

Closing the Loop: A Radiology Follow-up Recommendation Tracking System

PURPOSE

An unexpected incidental finding represents an opportunity to identify malignancy or other serious medical condition at an early and treatable stage. Communication of the incidental finding and follow-up recommendation to the referring provider, while consistent with the current standard of care, does not assure that the follow-up study will be performed. Recent studies have confirmed that current systems in place by primary care providers (PCPs) are only 30-70% effective in assuring that recommended follow-up examinations are performed (1, 2). This low rate of compliance with radiologist recommendations reduces the ability of radiologists to positively impact the outcome of our patients and to add value to the health system.

Causes of non-compliance with obtaining follow-up imaging studies include inconsistent communication between radiologists, emergency department providers, subspecialists, and PCPs. Tracking systems in PCPs' offices are variable and inconsistent. Failure to obtain timely recommended follow-up imaging studies may result in delay in diagnosis of malignancy with an associated reduction in treatment options, increased cost of care and morbidity, and increase in medical legal liability. Multiple patients were identified at our institution through our quality assurance program in which failure to obtain a recommended follow-up study, despite documented communication of the findings to the referring provider, led to delay in diagnosis and presentation of untreatable end stage metastatic malignancy. An example is demonstrated in Figures 1 and 2.

Many of the failure points in the communication and operational aspects of compliance with radiologist recommendations are outside of the control of the radiology department. Given this, we have developed a three stage radiology recommendation follow-up tracking system to serve as a backstop to the currently existing tracking systems within PCPs offices. The objectives of our tracking system include: increasing the rate of compliance with obtaining recommended imaging, identifying the clinical rationale for why recommended imaging is not obtained, and improving patient outcomes by reducing the rate of patients for whom recommended follow-up "falls through the cracks".

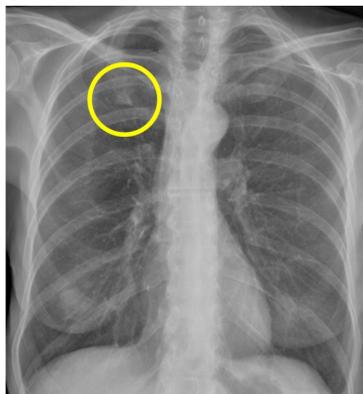


Figure 1 – Initial presentation to ED for chest pain in 2012. Possible right upper lobe lung nodule identified. CT follow-up recommended. Communication to ED provider documented.

Figure 2 – CT Chest follow-up was not performed. Patient returned to ED in 2015, again with chest pain. Large right upper lobe lung mass confirmed to be Stage IV lung cancer.

METHODS

A three stage system was developed to track all recommendations for additional radiology imaging studies and image guided interventional procedures. All imaging modalities were included with the exception of mammography, obstetrical ultrasound, and interventional radiology. Recommendations were tracked for patients from the emergency department as well as inpatient and outpatient settings. Radiologists were asked to identify all reports with non-conditional recommendations at the time of dictation which were flagged by transcription for entry into the tracking system. Each recommendation entered required both a specific imaging modality or modalities which would satisfy the recommendation and a recommendation due date. If a range was provided for the recommendation due date then the longest time interval was used for tracking purposes. Individual recommendations were tracked, not patients or reports, as some reports contained more than one recommendation with separate imaging modalities recommended and separate due dates. All tracking interventions were directed to the patient's PCP. If no PCP was recorded for this patient, a letter was sent directly to the patient explaining that a radiology recommendation was overdue and they were encouraged to obtain a PCP and discuss the recommendation with them.

For this project, timely follow-up was defined as completion of the recommended imaging test or procedure within one month (before or after) the recommendation due date. One month following the recommendation due date, our tracking system navigator would query the radiology information system (RIS) to determine if the recommended study had been completed or scheduled. If it was completed, this was documented and tracking for this recommendation was closed. If it was not, our Stage 1 intervention was performed. This consisted of re-sending the radiology report from which the recommendation was generated along with a cover letter to the PCP office explaining that our department had identified a patient whose follow-up may be "falling through the cracks". This form could be faxed or emailed back to our navigator with explanation for why the recommendation was not performed if one could be identified. If our RIS query at any stage of the process revealed that the recommended study was scheduled but not yet performed, the patient was held at the same stage of the process and reassessed the following month.

