

## Supporting the “Clinic without Walls” with an event-directed messaging system integrated into an electronic medical record

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*To facilitate the communication of ideas, orders and treatment plans among providers practicing in a multidisciplinary ambulatory care setting, we have created an event-directed messaging system integrated into our larger Ambulatory Care Information System (ACIS).<sup>1</sup> ACIS has been operational since 1992 and currently supports an average of 350 patient visits per day. The new messaging system permits a provider to send a message to the next provider who will be caring for a patient. The messages can be sent to any provider offering care in the future, or they can be directed to future visits with a particular clinical service. In contrast to traditional electronic mail systems, messages are not directed to specific providers or groups of provider. Messages are instead directed to a specific clinical event, namely a patient's visit to an appropriate clinic. Messages are displayed when a patient returns for a designated visit, both as part of a pre-printed progress note upon which a provider documents the visit and as part of a hypertext-based general information display in an electronic medical record. The messaging system helps providers ensure that subsequent providers caring for their patients will be alerted to pertinent aspects of a patient's care. It also similarly helps providers quickly gain familiarity with those issues prior providers had felt were important to highlight or did not want to risk being overlooked.*

### INTRODUCTION

Enhancing communication among providers is becoming an increasingly important task in our ever changing health care delivery arena. Current trends are shifting care from brief, focused inpatient experiences to episodic outpatient care. They are also shifting a patient's outpatient care from being provided by a collection of sub-specialists, each concerned with his or her own area of expertise, to a system where generalists are responsible for the overall care of a patient. When subspecialty involvement is needed, generalists often will request focused consultations to assist in particular evaluation tasks or in designing treatment plans the generalists can carry out. In emerging “clinic without walls”

models, the sub-specialists may not practice in close proximity to the generalists, limiting opportunities for face-to-face discussions among providers and straining the ability to share clinical information simply by transporting medical charts. Facilitating communication of ideas among providers, both among generalists and sub-specialists and from one generalist to himself (i.e., visit to visit), is crucial to providing effective health care in these settings.<sup>2</sup>

Current health care information systems are lacking in many respects in facilitating this kind of communication. Paper-based charts that are shared by multiple providers serve as a confusing tool for communicating ideas from one provider to another. Often, important facts may be buried deep within a chart and may be missed by subsequent providers caring for a patient. Also, providers may concentrate on old progress notes from providers in their own service and may not read thoroughly all of the notes from the other providers who have cared for the patient in the past. Thus, communication of ideas may be hampered. Team approaches to ambulatory care, or academic teaching settings where there is a high turnover of providers, hinder efforts at providing continuity of care and frequently require providers to continue the care begun by their predecessors. These clinicians require secure tools for ensuring that the wishes and ideas of their predecessors are brought to their attention and that their requests of future providers are delivered reliably.

Electronic mail systems have not adequately addressed these interprovider communication needs. Their main deficiency stems from their inherent nature to deliver mail immediately from the author of a message to one or more defined recipients. In a multidisciplinary clinical environment, if one is trying to send a message to the next provider who will care for a patient, it is not always clear who that future provider will be at the time a message is created. Also, such messages need to be delivered at the time when the future provider is conducting his or her examination of the patient. Delivering it as soon as it is created is an inconvenience to the future provider and requires extraordinary efforts on the part of that

provider to recover the message at an appropriate future visit.

As part of ongoing Total Quality Improvement (TQI) activities at the Sepulveda Veterans Health Administration (VHA) medical center, a number of specific problems with interprovider communications have been recognized and have been given high priority for improvement. These included difficulties in obtaining and transmitting appropriate clinical histories from generalists to sub-specialists as part of consultation requests, problems with sub-specialist consultation reports not being appropriately reviewed by generalists at follow-up visits, difficulties for generalists and sub-specialists to have ongoing dialogs from patient visit to visit, and problems with diagnostic studies and treatment plans not being appropriately evaluated and commented upon when patients return for follow-up visits. The TQI review committee determined that these problems arise primarily due to the difficulties a provider encounters in trying to extract from a patient's chart those key facts that prior providers had hoped to convey to future providers. To address these difficulties, it was proposed that our existing Ambulatory Care Information System (ACIS), a networked, personal computer-based medical information system linked to the VHA's hospital information system (DHCP), be modified to help deliver messages among providers caring for patients. Towards this goal, a messaging component was added that basically serves as an electronic "post-it" system whereby providers can leave messages for themselves or subsequent providers caring for their patients and helps foster a dialog conducive to quality patient care.

