COMPUTERIZING DATA SOURCES FOR ORTHOPEDICS PATIENTS

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Purpose: The duplicated effort of data input for orthopedic patients can be eliminated by computerizing patient data sources. It provides a convenient method to gather the essential report for routine annual accreditations.

Methods: We created a departmental database by using commercial software to automatically capture data from our institutional healthcare information system. Using patients' information from 2001 to 2005, we assessed the utility of our database in applying general statistical procedures and generating patient lists and procedural reports.

Results: The comprehensive analytic reports can be generated by this system. These reports include midterm patient list, special operation query and statistical graph of patient population.

Conclusion: Computerizing data sources saves manpower and time and improves quality in departmental and hospital accreditation.

Key words: computerized data source, orthopedics patient, healthcare information system

(J Orthop Surg Taiwan 22: 172-182, 2005)

INTRODUCTION

Computerizing patients' charts has become the trend in every hospital. The advantages of computerization are easy storage, easy distribution, and good organization of the data. Although a small staff maintains the main data source at an information center, data analysis in individual departments often depends on duplicated effort to input data and to maintain the integrity of their own data banks.

Annual accreditations are crucial to departments and hospitals. Therefore, without systemic and continuous data maintenance, excessive time and personnel are required to create the required reports. In addition, inconsistencies between medical specialists and information-center staff in terms of the preferences for user interfaces, indexing, and query styles contribute to inconvenient keying-in procedures, inadequate queries, and inaccurate statistics. One reason is because the computer-information staff may not have specific knowledge and training in the comprehensive commands for each department.

Patient-centered care is a current focus in our orthopedics department, which assumes the responsibility of informing patients about their statistical results. A continuing data-capture program from our healthcare...
The information system (HIS) serves as its own departmental data source that avoids prolonged procedures involving the information center when we need to obtain statistic reports, and it easily supports the needs of medical quality control. The purpose of this study was to evaluate the outcomes of computerizing our patients’ data. The findings might provide a model for other departments.

**MATERIALS AND METHODS**

Our patients’ data, including standard computerized admission notes, operational notes, discharge summaries, and insurance applications, were stored on the server of the HIS of Chimei Medical Center, Tainan, Taiwan, from 2001 to 2005. Residents or attending physicians inputted the admission and operational notes on a daily basis. The first author designed a database by using software (Access; Microsoft, Redmond, WA, USA) and by programming an automatic function (Visual Basic; Microsoft) (Fig. 3). Our information center implemented the programs on the computer system.

The database had two major components: admission notes and operational notes. The former contained over 24,000 records, which included general statistics, the female-to-male ratio (that is, 11,317 [47%] to 12,987 [53%]), the patients’ age distribution, and the population per year (Figs. 1, 2). The main admission database was extracted from patients’ discharge files. Our database of about 24,000 records was the largest among the departments in our hospital and represented the number of patients admitted to our department. None were excluded.

The operational database include outpatient, consultation, and combined surgical files.

Each admission record had its own discharge file, which may have had variable number of operational files. Therefore, the operational database was separated from the whole database to permit queries about specific operations. The operational and admission databases were linked by means of chart identification, which served as the index field.

Our database captured the records from the system every 5 minutes, and it verified the old data and updated the records to maintain its accuracy. In some circumstances, entries were missing and/or data conflicted with that already in the system as a result of delayed or duplicated input by different people. Therefore, automatic retrospective data (previous 60 admission days) capture was performed every 2 hours to renewed outdated information and to maintain the integrity of database.

Periodic backup of patients’ database was crucial.

Fig. 1: The sex distribution ratio of enrolling population since 2001 to 2005.

Fig. 2: The age distribution graph of enrolling population since 2001 to 2005.

Fig. 3: The patient number per year of enrolling population since 2001 to 2005. The minor decrease in 2001 is due to incomplete HIS databank.
The first author served as the administrator of the departmental database and was responsible for developing and maintaining it. A password and authority was set up in the software (Access; Microsoft) to restrict queries and synchronization by other users. Our departmental computer was the exclusive database server. It was connected to the HIS of our hospital by means of open database connectivity in Access (Microsoft). Security measures of the server included a firewall, password protection, and authority set-up.

The application of statistics in special operations (e.g., reconstruction nailing, revision arthroplasty and failed back surgery) was the main goal of this study. The results of these operations and diagnostic statistical reports were developed by using a query function (Access; Microsoft) or a spreadsheet (Excel; Microsoft) and could be presented as tables or graphs form.