One month following our Stage 1 intervention, the RIS was again queried for completion of the recommended study. If completed, this was documented and tracking for this recommendation was closed. If not, our Stage 2 intervention, a phone call from our tracking system navigator to the PCP office secretary or nurse, was performed. If no information was obtained from this phone conversation that allowed us to close the tracking of this recommendation, we again queried the RIS the following month. If the examination had still not been completed, our Stage 3 intervention was performed. This intervention was a direct radiologist to PCP phone call. For any recommendation that could not be closed following this conversation, the patient was sent a letter explaining that an overdue radiology recommendation exists and instructing them to contact their PCP.

Both on-site community hospital radiologists and academic subspecialist radiologists reading remotely participated in the tracking system. The program was rolled out at the Department-wide Quality Assurance conference and followed with intermittent reminder emails. Best practice recommendation guidelines including the ACR white papers on incidental findings and the Fleischner Society Guidelines for pulmonary nodules were distributed electronically for easy access in an attempt to improve the consistency of radiologist compliance with evidence based best practice follow-up guidelines.

All recommendations were entered into a Microsoft Access database developed in-house for this tracking system. Statistical analysis was performed with the assistance of the hospital's quality assurance division.

RESULTS

BASELINE (PRE-INTERVENTION)

881 follow-up recommendations were entered into the tracking system from Feb 1, 2015 to Feb 29, 2016. This represents 1.3% of the 69,867 total radiology studies performed at F.F. Thompson Hospital (Canandaigua, NY) over these 13 months. 591 of the 881 (67.1%) tracked recommendations had a due date within the time frame of this project. Of the 591 recommendations tracked and closed, 254 (43.0%) had the recommended study completed at our institution in a timely manner (within a month before or after the recommendation due date). An additional 10 recommended studies (1.7%) were completed more than one month prior to the recommendation due date. Of these 10 exams, 7 (70%) did not resolve the clinical question and generation of an additional recommendation was required. An alternative imaging study was performed in 9 (1.5%) patients which, although not the specific recommended examination, resolved the clinical question (Figure 3).

Four recommendations were clinically closed following surgical biopsy. During recommendation entry, 16 patients (2.7%) were identified as not having an active PCP. They were sent a letter disclosing the presence of an outstanding follow-up recommendation, information on how to register with a health system based PCP, and were encouraged to do so. The remaining 296 recommendations (50.1%) entered the first stage of our tracking system.

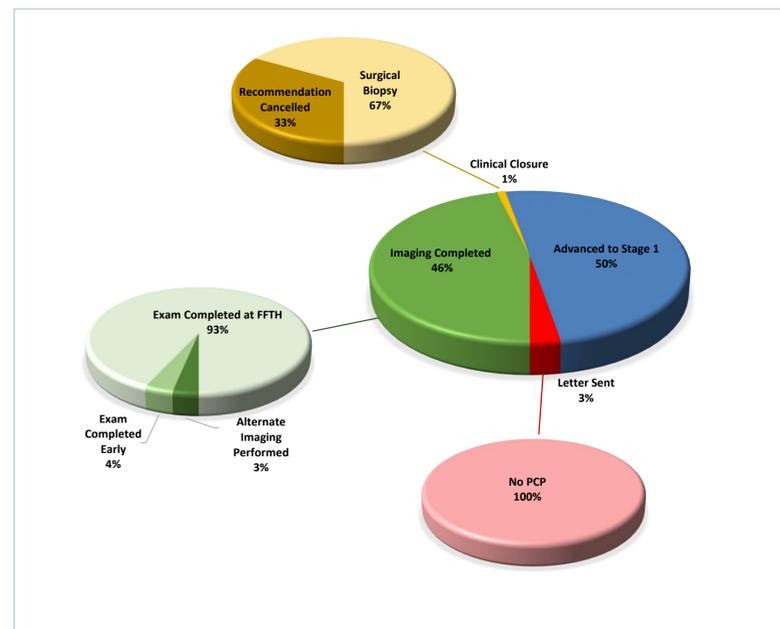


FIGURE 3

STAGE 1 (RESEND THE REPORT)

Within the month following Stage 1 intervention (resending the radiology report to the patient's PCP's office with a cover letter requesting attention to the overdue recommendation), 41 patients of the 296 intervened upon (13.9%) had the recommended study performed at our institution. Another 8 patients (2.7%) at an affiliated hospital and 7 patients (2.4%) at non-affiliated imaging centers were identified as having the recommended imaging performed. An additional 4 patients (1.4%) obtained alternative imaging which resolved the clinical question. A total of 60 patients (20.3%) were confirmed to have obtained imaging following Stage 1 intervention (Figure 4).

