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Assessment of Follow-up Completeness and Notification Preferences for Imaging Findings of Possible Cancer:

What Happens After Radiologists Submit Their Reports?

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Abstract

Rationale and Objectives—To understand the reasons leading to potentially inappropriate management of imaging findings concerning for malignancy and identify optimal methods for communicating these findings to providers.

Materials and Methods—We identified all abdominal imaging examinations with findings of possible cancer performed on six randomly selected days in August to December 2013. Electronic medical records (EMR) of one patient group were reviewed 3 months after the index examination to determine whether management was appropriate (completed follow-up or documented reason for no follow-up) or potentially inappropriate (no follow-up or no documented reason). Providers of a second patient group were contacted 5–6 days after imaging examinations to determine notification preferences.

Results—Among 43 patients in the first group, five (12%) received potentially inappropriate management. Reasons included patient loss to follow-up and provider failure to review imaging results, document known imaging findings, or communicate findings to providers outside the health system. Among 16 providers caring for patients in the second group, 33% were unaware of the findings, 75% preferred to be notified of abnormal findings via e-mail or EMR, 56% wanted an embedded hyperlink enabling immediate follow-up order entry, and only 25% had a system to monitor whether patients had completed ordered testing.

Conclusions—One in eight patients did not receive potentially necessary follow-up care within 3 months of imaging findings of possible cancer. Automated notification of imaging findings and follow-up monitoring not only is desired by providers but can also address many of the reasons we found for inappropriate management.

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Keywords

Follow-up; communication; continuity of patient care; physician practice patterns

Lack of follow-up for imaging findings of possible cancer can result in missed or delayed diagnoses and preventable patient harm (1–5). When radiologists report imaging findings that may represent cancer and issue recommendations for follow-up, they may be unaware of whether follow-up is clinically indicated. For some patients (eg, those with diffuse metastatic disease, limited life expectancy, or guarded prognosis), it is appropriate for clinicians not to pursue further testing or interventions, even if follow-up is recommended by a radiologist. Conversely, when follow-up is clinically indicated, lack of follow-up is inappropriate and generally due to system errors (eg, provider fails to read radiology report, provider fails to order follow-up test, patient misses scheduled test) (1,2,4,5). Patients who do not complete clinically indicated follow-up may present with advanced cancer long after follow-up should have occurred, often resulting in medical malpractice suits (1–4). Therefore, to improve patient safety and reduce medicolegal risk, it is critical for providers and health systems to monitor follow-up of imaging findings of possible cancer and ensure that indicated follow-up actually occurs.

Automated systems have decreased provider notification time for abnormal laboratory and pathology results, increased rates of completed laboratory and pathology follow-up, and improved provider and patient satisfaction regarding communication of these test results (5–15). Because imaging findings of possible cancer generally require delayed follow-up, sometimes up to 12 months after initial detection, automated systems are ideally suited to provide notification and monitoring of these findings. However, the effect of these systems in radiology remains relatively unexplored compared to other areas of medicine (5,16,17). In addition, optimal methods for communicating nonemergent radiology findings to physicians are poorly understood.

To better understand the reasons leading to inappropriate lack of follow-up after imaging findings of possible cancer and to determine the best methods for communicating these findings, we conducted a pilot study of provider follow-up patterns and communication preferences.

MATERIALS AND METHODS

In July 2013, our Department of Radiology implemented a standardized ordinal lexicon for reporting focal lesions on all magnetic resonance imaging (MRI), computed tomography (CT) scan, and ultrasound examinations of the liver, pancreas, kidneys, and adrenal glands. Similar to the Breast Imaging Reporting and Data System, lesions are categorized by global assessment codes indicating normal, benign, indeterminate for malignancy, suspicious for malignancy, known malignancy, or treated malignancy (18,19). We identified all examinations with imaging findings of possible cancer, defined as findings indeterminate or suspicious for malignancy, that were performed on six randomly selected days in 2013: August 15, August 16, September 10, September 11, November 21, and December 6.

At our institution, all documentations are recorded in an electronic medical record (EMR). We reviewed medical records to categorize patients as outpatients, emergency department patients, or inpatients at the time of the imaging study. Patients with any known history of cancer were stratified into active cancer (chemotherapy, radiation therapy, or surgery for cancer within the past year) and inactive cancer, as it is likely that providers follow patients with active cancer more closely.