RESULTS

In real-time data capture, which involved connecting to the HIS and obtaining data, we were able to verify data and erase duplicated information (Fig. 4). New admissions and operational information were revealed in a flashed window. Daily, weekly, and monthly reports were easy to create. In clinical application, an attending physician's name could be assigned to produce a list of his or her patients (Fig. 5). Transfer of data to a portable...
device was simply accomplished by means of periodic synchronization (Figs. 6-8).

In departmental information analysis, the system permitted us to generate important midterm analytic reports (such as yearly lists of patients') and aided in the comparison of consecutive data sets to evaluate trends in patient populations and specific operations (Figs. 9-11).

Reports for specific operations or diagnostic statistics could be manufactured by searching for key
words or insurance codes or by means of programming, among other methods.\textsuperscript{1,2,13} The results were easily reproduced by modifying our queries (for example, by limiting patients' ages, changing admission date interval, and hospital stays (Fig. 12).

**DISCUSSION**

At present, only the system administrator can access our data source. However, every orthopedic physician, and others, can use the information generated from this data source. For example, highly usable statistical reports were generated for the routine department chief meeting of our hospital. This database also provides substantial amounts of raw data for the writing of academic papers. Providing access such a source of data is difficult for hospitals and often accomplished only inefficiently and only during a departmental or institutional accreditation period with the help of the computer information center.\textsuperscript{3,4}

Access software, part of the Office package
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(Microsoft) offered several advantages. First was ease of use. Tables and forms creation was simple, and the entire database could be set up quickly. Second was ease of connection. The program offered use the ability to connect to a high-level server (Oracle, Informix, SQL, etc) by means of its open database connectivity. Third was easy incorporation. Because this program was part of the Office suite, it enabled excellent transportation of information among programs (including Excel and Word; Microsoft). In addition, publications and analytic reports in any of these applications could be generated by executing simple functions. Fourth was ease of portability. Access provided a formal database format to use on the pocket PC platform. Therefore, databases kept on portable devices were easily synchronized with our main database.

Many obstructions still limit our data collections in our database. Examples are keying-in errors, duplicated records, and incomplete data. Keying-in errors may be due to the medical staff's unfamiliarity with how to operate computers or mistakes in entering the electronic charts, both of which contribute to data inaccuracy. Most duplication errors were double entries by residents and attending physicians and enlarged the data. Some duplication was due to double entry during a single admission of longer than 1 month in which insurance charges changed monthly. In addition, the various settings in which patients were examined resulted in incomplete-collection errors. For example, databases differ among consultants' offices or clinics, day-surgery centers, and outpatient surgery facilities. Therefore, it was hard to retrieve information by importing a single database.

In clinical practice, all physicians must update their patient lists. Data capture every 5 minutes provides for electronic, real-time charting, while automatic retrospective mid-term data capture imports any missing data (due to delayed data entry, for example). In our experience, most of these late-entered records were related to incomplete charts completed by on-duty residents.

Data collection, along with diagnostic and specific analyses, is crucial and time-consuming work for every department. Variations in diagnostic impressions and procedural entry, as well as mistakes such as spelling errors, can make later queries difficult. Our insurance codes for inquiring about specific operations are arduous to retrieve by means of simple keyword searching. In contrast, collecting statistics (for example, the ratio of elective to emergency surgeries) was simple to do by querying the complete data pool. In academic arenas,
investigators could collect records on patients with specific operations or diagnoses to write articles, for example. Likewise, statistics about the indications for surgery, as needed for hospital or department accreditation, were easy to acquire. Besides statistics, our database included a field for patients’ complications. Therefore, statistical reports about complications could be generated to provide information to departmental chairpersons as they performed quality-control processes. With regard to privacy, all data retrieved from the HIS did not have to be obscured because of their public source. Confidential information can be stored in each physician’s database extracted from our departmental database, which can retain individual privacy because the database is on a single server in a fixed location. For convenience, queries can be conducted on a Web page accessed on the Internet from peripheral computers. In addition, our hospital has been using a picture archiving and communication system for years. For some uses, the image files are not incorporated with the text files. However, in orthopedic practice, images are essential for initial diagnoses and outcome evaluations. Therefore, image capability will be added to our database to expand its utility. Every hospital has both discharge and operational files; therefore, a computerized orthopedic database such as ours can be created in similar fashion. The information-center staff can develop the interlinked programs by special request.

In conclusion, automatic data importing reduces the need for manpower, improves statistics-gathering efficiency, and inevitably supports continuing quality improvement. For efficiency, self-storage of departmental database is required. Obstacles to this computerization may arise in some hospitals or departments because of the need for specialized staff with computer knowledge to maintaining and process the database.

REFERENCES