Information was obtained following Stage 1 intervention that allowed clinical closure for an additional 25 patients (8.5%). Examples include clinical management such as referral to the medical oncology or pulmonary service (13), patient deceased or on palliative care (10), and biopsy (2). Tracking was unable to continue for 8 patients (2.7%) who were deemed at risk for being lost to follow-up. Each of these patients received a letter. The remaining 203 tracked recommendations (68.6%) were advanced to Stage 2.

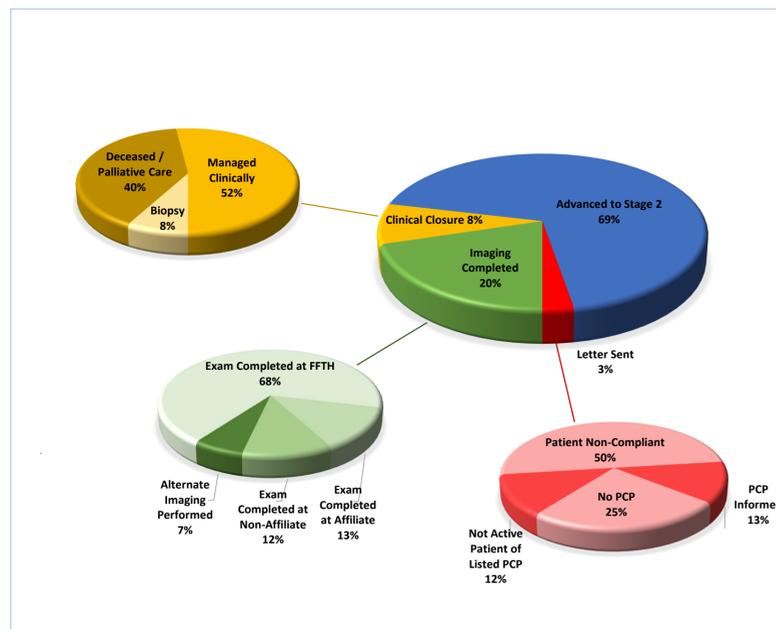


FIGURE 4

STAGE 2 (NAVIGATOR TO PCP OFFICE CALL)

Following Stage 2 intervention (tracking system navigator call to PCP office secretary or nurse), 18 patients of the 203 intervened upon (8.9%) had the recommended study performed at our institution. Another 15 patients (7.4%) at an affiliated hospital and 18 patients (8.9%) at non-affiliated imaging centers were identified as having the recommended imaging performed. An additional 4 patients (2.0%) obtained alternative imaging which resolved the clinical question. A total of 55 patients (27.1%) were confirmed to have obtained imaging following Stage 2 intervention (Figure 5).

Information was obtained following Stage 2 intervention that allowed clinical closure for an additional 45 patients (22.2%). Examples include clinical management such as referral to medical oncology or the pulmonary service (29), patient deceased or on palliative care (13), and biopsy (1). Tracking was unable to continue for 39 patients (19.2%) who were deemed at risk for being lost to follow-up. The largest share (23) were non-compliant with PCP efforts to schedule the imaging test or a follow-up clinical appointment to discuss the recommendation. Each of these patients received a letter. The remaining 64 tracked recommendations (31.5%) were advanced to Stage 3.

