTUPDATE
  CASE ROW = 1 .AND. COL = 3
    DO RESUPDATE
  CASE ROW = 1 .AND. COL = 4
    DO CODEUPDATE
  CASE ROW = 2 .AND. COL = 1
    DO CODE
```

```
   CASE ROW = 2 .AND. COL = 2
     DO ATTENDANT
   CASE ROW = 2 .AND. COL = 3
     DO RESIDENT
   CASE ROW = 2 .AND. COL = 4
     DO CPT
   CASE ROW = 3
     DO REPORT
   CASE ROW = 4
     DO CONSULT
   CASE ROW = 5 .AND. COL =1
     DO LOG
   CASE ROW = 5 .AND. COL = 2
     DO BACKUP
   CASE ROW = 5 .AND. COL = 3
     DO USERUPDATE
   CASE ROW = 6 .AND. (COL = 1 .OR. COL = 2)
     IF COL = 1
       END = 1
     ELSE
       END = 2
     ENDIF
   OTHERWISE
     CLEAR
     SCREEN HEADING "Waiting"
     @06,10 TO 16,65 DOUBLE
       @10,15 SAY "Take it easy! I am still designing." FONT ,12+256
       @12,25 SAY "Press any key to continue...."
     SET CONSOLE OFF
       WAIT
     SET CONSOLE ON
ENDCASE
CLEAR
SCREEN 2 OFF
MENU BAR BARTOP,6
MENU 1,BAR1,4
MENU 2,BAR2,4
MENU 3,BAR3,2
MENU 4,BAR4,2
MENU 5,BAR5,3
MENU 6,BAR6,2
SCREEN 1
RETURN
```

APPENDIX C

PROCEDURE CODES LIST

A		SKIN AND SOFT TISSUE
A001	B	Major lymphadenectomies
A002	C	Major excision and repair/graft for skin neoplasms
A003	B	Radical excision of soft part tumor
A004	C	Other Major

B		HEAD AND NECK
B1		Resections of Lesions of:
B001	C	Lips
B002	C	Tongue
B003	C	Floor of mouth/buccal mucosa
B004	C	Other major salivary glands
B005	B	Parotidectomy
B006	B	Radical neck dissection
B007	B	Resection mandible or maxilla
B008	A	Tracheostomy
B009	C	Other Major(Specify)

C		BREAST
C001	A	Biopsy
C002	A	Simple mastectomy
C003	A	Modified radical mastectomy
C004	C	Radical mastectomy
C005	A	Excisional biopsy or quadrant excision with axillary sampling
C006	C	Breast reconstruction
C007	C	Other Major(Specify)

D		ALIMENTARY TRACT
D1		Esophagus
D101	B	Esophagectomy
D102	B	Esophago-gastrectomy
D103	A	Antireflux procedure
D104	B	Esophageal bypass procedure
D105	B	Repair of perforation (esophageal disease)
D106	C	Other operations for esophageal stenosis
D107	C	Esophageal diverticulectomy
D108	C	Other Major(Specify)

D2		Stomach
D201	A	Gastrostomy(All Types)
D202	A	Gastric resection, partial
D203	B	Gastric resection, total
D204	A	Vagotomy, truncal/selective with drainage or resection

D205	A	Repair of perforation (gastric disease)
D206	B	Proximal gastric vagotomy, highly selective
D207	C	Gastric reduction for morbid obesity(All Types)
D208	C	Other Major(Specify)

D3		Small Intestine
D301	A	Enterolysis
D302	A	Enterectomy
D303	A	Repair of perforation (duodenal disease)
D304	A	Repair of perforation (small bowel disease)
D305	A	Ileostomy(not associated with colectomy)
D306	A	Diverticulectomy
D307	C	Other Major(Specify)

D4		Large Intestine
D401	A	Appendectomy
D402	A	Colostomy(All types)
D403	A	Colostomy closure
D404	A	Colostomy, partial
D405	B	Colostomy, total or subtotal with ileostomy
D406	B	Colectomy with ileo-anal pull-through
D407	B	Colectomy with continent reconstruction
D408	B	Abdomino-perineal resection
D409	A	Repair of perforation (colon disease)
D410	C	Other Major(Specify)

D5		Ano-rectal
D501	A	Hemorrhoidectomy, all types
D502	C	Sphincterotomy/Sphicteroplasty
D503	A	Drainage procedures for anorectal abscess
D504	A	Repair of anorectal fistula
D505	C	Other operations for anal incontinence
D506	C	Repair of rectal prolapse
D507	A	Pilonidal cystectomy
D508	C	Other Major

E		ABDOMEN
E1		General
E101	C	Exploratory laparotomy exclusive of trauma
E102	A	Drainage intra-abdominal abscess
E103	B	Pelvic exenteration
E104	B	Major retroperitoneal/pelvic lymph node dissection
E105	C	Other Major

E2   Liver
E201 B   Lobectomy or segmentectomy
E202 A   Wedge resection or open biopsy
E203 B   Liver transplantation
