Facilitating Physician Referrals on the World Wide Web: Representation and Appropriate Utilization of Clinical Expertise

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In highly integrated and increasingly complex health care systems, the identification and proper utilization of clinical staff expertise are key factors for efficiently delivering high quality patient care. To achieve these capabilities on an enterprise-wide scale, we have embarked on a multi-phased project to develop World Wide Web (WWW)-based physician referral capabilities for two large teaching hospitals. Currently, users may search for information concerning the education, training, board certifications, and self-designated clinical interests of staff members. Address, phone number, email address, and a photo are also presented. Our experience indicates that institutional changes are required to successfully deploy and maintain online physician referral services and that accurate and equitable representation of clinical expertise and the incorporation of referral guidelines require an incremental introduction of a carefully planned program that addresses the needs of clinicians, administrators, and health care policy-makers.

INTRODUCTION

While it is generally acknowledged that economies of scale reduce the operating costs of health care organizations, it is uncertain that they necessarily result in optimal patient care.[1] As health care systems consolidate and integrate, enterprise-wide solutions need to be developed to provide patients with the most appropriate caregivers available within these large and increasingly complex organizations. Reports in medical trade newspapers describe the ongoing debate concerning the choice of guidelines to follow in selecting appropriate health care providers[2] and the well known difficulties associated with guideline implementation in general.[3] Surprisingly, programs that succeed in diverting patients from medical services that are considered inappropriate and expensive may not produce the expected benefits.[4] Although the obstacles are formidable, health care organizations in a competitive marketplace are obliged to efficiently facilitate the selection of appropriate specialists within the extended enterprise and to provide community physicians with useful information describing the expertise of their clinical staff.

Many health care organizations are now developing WWW directories containing information about their clinical staffs; however, we are not aware of others who have undertaken programs for the development of online directory features to enhance the representation, identification, and utilization of clinical expertise. In response to early feedback from clinicians during our preliminary WWW referral directory development,[5] we recognized that accurate representation, equitable selection, and appropriate utilization of clinical expertise through electronic media would require a high level of participation and approval by staff members and clinical administrators. To address these needs, it was essential that we develop a versatile plan that would accommodate the requirements of stakeholders throughout the multi-phased development process. In approaching this task, we identified several desiderata:

- The information presented for supporting the referral process should be succinct, easily obtained, and sanctioned by the clinical departments and the individuals represented.

- The information should be managed through distributed maintenance by designated members of clinical departments.

- Referral facilitation should be introduced in an incremental fashion, accommodating the suggestions and requirements of clinical departments, observing relevant institutional policies, and incorporating the suggestions of user focus groups to ensure staff participation and user satisfaction.

- Initial improvements should focus on enhancing the representation of clinical expertise and should primarily provide assistance in activities occurring subsequent to the referral decision ("Referral Assistance," see below).

- Later improvements should introduce institutionally approved referral criteria as they are developed and should provide support in the referral decision process ("Referral Decision Support," see below).

METHODS

Design and Staged Implementation of a WWW-based Physician Referral Service

We have undertaken a multi-phased project to develop a WWW-based application that can facilitate referral to clinicians on staff at the Brigham and Women's Hospital and Massachusetts General Hospital, two large teaching hospitals in the Metropolitan Boston area and members of the Partner's HealthCare System, Inc.[5] The application enables searching of online clinical staff directories at the two institutions. Intramural health care professionals comprise the initial user groups, to be followed by community health care professionals and the general public. Directory users can search databases containing descriptions of clinical training and expertise provided by clinical staff members. For each staff member, the database contains a clinical training and education summary, a list of board certifications, a description of the clinical interests within the individual's practice area, a photograph, identification of non-English languages spoken, and information necessary to contact and locate the individual, including email address.

Data collection was coordinated with the production of complementary printed versions of the staff directories for the two institutions. We participated in inter-institutional meetings to determine the content and format of the print and electronic directories, offered individual staff members the opportunity to correct their directory entries, and obtained approval for print and electronic publication. The edited and corrected staff member clinical profile data now reside in relational database tables, enabling the WWW pages to be easily maintained and assembled "on the fly" upon retrieval. As the application is deployed throughout the institutions, form-based data entry tools will be developed for distributed maintenance of the databases.