To understand clinician follow-up patterns, we conducted a manual review of the medical records of all patients whose imaging examinations were performed on August 15–16 and September 10–11, 2013. We reviewed medical records 3 months after initial detection of imaging findings of possible cancer for documentation of planned/completed relevant follow-up imaging, pathology, or therapy (Table 1). Appropriate management was defined as 1) completion of ordered follow-up testing or treatment, or 2) documented reason for lack of follow-up. Potentially inappropriate management was defined as lack of follow-up without a documented reason (eg, provider did not order follow-up that was clinically indicated, patient missed ordered follow-up). When no reason could be found in the medical record for why follow-up was not ordered or completed, the ordering provider was contacted to determine if this lack of follow-up constituted appropriate or potentially inappropriate management.

To understand provider communication preferences regarding imaging findings of possible cancer, we contacted the ordering provider listed on the radiology report for patients whose examinations were performed on November 21 and December 6, 2013. Providers were contacted 5–6 days after the index imaging studies and were asked several questions, including whether they had ordered the imaging studies, their notification preferences for imaging findings of possible cancer, and their methods for monitoring patient completion of ordered examinations (Table 2). Initially, we contacted providers by telephone at their clinics or academic offices. When there was no answer, they were paged and/or contacted via mobile phone. If they were unavailable or preferred not to communicate by telephone, they were contacted by e-mail. If there was still no answer, their office was called again at least twice.

Data Collection and Management

Reported data were deidentified and summarized in aggregate using means and proportions. Our institutional review board approved this study.

RESULTS

Overall, 71 of 606 (12%) patients imaged during the 6 days selected for this study were flagged as having at least one imaging finding of possible cancer in the liver, pancreas, kidney, or adrenal gland (Table 3); 43 of 401 (11%) from August and September, and 28 of 205 (14%) from November and December. These 71 imaging examinations contained 79 findings of possible cancer. Mean patient age was 61 years (range, 18 to >90 years); 54% (38 of 71) of patients were men. Most examinations were performed on outpatients (54 of 71, 76%). Most imaging examinations performed were CT scans (47 of 71, 66%) and most findings of possible cancer were categorized as suspicious for malignancy (48 of 79, 61%).

The proportion of findings that were suspicious for malignancy was greater on CT and MRI scans (34 of 55, 62%; and 13 of 17, 76%; respectively) than on ultrasound examinations (1 of 7, 14%). Of 48 patients with a known history of cancer, 81% (39 of 48) had active cancer. There were no notable differences in demographics, frequency of imaging findings of possible cancer, or involved organs among patients included in the August/September sample and the November/December sample.

Patient Follow-up Patterns

Thirty-eight physicians, nurse practitioners (NP), and physician assistants ordered 43 imaging examinations showing imaging findings of possible cancer on August 15–16 and September 10–11, 2013. Acknowledgment of the imaging findings was documented in 79% of patient charts (34 of 43), a mean of 7 days after the index examination.

Nearly three-quarters of patients (32 of 43, 74%) had documentation of planned follow-up in the medical record, including imaging (13 of 32, 41%), continuation or change in chemotherapy (12 of 32, 38%), biopsy or surgery (6 of 32, 19%), and referral to specialists (3 of 32, 9%). Planned follow-up was documented among 43% (3 of 7) of patients initially imaged with ultrasound, 51% (24 of 47) of patients imaged with CT scans, and 29% (5 of 17) of patients imaged with MRI. Three months after initial detection, 84% (27 of 32) of these patients had completed follow-up, whereas 16% (5 of 32) had not (Figure 1). Of the five patients who had not completed follow-up, three had reasons noted in the patient record: two had scheduled follow-up imaging or surgery for a future date and one had decided to follow up at a local hospital. Contact with the providers of the two patients without documented reasons for lack of follow-up revealed that both patients had undergone imaging examinations as inpatients. One patient expired after discharge and before initiating new therapy; lack of follow-up in this case was thus appropriate. The second patient had been referred to a specialist for a finding suspicious for malignancy but had not presented to care after discharge. Contact with the patient's outpatient provider revealed that they agreed with the clinical need for specialist referral and that the patient had not expressed any hesitancy to complete this follow-up. Accordingly, this patient's lack of follow-up was inappropriate. Thus, among patients with plans for follow-up documented in the medical record, 97% (31 of 32) received appropriate management and 3% (1 of 32) received potentially inappropriate management.

