A COMPUTERIZED EXPERT SYSTEM FOR OUTCOME-VALIDATED MEDICAL PRACTICE GUIDELINES

Scott Weingarten, M.D., M.P.H.
A. Gray Ellrodt, M.D.
Mary S. Riedinger, R.N.
Chris Huang, M.S.
Cedars-Sinai Medical Center, Los Angeles, CA

ABSTRACT

Our ongoing efforts in health services research have resulted in outcome-validated medical practice guidelines for common medical conditions. These practice guidelines have been shown to substantially reduce health care costs while maintaining quality of care [1-6]. We have developed a computerized expert system from our practice guidelines which enhances the ease in which they can be implemented by Utilization Management (UM) Coordinators, physicians, nurses and other health care providers.

INTRODUCTION

Hospitals and health insurance companies spend millions of dollars annually for UM activities and functions. Until recently, it has been widely assumed that UM departments reduce the cost of health care without compromising quality of care. However, there are few data found in the research literature that support or refute this assumption. Neither is there data available that demonstrate whether the cost savings provided by UM departments exceed the cost of their operation. Moreover, the safety and reliability of UM activities are not known. Because of the subjective nature in which UM activities are performed and the lack of formal evaluations of their performance, there is uncertainty about the effectiveness and safety of UM activities. In this era of declining hospital reimbursement and the emergence of prospective payment and managed care, it is of great importance that UM departments become more accountable to hospital administrators, payors, and physicians in terms of effectiveness, safety, and whether the return justifies the cost of their operation.

MEDICAL PRACTICE GUIDELINES

Unfortunately, of the numerous guidelines, critical pathways, protocols, and algorithms in existence, an overwhelming majority have never been validated by examining patient outcomes [4,7]. Often the actual effect of practice guidelines on patients' outcomes, quality of care, satisfaction, and health care costs is unknown [8]. A recent study demonstrated that inter-physician agreement on the appropriateness of hospital discharge is very poor in the absence of practice guidelines [9] or other explicit criteria upon which to base discharge decisions. Practice guidelines may provide the structure to UM activities, so that judgements are based on carefully analyzed

0195-4210/92/$5.00 © 1994 AMIA, Inc.

patient outcomes data. If the effect of UM intervention of health care costs and patients outcomes could be predicted in advance (and later measured), UM activities may become more acceptable to physicians, payors, and patients. Furthermore, the development and dissemination of medical practice guidelines has gained the support of Congress, the Physician Payment Review Commission, the Institute of Medicine, the American Medical Association, the American College of Physicians, payors, and the public [10]. With this groundswell of support, it seems likely that guidelines will play an increasingly prominent role in health care reform, clinical medicine, and UM activities in the future. Guidelines that are proven to be safe and effective have the greatest chance of adoption by physicians, other health care providers, payors, employer groups, and regulatory agencies. Finally, the current movement towards total quality management in health care will require that quality improvement efforts be driven by objective and reliable data.

GUIDELINES HAVE BEEN SHOWN TO REDUCE COST AND IMPROVE QUALITY

As previously described [1-6], use of practice guidelines has been shown to significantly improve the effectiveness of UM activities when tested in a rigorous and controlled clinical trial. Guideline implementation resulted in a significant reduction in hospital costs at Cedars-Sinai Medical Center when used to facilitate early **transfer** of "low-risk" chest pain patients from the coronary care unit or intermediate care unit to non-monitored beds [2]. Moreover, UM Coordinators and physicians using the guidelines achieved these potential benefits without compromising quality of care or patient outcomes [2]. The guideline was later implemented at Kaiser Permanente (Woodland Hills, CA) to test its effectiveness within a health maintenance organization [3]. Use of the guideline by nurses and physicians resulted in a reduction in hospital length of stay of 0.55 days for selected "low-risk" chest pain patients [3]. Moreover, this reduction in length of stay was achieved while maintaining excellent patient outcomes when measured during the hospitalization and two weeks after hospital discharge.

TRANSLATING GUIDELINES INTO PRACTICE

Although there is widespread enthusiasm for medical practice guidelines, few have actually been used by hospitals in order to reduce costs or improve quality of care. In fact, several excellent studies have documented the failure of guidelines to produce sustained changes in physician practice [11,12]. Perhaps a key obstacle to successful guideline implementation lies within the fact that they are often complex, detailed, and difficult for health care providers to remember. Investigators have developed decision aids and other methods in efforts to influence physician decisions (such as hand-held calculators and other devices), but the typically busy physician often prefers to

rely on unaided clinical judgement rather than expend the effort to operate each system [13,14]. Moreover, we recently completed a study in which it was discovered that the actual effectiveness of guideline implementation efforts (when performed by hospital personnel with competing demands for their time) may differ from the theoretical efficacy of guidelines as reported in research settings [5]. In this study of 628 "low-risk" chest pain patients, who were classified as either suitable or not suitable for early hospital discharge by the practice guideline, 11% of patients were misclassified and 89% of patient were correctly classified by UM Coordinators {5}. Although the reasons for misclassification were numerous, many problems may have been related to the complicated nature and branching logic inherent in our guidelines. The logic of the guidelines was difficult to follow when it was displayed on several sheets of paper, and this cumbersome method of guideline implementation would rapidly become impractical once many guidelines for patient care were introduced in a single hospital. In addition, since patient risk status is often dependent on treatment with certain types of medications, and the number of medications available to treat any given condition is continually increasing, it is necessary to update the guidelines on a regular basis.