A controlled medical problem vocabulary was provided during the initial data collection process; however, many staff members at both institutions chose free text descriptions of their clinical interests. Because of our obligation to support approved representations of clinical expertise, and the challenges associated with maintaining a highly modifiable controlled vocabulary[6], we concluded that our initial referral assistance improvements should accommodate departmentally provided free text.

Plan for Implementing Referral Assistance

In the current internal implementation of the application, directory users search for clinical interests by explicit word fragment match of terms specifically listed by staff members. However, referring physicians are not given information describing patient data that would be required by consultants at the first appointment, or offered guidance in the referral process. In keeping with the desiderata described above, we decided to implement a supplementary strategy for selecting appropriate caregivers based on lists of medical problems and procedures defined by clinical departments as being appropriate for one or more of their staff. This additional feature will allow staff members to self-describe their interests in an unrestricted fashion (subject to departmental approval) and provides clinical departments with oversight regarding distribution of referrals for designated problems and procedures. We have also defined a minimal dataset to be supplied by the department concerning particular problems or procedures, consisting of a list of appropriate staff members and brief text entries in the following categories:

- Patient information required at the time of the first appointment

- General interim recommendations for managing the problem, if appropriate

- Alerts describing conditions requiring immediate referral, if any

Using this approach, clinical departments may define the available range of staff expertise for each problem. The problem "angina," for example, could be appropriate for all members of a cardiology staff, while "radiofrequency catheter ablation" may be appropriate for only a single staff member. This modular approach also gives clinical departments the opportunity to gradually enlarge and refine their problem lists. The problem definition also provides a potential mechanism for adjusting the scope of problems considered for referral and an opportunity to introduce selection criteria to guide the referral process.

As with a search by individual clinical interest, a search by problem or procedure provides the user with a summary list containing the name, department, service, and clinical interests of candidate clinicians. Users inspect this summary before selecting an individual and displaying his or her full clinical profile. When selecting problems appropriate for more than one department or service, "diabetes," for example, users may be directed to clinicians in internal medicine, endocrinology, nephrology, neurology, ophthalmology, or other clinical departments that identify themselves as offering services for this problem. Referral assistance information for three sample problems is shown schematically in Figure 1. The vertical columns below the problem list items indicate the sequence of referral assistance information presented for the problem selected. We emphasize that the information to be presented for