Eleven patients (11 of 43, 26%) did not have any follow-up ordered within 3 months of their index radiology examinations (Figure 1). In almost two-thirds of these patients (7 of 11, 64%), lack of follow-up was appropriate. In six instances, the reasons for lack of follow-up were documented within the medical record; in one instance the reason was revealed through direct provider contact. Reasons for appropriate lack of follow-up included disagreement with the radiologist's recommendation for follow-up (2 of 7), patient choice not to proceed with the recommended follow-up (1 of 7), and decision not to pursue aggressive care given poor patient prognosis (4 of 7) (Table 4).

In contrast, lack of follow-up was potentially inappropriate for the remaining four patients, as revealed through contact with their ordering providers. Two providers had not seen the radiology results and one provider had seen the results but had not made a note in the chart.

The final patient had an indeterminate abnormality detected on a trauma CT scan. This finding was documented in the inpatient discharge summary, and the patient was instructed to follow-up with a primary care provider upon discharge. Although this patient saw several specialists at our institution after discharge, the ordering provider was not aware whether follow-up for the abnormal finding had been obtained at an outside institution. Discussion with all four ordering providers revealed that planned follow-up included referral to specialist/primary care provider (2 of 4), follow-up imaging (1 of 4), and unknown (1 of 4). Thus, including the patient described previously who did not present for specialist referral after discharge, 12% (5 of 43) of patients with imaging findings of possible cancer received potentially inappropriate management.

Communication Preferences

Twenty-six providers ordered 28 examinations showing imaging findings of possible cancer on November 21 and December 6, 2013. We successfully contacted 16 providers who had either ordered the imaging examination or recently seen the patient in the same clinic as the ordering provider. Providers were contacted within 5–6 days of the index examinations. Nearly all (94%, 15 of 16) providers confirmed that they had ordered the imaging examination, consistent with the information listed on the radiology report. Of the 15 providers who chose to disclose their knowledge of the imaging results, one-third (5 of 15, 33%) were not aware of the imaging findings of possible cancer, most commonly because they had not had time to review the results. Providers caring for patients with active cancer were as likely to be unaware of possible imaging findings of cancer (2 of 6, 33%) as providers caring for patients without active cancer (3 of 9, 33%).

Opinions regarding methods of notification for abnormal imaging results were varied. Most providers preferred to receive electronic notification through the EMR (12 of 16, 75%) and/or e-mail notifications (7 of 16, 44%). Phone calls (4 of 16, 25%), pages (4 of 16, 25%), and text messages (1 of 16, 6%) were deemed less desirable. Two physicians suggested either an automated phone call, in which the provider could press a number to receive a short message, or a page notification that would prompt providers to look at the medical record for a detailed report. One NP noted that e-mails would be more advantageous because some providers have limited access to medical records at home or while traveling. Finally, one provider proposed notifying each patient's primary care physician even if she/he were not the ordering provider, to offer greater continuity of care. This was felt to be particularly important for imaging findings identified during inpatient admissions.

When questioned about how an automated notification system could facilitate follow-up, nine providers (9 of 16, 56%) preferred the option of an embedded hyperlink in an e-mail or EMR notification that would allow them to order follow-up immediately. Two providers disapproved of this suggestion, explaining that it would lead to decreased clinical reasoning and increased resource utilization. One provider suggested making clinicians document that they had seen a radiology report by clicking a pop-up box in the medical record. Half of the providers (8 of 16) did not want patients to be contacted regarding abnormal imaging findings via telephone or e-mail, because of concern about patient anxiety, even if this

message simply told patients to contact their providers about the results. Four providers said both providers and patients should receive notification and four had no preference.

Only four providers had a system for monitoring whether patients had completed imaging examinations ordered within our health system. Three sent themselves reminder messages through the medical record to check the results on the day of the ordered examination. The fourth provider asked her patients to call her clinic after completing the ordered test. All providers thought that an automated monitoring system that would notify them when patients had not completed ordered follow-up for imaging findings of possible cancer would greatly improve the quality of their patients' care.