E204 C   Drainage, liver abscess
E205 C   Other Major(Specify)

E3   Biliary Tract
E301 C   Cholecystostomy
E302 A   Cholecystostomy with or without operative cholangiograms
E303 A   Comman bile duct exploration
E304 B   Choledochoenteric anastomosis
E305 B   Sphincteroplasty (Oddi)
E306 C   Other Major(Specify)

E4   Pancreas
E401 A   Pancreatic abscess, drainage
E402 B   Resection, distal
E403 B   Resection, Whipple
E404 B   Resection, total
E405 B   Pancreas transplantation
E406 A   Pseudocyst drainage(all types)
E407 B   Pancreaticojejunostomy
E408 C   Other Major(Specify)

E5   Spleen
E501 A   Splenectomy for disease
E502 C   Staging laparotomy
E503 C   Other Major

E6   Hernia Repair of
E601 A   Inguinal-femoral(all types)
E602 A   Ventral
E603 A   Repair of other hernias

F   VASCULAR
F1   Aneurysms Repair of
F001 B   Infrarenal aorta, emergent (ruptured)
F002 B   Infrarenal aorta, elective
F003 B   Suprarenal aorta, emergent (ruptured)
F004 B   Suprarenal aorta, elective
F005 B   Iliac, emergent (ruptured)

F006	B	Iliac, elective
F007	B	Femoral, emergent (ruptured)
F008	A	Femoral, elective
F009	B	Popliteal, emergent (ruptured)
F010	A	Popliteal, elective
F011	C	Other Major(Specify)

F2		Cerebrovascular
F101	A	Carotid endarterectomy, bypass, or repair
F102	C	Vertebral endarterectomy, bypass, or repair
F103	B	Aortic arch branches, direct
F104	C	Aortic arch branches, cervical bypass
F105	C	Other Major

F3		Peripheral Obstructive
F201	B	Aorta-Iliac-Femoral endarterectomy, bypass, or repair
F202	A	Femoral-popliteal-tibial endarterectomy, bypass, or repair
F203	C	Other Major(Specify)

F4		Intra-abdominal Obstructive
F301	B	Celiac/superior mesenteric axis endarterectomy, bypass, or repair
F302	B	Renal artery endarterectomy, bypass, or repair
F303	C	Other Major(Specify)

F5		Upper Extremity (Auxillary, brachial)
F401	A	Direct repair or graft(not vascular access)
F402	C	Other Major

F6		Extra-cativity Bypass Procedures
F501	A	Axillary-femoral
F502	A	Femoral-femoral
F503	C	Other Major(Specify)

F7		Portal Decompression Procedures
F601	B	Portacaval shunt
F602	B	Splenorenal shunt, proximal or distal
F603	B	Mesocaval shunt
F604	C	Other Major(Specify)

F8		Miscellaneous Vascular
F701	A	Varicose vein, stripping or ligation

F9		Embolectomy or thrombectomy

F702　A　　　　　　　Arterial or graft
F703　C　　　　　　　Venous
F704　A　　　　　Vena caval interruption/prosthesis insertion
F705　C　　　　Operations for venous ulceration
F706　C　　　　Sympathectomy, cervical or lumbar
F707　C　　　　Transluminal angioplasty(not counted elsewhere)
F708　C　　　　Operation for lymphedema
F709　C　　　Other Major(Specify)

F10　　　　　Vascular access procedures
F801　A　　　　Shunt
F802　A　　　　Fistula
F803　A　　　　Graft
F804　A　　　Insertion of peritoneo-venous or indwelling venous catheter
　　　　　　　　　(long-term venous access)
F805　C　　　Other Major

F11　　　　Amputations related to vascular
F901　A　　　　Digit
F902　A　　　　Transmetatarsal
F903　A　　　Below knee
F904　A　　　　Above knee
F905　C　　　Arm
F906　C　　　Other Major(Specify)

G　　ENDOCRINE
G101　A　　　　Throidectomy, partial or total
G102　A　　　　Parathyroidectomy
G103　B　　　Adrenalectomy
G104　B　　　Pancreatic endocrine procedure
G105　C　　　Other Major(Specify)

H　　HAND
H101　C　　　Soft tissue repair or graft
H102　C　　　Tendon repair or transfer
H103　C　　Nerve repair
H104　C　　Vascular repair
H105　B　　　Replantation of digit or hand
H106　C　　Other Major

I　　THORACIC
I101　C　　　Exploratory thoracotomy
I102　B　　　Repair diaphragmatic hernia

I103	B	Excision mediastinal tumor
I104	B	Pneumonectomy
I105	B	Lobectomy or segmental resection of lung
I106	A	Wedge resection of lung
I107	C	Thoracic outlet decompression procedure
I108	C	Open drainage of empyema
I109	C	Pericardiotomy