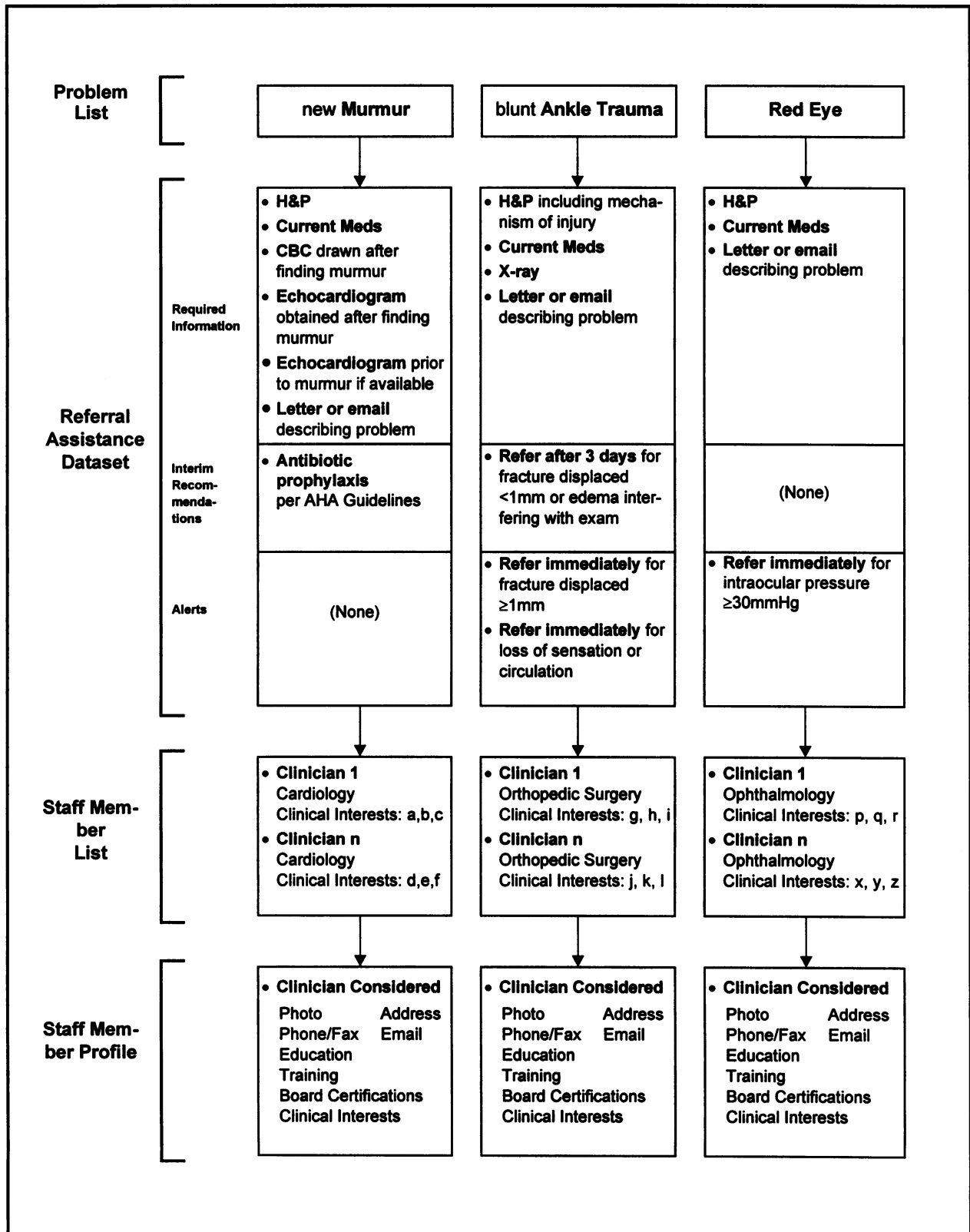|	new Murmur	blunt Ankle Trauma	Red Eye
Problem List	new Murmur	blunt Ankle Trauma	Red Eye
Referral Assistance Dataset — Required Information	• H&P • Current Meds • CBC drawn after finding murmur • Echocardiogram obtained after finding murmur • Echocardiogram prior to murmur if available • Letter or email describing problem	• H&P including mechanism of injury • Current Meds • X-ray • Letter or email describing problem	• H&P • Current Meds • Letter or email describing problem
Interim Recommendations	• Antibiotic prophylaxis per AHA Guidelines	• Refer after 3 days for fracture displaced <1mm or edema interfering with exam	(None)
Alerts	(None)	• Refer immediately for fracture displaced ≥1mm • Refer immediately for loss of sensation or circulation	• Refer immediately for intraocular pressure ≥30mmHg
Staff Member List	• Clinician 1 Cardiology Clinical Interests: a,b,c • Clinician n Cardiology Clinical Interests: d,e,f	• Clinician 1 Orthopedic Surgery Clinical Interests: g, h, i • Clinician n Orthopedic Surgery Clinical Interests: j, k, l	• Clinician 1 Ophthalmology Clinical Interests: p, q, r • Clinician n Ophthalmology Clinical Interests: x, y, z
Staff Member Profile	• Clinician Considered Photo　Address Phone/Fax　Email Education Training Board Certifications Clinical Interests	• Clinician Considered Photo　Address Phone/Fax　Email Education Training Board Certifications Clinical Interests	• Clinician Considered Photo　Address Phone/Fax　Email Education Training Board Certifications Clinical Interests

Figure 1: Schematic representation of referral assistance information offered for three sample problems. Problems map to departmentally designated staff members.

referral assistance is minimal and is intended to provide assistance that is considered always useful when making referrals for the particular problem.

RESULTS

The staff clinical profile datasets for the two hospitals, including self-described clinical interests, have been assembled, edited, and approved by staff members for content and publication. The data represents approximately 2000 individual staff members in total, with affiliations to approximately 200 clinical departments and services. Compilation, correction, and obtaining staff member approval of this data was achieved through the cooperative efforts of the administrative staffs and physician organizations of the two hospitals.