DISCUSSION

This pilot study sheds light on follow-up patterns and provider communication preferences for imaging findings of possible cancer in four ways. First, we found that 12% (5 of 43) of patients with imaging findings of possible cancer received potentially inappropriate management 3 months after initial detection. Second, one third of providers were unaware of imaging findings of possible cancer nearly a week after detection. Third, most providers preferred to be notified of imaging findings of possible cancer via an e-mail or an EMR message containing an embedded hyperlink enabling immediate follow-up order entry. Finally, only 25% (4 of 16) of questioned providers had a system to monitor whether their patients had completed ordered testing in our health system.

Most data on missed and delayed diagnoses are derived from analyses of malpractice cases, which are not representative of the overall proportion of patients who receive inappropriate care after imaging findings of possible cancer. The scale of this important quality and safety issue is thus difficult to assess. Our pilot study suggests that one of eight patients with imaging findings of possible cancer does not receive potentially necessary management, which may include imaging, continuation or change in chemotherapy, biopsy, surgery, or specialist referral. This rate of missed follow-up is higher than the rate found by Choksi et al. Their study, performed at a Veterans Administration (VA) hospital, showed that 2% (8 of 395) of patients with imaging findings that were equivocal or suspicious for malignancy were potentially lost to follow-up (5). Differences in our results may reflect variations in methodology, sample size, patient population, or out of pocket costs for health care between the VA and our private health care system. Ultimately, systems that reliably identify and monitor patients with imaging findings of possible cancer can help quantify the true number of patients who do not receive appropriate follow-up care. Such systems could further improve patient care by also measuring the effects of interventions aimed at increasing the number of patients who receive appropriate management.

Reasons for potentially inappropriate management in our study included failure of the referring provider to receive imaging results, failure of the referring provider to document a known imaging finding, and patient loss to follow-up. None of the five patients who received potentially inappropriate management had documented reasons for lack of follow-up, even though one patient had active cancer and was likely under close surveillance. These findings are concordant with prior literature demonstrating that when a specified follow-up plan is

not documented, patients are less likely to receive follow-up care, even when physicians are aware of the abnormal results (16,17,20). Similar to prior studies, we also found that documented acknowledgment of imaging findings of possible cancer in the patient record was not sufficient to ensure appropriate management (20). For example, although one imaging finding of possible cancer was acknowledged in an inpatient discharge summary, failure to document a follow-up plan and assure that the radiologist's recommendations were communicated to and carried out by the outpatient provider located outside of our health system contributed to potentially inappropriate management. Ensuring that outpatient providers are aware of abnormal imaging findings is particularly challenging when the care team is spread across multiple health systems. Electronic notification systems can improve awareness of abnormal test results that are pending at inpatient discharge when outpatient providers are within the same health network (13). However, when these providers are outside the network in which the imaging abnormality is discovered, automated exchange of health information may not be available and can only be accomplished through alternative mechanisms (eg, facsimile, manual contact).

One-third of providers surveyed were unaware of imaging findings of possible cancer nearly 1 week after detection, often because they had not had time to review the radiology reports. This observed delay demonstrates that reliance on providers to track all radiology results is inefficient and may also be ineffective. Direct communication and automated tracking of abnormal imaging results by our radiology department could ensure that providers discover these results promptly, assuring appropriate and timely follow-up. Not surprisingly, most providers we surveyed wanted to be notified of imaging findings of possible cancer through the medical record or e-mail. Most also desired a hyperlink embedded within the electronic message to facilitate follow-up order entry at the time of notification. Automated systems using the medical record and e-mail to notify providers of abnormal pathology and laboratory medicine results have shown considerable success (13). Such systems could be used to notify providers electronically of imaging findings of possible cancer, with standardized language for communicating the urgency of findings and any associated follow-up recommendations. Although we did not ask providers about report style preferences, prior studies show that primary care providers prefer explicit follow-up recommendations, whereas specialists prefer reports without recommendations (21). Follow-up recommendations could be provided according to evidence-based guidelines, including the American College of Radiology's guidelines for monitoring incidental findings (22–24). Electronic notification via e-mail or the medical record, which is feasible within the most existing EMR systems, could be adapted to incorporate embedded hyperlinks, thereby allowing providers to generate a follow-up plan at the time they receive the notification (24). It remains to be seen, however, whether implementation of either of these methods can improve communication with providers, patient follow-up rates, and patient satisfaction, as has been demonstrated outside of radiology (4–16).