### METHODS

As part of ACIS, we have created an electronic clinical data browsing tool (medRecord) that is available to all providers caring for patients. Through a graphical user interface, this tool allows providers easy on-line access to patient demographic data, laboratory and procedure results, vital signs, medication profiles, problem lists and free text tools for progress note entry and review. medRecord is accessed by providers during almost every patient visit. Since we have not mandated progress note entry into medRecord, providers document visits via handwritten comments onto customized progress notes (figure 1). These notes are pre-printed with patient- and clinic-specific information such as problem lists, medication profiles, selected laboratory results and vital signs, recently ordered consults and procedures, dates of health maintenance activities as well as

clinic-specific templates for entry of clinical history, assessment and plan. Once signed by providers, these notes are then entered into standard paper-based charts.

The form is a pre-printed medical progress note template. It contains the following sections and data:

- COMPLAINT:** Cough x 3 weeks
- PROBLEMS:** COPD, Diabetes, Folic Acid 1mg, Hypertension
- MEDICATIONS:** RUFOSMIC 30MG TAB, TPO 50, ISOSORBIDE DINITRATE 30MG, TPO 10, QUINAPRIL HCL 10MG TAB, TPO 50, THE WELL REPL, GLYBURIDE 5MG TAB, ZIPTO GAN AND 1 & 1/2 TA, ALBUTEROL INHALER 175MG, BPODFIN
- REQUESTED FOLLOW-UP:** A table with columns for DATE, TIME, and SERVICE. The entry shows a follow-up on 10/20/98 at 1300 for 10000.
- PACE Note:** A section for leaving messages for future providers.
- Patient Information:** Name: BLUE ODIT, (JONES); Date of Birth: 11/11/1951; Sex: M.

Figure 1: Progress note pre-printed for each patient visit displaying follow-up messages sent to the visit in the lower right hand corner (front side of form displayed).

To address the deficiencies with interprovider communications, it was proposed that a messaging component be incorporated into medRecord. A key feature of this messaging system is the ability to link delivery of messages to the occurrence of an event in a patient's future. By this scheme, a message can be sent to a future clinic visit, not to a specific provider, and the message does not get "delivered" until the future clinic visit occurs. Providers are able to leave messages that are specific to a particular treating service. For example, a general medicine provider can leave a message for the next cardiologist who sees the patient. Providers can create multiple messages during a clinic visit, each directed to different services to ensure all appropriate future providers are informed of service-specific, pertinent facts about a patient. They can also leave messages to future providers in the same kind of clinic (e.g. a cardiologist leaving a message to the next cardiologist who sees the patient) or they can leave a message to the next provider to see the patient, regardless of clinic type, for follow-up issues that can be addressed by anyone.

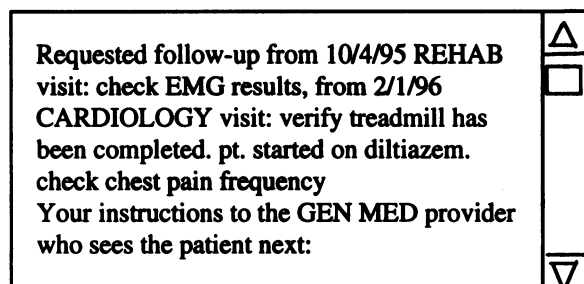


Figure 2. Message display and editing text box. This box appears as part of the display of basic clinical and demographic information upon selecting a patient in the medRecord application. Text components appear in varying colors and have specific actions when clicked (see text).

Message entry into medRecord is performed by users interacting with a hypertext-based scrollable text box (figure 2). This box combines, into a single narrative, any messages addressed to the current provider from prior visits, any messages to be sent to future providers by other providers during the current visit (e.g. the attending and nurse practitioner both may wish to leave messages for future providers during the course of their both seeing a patient during the same clinic visit) and messages to be sent to future providers by the current provider. All messages are prefaced with a brief piece of identifying text (displayed in blue) which, if clicked on, will display the author's name, the clinic in which the message was created, the service to which the message is addressed, and any acknowledgments or deferrals performed on the message by prior providers. Messages requiring action (acknowledgment or deferral) by the current provider are displayed in red; messages already acknowledged by the current provider or another provider during the current visit appear in green, and messages that have been deferred during the current visit are displayed in violet. Providers acknowledge or defer messages by clicking with a mouse on the message text and choosing an action from a pop-up menu. New messages are added by clicking in or after the "Your instructions to the GEN MED provider who sees the patient next" part of the narrative, which places a cursor in the text box in the appropriate location for text entry. (GEN MED is replaced by the clinic category for the current visit when patients are seen in clinics other than general medicine, such as neurology, cardiology, orthopedics, etc.). Clicking on the clinic category (i.e., GEN MED) brings up a dialog that allows the user to direct the message to a different service, to ANY service, or to start an additional message. Messages are stored by clicking on a SAVE button appearing below the text box.

