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1. Andriole GL, Crawford ED, Grubb RL III, et al; PLCO Project Team. Mortality results from a randomized prostate-cancer screening trial. *N Engl J Med.* 2009;360(13):1310-1319.
2. Walter LC, Bertenthal D, Lindquist K, Konety BR. PSA screening among elderly men with limited life expectancies. *JAMA.* 2006;296(19):2336-2342.
3. Albertsen PC, Hanley JA, Fine J. 20-year outcomes following conservative management of clinically localized prostate cancer. *JAMA.* 2005;293(17):2095-2101.
4. Wennberg JE, Cooper MM, eds. *The Dartmouth Atlas of Health Care in the United States.* Hanover, NH: Center for the Evaluative Clinical Sciences at Dartmouth Medical School, American Hospital Publishing Inc; 1999.
5. Wilt TJ, MacDonald R, Rutks I, Shamliyan TA, Taylor BC, Kane RL. Systematic review: comparative effectiveness and harms of treatments for clinically localized prostate cancer. *Ann Intern Med.* 2008;148(6):435-448.
6. Weinstein MC, Skinner JA. Comparative effectiveness and health care spending—implications for reform. *N Engl J Med.* 2010;362(5):460-465.
7. Konski A, Speier W, Hanlon A, Beck JR, Pollack A. Is proton beam therapy cost effective in the treatment of adenocarcinoma of the prostate? *J Clin Oncol.* 2007;25(24):3603-3608.
8. Brada M, Pijls-Johannesma M, De Ruysscher D. Current clinical evidence for proton therapy. *Cancer J.* 2009;15(4):319-324.
9. Bannuru RR, Dvorak T, Obadan N, et al. Comparative evaluation of radiation treatments for clinically localized prostate cancer: an updated systematic review. *Ann Intern Med.* 2011;155(3):171-178.

Electronic Health Record–Based Messages to Primary Care Providers: Valuable Information or Just Noise?

Communication between clinicians is critical to coordination of care and prevention of adverse outcomes in the outpatient setting. Increasing the adoption of electronic health records (EHRs) and medical home-based care models will greatly increase electronic communication between different members of the health care team.[1-3] One method of clinician-to-clinician communication is note-based messaging through the EHR, where the recipient is requested to provide their "additional signature" to a message to attest that it was received. We recently found that primary care providers (PCPs) receive a large number of EHR-based additional signature request (ASR) alerts and spend considerable time processing them.[4] Large numbers of messages[5,6] might also cause PCPs to miss certain higher-priority notifications.[7,8] Whether ASR alerts and other types of electronic messaging (called "routing" in some systems) are relevant to patient care or just a medium for distributing legal risk is unclear.[9]

To determine the value of clinician-to-clinician messaging in the EHR, we developed and tested a new method to evaluate the content of electronic messages and determined whether they were essential to clinical care.

See Invited Commentary at the end of this letter

Methods. We conducted the study in the outpatient clinics of a large tertiary care Department of Veterans Affairs (VA) facility. In the VA, clinician-to-clinician electronic communication occurs through an asynchronous alert notification inbox within the EHR, much like e-mail, where the sender and recipient need not be simultaneously engaged. We defined an ASR alert as any note-based message that required an electronic signature to complete the alert. Messaging systems with capabilities to track routing are now available in many commercially available EHRs.

We queried a centralized alert tracking file containing details of all ASR alerts. Using methods developed in prior work,[4] we extracted 160 days of ASR alerts transmitted to any full-time PCP (physician, physician assistant, or nurse practitioner) beginning May 27, 2009. A 1% sample was randomly selected for further analysis, based on the feasibility of medical chart review.

Because each ASR alert originated from a specific note within the EHR, medical chart reviews were focused on the content of the parent note. Two PCP reviewers (H.K. and K.H.) identified each parent note and rated alerts on 3 "value" attributes: (1) urgency with which follow-up action was needed to avoid patient harm, (2) level of patient harm that might occur if the PCP missed the alert, and (3) subjective importance of the alert to PCP's care. To identify alerts that most affected clinical care, we defined "high-value" alerts as those which both reviewers rated as urgent, potentially harmful if missed, and important.

Reviewers also determined the alert sender's role, reason for the alert, and whether the information transmitted would be received through other means of communication regardless of the alert. To determine the proportion of pertinent note content, reviewers collected word counts for both the parent note and the section directly relevant to the recipient.

Results. Of 420 927 total alerts collected during the study period, 53 606 (12.7%) were ASR alerts, of which 536 (1.0%) were reviewed. For analysis, 525 ASR alert–parent note pairs were usable.