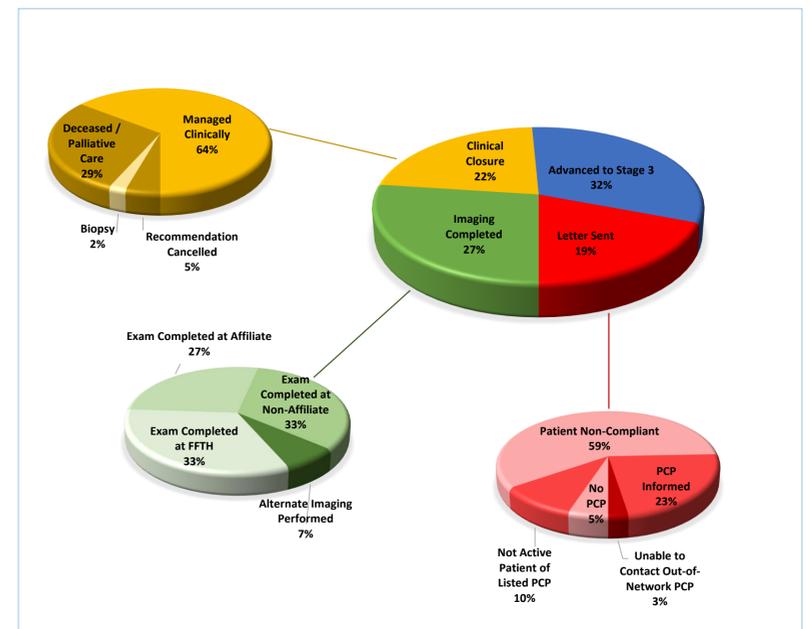


FIGURE 5

LETTERS TO PATIENTS

Letters were sent to a total of 97 patients identified as at risk to be lost to follow-up. Of the 97 patient letters sent, 15 (16.0%) resulted in exam completion at our hospital (Figure 7). These exam completions are included in the individual stage exam completion data above, associated with the intervention stage that prompted the letter to be sent.

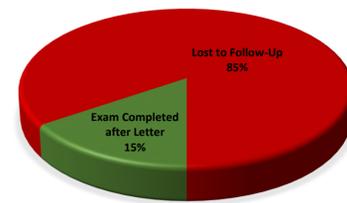


FIGURE 7 – LETTERS TO PATIENTS

COMPLETE THREE STAGE TRACKING SYSTEM

The combined three stage tracking system increased the number of recommended imaging studies completed at F.F. Thompson Hospital from 254 (43.0%) to 317 (53.6%). In addition to these 63 imaging studies completed at our hospital, following one of our three intervention actions, 8 recommended imaging studies were performed at affiliated hospitals and 15 recommended imaging studies were performed at non-affiliated imaging centers. Six patients had an alternative imaging study performed following our intervention that answered the clinical question. Fifteen patients completed recommended imaging examinations after receiving a letter from our department explaining the overdue recommendation. A total of 107 imaging studies were performed following our tracking system intervention out of 312 recommendations intervened upon (34.3%) (Figure 8).

The tracking system also provided information regarding both acceptable clinical non-imaging follow-up and imaging tests performed prior to our intervention at other facilities that was not available to our navigator upon review of our RIS. An acceptable rationale for clinical closure increased from 6 recommendations (1.0%) prior to intervention to 94 recommendations (15.9%) following tracking system intervention. These include 52 patients managed clinically (referral to specialist), 23 palliative care or deceased, 7 biopsies, and 12 recommendations cancelled. In addition to these 88 clinical closures, information was obtained confirming pre-intervention completions of recommended imaging for 15 recommendations at affiliated hospitals and 17 recommendations at non-affiliated sites. Three patients were also identified as having an alternative imaging test performed prior to intervention which answered the clinical question. Information allowing for confident closure of the recommendation outside of routine navigator query of our RIS was identified for 123 recommendations.

Combining imaging completion and information obtained leading to clinical closure; the tracking system confirmed satisfactory follow-up for 509 of 591 recommendations (86.1%) entered into the system. The remaining 82 recommendations (13.9%) remained lost to follow-up, the result of patient non-compliance. The tracking system resulted in an 82.4% increase in our department's ability to "close the loop" when compared to an initial RIS check performed one month following the recommendation due date (from 279 exams to 509 exams).

Aggregate Tracking System Effectiveness

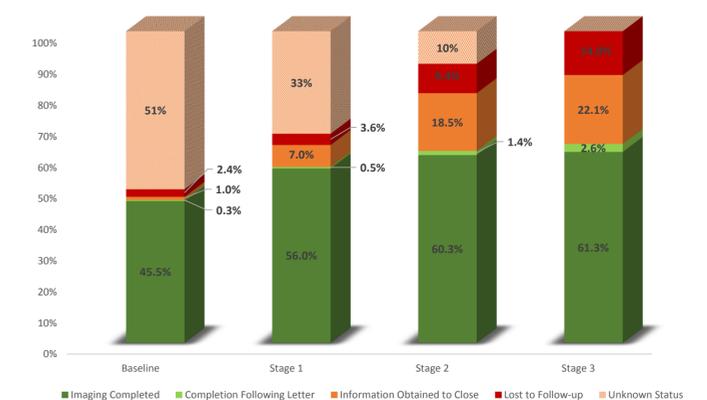


FIGURE 8

Ben C Wandtke, MD, MS and Sarah Gallagher, RN, BS



STAGE 3 (RADIOLOGIST TO PCP CALL)

