Improving Test Result Follow-up through Electronic Health Records Requires More than Just an Alert

Dean F. Sittig, PhD[1] and Hardeep Singh, MD, MPH[2,3]

[1]University of Texas – Memorial Hermann Center for Healthcare Quality & Safety, School of Biomedical Informatics, University of Texas Health Sciences Center, Houston, TX, USA; [2]Houston VA Health Services Research and Development Center of Excellence and The Houston VA Patient Safety Center of Inquiry, Michael E. DeBakey Veterans Affairs Medical Center, Houston, TX, USA; [3]Section of Health Services Research, Department of Medicine, Baylor College of Medicine, Houston, TX, USA.

J Gen Intern Med 27(10):1235–7
DOI: 10.1007/s11606-012-2161-y

A recent American Medical Association report highlighted failures in communication of abnormal test results as an important but understudied facet of improving safety in ambulatory care.[1] Because many outpatient test results are not life-threatening and don't require verbal communication, health information technology (IT) has potential to reliably transmit result information in the fragmented outpatient setting. Thus, few will disagree that communication of abnormal test results is an obvious context where advantages of health IT will be observed.

In this issue of JGIM, Callen et al. report the results of a timely systematic review of 19 studies that documented quantitative evidence of test results not followed up in ambulatory settings.[2] They found wide variation in abnormal results lacking follow-up: 7 % to 62 % for laboratory, and 1 % to 36 % for imaging tests. Although evidence of the effectiveness of electronic test management systems was limited, there was a general trend towards improved follow-up in electronic systems.

In another article in this issue, El-Kareh et al. discuss the results of a randomized controlled trial that put electronic communication to the test. The authors studied the effectiveness of sending microbiology test result alerts via a secure, internal e-mail system to clinicians when results were finalized post-discharge.[3] They found better documented evidence of appropriate follow-up within 3 days in the intervention group (28 % vs. 13 % in controls). Neither group's laboratory follow-up rate was particularly encouraging.

On the bright side, both studies used distinctly different research approaches to reach similar conclusions, i.e., application of information and communication technologies, such as electronic health records (EHRs) with alerting capability, can increase the likelihood of appropriate test result follow-up. In paper-based systems, evaluating evidence of follow-up is itself challenging. On the other hand, both articles remind us that using EHR-based technology by itself does not entirely solve the problem of failure to follow up test results. Callen et al., as well as others, have made a strong case for addressing these failures based on safety implications. Additionally, Stage 2 meaningful EHR use (slated for implementation in 2014) includes laboratory test result reporting criteria. Time is now ripe for novel approaches to understand and improve this complex problem.

The use of technology in the complex healthcare system must take into context the social environment where technology is embedded. For example, Callen et al. found lack of clear policies and procedures in relation to test result follow-up. We previously identified ambiguity of responsibility for test result follow-up to be a key factor in failure to follow up abnormal results.[4] Several EHRs now use asynchronous alert notifications to transmit results, but providers often receive many other types of notifications in their electronic in-box. We found that primary care providers (PCPs) receive a mean of 57 alerts a day in an integrated delivery system's EHR, all with new information they need to process and/or act upon.[5] Important information about abnormal results might get buried among other alerts.

To help understand the complexities involved with electronic communication of test results and facilitate progress in developing multifaceted solutions, a "socio-technical" approach is needed. In our work, we use an eight-dimension sociotechnical model to study both problems and solutions related to safe and effective EHR implementation and use.[6] In the sections below, we illustrate the usefulness of this model by discussing each of its eight dimensions, as applied to issues raised by the

Dr. Singh is supported by the Department of Veterans Affairs National Center of Patient Safety, an NIH K23 career development award (K23CA125585) and in part by the Houston VA Health Services Research Development Center of Excellence (HFP90-020).

Dr Sittig is supported in part by a Strategic Health IT Advanced Research Projects (SHARP) contact from the Office of th National Coordinator for Health Information Technology (ONC #10510592)

The views expressed in this article are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs or any of the other funding agencies.

Published online July 13, 2012

two studies. We also take the liberty of making several recommendations that might be useful to reduce failures in test result follow-up in EHR-based systems.