I110	C	Pacemaker insertion
I111	B	Cardiac procedures
I112	C	Other Major(Specify)

J   PEDIATRIC

J101	A	Herniorraphy, inguinal and umbilical
J102	C	Repair branchial cleft anomalies/thyroglossal duct cyst
J103	B	Repair deformity in chest wall
J104	B	Repair diaphragmatic hernia
J105	B	Repair esophageal atresia/TEF
J106	A	Repair intestinal atresia or stenosis
J107	A	Repair pyloric stenosis
J108	C	Operation for malrotation/intussusception
J109	A	Procedures for meconium ileus/NEC
J110	B	Difinitive operation for Hirschsprung's/imperforate anus
J111	B	Excision Wilm's tumor/neuroblastoma
J112	B	Repair omphalocele/gastroschisis
J113	B	Repair of extrophy
J114	B	Repair epi- and hypo-spadias
J115	A	Orchiopexy
J116	C	Other Major(Specify)

K   GENITO-UNINARY

K101	C	Prostatectomy, all types
K102	C	Circumcision
K103	A	Hydrocoelectomy
K104	C	Cystostomy
K105	B	Cystectomy
K106	A	Nephrectomy
K107	C	Ureterolithotomy
K108	C	Pyelotomy
K109	A	Orchiectomy
K110	B	Ileal urinary conduit
K111	B	Renal transplant
K112	C	Other Major(Specify)

L   GYNECOLOGY
L101 C   Dilatation and curettage
L102 A   Hysterectomy, all types
L103 A   Salpingo-oophorectomy
L104 C   Other Major(Specify)

M   PLASTIC
M101 B   Repair cleft lip/cleft palate
M102 C   Revision of scars and resultant deformities
M103 B   Reconstructive procedures on burns
M104 A   Skin grafting, nonburn(all types)
M105 B   Skin, muscle or other soft tissue transfers
M106 C   Body wall reconstruction
M107 C   Other Major(Specify)

N   NERVOUS SYSTEM
N101 C   Cranial decompression or exploration
N102 B   Extracranial/ventricular shunt
N103 B   Spinal cord decompression or exploration
N104 B   Nerve root decompression
N105 A   Peripheral nerve operation or decompression
N106 C   Other Major(Specify)

O   ORTHOPAEDICS
O101 C   Open operations on bone or joints
O102 C   Tendon/nerve repair or transfer
O103 B   Prosthetic joint replacements
O104 C   Arthroscopy
O105 C   Other Major(Specify)

P   TRAUMA SURGERY
P101 A   Drainage of sub- or extra-dural hematoma
P102 C   Reduction and stabilization of maxillofacial fracture

P1   Closure, resection or exclusion due to disease:
P103 B   Esophageal trauma
P104 A   Gastric trauma
P105 A   Duodenal trauma
P106 A   Small Bowel trauma
P107 A   Colon trauma
P108 A   Tendon or nerve repair
P109 A   Neck exploration for trauma
P110 C   Exploratory thoracotomy

P111	A	Exploratory laparotomy
P112	A	Splenectomy or splenorrhaphy
P113	A	Repair and drain hepatic lacerations
P114	B	Hepatic resection for injury
P115	A	Pancreatic injury, drainage
P116	B	Pancreatic injury, resection
P117	A	Closed reduction of fracture
P118	B	Open reduction of open/closed fracture
P119	A	Debridement and reduction of open fracture
P120	A	Debridement and suture major wounds
P121	A	Bladder injury, repair
P122	C	Ureteral injury, repair
P123	B	Repair or resection for kidney trauma

P2		Repair of vascular injury
P124	B	Thoracic aorta, inominate/subclavian
P125	B	Carotid or other major neck vessels
P126	B	Abdominal aorta or vena cava
P127	A	Peripheral vessels
P128	A	Fasciotomy for injury
P129	C	Repair of other major vascular injury
P130	B	Management of cardiac injury
P131	A	Burn debridement and/or grafting
P132	C	Other major operations for trauma

Q		ENDOSCOPIC PROCEDURES
Q101	A	Laryngoscopy
Q102	A	Bronchoscopy
Q103	C	Mediastinoscopy
Q104	C	Sclerotherapy for esophageal varices
Q105	A	Esophago-gastro-deodenoscopy
Q106	C	Peritoneoscopy
Q107	B	ERCP
Q108	A	Sigmoidoscopy, rigid or flexible
Q109	A	Flexible colonoscopy
Q110	A	Choledochoscopy
Q111	C	Cysto/Urethroscopy
Q112	C	Other Major(Specify)

R		OTHER PROCEDURES
R101	A	Removal of skin moles, small tumors, etc.
