Radiology Order Entry With Decision Support: Initial Clinical Experience

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Purpose: To determine whether an appropriately designed computerized order entry system for radiology can be clinically accepted and influence ordering practices.

Materials and Methods: An intranet-based outpatient ordering and scheduling system was designed and implemented beginning in 2001. Indications used to request imaging have been standardized and keystrokes minimized by using menus. The system offers online scheduling and provides patient reminders, preparation instructions, and driving directions. Since November 2004, examination requests have been given utility scores on the basis of the indications provided. Comparative scores for other types of imaging examinations are displayed alongside the scores for the examinations requested. Physicians' performance is tracked, and senior clinicians counsel physicians with many low-scoring examinations. Data collected from the order entry system were used to evaluate rates of use, examinations with low "utility scores," and changes in the scores over the first year of use.

Results: The use of the order entry system has increased steadily, currently constituting 75% of all potential outpatient studies. Since the addition of decision support in November 2004, almost 72,000 examinations have been scored. The highest number of low utility examinations were imaging of the spine, either computed tomography or magnetic resonance imaging. The percentage of low utility examinations declined from 6% to 2% overall. The amount of the decline was greatest for primary care physicians and for those who interacted with the computer themselves rather than through office staff members.

Conclusions: Computerized order entry with decision support can be widely accepted by clinicians and can have an impact on ordering practices.

Key Words: Order entry, decision support, imaging, health care economics

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INTRODUCTION

The United States outspends every other country in the world on health care, both in absolute terms and as a percentage of the gross national product. The costs of health care continue to increase, and the growth rate is accelerating. Between 1991 and 2001, spending on health care grew at an average per capita annual growth rate of 3.1% [1], but the annual growth rate in 2002 was 9.3% [2]. Despite the high rate of spending, the United States does not rank high in measures of national health [1] or patient satisfaction [3].

Some of the high costs can be attributed to a highly complex and fragmented payment system that entails high administrative expenses and weakens the market power of payers [1]. However, the increased utilization of health care services and the increasing costs of those services probably account for the majority of the cost increases. Overall, the utilization of diagnostic radiology has increased at a similar rate to that of health care costs as a whole, with a 3.1% compound annual increase in the period from 1992 to 2001. However, the use of high-tech and high-cost radiology services has increased dramatically in the past decade, as has been demonstrated for Medicare enrollees [4-9], privately insured groups [5,7,9], and individual institutions [10,11] (Figure 1).

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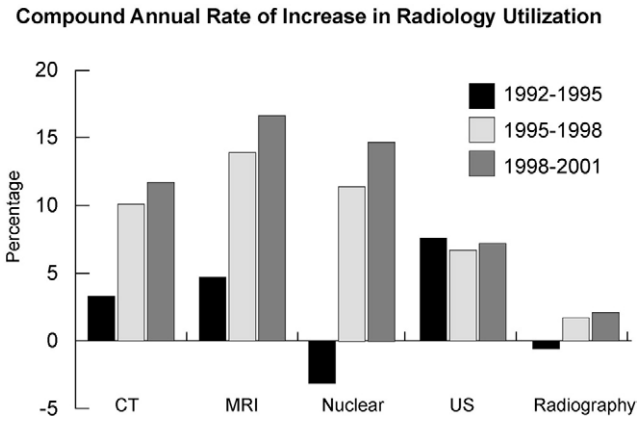

Fig 1. Compound Annual Increases in Imaging Utilization per 1000 enrollees. The past ten years have seen a disproportionate increase in the high-cost imaging modalities. Whereas the use of radiography has been relatively flat, CT and MRI have increased by double-digit annual rates. Data from Bhargavan and Sunshine, 2005 [9]

This disproportionate increase in high-tech modalities has caused spending on radiology services to grow faster than overall utilization rates.

Some of this increased utilization is both beneficial and cost-effective [12] Moreover, a study by McGlynn et al [13] showed that underutilization may occur in certain circumstances. However, it is frequently asserted that a sizable percentage of diagnostic imaging is inappropriate. Such opinions are based on extrapolations from extremely limited data. Moreover, there is no simple definition of what is meant by appropriate use. For example, a true positive rate of 1% (or even less) may be appropriate in some circumstances but not others depending on the severity or importance of the condition that is being sought.

Nonetheless, most radiologists would agree that inappropriate use does occur. It can be attributed to various factors. Self-referral by nonradiologists has grown at a particularly rapid rate [14,15]. Clinicians seem uncertain concerning current indications for imaging. A survey of internal medicine residents showed that fewer than half scored more than 50% when asked to correctly select the most appropriate diagnostic imaging examination for a series of clinical scenarios [16]. Another contributory factor is the practice of defensive medicine, which drives physicians to order imaging studies even when the possibility of a significant finding is remote. Imaging is increasingly being used as an alternative to physical examinations, especially in emergency settings [17], a practice that inevitably results in a low diagnostic yield [18]. Finally, patients' expectations also help drive the demand for imaging. Although possibly not contributing to medical management, negative examination results may reassure a patient [17,19].

Not surprisingly, there is considerable pressure from health insurance companies and from Medicare to contain the costs of radiology [20,21]. Insurance companies may require authorizations from utilization management companies. Algorithms used to approve or deny coverage may be published or proprietary but usually lead to binary decisions to pay or not to pay. Such an approach does not permit comparison among imaging alternatives and provides no educational value. This transactional approach is highly time and labor intensive and is unpopular in the medical community.

In 1993, the ACR recognized the need for practice guidelines and set up a multidisciplinary panel to establish its Appropriateness Criteria® for a wide variety of clinical conditions. Because scientific outcome and assessment data were often not available, the panel used broad-based consensus techniques. The ACR Appropriateness Criteria® list possible radiologic examinations for given conditions, rated on a scale of 1 to 9, in which 9 is most appropriate [22].

Computerized physician order entry has been widely touted as a means of minimizing medical errors. Computerized physician order entry can also be used to enhance the process by which medical imaging is ordered. By using a standard set of indications whose appropriateness (or lack of it) is clear, the appropriateness of a request can be determined, and immediate feedback can be given to the ordering physician.

We developed a computerized physician order entry system for this purpose. The goal was to create a simple tool that would capture all information necessary for decision support, scheduling, examination performance, and International Classification of Diseases, 9th rev, coding, while maintaining simplicity and ease of use. We replaced the individual transaction approach with a "physician scorecard" that reflects each physician's overall performance in ordering examinations. Finally, rather than a go/no-go approach to a single order, our system simultaneously provides comparative scores for various examinations that might be ordered in the clinical context, thus serving as an educational aid and a patient management tool.

The radiology order entry (ROE) system was gradually phased into clinical use beginning in 2001. Decision support for all computed tomography (CT), magnetic resonance imaging (MRI), and nuclear cardiology examinations was added in November 2004. Plain films can be ordered using ROE, but plain-film utility numbers are offered only as comparison numbers when one of the high-cost imaging studies is ordered. The use of ROE and ROE with decision support (ROE-DS) is voluntary. Traditional methods