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Process for Managing and Optimizing Radiology Work Flow in the Electronic Heath Record Environment

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Abstract Electronic health record (EHR) implementation has dramatically impacted all facets of radiology workflow. Many departments find themselves unprepared for the multiple issues that surface following EHR deployment and the ongoing need for workflow optimization. This paper reviews the structure and processes utilized by the team, developed at the University of Colorado Hospital to evaluate, prioritize, and implement requests for workflow repairs and improvements within the EHR. The evolution of this team as the academic hospital formed a health system with two community hospital sites is also described. This structure may serve as a useful template for others considering EHR deployment or struggling to manage radiology workflow within an existing EHR environment.

Keywords Radiology · Electronic health record · Optimization · Staff

Introduction

The explosion of electronic health record (EHR) implementation has revolutionized the practice of health care. Nowhere has this been truer than in radiology, where the radiology information systems that manage every aspect of imaging workflow increasingly reside within the EHR. From order entry to scheduling/authorization to protocol selection to reporting, all facets of the imaging chain are impacted by the functionality of the EHR [1]. The most challenging components of a highly functioning and efficient EHR are decision-making and prioritization. While IT staff may have insight into an efficient and low maintenance record, they cannot provide the medical or day-to-day perspective of clinicians. Clinical staff can provide details on the operational processes and workflows, but not the technical understanding necessary for EHR system changes. The divide between these two perspectives may fulfill the needs of individual clinical areas, but neglect data integrity and a coherent user experience. When healthcare systems experience growth, these issues are compounded, causing focus to be on expansion while relegating stability and foundational design to a lower priority.

Although previous authors have focused on components of a successful enterprise EHR implementation [2], little has been written on the post go-live maintenance and optimization in the realm of radiology imaging workflow. An effective radiology workflow in the EHR requires a record well integrated with other components of radiology workflow, real-time access to data, a full and readily accessible picture of a patient's medical history, intuitive user interfaces, optimizing efficiency and speed for end-users, maintaining data integrity, reliable reporting, minimizing mistakes and risks, and minimizing support time. This paper reviews the challenges faced subsequent to EHR implementation at the University of Colorado Hospital (UCH) and the development of teams and processes to manage the radiology imaging workflow.

The Problem

In September of 2012, UCH deployed a new and comprehensive EHR system. Soon after go-live, the consequences of the limited involvement of radiology leadership (technical, clinical,

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and IT) in the build of the EHR tools specific to radiology became apparent. Within 30 days of deployment, the "ticket" list of break-fix items (broken, missing, or poorly designed) and optimization requests exceeded 450. As the list of issues grew, prioritization and workload distribution became increasingly chaotic. Efforts were primarily focused on the "quick fixes," which may or may not have been high priority. Radiology had no organized structure to manage problems, optimize workflow, and sustain the highest quality of patient-centered, value-driven service. An effective, nimble response was needed to meet the needs of the radiology service line.

Approximately 1 year following the initial go-live, UCH merged with two community-based health systems, introducing the additional need to coordinate and unify all aspects of the imaging process. Some of these components, such as the layout of the imaging order, were mandated by the requirements of being on a single instance of the EHR. The cultural differences in three previously independent technical and professional practices (one academic, two private practice community) necessitated adaptation of the team structure instituted at UCH to a more diverse constituency. Specific obstacles included conflicting ideologies (community vs. academic), attention to local interests and preferences with desire to preserve historical workflows, increased focus on revenue and expansion, onboarding of new physicians and clinics, and limited understanding of newer technology options.

The Solution

We initiated a structural change by forming and organizing a team as shown in Fig. 1a (at this stage, the merger of the health systems had not taken place). The team met weekly with the goal of organizing and prioritizing the existing 450+ issues and providing guidance to those responsible for managing them. The team also utilized this strategy to prioritize the continual influx of new issues and requests. Frank discussion was encouraged during these meetings to foster consideration of less traditional solutions and unanticipated downstream effects and optimization needs.

A radiologist (PBS) volunteered to serve as team leader (TL) and provide high-level analysis and direction. The radiologist not only anchored the team but also performed the additional functions of setting the agenda, running the meetings, representing the interests/needs of the radiologists, and interfacing with multiple other teams that interact with imaging services and workflow (hospital administration, hospital IT, other clinical departments, the vendor). Having a radiologist champion this effort has proven critical to its success [3].

Three EHR analysts served as the backbone of the team. These were individuals trained and certified in the build and maintenance functions of the radiology module of the EHR. Two had backgrounds in radiology, one as a technologist and one as a picture archiving and communication system (PACS) administrator. The third had certification in multiple additional modules in the EHR, most importantly scheduling and ordering. This trio of skill sets proved invaluable in understanding the radiology workflow as well as the interactions and dependencies of radiology with respect to the other users of imaging services.