Only four providers (4 of 16, 25%) surveyed had a system to monitor whether their patients had completed ordered follow-up. This result is consistent with previous literature demonstrating that despite an average of 74 minutes spent managing test results per clinical day, 48% of primary care providers have no system to monitor ordered tests and 68% have no system to determine if patients have completed ordered tests (25,26). These findings are

troubling, given that inadequate and absent follow-up tracking are known to contribute to up to 30% of missed and delayed diagnoses in the outpatient setting (2,4,27,28). Automated monitoring, which is highly desired by our provider population, could help by promoting completion of clinically indicated follow-up for imaging findings of possible cancer.

Half of providers surveyed (8 of 16) did not want patients to be contacted via telephone or e-mail, even if the message simply prompted patients to contact their providers about their results. This finding differs from prior surveys demonstrating that 65% of providers and up to 92% of patients wanted radiologists to report imaging results to both the physician and the patient (29–31). Our results may differ for a variety of reasons, including sample size, methodology, or the increasing ease with which patients are able to contact providers through electronic means. At the heart of this discrepancy is the question of whether the main consumer of the radiology report is the patient undergoing the examination or the provider ordering the examination. In 2004 and 2008, two separate court decisions found that radiologists should communicate abnormal imaging findings directly to patients (32). Yet, radiologists often do not know whether follow-up is clinically indicated. Additionally, they cannot accurately predict which patients with imaging findings of possible cancer will be lost to follow-up. As our study illustrates, even patients with active cancer who are followed closely by multiple providers can have missed or delayed follow-up. Direct communication of all imaging results to patients could provide yet another safeguard for ensuring that providers read and follow up on abnormal findings, but this will require great consideration and resources. Patient access to radiology reports through secure Web portals can facilitate direct communication, although patient utilization of these systems varies widely (33) and requires coordination with referring provider workflow. At our institution, patients can access test results online after a delay of several days, allowing referring providers to view reports and, if warranted, contact patients proactively to provide an interpretation of the results.

Our study has several limitations. First, it is limited by a small sample size, particularly in its assessment of provider communication preferences. Second, although our findings regarding provider follow-up patterns and communication preferences are similar to prior studies, all patients and physicians in this study were located at a single large urban adult-only academic medical center that is also a National Cancer Institute designated cancer center and a level I trauma center. Thus, our results may be less applicable in other settings. Finally, we did not confirm rates of proven cancer among patients in our study, as this was not our objective.

In conclusion, we found that 12% of patients at our institution received potentially inappropriate management for imaging findings of possible cancer. Electronic tracking of these imaging findings could address some of the reasons for lack of follow-up found in our study, such as failure to receive results or generate a follow-up plan, but will not address other reasons, such as failure to communicate inpatient imaging findings to outpatient providers outside the health system. Nonetheless, we are currently exploring methods for electronically monitoring patients with imaging findings of possible cancer, both to measure and to reduce the amount of inappropriate lack of follow-up at our institution.

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Figure 1.

Follow-up patterns among 43 patients with imaging findings of possible cancer. Overall, 38 patients received appropriate management. Among these, 23 had active cancer, 31 imaging findings were indeterminate for cancer, and 12 imaging findings were suspicious for cancer. The remaining five patients received potentially inappropriate management (ie, because of system errors). Among these patients, one had active cancer, four imaging findings were indeterminate for cancer, and one imaging finding was suspicious for cancer.

