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Ten Strategies to Improve Management of Abnormal Test Result Alerts in the Electronic Health Record

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Missed abnormal test results are a significant patient safety problem, especially in the outpatient setting. Failure to communicate and follow up on abnormal diagnostic test results can lead to diagnostic errors, adverse events, and liability claims.^{1–4} Automated alert notification systems integrated within electronic health records (EHRs) offer a potential solution.^{5–6} For instance, communication of abnormal clinical information through “alerts” (computerized notifications of significantly abnormal or critical test results) can potentially facilitate rapid review of patient information.⁷ The Computerized Patient Record System (CPRS), an integrated EHR used at all Veterans Affairs (VA) facilities, uses an automated notification system (the View Alert system) to communicate abnormal diagnostic test results (Figure 1). Despite this automated notification system, we recently found that 7% of abnormal outpatient laboratory results and 8% of abnormal imaging results lacked follow-up within 30 days.^{8–9} Therefore, electronic alerts do not eliminate the problem of missed results. We also found that clinicians did not acknowledge 18% of diagnostic imaging alerts and 10% of diagnostic lab alerts. Some clinicians received an overwhelming number of alerts (e.g., > 50 per day), some of which they never reviewed. Many clinicians had inconsistent knowledge of specific features in the EHR to help manage alerts.

Improving critical test result reporting is a national patient safety goal of the Joint Commission.¹⁰ Additionally, the VA recently released a directive emphasizing timeliness of test result communication to practitioners and patients and further recommended that each VA facility

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address ordering and reporting test results.¹¹ Based on our ongoing quantitative and qualitative evaluation work, we have identified ten strategies that clinicians can use immediately to improve their management of automated notifications related to abnormal test results. We identified these strategies on the basis of two chart review studies,^{9, 12} a focus group study,¹³ and in-depth task analysis sessions¹⁴ that we conducted over the course of a 2-year project funded by the VA National Center for Patient Safety. Subsequently, we obtained informal feedback from numerous primary care physicians who agreed that adoption of these strategies could help them manage alerts more reliably and effectively. Consistent with our recently proposed model for safe EHR use,¹⁵ the strategies are divided into three groups: clinician (user) centered, human-computer interface centered and communication and workflow centered.

Clinician (user) centered

Clinician centered strategies generally require additional user training. They include:

1. Adjusting volume of notifications according to clinician preferences

Clinicians receive several types of notifications, not just abnormal test results. Many clinicians do not realize that certain non-mandatory notifications can be turned on or off. For instance, if they don't believe particular types of notifications are useful in their practice, they may decide to turn them off to reduce information overload and alert fatigue. Similarly, new users may expect to receive certain types of notifications, but these may have been turned off in the EHR by default. Therefore, clinicians must use the notification menu in the EHR to customize their notifications according to their preferences. Conversely, the EHR should allow system administrators to identify some alerts as "mandatory" so that they cannot be turned off.

2. Prevent losing track of notifications

Once acknowledged, notifications may not always stay in the clinician's inbox. Thus, if the clinician is interrupted while processing an alert, the information may be lost. CPRS offers a 'Renew Alert' feature to prevent the alert from disappearing (if, for instance, the clinician is called out of the office while processing an alert). Even though this feature currently exists in the software, and clinicians would like to have the ability to "save" alerts, we found most clinicians had no knowledge of this feature.

3. Make the processing software ("Process All") feature work

In CPRS, the "Process All" feature allows clinicians to process alerts one after the other without returning to the View Alert window. This may increase the efficiency of processing. Using this feature does not imply clinicians have to process all alerts at once; it may still be done piecemeal.

4. Create a strategy to prioritize

Clinicians who are short on time should use a strategy to prioritize alerts based on urgency level. For instance, we recommend processing high priority and critical (abnormal imaging and laboratory) alerts first. We also recommend that clinicians avoid processing alerts altogether when they are particularly rushed. Setting aside a specific time of day best suited to the clinician's workflow may be required to manage the increasing number of alerts being generated.

Human-computer interface centered

The human-computer interface centered strategies require optimal use of the existing display features of the EHR screen. They include:

5. Sorting alert notifications for easier processing

Depending on personal preferences, clinicians can sort alerts by any heading in the View Alert window (Figure 1). They may use the sorting feature to view higher priority alerts at the top of the list or to process similar kinds of alerts at the same time. For instance, sorting by location would generate a view of all inpatient alerts categorized by ward location, followed by all outpatient alerts. This technique can improve the efficiency of alert processing.

6. Resize the notification window to see more alerts

The size of the notification window can be adjusted to see more alerts on the screen. This may help to decrease the risk of missing an important alert. Particular care should be taken to ensure that the default window size does not force users to use a horizontal scroll bar to see all alert details. Horizontal scrolling could be a difficult skill for some users to master.

7. Don't miss critical information in the EHR due to small column size

When viewing information about patient diagnostic tests or labs in the EHR, clinicians may miss supplemental information due to narrow column width. For instance, in the CPRS imaging reports menu, abnormal reports are often hidden with only the "A" visible after the report. Resizing data columns will show the entire word "Abnormal." As described above in (6), default column widths should be set wide enough to see all text in the longest string.

Communication and workflow centered

Patients are often seen by multiple providers, and test results must continue to be monitored and acted upon when the primary or ordering clinician is unavailable. Strategies that focus on communication and workflow aspects include:

8. Using the "Surrogate Clinician" feature in the EHR

While clinicians are away from their offices, especially for extended periods, they must identify another clinician to receive their alert notifications. Before designating surrogates, we recommend that clinicians minimize the volume of alerts that will be transmitted to their covering partner by temporarily customizing their notifications (e.g., turning off non-urgent alerts).