The team also incorporated additional key administrative, modality, finance, and research personnel. The administrative director of the Department of Radiology provides a strategic overview of the departmental technical operation and goals.

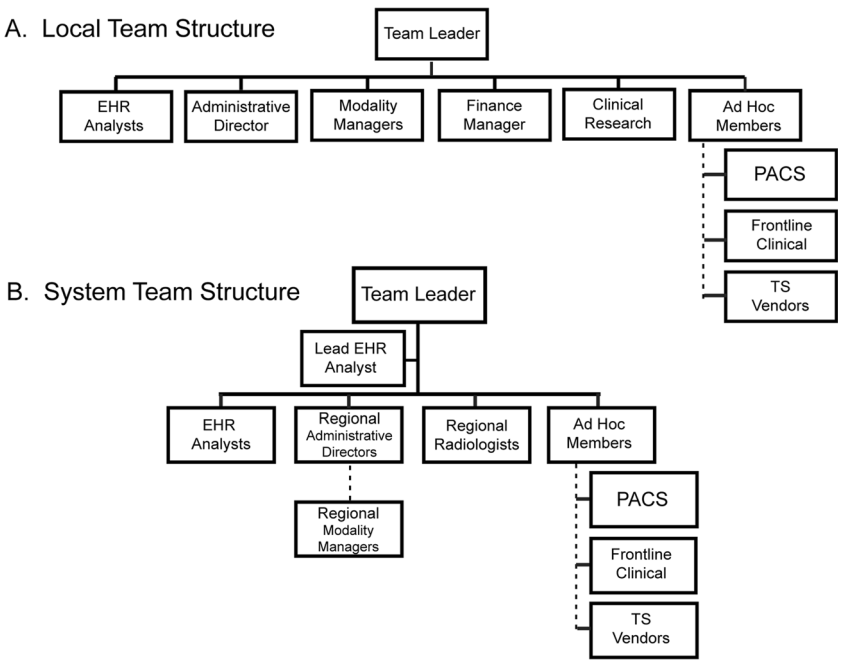

Fig. 1 Team structure used to organize and prioritize EHR workflow. **a** Local team structure. **b** System team structure

Modality managers (CT, MR, diagnostic, ultrasound, breast imaging, and nuclear medicine) have a detailed understanding of departmental workflow and are the first to receive complaints about functionality. They are also a fertile source of requests for optimizations. Including the finance representative was critical, as coding and billing for imaging services is an integral function of the EHR, and changes to improve EHR functionality can easily disrupt billing workflows. To meet the needs of research imaging, we also included a clinical research associate. Multiple clinical trials that utilize imaging services are in place at the university; these have specific protocol requirements, which often differ from routine diagnostic imaging exams and have more complicated billing workflows.

Three groups offered representation on an ad hoc basis. Initially, the PACS team was part of the regular representation at our team meetings. However, once the go-live period was navigated, this was no longer necessary since the EHR analysts (especially those with radiology experience) proved to be adept at anticipating and understanding the relationship of break-fix or optimization events to PACS. Hence, the PACS team is now only engaged when needed. Additional ad hoc representation comes from the frontline clinical staff (e.g., technologists or schedulers). A vendor technical services (TS) specialist is also an ad hoc member and is absolutely critical to the process of optimizing workflow. Our analysts are extremely experienced and knowledgeable but reach out to the vendor with inquiries on a daily basis.

As mentioned, the list of break-fix and optimization requests exploded shortly after go-live. It became apparent that a method of organizing and prioritizing was essential. The analysts designed a simple Excel spreadsheet into which all break-fix issues and optimization requests were logged, which allowed all team members to easily see and review the outstanding issues in detail. A "rule" was established, which made it mandatory that all requests be presented to the team and approved for addition to the spreadsheet.

Radiology interfaces with all departments in the institution, and the TL role grew rapidly to insure that Radiology's interests were represented in the other departments, and that decisions made by other groups did not adversely impact our workflow. The TL adds significant value to the department: providing an understanding of projected departmental and institutional growth, long-term field-of-practice direction and timelines, impending technological advancements and compliance/regulatory expectations, and meeting monthly with the CMIO and CIO. The department chair recognized that the increasing workload of the TL to prepare for and attend meetings across the health system warranted the creation of the position of Vice-Chair of Informatics with 20 % full-time equivalent (FTE) support.

Merging with additional health systems 1 year after go-live necessitated adaptation of the team structure to a more diverse constituency. Our visionary CIO and his team guided the health system leadership team in quickly unifying the system on a single instance of the EHR. Standardization of imaging orders and workflow became an immediate goal, which necessitated some adjustments to the structure described above.

To accommodate the needs of each individual campus as well as the needs of the system, the local radiology steering team moved to biweekly meetings, and a system level team was formed to meet on the intervening weeks as shown in Fig. 1b. In parallel, the EHR analysts from the three sites were unified into a single team of six. Importantly, one of these six analysts was designated as the lead, assigning tasks and projects. This individual serves alongside the TL to provide strategic direction for the team. To prevent excessively large meetings, the team was limited to the TL, the six analysts, the administrative directors, and a single physician representative from each campus. Additional individuals were invited on an ad hoc basis.