TABLE 1**Chart Review and Telephone Survey for Determining Patient Follow-up Patterns**

1	Admission status when imaging examination was performed (ambulatory, Emergency Department, inpatient)
2	Was the imaging finding of possible cancer acknowledged in the patient chart? If yes, proceed to question 3; if no, skip to question 4
3	Days between date of imaging examination and acknowledgement of finding(s)
4	Did the provider order/plan to order any follow-up for the imaging finding of possible cancer? If yes, proceed to question 5; if no, skip to question 6
5	What type of follow-up did the provider order/plan to order?
6	If no follow-up was planned/ordered, was a reason found in the patient chart? If yes, proceed to question 7; if no, skip to question 8
7	What reason for lack of planned/ordered follow-up was given in the chart?
8	What reason for lack of planned/ordered follow-up was given by the provider (via telephone or email)? <i>Chart is complete</i>
9	Did the patient receive planned follow-up? If yes, chart is complete; if no, proceed to question 10
10	Was a reason for lack of follow-up found in the patient chart? If yes, proceed to question 11; if no, skip to question 12
11	What reason for lack of follow-up was given in the patient chart?
12	What reason for lack of follow-up was given by the provider (via telephone or email)?

TABLE 2**Telephone Survey for Determining Provider Communication Preferences**

1	Are you the provider who ordered this imaging examination?
2	Were you aware of the abnormal finding(s) on the imaging examination?
3	How do you plan to follow-up on the abnormal finding(s)?
4	We are creating an automated system to notify providers about abnormal imaging findings. What type of automatic notification would you prefer? Examples include: <ul style="list-style-type: none"> a. Message through electronic medical record b. Email c. Telephone call d. Page e. Text message f. Other
5	Do you have suggestions for how this automated system could facilitate follow-up? Examples include: <ul style="list-style-type: none"> a. An automated email or phone call to the patient that provides imaging results b. An automated email or phone call to the patient that asks him/her to call the office but does not provide results c. A hyperlink embedded within the electronic medical record or email notification allowing you to order a follow-up examination immediately d. An automated message sent to a staff member who can contact the patient on your behalf and order follow-up testing e. Other
6	Who should be notified of imaging findings of possible cancer? Options include: <ul style="list-style-type: none"> a. Provider only b. Patient only c. Provider and patient
7	Do you currently have a system to monitor whether a patient for whom you have ordered a test has received that test? If no, survey is complete; if yes, proceed to question 8
8	Please describe your monitoring system.

TABLE 3

Patient and Imaging Characteristics

Variable	Value	
	<i>n</i>	%
Number of exams flagged	71	—
Mean examinations flagged per day	12	—
Patient age, years (mean, range)	61	18 to >90
Male gender	38	54
Admission status		
Outpatient	54	76
Emergency department *	6	8
Inpatient	11	15
Known history of cancer	48	68
Active cancer †	39	55
Imaging modality of initial detection		
Computed tomography (CT)	47	66
Magnetic resonance imaging (MRI)	17	24
Ultrasound	7	10
Organ with imaging finding of possible cancer (<i>n</i> = 79) ‡		
Liver	36	46
Pancreas	5	6
Kidney	29	37
Adrenal gland	9	11
Types of imaging findings (<i>n</i> = 79) ‡		
Indeterminate	31	39
Suspicious for malignancy	48	61

CT, abdomen/pelvis or urogram, with or without contrast; MRI, with or without contrast; Ultrasound, retroperitoneal or right upper quadrant.

* Including trauma.

† Defined as chemotherapy, radiation therapy, or surgery for malignancy within the past year.

‡ There were a total of 79 imaging findings of possible cancer, as some patients had more than one abnormality.

TABLE 4**Reasons for Incomplete Follow-up of Imaging Findings of Possible Cancer**

Reason	Follow-up Management	<i>n</i>
Follow-up ordered but not completed; reason documented (<i>n</i> = 3)		
Follow-up planned for future date	Appropriate	2
Follow-up at outside institution	Appropriate	1
Follow-up ordered but not completed; reason not documented (<i>n</i> = 2)		
Patient death	Appropriate	1
Loss to follow-up after hospital discharge	Potentially inappropriate	1
Follow-up not ordered; reason documented (<i>n</i> = 6)		
Disagreement with recommended follow-up	Appropriate	1
Patient choice	Appropriate	1
Poor prognosis	Appropriate	4
Follow-up not ordered; reason not documented (<i>n</i> = 5)		
Disagreement with recommended follow-up	Appropriate	1
Provider unaware of finding	Potentially inappropriate	2
Provider aware of finding; no follow-up ordered	Potentially inappropriate	1
Patient presumed to have followed up at outside institution	Potentially inappropriate	1