Messages are displayed at appropriate follow-up visits both in the above described text box in medRecord and by being incorporated into the pre-printed progress notes all providers use in documenting patient visits (figure 1). Providers are obligated to acknowledge in medRecord those messages directed to the current visit for which they are personally taking responsibility for attending to the requested follow-up. Providers may elect to defer such messages if they do not wish to take responsibility for taking the requested action and they want to ensure future providers are made aware of such desires (e.g., a message is received requesting following up in an echocardiogram that had been previously ordered. If the echocardiogram has not yet been completed, the current provider may choose to defer the message so that the message will be sent to the next provider in the same kind of clinic who sees the patient). Additionally, providers may request that when a future provider acknowledges a message, the future provider should be prompted to provide a reply that will be returned to the first provider by traditional electronic mail methods. These replies permit providers to receive follow-up from subsequent providers as to the outcome of their management of a patient, furthering a provider's educational experience and fostering a dialog among providers that is not tied to particular clinic visits. Thus, the provider who orders an echocardiogram on a patient he is not likely to see again can still receive a reply from the provider who follows-up on the study when it is completed, enabling the ordering provider to learn whether his or her suspicions and plans were correct. Finally, the system supports tracking of messages and alerting administrative staff to messages that have remained unacknowledged for greater than a specified time period. This tracking helps ensure all ordered studies and treatment plans receive appropriate attention and documentation.

## RESULTS

The messaging system has been implemented only recently. It has been introduced into our multidisciplinary ambulatory care clinics staffed by twenty-four full-time faculty and nurse practitioners as well as numerous rotating house officers and medical students. Provider use of the system for message entry currently is voluntary, and we find users entering approximately ten to twenty messages per day during the course of processing an average of 350 patient visits. A total of eighty-one providers have entered at least one message. A random sample of 150 messages were reviewed for content. 44% offered a treatment plan, 32% directed attention to a

study requiring follow-up, 8% requested assessing the effects of a newly started treatment, 6% requested assessing symptom progression, 4% dealt with compliance issues, and 12% were judged to be not conveying significant information. 5% of messages were acknowledged within one month, 20% within two months, 37% within three months, 43% within four months and 60% within five months. A study examining the number of follow-up visits occurring prior to acknowledgment has not yet been performed. For the majority of messages, the clinic category for authorship was the same as that for delivery (i.e. messages were not frequently sent to a different category of clinic. We expect this behavior to change as more consulting and non-medical clinics are added to the system).

In general, the system has been greeted with enthusiasm by both providers and administrators who recognize its potential for improving the care provided to our patients. It has been judged to be intuitive and easy to use and requires little training beyond that needed for basic navigation in medRecord.

## DISCUSSION

Inter-provider communications have long been a difficult problem in multidisciplinary ambulatory care settings. Traditional approaches based on paper charts, mailed messages and phone contacts have been viewed to be wanting. We have described here an alternative system that makes use of an event-directed message delivery system that helps ensure future providers are made aware of pertinent facts about and plans for the care of a patient.

The system offers a number of advantages over conventional paper-based approaches. First, since the requests are typed into a computer system, the messages are legible and available. If a patient's chart can not be located for a visit, messages from previous providers still will be delivered, obviating the "I don't know why you are here" syndrome. Since messages are directed to specific treating services, providers quickly can become familiar with issues about which their predecessors felt they should be informed. At the same time, providers need not be distracted by issues that their predecessors felt could best be addressed by other services, as they might become if they had to browse all old progress notes from a variety of clinical services. As well, a variety of orders are known to have a long lag time between the ordering date and the final result date, such as procedure requests, consult requests, or certain

laboratory studies such as acid fast bacterial cultures. The order may be documented on a progress note that is many layers down in a chronologically organized chart. If a message exists alerting providers to this outstanding order, the study is more likely to receive appropriate attention when a result becomes available.