EXPERT SYSTEM

The expert system computer software is written for both a Windows and DOS environment. In addition to housing the various peer-reviewed practice guidelines, there are extensive help screens with up-to-date listings of various medications and clinical definitions. There is also a data base linked with the system that allows for tracking and reporting of individual patients and groups of patients. For example, if hospital discharge is routinely delayed because of test unavailability or other operational problems, these delays can be tracked and addressed as part of a total quality management project.
The output of the expert system is a recommendation of the medically appropriate length of stay for patients based on clinical risk information. Guideline recommendations are supported by references from peer-reviewed articles which may enhance their acceptability. Moreover, the user is informed of the sample size of patients from which the risk information was derived to assess the confidence with which discharge decisions could be made. The user also has access to the actual effects of the guideline on patient outcomes, patient satisfaction, quality of care and health care costs as reported in prior studies.

EASE OF USE

We hypothesized that through the use of an expert system we could display guideline recommendations in a more time-efficient and user-friendly manner. We also hypothesized that the use of this system would be acceptable to UM Coordinators who were

inexperienced in operating computers, and could potentially reduce the misclassification rate of applying guidelines. In an effort to determine the feasibility of training previously inexperienced UM Coordinators to use the expert system, we studied four UM Coordinators who were introduced to the expert system for the first time. Three of the Coordinators had never used a mouse or Windows driven computer system and one Coordinator had used such a system only once in a store display. The Coordinators were trained to operate the system to risk classify and enter the data from an actual medical record of a chest pain patient into the system. All UM Coordinators were trained in less than 25 minutes (training for guidelines other than chest pain would have taken longer). UM Coordinators thought that this expert system would be helpful for performing UM functions, would save them time in implementing guidelines, would make their implementation of guidelines more accurate, and that the educational component of the system was helpful (Table I).

TABLE I

UM Coordinators Survey (n=4)
The expert system (compared to guidelines on paper) is:

Time saving	75%
More accurate	75%
Helpful for education	100%

CONCLUSION

The practice guideline expert system can enable hospital UM personnel to classify patient risk, determine the suitability for transfer from an intensive care unit, or determine the safety of hospital discharge for patients with selected common medical conditions. Immediate access to the expert system adds to the scientific rigor with which hospital UM departments implement practice guidelines. The expert system may also enhance the acceptability of UM activities to physicians and health insurance companies, since the basis of recommendations will be carefully derived patient outcomes data rather than subjective impressions. Practice guidelines that complement physician judgement have demonstrated in multiple health care settings to significantly **reduce health care costs while maintaining excellent quality of care** [2-4]. We believe that our expert system may bridge the important gap between guideline development and their implementation in the hospital setting.

ACKNOWLEDGEMENTS

We would like to thank Vanessa V. Walker for her excellent preparation of the manuscript and Laura Conner, R.N. for her expert technical editing, and to Betty Johnson, R.N., Elizabeth Gaddey, R.N., Carolyn Sharp, R.N. and Alberte Jacobs, R.N. for their participation in the study.

REFERENCE

[1]. Weingarten S, Ermann B, Shah PK, Riedinger M, Ellrodt AG. Selecting the best triage rule for patients with chest pain. Am J Med 1989; 87:494-500.

[2]. Weingarten SR, Ermann B, Bolus R, Riedinger M, Green A, Ellrodt AG. Early "step-down" transfer of chest pain patients to a nonmonitored bed. Ann Intern Med 1990; 113:283-289.

[3]. Weingarten S, Agocs L, Tankel N, Sheng A, Ellrodt AG. Reducing lengths of stay for patients with chest pain using medical practice guidelines and opinion leaders. Am J Cardiol 1993; 71:259-262.

[4]. Weingarten S, Ellrodt AG. The case for intensive dissemination. Adoption of practice guidelines in the coronary care unit. QRB 1992; 18:449-455.

[5]. Ellrodt AG, Conner L, Riedinger MS, Weingarten SR. Implementing practice guidelines through a utilization management strategy: The potential and the challenges. QRB 1992; 18:456-460.

[6]. Weingarten S, Riedinger M, Shinbane J, et al. Triage practice guideline for patients hospitalized with congestive heart failure: Improving the effectiveness of the coronary care unit. Am J Med 1993; 94:483-490.

[7]. Selker HP. Criteria for adoption in practice of medical practice guidelines. Am J Cardiol 1993; 71:339-41.

[8]. Field MJ, Lohr KN. Guidelines for clinical practice. National Academy Press, Washington, D.C. 1992.

[9]. Hayward RA, McMahon LF Jr, Bernard AM. Evaluating the care of general medicine inpatients: How good is implicit review? Ann Intern Med 1993; 118:550-6.

[10]. Woolf S. Practice guidelines. A new reality in medicine. I. Recent developments. Arch Intern Med 1990; 150:1811-1818.

[11]. Lomas J, Anderson GM, Dominick-Pierre K, et al. Do practice guidelines guide practice? The effect of a consensus statement on the practice of physicians. N Engl J Med 1989; 321:1306-1311.

[12]. Kosecoff J, Kanouse DE, Rogers WH, et al. Effect of the National Institutes of Health Consensus Development Program on physician practice. JAMA 1987; 258:2708-2713.

[13]. Pozen MW, D'Agostino RB, Selker HP, et al. A predictive instrument to improve coronary-care-unit admission practices in acute ischemic heart disease. A prospective multicenter clinical trial. N Engl J Med 1984; 310:1273-1278.

[14]. Corey GA, Merenstein JH. Applying the acute ischemic heart disease predictive instrument. J Fam Pract 1987; 25:127-33.