R102	A	Removal of subcutaneous small tumors, cysts, foreign bodies, etc.
R103	A	Repair of minor wounds and grafts

R104 C   Sclerotherapy for peripheral venous disease
R105 C   Banding or incision thrombosed hemorrhoids
R106 C   Lithotripsy
R107 C   Other Minor

APPENDIX D

PROPS SYSTEM WORKSHEET

PROPS System Surgical Case Worksheet

CASE/OR #: _____   Date of Surgery: __/__/__

Service Code: cardio-thor gyne neuro orth pedia plas urol vasc
(circle one)   trans burn tr/em head anesth gsurg other

Hospital: UUMC   PCMC   LDSH   HCH   VAMC
(circle one)

Patient Last Name: _____   First Name: _____

Date of Birth: __/__/__   Sex: _____

Surgical Type: Emergency   Patient Status: In-Patient
(circle one)   Elective   (circle one)   Out-Patient

Pre-Op Visit: __/__/__

Location:
(circle one)   Dr. Office Clinic Pre-Adm. Suite E.R. Surg. Ctr. Hosp. In-Pt Other

Attending Surgeon: _____

Procedures Performed: Code:

_____   _____
_____   _____
_____   _____
_____   _____
_____   _____

Specify other major:

_____   _____

Residents in OR (Indicate: CS, SJ, TA, FA):   RR Code:

          _____   _____
          _____   _____
          _____   _____
          _____   _____

APPENDIX E

CONCISE BOOKLET OF INSTRUCTIONS

User's Guide to PROPS System for Updating Case

A. To start the PROPS system:

1. Power on the Macintosh. The Finder will appear.

2. Double-click the FOX folder to open it.

3. Double-click the FoxBASE icon to start the PROPS system.

A little while later the PROPS system will be loaded automatically and you will be prompted to enter your Social Security Number and Password for verifying. Enter your SSN and Password followed by a Return key. You have three chances to enter your SSN and Password. If you are eligible to use the PROPS system, then the screen will show you the **Main Menu**.

B. From the **Main Menu**, you can pull down the "**Update**" menu at the top of screen and click the "**Case**" item (or just press Command-C simultaneously) to update the procedure case. Then the screen will show you the "**Update Case**" menu.

C. From the "**Update Case**" menu you can click the button at the bottom of screen. The function of each button is:

1. **Next** - to show the next procedure case to the current one.

2. **Upper** - to show the previous procedure case to the current one.

3. **Search** - to search the procedure case you want based on the key.

4. **Add** - to add a new procedure case into the PROPS system.

5. **Modify** - to modify the procedure case you selected.

6. **Delete** - to delete the procedure case you selected.

7. **Exit** - to exit from the "**Update Case**" menu to **Main Menu**.

D. Click the "**Add**' button and the screen will show you the entry form to enter data for a new procedure case. You can use mouse to move the cursor to any field you want or just press Return key to move the cursor to the next field after you enter the data for any field.

The format for each field in the entry form is:

1. CASE/OR # - enter the case number("MMDDYYFLN") where:

   MM: month \

   DD: day   } the date of the procedure case performed.

   YY: year   /

   F: the initial of resident's first name.

   L: the initial of resident's last name.

   N: optional and just needed for more than one procedure performed by the resident on the same date.

Notice: The procedure case is added into the PROPS system by each case not by individual resident. Therefore, if there are more than one residents participated in one case, only the resident who received the highest RR code (CS > SJ > TA > FA) can add the case for other residents participated.

2. Date of Surgery - enter the date of surgery ("MMDDYY").

3. Service Code - drag the popup and click the code you want.

4. Hospital - drag the popup and click the hospital you want.

5. Patient Last Name - enter the patient's last name.

6. First Name - enter the patient's first name.

7. Age - enter the patient's age.

8. Sex - drag the popup and click the sex you want.

9. Surgery Type - drag the popup and click the type you want.

10. Patient Status - drag the popup and click the status you want.

11. Pre-op Visit - enter the date of pre-op visit ("MMDDYY").

12. Location - drag the popup and click the location you want.

13. Attending Surgeon - click the name from the scrollable list.

14. Procedure Performed - enter the procedure codes performed in this case.

Notice: Before you add the procedure case into the PROPS system, you need to find out the special code assigned for each procedure performed from the table or from "Browse" menu and then record them on your worksheet. Another way to find out the special code is press Command-H simultaneously to call for the Help Menu when you are updating the procedure case.

