THE HELP SYSTEM AS A TOOL FOR MONITORING PHYSICIAN PRESCRIBING PATTERNS

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Although much has been learned regarding the pharmacological properties of substances given by physicians to patients, this information is often disregarded by the practicing physician. We have developed tools for examining the extent to which drugs are, or are not, prescribed in accordance with current medical knowledge and in this paper will describe these tools and some examples of studies that have been performed with them.

The HELP system for computer-assisted medical decision-making has been developed and implemented at the LDS Hospital over the past ten years. This system consists of a computer-based medical data file, another file consisting of medical knowledge in the form of decision criteria, a set of terminals which are used to interface medical and paramedical personnel throughout the hospital with these files through a network of minicomputers and a central file handling machine. As any item of data originates from one of these sources on a particular patient, it is filed by the HELP system in that patient's record. As this takes place, the system automatically calls from its knowledge base any decision logic which makes use of that data item. As this logic is executed by the HELP program in the central machine, it calls from the patient's file any additional data needed to execute this algorithm. If the decision criteria are satisfied, that decision is stored as an item of data itself in the patient file and the message associated with it is distributed to the appropriate terminals as an alert or as part of a printed report of the data.

For example, a prescription received by the pharmacist is entered by him through a terminal and is logged in the indicated patient's file. If the HELP system has knowledge bearing on the prescribed drug, the corresponding decision logic is read from the knowledge file and executed. This may result, for instance, in a message being printed back to the pharmacist suggesting that this drug is inappropriate as prescribed for this patient. The message may suggest an alternative action such as a reduction in dose or the monitoring of renal function at regular intervals. In this mode the system has proven very effective in changing physician behavior to conform to the knowledge base provided to the HELP system by experts in particular areas of drug therapy. We have previously reported our experience with the use of this system as a tool for providing real-time alerts to physicians.

In this paper we would like to discuss another capability of this system as it is being used in the study of prescribing habits of physicians under certain well-defined clinical conditions. The basis for this is the STRATO program which was designed to facilitate stratification of a population into subpopulations using the HELP language to express the decision logic to be used in performing this separation of patients into groups for analysis. Perhaps the easiest way to provide an understanding of the STRATO system is to step through the sequence of actions a user of the STRATO system might perform to seek an answer to the following question: "What are the differences in the frequencies with which digitalis is given to patients in the first twenty-four hours following induction of anesthesia for coronary artery bypass patients among four surgeons performing this procedure at the LDS Hospital?"

The researcher sitting at a terminal calls the program and is presented with a list of program options. These are:

1 create a patient population,

2 create a variable for analysis, one value from each patient in a population,

and 3 analyze variables or populations.

He chooses option 1 and is asked if he wishes to use existing logic already on the knowledge disc as criteria for building his new population, or whether he wishes to create a new HELP sector or decision logic. If he chooses option 2, this allows him to proceed in defining both the data and the criteria to be used for creating a new population. For example, in this case he may specify the criteria as having undergone coronary artery bypass surgery in the last six months. All patient records in the file satisfying this criteria will then be listed under a label which he is asked to enter, such as "patients undergoing bypass surgery." The HELP compiler permits the user to enter free text in the form of keywords which it then uses to present back to him from the data dictionary all terms having key words containing the characters he entered. This data dictionary contains over forty thousand SNOMED codes, codes for all drugs used in the hospital, laboratory test names and a large set of terms used for history, physical examination, x-ray, electrocardiography, and many other ancillary services of the hospital. In addition, each decision algorithm has text entered and key word pointers created in the directory at the time the logic is entered by the user and stored in the knowledge base. This provides an interface between the computer and any user to be in English language, while data is stored in an unambiguous numerically coded form in the patient record.

Now the user wishes to separate this initial population into four subgroups corresponding to the four thoracic surgeons whose prescribing patterns are being studied. To do this he must create four additional HELP sectors, setting the criteria in each that the attending physician must be Dr. A, B, C, or D, and he labels each of these populations as "patient of Dr. A", etc. Now the STRATO system will create four additional lists of patient numbers, the first labeled "patient of Dr. A undergoing coronary bypass surgery" by combining the two labels.

The user may now further separate each of these populations by creating another HELP sector and running it against each of the four lists of patients. This sector would contain the following logic: "did not receive digitalis prior to surgery but received digitalis within 24 hours after the time of onset of surgery." The results of this analysis revealed that two of the surgeons prescribed digitalis during this interval to 80% or more of their patients, one gave digitalis to 55% of his patients, and the fourth only 27% of his patients.

A similar procedure is used to define a variable in any one of these populations to be analyzed. For instance, a HELP sector was written to define the initial dose of digitalis prescribed in those patients who received it during this twenty-four hour period. This was then correlated with another variable, the patient's weight, to see whether weight was used by the physician in arriving at the appropriate dose. In this case there was no correlation between the dose prescribed and the patient weight for any one of the four physicians.

The crucial question one would like to ask upon encountering such wide differences in the use of a drug by different physicians in a given clinical situation is, "Does it make any difference whether a patient gets the drug?" Unfortunately, for many drugs, and particularly one such as digitalis, a satisfactory answer cannot be obtained. The therapeutic response is difficult to judge, since the drug is obviously given prophylactically to most of these patients and, in addition, a variety of major factors are influencing outcome in this critical post-operative period. However, this information does serve a very useful purpose. First, it is brought to the attention of these surgeons and others involved in managing patients under these circumstances. In addition to providing an incentive for educational programs and in some cases even for research, logical inconsistencies in prescribing patterns can be monitored by

the HELP system by implementing new sectors as additions to the system's knowledge base.

Drugs are chemicals with complex effects, which may be beneficial in certain doses and under certain circumstances, but harmful or useless in others. The HELP system provides a tool not only for uncovering discrepancies between knowledge and practice in the use of a drug, but also in monitoring and prompting a physician in its use toward the optimal care of his patients.