Additional signature request alerts were most commonly (38.7%) transmitted by other members of the primary care clinic, including medical assistants, technicians, nurses, and less commonly, mid-level health care providers and other PCPs. Twenty-six percent originated from the telephone triage service, which provides after-hours telephone support, while the remaining were transmitted by specialists, pharmacists, and other support services. In almost all alerts (99.2%), the PCP would not typically receive the information outside the alert notification system. Parent notes contained a median of 142 words, of which 28 (19.7%) were considered relevant to the PCP receiving the note.

Reviewers identified 15 unique reasons for alert transmission (**Table**), the most frequent of which was to inform PCPs about patients' medication refill requests (40.0%). In addition, 18.9% relayed new or persistent symptoms reported by patients.

Overall, 282 alerts (53.7%) met high-value criteria. Most refill requests (89.0%) and reports of new or persistent symptoms (64.6%) were deemed high value. Conversely, alerting about patient home events, order status updates, inpatient visits, and progress note completion (residents to supervising attending) were infrequently (<15%) of high value, even though many were rated as "important."

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Table. Characteristics and Reviewer Ratings of Value of Additional Signature Request–Based Alerts

Reason for Clinician-to-Clinician Message	Alerts, No. (%)[a]	First and Second Most Common Service Generating the Alert (No. of Alerts)	Attributes Rated by Both Reviewers, %			High Value[b]
			"Urgent"	"Potentially Harmful if Missed"	"Important to PCP"	
Inform PCP that patient requests prescription or refill *Example: Patient called to request refill for insomnia medication*	210 (40.0)	1–Primary care (91) 2–Telephone triage (71)	92.9	94.3	97.1	89.0
Inform PCP that patient reports new or persistent symptoms *Example: Patient called with symptoms of cough and congestion*	99 (18.9)	1–Telephone triage (48) 2–Primary care (33)	73.7	71.7	88.9	64.6
Inform PCP about outcome of a visit with an ancillary staff or other team member *Examples: Patient was taught insulin administration by team nurse*	64 (12.2)	1–Primary care (45) 2–Support services (8)	12.5	26.6	45.3	12.5
Inform PCP that patient requests clinical information *Example: Patient called requesting to talk to his PCP about how to take medications*	62 (11.8)	1–Primary care (37) 2–Telephone triage (25)	69.4	40.3	85.5	38.7
Inform PCP about outcome of a clinic visit with a specialist *Example: Consult visit note sent by cardiologist*	58 (11.0)	1–Medical subspecialty (28) 2–Mental health (24)	20.7	27.6	50.0	19.0
Inform PCP of the results of a test *Example: PCP's nurse informed the PCP of an abnormal blood pressure*	54 (10.3)	1–Primary care (25) 2–Medical subspecialty (15)	33.3	48.1	55.6	31.5
Inform PCP that patient requests an appointment or referral *Example: Patient requested a follow up primary care appointment*	38 (7.2)	1–Primary care (15) 2–Telephone triage (10)	63.2	55.3	84.2	39.5
Ask PCP to place an order (eg, test, referral) or complete paperwork *Example: Social work requested a signature on a home nursing form*	27 (5.1)	1–Medical subspecialty (9) 2–Primary care (6)	63.0	55.6	81.5	40.7
Inform PCP about treatment received in during an ED visit *Example: ED physician conveying that patient treated and discharged from ED*	20 (3.8)	1–Emergency medicine (18) 2–Primary care (2)	20.0	25.0	85.0	15.0
Inform PCP about patient's admission to the hospital *Example: Inpatient medical service sending discharge summary to the PCP*	17 (3.2)	1–Inpatient service (9) 2–Emergency medicine (4)	11.8	17.6	70.6	11.8
Other nonclinical reason *Example: Nurse relayed that a patient updated his telephone number*	11 (2.1)	1–Primary care (5) 2–Telephone triage (2)	27.3	18.2	45.5	18.2
Note from a resident to a supervising physician sent for review *Example: Visit note from a resident regarding a patient seen together with the PCP*	10 (1.9)	1–Primary care (8) 2–Inpatient service (2)	20.0	20.0	80.0	10.0
Ask PCP to follow up results of a test ordered by another clinician *Example: Hematology service ordered cardiac echo testing and requested follow-up by the PCP*	4 (0.8)	1–Medical specialty (3) 2–Primary care (1)	25.0	75.0	75.0	25.0
Inform PCP of an order status update *Example: Cardiologist informed the PCP that a cardioversion has been scheduled*	4 (0.8)	1–Medical specialty (2) 2–Primary care (1) 2–Inpatient medical service (1)	0.0	0.0	25.0	0.0
Inform PCP of major event (eg, death, moved away) *Example: Nurse relayed message from patient's daughter that the patient died*	2 (0.4)	1–Inpatient service (1) 1–Pharmacy (1)	0.0	0.0	100.0	0.0
Total (all reasons)			61.1	61.3	80.8	53.7

Abbreviations: ED, emergency department; PCP, primary care provider.