Following Stage 3 intervention (direct radiologist to PCP phone call), 4 patients of the 64 intervened upon (6.3%) had the recommended study performed at our institution. Another 7 patients (10.9%) were identified as having the recommended imaging performed at a non-affiliated imaging center. One additional patient (1.6%) obtained alternative imaging which resolved the clinical question. A total of 12 patients (18.8%) were confirmed to have obtained imaging following Stage 3 intervention (Figure 6).

Information was obtained following Stage 3 intervention that allowed clinical closure for an additional 18 patients (28.1%). Clinical management such as referral to medical oncology or the pulmonary service accounted for 10 closures (15.6%). The radiologist cancelled 8 recommendations (12.5%) prior to intervention that were not required. Most commonly, a new comparison study was made available that demonstrated long-standing stability of the lesion in question. The remaining 34 patients (53.1%) were unable to be closed despite all three interventions and were deemed at risk for being lost to follow-up. Patients were either identified to be non-compliant with PCP efforts at obtaining recommended follow-up (19) or the PCP had simply lost track of the recommendation and expressed an intent to reach out to the patient to have the recommended imaging scheduled. Each of these 34 patients received a letter.

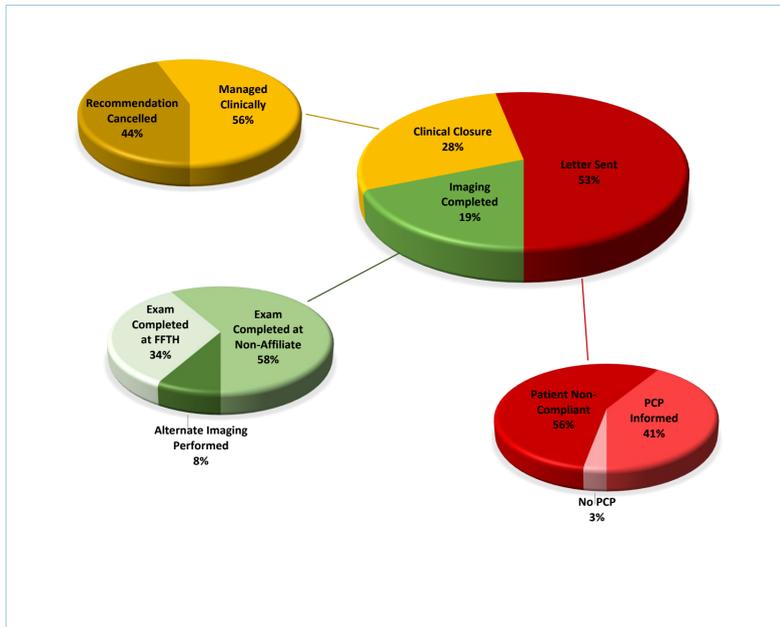


FIGURE 6

DISCUSSION

Follow-up imaging recommendations are utilized by radiologists in 2-5% of all radiology reports (3, 4). This small subset of patients has the highest likelihood to have a potentially serious medical condition, such as an early stage malignancy. The potential impact of radiologist reports to the health outcomes of these patients is subsequently much greater than other radiology reports. Current standard of care communication and recommendation tracking practices are inconsistent, with as many as 71% of recommendations falling through the cracks (1). Those patients for whom a follow-up recommendation is generated represent an optimal patient population to focus additional resources upon in order to more effectively link the diagnostic efforts of radiologists to the outcomes of patients they care for. Closing the loop on these recommendations reduces the risk of delay in diagnosis for our patients and improves the care options available for those diagnosed with serious medical conditions. 60-80% of lawsuits involving radiologists involve a breakdown in communication between radiologist and provider (5-8). Improving the rate of compliance with follow-up imaging would reduce the medical legal liability associated with delay in diagnosis for the radiologist, ordering provider, PCP, hospital / health system, and covering insurance provider.