1) ***Hardware/Software:*** To maintain superiority over paper, EHRs must be configured to ensure that results are reported to the correct provider in a timely fashion. Thus, all test orders should be placed via a Computer-based Provider Order Entry (CPOE) system. Orders should be transmitted in a coded format to the entity performing the test, and the transmission should occur via a two-way system-to-system interface that can send orders and receive results. Otherwise, results might not make it back into the EHR in a form that allows clinical decision support interventions (e.g., alert for abnormal creatinine will not fire while entering an order for metformin).
2) ***Clinical Content:*** Results should be stored as structured/coded data to facilitate reporting and tracking of results. This feature enabled El-Kareh and colleagues to extract results from the EHR, and can facilitate result-tracking functions. Institutions must also define standardized result categories and definitions (e.g., critical, normal, etc.) to facilitate prioritization and reporting. For instance, certain levels of abnormalities can be flagged in the EHR for more immediate action based on urgency. Care should be taken to avoid flagging borderline or clinically insignificant results as urgent.
3) ***User Interface:*** A poor user interface can lead providers to miss critical information. EHRs should have result review screens that ensure that all critical information is displayed on one screen (i.e., no scrolling is required) and all columns are sufficiently wide to allow users to see all pertinent information. In addition, users should be able to sort, or filter, results by date, type, patient, or urgency.[7]
4) ***Personnel:*** Providers should be trained to process their alerts in a timely manner and document follow-up and communication of results to patients in the EHR. Poor documentation is widely prevalent and might be one reason to explain the low follow-up rates reported in El-Kareh et al.'s study.
5) ***Workflow/Communication:*** Institutions must avoid partial use of EHRs for test result management (i.e., results or notes, but not both, available electronically[8]), because this leads to a higher risk of test result follow-up failures. Workflows related to certain high-risk areas (tests ordered by residents, part-time physicians, emergency deparment physicians; send-out tests; and post-discharge results) must be well-defined. This process should include creation of back-up procedures (including use of surrogates) and fail-safe escalation systems to safeguard against results "falling through the cracks". To what extent this was done, if at all, in the El-Kareh study is unclear, and thus a seemingly straightforward technological intervention might not have reached its full potential. Additionally, practices must create robust processes to send both normal and abnormal test results to patients. In the Veterans' Health Administration (VA), providers can generate letters though EHR templates, which are then sent to patients through centralized mailing facilities. Many institutions use web-based portals to make results accessible to patients, and some directly notify patients bypassing provider review. Whether the latter approach reduces follow-up failures is unclear.[9]
6) ***Internal Organizational Policies, Procedures, Culture and Environment:*** Responsibility for test result follow-up is an under-recognized and underemphasized contributory factor in follow-up failures. Responsibility should always be clear, and can be delegated to someone as long as that procedure is clear to both parties. It is unclear how physicians in the El-Kareh study perceived their test result follow-up responsibilities; many that did not answer the survey or follow up appropriately might have attributed this responsibility to someone else (e.g., inpatient physician thought that the PCP was responsible post-discharge). We also recommend that all institutions/clinics should have an annually updated, written policy on all aspects of test result management (e.g., provider notification, patient notification, follow-up responsibilities).[10] This document should define processes and procedures for test result communication, including which results are critical and need verbal communication. Institutions should also maintain updated contact information for all providers and patients. Some of the e-mail alerts sent by the investigators might not have reached the study physicians.
7) ***External Rules and Regulations:*** In 2009, the VA released a policy directive requiring communication of all test results to patients within 14 calendar days after the test result is available to the ordering practitioner. To the best of our knowledge, there are no other federal or state policies giving guidance on definitions and measurement of timeliness of test result follow-up.
8) ***Measurement and Monitoring:*** The VA is now instituting a measurement system for test results follow-up, and we encourage other institutions to do the same. Logs of test result values, alerts, and provider acknowledgment of alert receipt (results review) could be used for this purpose. However, acknowledgment of a test result receipt does not guarantee that the follow-up action has taken place;[4] alternative measurement systems should be in place to monitor test result follow-up.

CONCLUSIONS

Timely follow-up of test results remains a problem even in institutions that use state-of-the-art EHR systems to alert providers about abnormalities. We believe that solutions to these problems will require a comprehensive sociotechnical approach beyond just implementing alerts and other technologies to improve information transfer. Both research reports in this issue of the journal convincingly illustrate this point.

Corresponding Author: *Dean F. Sittig, PhD; University of Texas – Memorial Hermann Center for Healthcare Quality Safety, School of Biomedical Informatics, University of Texas Health Sciences Center, 6410 Fannin St. UTPB 1100.43, Houston, TX 77030, USA (e-mail: dean.f.sittig@uth.tmc.edu).*

REFERENCES

1. **Lorincz CY, Drazen E, Sokol PE, Neerukonda KV, Metzger J, Toepp MC, Maul L, Classen DC, Wynia MK.** Research in Ambulatory Patient Safety 2000–2010: A 10-Year Review. American Medical Association, Chicago IL 2011. Available at: www.ama-assn.org/go/patientsafety.
2. **Callen JL, Westbrook JI, Georgiou A, Li J.** Failure to Follow-Up Test Results for Ambulatory Patients: A Systematic Review. J Gen Intern Med. 2012 doi:10.1007/s11606-011-1949-5.
3. **El-Kareh R, Roy C, Williams DH, Poon EG.** Impact of Automated Alerts on Follow-Up of Post-Discharge Microbiology Results: A Cluster Randomized Controlled Trial. J Gen Intern Med. 2012 doi:10.1007/s11606-012-1986-8.
4. **Singh H, Thomas EJ, Mani S, Sittig D, Arora H, Espadas D, Khan MM, Petersen LA.** 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):1578–86.
5. **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 Feb;125(2):209.e1-7.
6. **Sittig DF, Singh H.** A new sociotechnical model for studying health information technology in complex adaptive healthcare systems. Qual Saf Health Care. 2010;19(Suppl 3):i68–74.
7. **Singh H, Wilson L, Reis B, Sawhney MK, Espadas D, Sittig DF.** Ten strategies to improve management of abnormal test result alerts in the electronic health record. J Patient Saf. 2010;6(2):121–3.
8. **Casalino LP, Dunham D, Chin MH, Bielang R, Kistner EO, Karrison TG, Ong MK, Sarkar U, McLaughlin MA, Meltzer DO.** Frequency of failure to inform patients of clinically significant outpatient test results. Arch Intern Med. 2009;169(12):1123–9.
9. **Davis Giardina T, Singh H.** Should patients get direct access to their laboratory test results? An answer with many questions. JAMA. 2011 Dec 14;306(22):2502-3.
10. **Singh H, Vij MS.** Eight recommendations for policies for communicating abnormal test results. Jt Comm J Qual Patient Saf. 2010;36(5):226–32.