15. Residents in OR - drag the popup and click the name you want.
16. RR Code - drag the popup and click the code for each resident received.

E. Click the "OK to exit" button at the bottom of screen when you finish entering all the data for each procedure case. The PROPS system will check the data format you input and give you an error message if anything wrong. In this case, you just click the button shown on the error box and then you can continue to correct the

data. If everything is ok after you click the "**OK to exit**" button, the screen will show the "**Update Case**" menu to you again.

Once a procedure has been added into the PROPS system, the way to change the data is to click the "**Modify**" button and the screen will show you the same format as "**Add**" to modify the data you want. If the procedure case shown on the "**Update Case**" menu is not the one you want, you can click the "**Next**", "**Previous**", or "**Search**" button to find out the exact one and then click the "**Modify**" button to make any changes.

After you finish updating the procedure case, click the "**Exit**" button shown on the "**Update Case**" menu to exit to **Main Menu**.

F. Pull down the "**Report**" menu from the **Main Menu** and click the "**To Screen**" (or just press Command-S simultaneously) to show the Resident Record report. From this report the PROPS system will show the detail of your RRC operative experience to date.

G. Finally, pull down the "**Exit**" menu from the **Main Menu** and click the "**To Apple Finder**" (or just press Command-Q simultaneously) to end up the PROPS system. Just click the "**Yes**" button and then switch off the Macintosh.

APPENDIX F

QUESTIONNAIRES

PROPS System User Evaluation

Name: _____

Date: _____

Dear User:

Please help us evaluate the PROPS system! We would greatly appreciate your taking a few moments to answer the following questions regarding the system.

Thank you.

1. Are you a
    a. Attending
    b. Resident
    c. Office Secretary
    d. Other (please describe: _____)

2. How many cases did you perform in June? _____

3. How many cases did you input into the PROPS system in June? _____

4. How often did you use the PROPS system in June?
    (Please circle the most appropriate response)

    (1)   (2)   (3)   (4)   (5)   (6)   (7)   (8)   (9)

    [1 = Never   5 = Sometimes   9 = Very Often]

5. How would you rate the ease of use of the PROPS system?
    (Please circle the most appropriate response)

    (1)   (2)   (3)   (4)   (5)   (6)   (7)   (8)   (9)

    [1 = Very Unfriendly   5 = Tolerable   9 = Very Friendly]

6. How would you rate the speed of performance of the PROPS system?
    (Please circle the most appropriate response)

    (1)   (2)   (3)   (4)   (5)   (6)   (7)   (8)   (9)

    [1 = Not Fast   5 = Somewhat Fast   9 = Very Fast]

7. How would you rate the accuracy of results provided in the PROPS system?
    (Please circle the most appropriate response)

    (1)   (2)   (3)   (4)   (5)   (6)   (7)   (8)   (9)

    [1 = Not Accurate   5 = Somewhat Accurate   9 = Very Accurate]

8. How useful or informative to you are the results provided in the PROPS system?
    (Please circle the most appropriate response)

    (1)   (2)   (3)   (4)   (5)   (6)   (7)   (8)   (9)

    [1 = Not Useful   5 = Somewhat Useful   9 = Very Useful]

9. How useful to you is the PROPS system?
    (Please circle the most appropriate response)

    (1)   (2)   (3)   (4)   (5)   (6)   (7)   (8)   (9)

    [1 = Not Useful   5 = Somewhat Useful   9 = Very Useful]

10. How often is the information that you need to get from the PROPS system available?
    (Please circle the most appropriate response)

    (1)   (2)   (3)   (4)   (5)   (6)   (7)   (8)   (9)

    [1 = Never Available   5 = Sometimes available   9 = Always Available]

11. How has your use of the PROPS system affected your productivity?
    (Please circle the most appropriate response)

    (1)   (2)   (3)   (4)   (5)   (6)   (7)   (8)   (9)

    [1 = Greatly Decreased   5 = Stay Same   9 = Greatly Increased]

12.   Will you like to use the PROPS system during your residency program?

Yes _____   No _____   If answer No, please give the reason:

_____

13.   Please offer any comment, suggestions, or complaints:

_____

_____

_____

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