The initial internal deployment of the application is under way at Brigham and Women's Hospital and arrangements are being concluded for the installation of a WWW server to accommodate the referral directory for Massachusetts General Hospital. External deployment is pending and will follow the establishment of enterprise-wide policies regarding the means and extent of extramural distribution of the referral directories.

We have established network connections to servers in the two hospitals that currently contain portions of the datasets that comprise the clinical staff profile and have developed query routines to retrieve the relevant data. However, because the datasets are incomplete and are less current than our existing database, this feature is not yet useful.

We are currently working with hospital administrators to develop a system for electronically updating the databases through form-based entry tools and/or queries to an institutionally sanctioned "gold standard" staff profile data repository. We have initiated discussions with members of clinical departments aimed at developing the problem and procedure lists, the required information datasets, and mapping to appropriate staff members that will be required for implementing referral assistance. We have also established contacts with other medical informaticians within our enterprise for the purpose of developing standards for representing criteria for referral decision support.

DISCUSSION

Throughout the application development process, we have identified new requirements for institutional change and opportunities for increased cooperation among institutional entities. Because of the enterprise-wide scope of our project, similar but previously unrelated software development and data collection efforts were consolidated, enabling simultaneous production of printed and electronic directories for both hospitals. New policies and closer relationships are needed on the part of physician's organizations and hospital administrations to ensure that the databases are efficiently maintained and validated. Electronic publication of information that accurately and appropriately directs referring physicians to consultants will require a high degree of cooperation and planning among staff members, clinical administrators, and application developers.

At present, communication with a selected consultant consists of an email message or telephone call. We are considering making available additional logistical capabilities, including appointment scheduling and a queuing feature to provide an equitable distribution of referrals for problems appropriate for many staff members. We have also begun planning for the introduction of referral decision support.

Goals for Referral Decision Support

Referral decision support represents an important opportunity to assist physicians at a critical point in case management. Its implementation requires the development of evidence-based, institutionally approved, and clearly interpretable recommendations.[7,8] Development, implementation, and validation of such recommendations will require effort in several areas, including:

- Collaboration with representatives of clinical departments aimed at formulating appropriate medical problem and procedure lists and referral recommendations

- Development of enterprise-wide standards for representing and comparing referral recommendations

- Identification of indices available in electronic medical records for assessing the impact of referral recommendations

- Development of an enterprise-wide repository of referral recommendations available to caregivers, clinical application developers, clinical administrators, and health care policymakers

A related goal is to help clinicians make expert referral decisions. When considering referral, an expert decision-maker may defer, delay, or hasten consultation with a specialist. Evidence suggests that expert clinicians often favor case management strategies involving further situation assessment, while their less experienced colleagues may order additional tests and treatments.[9] In the context of referral decision support, providing physicians with more comprehensive situation assessment methods may result in more appropriate use of the studies that are required for referral or that trigger referral. For example, application of the Ottawa ankle rules[10] before obtaining the radiological studies

recommended for our sample blunt ankle trauma problem (Figure 1) would provide physicians with a systematic method for determining the need for x-ray studies and for thoroughly evaluating the injury itself. A potentially useful approach to broadening the utility of our problem and procedure list would be to incorporate such evidence-based guidelines.

CONCLUSION

Offering physician referral services through electronic publishing presents challenges and opportunities for clinicians, clinical department administrators, health care policymakers, and application developers. In our WWW project development strategy, we have planned for anticipated institutional needs, with particular attention to the requirements of teaching hospitals and their diversified clinical staffs. We expect that WWW-based physician referral services will improve outreach to community physicians and patients, and may also facilitate optimal patient management within large and complex health care networks when coupled with institutionally sanctioned, evidence-based referral decision support. It will be important to verify these assumptions through objective evaluation of suitable indices available in electronic medical records.

Electronic distribution of information facilitating the identification and selection of health care professionals may eventually have a global effect on the pattern of utilization of health care services. Referral decisions are important checkpoints regulating the use of these services. Electronic physician referral services require explicit representation of the individuals providing these services and specific recommendations for employing them. The descriptive and proscriptive language used in these applications may influence health care costs and health outcomes, and in this way resembles the benefit language defining the medical services offered by health care plans.[11] Thoughtful choices by those designing and providing content for online physician referral services are necessary to ensure that maximum benefits are achieved for health care institutions, their staff members, and the patients they serve.

Acknowledgments

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