PROBLEMS WITH THE STANDARD OF CARE

The current standard of care for communication of radiology results is provided by the ACR Practice Parameter for Communication of Diagnostic Imaging Findings 2014. In "non-routine clinical situations, the interpreting physician should expedite the delivery of a diagnostic imaging report (preliminary or final) in a manner that reasonably ensures timely receipt of the findings. This communication will usually be to the ordering physician/health care provider or his/her designee." Non-routine communications include: "Findings that the interpreting physician reasonably believes may be seriously adverse to the patient's health and may not require immediate attention but, if not acted on, may worsen over time and possibly result in an adverse patient outcome". (9) Consequently, non-routine communications, as defined by the ACR, include both unexpected incidental findings and actionable findings such as any other potentially malignant lesion even if not unexpected.

Following additional communication steps outlined above or radiologist distribution of a duplicate report to the PCP if on record in the EMR, the responsibility for tracking pending follow-up recommendations rests primarily in the hands of PCPs. PCP office based tracking systems are variable in their quality and effectiveness. Compliance with follow-up recommendations varies in the literature from 29% to 78% (1, 2). Radiology departments have access to the Radiology Information System (RIS), a powerful tool to identify compliance with follow-up recommendations. By monitoring the RIS following the recommendation due date, radiology departments can add value to the health system by working collaboratively with our PCP colleagues and acting as a second line of defense by identifying when a patient may be "falling through the cracks" and attempting to prevent this occurrence.

DISCUSSION (CONTINUED)

ADDING VALUE – ACR 3.0

There are many possible ways to add value once you have identified this group of patients with high risk imaging findings that are at risk of being lost to follow-up. Many EMR systems allow for alerts to be generated when a recommendation is overdue. This may be effective, but if used in isolation runs the risk of "alert fatigue", a condition that occurs when health care providers are inundated with more alerts than they can reasonably act upon and as a consequence ignore important alerts. This has been documented in the VA system, a good example of a large health system with a single EMR. 70% of providers in this system already receive more alerts than they can effectively manage and 30% reported having personally missed results that led to care delays (10). Many smaller health systems and community hospitals such as ours contain private practices with disparate EMR systems which limits the ability of EMR to serve as the core intervention to improve follow-up compliance.

The novel 3 stage tracking system that we developed begins with the least disruptive form of communication and progresses to direct radiologist to PCP conversation. While the Stage 3 intervention is a disruptive communication event for both radiologist and PCP, it was only required for (11%) of recommendations tracked (64 of 591) and offers an excellent opportunity to demonstrate radiologist concern for patient outcomes and a commitment to quality that was routinely perceived by our PCP colleagues as exceptional. This intervention helps our radiologists "move out of the reading room" and fits well with the ACR 3.0 initiative.

Each of the interventions utilized in our tracking system demonstrated value (Table 1). We anticipated that more disruptive interventions would yield a higher rate of compliance improvement. This was clearly demonstrated when comparing Stage 1 intervention (29% combined imaging completed and clinical closure) with Stage 2 intervention (49% combined closure). Stage 3 intervention yielded similar results to Stage 2 intervention (47% combined closure). We suspect that a selection bias has limited the benefit of the Stage 3 intervention, as many compliant patients have been removed prior to patients entering Stage 3. Even mailing letters to patients proved beneficial, with 16% of letters sent yielding a completed imaging study.

CLINICAL FOLLOW-UP DEFINED

In order to identify patients at risk of being lost to follow-up, we had to define categories of appropriate clinical non-imaging follow-up. Patients who had undergone biopsy of the lesion in question, were on palliative care, or passed away clearly have a valid medical reason to not obtain the recommended imaging follow-up. The vast majority of patients that we defined as managed clinically were referred by the PCP to a subspecialist such as an oncologist for management of the actionable finding in question. Given our central tenet of working exclusively with PCPs, we did not want to expand our program to track these patients through their workup with the specialist. The act of the PCP discussing the recommendation with the patient and one or both parties choosing to see a specialist in regard to this finding was sufficient for us to determine that this patient was not "lost to follow-up".