[a] Percentage of total alerts reviewed (n = 525). The combined percentage is greater than 100% because some individual alerts contained multiple reasons for transmission.

[b] "High value" is defined as alerts rated by both reviewers as urgent, potentially harmful if missed, and important to the PCP.

Comment. Approximately half of EHR-based alerts for clinician-to-clinician messaging were of high value, but inefficiencies in information transfer required PCPs to read through large amounts of extraneous text to find relevant information. Few alerts were deemed nonessential, but in conjunction with the low percentage of relevant text in parent notes, they likely lead to a perception of information overload from ASR alerts.

Strategies to improve efficiency of electronic clinician-to-clinician messaging should be pursued to avoid bur-

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dening busy frontline health care providers. Other members of a medical home team could efficiently follow up many of the alerts we encountered. Alert systems could also allow the sender to highlight relevant text within the note. Because clinician-to-clinician messaging is likely to increase as systems become more integrated, our study might be useful to others as they explore interventions to improve outpatient communication.

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1. Baron RJ. What's keeping us so busy in primary care? a snapshot from one practice. *N Engl J Med.* 2010;362(17):1632-1636.
2. O'Malley AS. Tapping the unmet potential of health information technology. *N Engl J Med.* 2011;364(12):1090-1091.
3. Singh H, Graber M. Reducing diagnostic error through medical home-based primary care reform. *JAMA.* 2010;304(4):463-464.
4. Murphy DR, Reis B, Sittig DF, Singh H. Notifications received by primary care practitioners in electronic health records: a taxonomy and time analysis. *Am J Med.* 2012;125(2):209.e1-209.e7.
5. Wahls T. Diagnostic errors and abnormal diagnostic tests lost to follow-up: a source of needless waste and delay to treatment. *J Ambul Care Manage.* 2007; 30(4):338-343.
6. Ash JS, Berg M, Coiera E. Some unintended consequences of information technology in health care: the nature of patient care information system-related errors. *J Am Med Inform Assoc.* 2004;11(2):104-112.
7. Singh H, Thomas EJ, Sittig DF, et al. Notification of abnormal lab test results in an electronic medical record: do any safety concerns remain? *Am J Med.* 2010;123(3):238-244.
8. Singh H, Thomas EJ, Mani S, et al. Timely follow-up of abnormal diagnostic imaging test results in an outpatient setting: are electronic medical records achieving their potential? *Arch Intern Med.* 2009;169(17):1578-1586.
9. Hysong SJ, Sawhney MK, Wilson LA, et al. Understanding the management of electronic test result notifications in the outpatient setting. *BMC Med Inform Decis Mak.* 2011;11(1):22.

INVITED COMMENTARY

Electronic Medical Records and Preserving Primary Care Physicians' Time

We both hear strong complaints from primary care physicians (PCPs) about electronic medical records (EMRs) cutting their time efficiency. A long and detailed venting occurred 4 years ago when we were together at a social gathering and M.H.M. was bragging about his brother's (C.J.M.'s) involvement in the genesis of EMRs.[1,2] Two general internists—both women—did not agree that such involvement was praiseworthy. "Think Oppenheimer and the atomic bomb," one said wryly, " the EMR steals sixty minutes a day from me!" The other had a 6-month-old baby and said, "He is sleeping by the time I get home," and tears welled. There were positives. They loved its instant delivery of patient data. Computer order and prescription writing were probably okay. But note writing was a definite drag compared with paper, though they liked producing legible notes that were computer available. What vexed them the most was the EMR inbox. Compared with the paper version, it seemed to increase the number of work items, inflate the time to process each, and divert work previously done by office staff to them.

Murphy and colleagues[3] provide the smoking gun for the internists' complaints of time theft. In this issue of *Archives*, these authors report that nearly half of one kind of inbox message was unimportant and 80% of the message text within these messages was irrelevant. In a previous study they described the spectrum of inbox messages—including study reports, confirmation of consult requests and the return of consult reports, refill requests, signature requests, and so on. Patient e-mail was not mentioned as part of this content. They also reported that processing these messages consumed on average a whopping 49 minutes of PCP time per day.[4]

To get a current estimate of the effect that EMRs have on health care providers' free time and the relative effect

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