9. Ensuring another clinician also gets a notification about a particular test

A CPRS feature "Alert When Results" allows clinicians to notify an additional clinician when the results of an order are available. This is most useful when a specific clinician needs to be notified of a particular test on a one-time basis, or when residents want to hand off a potentially important test to their supervisors or alternates. When clinicians need to track a particular test order to ensure proper follow-up action (regardless of result), this is the most appropriate feature to use. This feature is of special significance because the Joint Commission has recently recommended that organizations distinguish "critical tests" and "critical results."¹⁶ "Critical tests" always require rapid communication of the results, even if normal.

10. Remain "alert" about responsibility

When multiple clinicians receive notification of the same test, responsibility for follow-up may be ambiguous. For instance, a sub-specialist and a primary care provider who receive the same alert may both assume that the other will provide follow-up. While there is a need for other reliable procedures to assign message responsibility in the EHR, currently it is best to communicate verbally and clarify responsibility with the other clinician in cases where no follow-up actions have been documented.

Although our strategies have face validity, we recommend them with the caveat that we have no systematic evidence linking these strategies to improved outcomes. We plan to conduct such validation studies in the future. Another potential limitation is that we identified these strategies through research on the particular EHR used in VA health care facilities. However, because other EHR systems have similar notification capabilities and features, we believe that many of these strategies can be utilized by providers outside the VA. For example, some of the interface suggestions would be applicable to any EHR that uses basic Microsoft Windows user interface features (e.g., sorting a column by clicking on the heading; resizing a column or a window by moving the pointer to the border and dragging the column border to the desired width). Other strategies involve setting user preferences, which most EHRs allow in some form or another. Finally, several strategies describe key features or functions that have proven useful to healthcare providers. Users should work with their EHR training and support personnel or EHR vendors to propose additional desired functions in future versions of their applications.

In conclusion, we propose ten strategies to help providers better manage alert notifications related to abnormal test results in the EHR. Once these strategies have been implemented, health care organizations using automated EHR-based notification systems could potentially see fewer communication failures and improvements in test result follow-up.

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Patient Selection

Patient List Patients (PROVIDER JOHN DOE)

☒ Default: ☐ Clinics
☐ Providers ☐ Wards
☐ Team/Personal ☐ All
☐ Specialties ☐ All

Patient	Time	Date	Role
ZZtest,A	08:00	Nov 19, 2009	lpt
ZZtest,B	08:00	Nov 20, 2009	lpt
ZZtest,C	08:00	Nov 20, 2009	lpt
ZZtest,D	08:00	Nov 17, 2009	lpt
ZZtest,E	11:00	Nov 18, 2009	lpt
ZZtest,F	08:00	Nov 16, 2009	lpt
ZZtest,G	08:00	Nov 23, 2009	lpt
ZZtest,H	08:00	Nov 19, 2009	Opt
ZZtest,I	08:00	Nov 19, 2009	lpt
ZZtest,J	08:00	Nov 18, 2009	lpt
ZZtest,K	08:00	Nov 17, 2009	lpt
ZZtest,L	08:00	Nov 23, 2009	lpt
ZZtest,M	08:00	Nov 23, 2009	lpt
ZZtest,N	08:00	Nov 18, 2009	lpt
ZZtest,O	11:00	Nov 16, 2009	Opt
ZZtest,P	08:00	Nov 23, 2009	lpt
ZZtest,Q	08:00	Nov 16, 2009	Opt

Save Patient List Settings

OK
Cancel

Notifications

"View Alert" window

Info	Patient	Location	Urgency	Alert Date/Time	Message
	ZZtest,A	NU3D	High	11/20/2009@17:45	Imaging Result: CHEST 2 VIEWS
	ZZtest,B		High	11/22/2009@16:01	Abnormal Labs: PROTHROMBIN TIME&INR
	ZZtest,B		High	11/20/2009@17:45	Abnormal Labs: COMPREHENSIVE METABOLIC PANEL
	ZZtest,C		High	11/21/2009@16:01	Abnormal Labs: LIPID PROFILE
	ZZtest,D	Step-down	High	11/23/2009@17:45	Imaging Result: CHEST 2 VIEWS
	ZZtest,D		High	11/21/2009@16:01	Abnormal Labs: PROTHROMBIN TIME&INR
	ZZtest,E		High	11/19/2009@17:45	Imaging Result: KNEE 3 VIEWS, RIGHT
	ZZtest,E		High	11/21/2009@16:01	Abnormal Labs: TROPONIN
	ZZtest,G		High	11/17/2009@17:45	Abnormal Labs: COMPREHENSIVE METABOLIC PANEL
	ZZtest,J		High	11/21/2009@16:01	Abnormal Labs: PROTHROMBIN TIME&INR
	ZZtest,L	NU4A	High	11/20/2009@17:45	Imaging Result: 3D/SAG/COR/RECONSTRUCT
	ZZtest,L		High	11/22/2009@16:01	Abnormal Labs: CBC(&PLT) WITH DIFF
	ZZtest,M		High	11/23/2009@17:45	Completed Consult: ORTHOPEDICS
	ZZtest,Q		High	11/21/2009@16:01	Abnormal Labs: COMPREHENSIVE METABOLIC PANEL

Process Info Process All Process Forward Show Comments Remove

Figure 1.

The View Alert Notification window of the VA's electronic health record