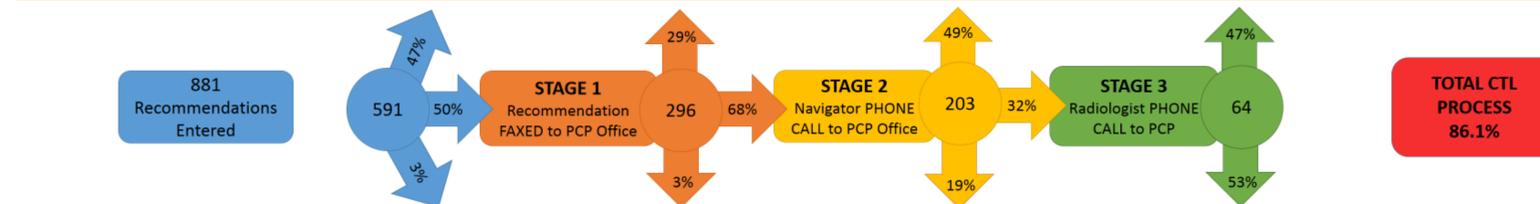
PATIENT CENTERED WORKFLOW

From a patient centric viewpoint, current communication of incidental findings to ordering ED and hospitalist providers is inherently flawed. By training, these providers are focused on the acute medical condition of the patient. These providers are not directly involved in ordering the recommended follow-up imaging study which often needs to be performed months in the future, but become responsible for again communicating the follow-up recommendation to the PCP. Only half of radiology follow-up recommendations are included in ED discharge summaries sent to PCPs and provided to patients (3). A similarly problematic dynamic occurs with subspecialists who may have only a single or few interactions with a patient or are asked to manage an incidental finding outside of the scope of their practice. Given that secondary communication between referring provider and PCP is inconsistent and out of control of the radiologist creates medical legal risk for the radiologist and the potential for patient harm via delay in diagnosis.

In order to place the patient's interests at the center of our workflow, we chose to center our tracking system efforts exclusively with primary care providers who have a longstanding relationship with the patient and well-rounded experience handling a wide range of incidental findings. Successful communication of an incidental finding to the referring provider does not ensure that the patient was ever informed of the recommendation. Therefore, before any patient was considered lost to follow-up and tracking efforts were stopped, that patient would be contacted by our radiology department via a direct mailing.

TABLE 1

	1	2	3	4	5	
Imaging Completed	Alternate Imaging Performed	9 (1.5%)	4 (1.4%)	4 (2.0%)	1 (1.6%)	18 (3.1%)
	Exam Completed Early	10 (1.7%)	-	-	-	10 (1.7%)
	Exam Completed @ FFTH	254 (43.0%)	41 (13.9%)	18 (8.9%)	4 (6.3%)	317 (53.6%)
	Exam Completed @ Affiliate	-	8 (2.7%)	15 (7.4%)	-	23 (3.9%)
	Exam Completed @ Non-Affiliate	-	7 (2.4%)	18 (8.9%)	7 (10.9%)	32 (5.4%)
	Total	273 (46.2%)	60 (20.3%)	55 (27.1%)	12 (18.8%)	400 (67.7%)
Clinical Closure	Recommendation Cancelled	2 (0.3%)	-	2 (1.0%)	8 (12.5%)	12 (2.0%)
	Surgical Biopsy	4 (0.7%)	2 (0.7%)	1 (0.5%)	-	7 (1.2%)
	Deceased / Palliative Care	-	10 (3.4%)	13 (6.4%)	-	23 (3.9%)
	Managed Clinically	-	13 (4.4%)	29 (14.3%)	10 (15.6%)	52 (8.8%)
	Total	6 (1.0%)	25 (8.5%)	45 (22.2%)	18 (28.1%)	94 (15.9%)



	1	2	3	4	5	
Letter Sent	No PCP	16 (2.7%)	2 (0.7%)	2 (1.0%)	1 (1.6%)	21 (3.6%)
	Not Active Patient of Listed PCP	-	1 (0.3%)	4 (2.0%)	-	5 (0.9%)
	Patient Non-Compliant	-	4 (1.4%)	23 (11.3%)	19 (29.7%)	46 (7.8%)
	PCP Informed	-	1 (0.3%)	9 (4.4%)	14 (21.9%)	24 (4.1%)
	Unable to Contact Out-of-Network PCP	-	-	1 (0.5%)	-	1 (0.2%)
	Total	16 (2.7%)	8 (2.7%)	39 (19.2%)	34 (53.1%)	97 (16.4%)
Exam Completed After Letter Sent	2 (12.5%)	1 (12.5%)	5 (12.8%)	7 (20.6%)	15 (16.0%)	
Lost to Follow-up	14 (2.4%)	7 (2.4%)	34 (16.8%)	27 (42.2%)	82 (13.9%)	