A single team now managed and prioritized issues from three geographically and operationally disparate campuses. The original Excel spreadsheet proved inadequate and was replaced with a binary arrangement. This involved the launch of a ticket system for break-fixes and creation of a folder for optimization requests within the existing Information Services SharePoint system. Optimizations could now be reviewed and prioritized in an organized, orderly manner (Fig. 2). Several principles guided optimizations: (1) do not create new solutions when answers already exist, (2) pursue and improve on outside ideas, (3) utilize extensive vendor-provided guidance and resources, and (4) identify when to say "no." When to say "no" includes requests that create more risk (example: duplicate procedures), detract from service line priorities, do not match vision/strategy for the health system, or benefits are marginal and resource costs are high.

The expansion of the scope of the team resulted in a further broadening of the responsibilities of the TL. Radiologists at both of the private practice groups at the other campuses joining the system did not have the time or resources to function as co-leaders. The health system recognized the utility of having the existing TL oversee imaging informatics across the entire system, which translated into an additional 40 % FTE funding and time allotment for the TL.

Outcomes

Between February 2014 and February 2015, the health systems generated 752 break-fix tickets, representing a small percentage of actual requests. Many are still submitted via direct email, messaging, or phone call and remain undocumented. This remains an ongoing logistical problem. On the optimization side, 185 tickets were logged (105 completed, 11 new, 4 pending (scored but not yet approved), 3 approved, 4 in progress, 9 on hold, and 49 canceled).

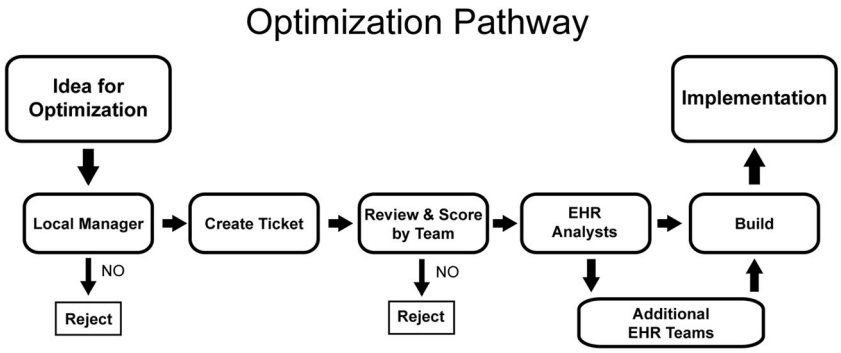

Fig. 2 Decision-making process used to evaluate and prioritize optimization requests

Some optimizations involved simple configuration changes while others necessitated building of new functionality. An example of the latter was the creation of a button to display existing tubes and lines on the radiologists' reading palette (pulled from nursing flow sheets), a change that subsequently was placed into the vendor's foundation system. Of the canceled tickets, some conflicted with the vision of the service line and/or health system. Others were requests for new procedures that already existed in another region, which would create confusion for ordering providers in those other regions. If optimizations required vendor support, we engaged the UCHealth analyst team that has direct contact with the vendor and requested project and go-live availability; the Project Portfolio committee assigned the proper teams and engaged vendors appropriately. For example, a new build to allow more detailed prioritization of imaging study performance and interpretation priority is underway, requiring involvement of the EHR, PACS, and workflow vendors.

Benchmarking the effect of optimizations is a challenge but is possible in certain circumstances. A debrief is held by the assigned analysts and the lead 2–4 weeks after release to assess for additional break-fixes or optimizations needed. With regard to the prioritization project, baseline data are available and will be compared to post-go-live study performance times and interpretation turn-around times.

The FTE staffing outlined here has proven adequate to handle the ongoing requests to date. However, as the health system continues to expand, with an expected tripling in size over the next 10 years, this will require ongoing assessment. We continually evaluate ticket "load" and time to complete break-fixes and optimization and compare to the same metrics for other teams outside radiology. As a result, productivity benchmarks can be established and reset and staffing needs can be continually evaluated.

This team structure has proven valuable for maintaining and optimizing radiology workflow in the EHR; a decisive, organized clinical team leader directs and guides optimizations and has the authority and support to say "no" when a request should not be pursued. The discussion forum and meeting structure encourage less traditional solutions and the ability to reevaluate requests as a project uncovers technical or operational nuances. The formal break-fix ticket and optimization request processes allow for coherent and efficient utilization of human, technical, and financial resources. Future directions will include improved leveraging of analytics, better use of the team to manage anticipated growth of the health system, and roll-out of standard radiology workflow builds to newly opened or acquired clinics and hospitals with a "plug-and-play" approach.

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