This messaging system differs in several respects to traditional electronic mail or notification-based approaches.<sup>3,4</sup> First, messages are directed to a future event, namely a visit by a patient to one or more clinics, where the clinics are all members of the same clinic category (e.g., RED CARDIOLOGY (JONES) is a clinic in the cardiology category). The message is not directed to any particular provider or group of providers or even to the appointment for the future visit. The message becomes activated only when the future visit occurs and the provider who is actually seeing the patient becomes the recipient. The author of the message does not need to know who is going to see the patient next, the specific clinic in which the patient will be seen, or when the visit will occur. An alternative approach, attempting to achieve the same functionality through electronic mail, would require authors to send messages to a mail group for a clinical service. This approach suffers since it requires maintenance of team lists that can be a difficult task in an environment with high provider turnover (e.g., academic teaching facilities with house officer continuity clinics). Similarly, the provider who actually sees the patient at the future visit may not have been a member of the mail group at the time the message was sent, so he would never receive the message. As well, in the group approach, everyone in the group would receive the message as soon as it is sent, even though the patient may not be due to be seen for quite some time, increasing the likelihood of missed follow-up opportunities or lost or forgotten messages. Since only one provider in the mail group would likely actually see the patient, the message is a nuisance to the other members of the group, possibly reducing future responsiveness to such messages. A system might be designed to try to send the message to a specific appointment for a future visit since the follow-up visit is often known at the time the current provider is creating the message (the provider may be ordering and scheduling the follow-up visit). If the visit is rescheduled or a different provider actually sees the patient in a different clinic due to staffing issues, it may be difficult to redirect such a message to the appropriate follow-up visit. Lastly, the VHA's current electronic mail system does not have an automatic mechanism for triggering actions when messages have remained unread beyond a set time

period. Lacking this, it would be difficult to ensure that messages would receive appropriate attention.

The VHA is currently implementing electronic consult entry, tracking and results reporting schemes.<sup>5</sup> While these utilities do address several key problems with interprovider communications, they do not solve all deficiencies. Consults entered through this system can contain clinical histories that can be viewed by the sub-specialist at the time he or she is entering the consult report. However, the system does not facilitate notifying the next generalist who sees the patient of the fact that the patient has been evaluated by the consultant. It is still left to the generalist to discover, via searching through progress notes or orders, the existence of the consult report. Further, beyond the initial consult request and report, there is no way to use the system for enabling an on-going dialog between generalist and sub-specialist between visits. If both the generalist and sub-specialist will be following the patient over a number of visits, the VHA's system does not offer a tool for the generalist to direct a question to the next sub-specialist from a particular service who will be continuing a patient's care (or vice versa).

The messaging system has several additional features that may benefit patient care. Unlike computer generated clinical reminders, the messages passed via this system are created by providers. They are a provider's thoughts during a clinical encounter and as such are likely to be more appropriate and palatable to a future provider than a computer generated message. The messages are essentially a brief summary of the progress note for a clinic visit, created with the notion of communication of ideas in mind. Messages provide a means for sub-specialists to continue a dialog with generalists after the need for a patient's sub-specialty care has passed. The sub-specialist can create a message that would be sent to the next generalist who sees the patient after a specified amount of time has passed and mark it as requesting a reply from the acknowledging generalist. For example, the sub-specialist may wish to ask the generalist to check a glycosylated hemoglobin level six months after the patient is returned the generalist's care. Sub-specialists could use such delayed messages as a means of ensuring patients they have returned to generalists are receiving appropriate care.

We will be evaluating the messaging system in terms of its effect on the frequency with which providers document the results of previously ordered tests and consults. Using random chart reviews, we expect to

find that providers are more likely to make reference to such results in their progress notes when they had been prompted by a message to the existence of such outstanding and possibly recently resulted orders. Ultimately, we anticipate the system should promote efficiency of care and improve patient outcomes.

## CONCLUSION

We have described an event-directed messaging system that facilitates communication among providers across patient visits. The system permits a provider to send a message to a future visit as opposed to a specific provider. Messages are delivered both by being incorporated into the pre-printed progress notes providers use to document patient visits as well as being displayed as part of a graphical, hypertext-based clinical browsing tool. The dual delivery ensures future providers will be made aware of messages even if they do not interact with the clinical workstation. Messages help ensure appropriate follow-up of ordered consults and studies, help familiarize providers with a patient's previously identified clinical issues and treatment plans, and help ordering providers receive feedback on patients with whom they are unlikely to have future contact.

## References

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