FINANCIAL IMPACT

Beyond improving patient care and reducing medical legal risk, the establishment of a recommendation tracking system creates a financial incentive in the current fee for service reimbursement system. In the course of tracking the recommendations generated from 69,867 examinations, our system was responsible for 107 additional examinations. Higher reimbursing imaging modalities represent the majority of additional imaging volume generated with CT (64 exams, 59.8%) leading the way, MRI (14 exams, 13.1%), ultrasound (21 exams, 19.6%), and X-Ray (8 exams, 7.5%) made up the remainder of volume generated. Excluding administrative time to establish an initial database (minimal) and radiologist time to make the rare Stage 3 call, expense was generated solely by the tracking system navigator position. Our navigator, with prior experience as a medical front office secretary, worked 8 hour per week resulting in a \$9,000 labor expense for the 13 months of this project. Preliminary analysis suggests a positive annual return on investment in addition to the quality gains demonstrated.

LIMITATIONS

A potential limitation of our project and the development of similar tracking systems in general is that the radiology literature does not contain evidence based guidance for follow-up recommendations of all worrisome lesions a radiologist encounters. Given the increased variability that surrounds recommendations without best practice guidance, there is a risk of harming a departments' or groups' reputation if radiologists generate excessive non-evidence based recommendations and PCPs perceive our tracking system as an effort to promote self-referral. Even when based best practice guideline such as the Fleischer criteria are available, radiologist compliance with guidelines is only 35-68% (4, 11). Tracking efforts have the ability to magnify the positive effects of accurate reports, but also to amplify overutilization of imaging if recommendations are more frequent than evidence requires.

NEXT STEPS

Our radiology recommendation tracking system has been praised locally by many of our referring providers, the hospital board of directors, and university quality and safety leaders. Surveying the satisfaction of PCPs, their office staff, and patients who have received letters regarding our program may help identify areas of improvement prior to an expansion of the project. Improvements in IT streamlining the navigation workflow and facilitating communication between navigators and radiologists would enable the system to be scaled throughout a multihospital health system in a cost effective manner. Future technological advances will change the way that health systems facilitate communication between providers and disseminate information to patients. Radiology should be ready to take advantage of tools such as smart phones and patient portals to improve our communication with patients and other health care providers, increasing our impact upon patient care, and improving our visibility to our patients.

REFERENCES

- 1 - DP Blagev et al. Follow-Up of Incidental Pulmonary Nodules and the Radiology Report. *J Am Coll Radiol* 11 (4), 378-383. 2013
- 2 - Little B, et al. Outcome of Recommendations for Radiographic Follow-Up of Pneumonia on Outpatient Chest Radiography. *AJR* 2014; 202 (1):54-59
- 3 - Dutta S, et al. Automated Detection Using Natural Language Processing of Radiologists Recommendations for Additional Imaging of Incidental Findings. *Ann Emerg Med*. 2013 Aug; 62(2): 162-9.
- 4 - Hanna TN, et al. Incidental findings in emergency imaging: frequency, recommendations, and compliance with consensus guidelines. *Emerg Radiol*. 2016 Apr 23(2):169-74
- 5 - Berlin L. Communicating Findings of Radiologic Examinations: Whither Goest the Radiologist's Duty? *AJR* 2002; 178: 809-815.
- 6 - Beckman HB, Markakis KM, Suchman AL, Frankel RM. The doctor-patient relationship and malpractice: lessons from plaintiff depositions. *Arch Intern Med* 1994; 154:1365-1370.
- 7 - Levinson W. Physician-patient communication: a key to malpractice prevention. *JAMA* 1994; 272: 1619-1620.
- 8 - Physician Insurers Association of American and American College of Radiology. *Practice standards claims survey*. Rockville, MD: Physician Insurers Association of America, 1997.
- 9 - ACR Practice Parameter for Communication of Diagnostic Imaging Findings 2014
- 10 - Hardeep Singh, et al. Information Overload and Missed Test Results in EHR-based Settings. *JAMA Intern Med*. 2013 Apr 22; 173(8)
- 11 - Eisenberg RL, Bankier AA, Boiselle PM. Compliance with Fleischner Society guidelines for management of small lung nodules: a survey of 834 radiologists. *Radiology*; 2010 April Volume 255: (1) 218-24.