A Radiology Dashboard as a Tool to Improve the Turnaround Time of Dictated Reports

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Introduction to the Problem:

- One of the hopes of digital imaging was that the problem of studies being lost and subsequently not dictated would disappear

- While the number of undictated studies has decreased, the problem still exists
  - Cause of the problem has changed
    - Film-based era: undictated studies in the possession of the ordering clinician or lost in the file room
    - Digital era: technologist error and radiologist error

- Technologist error
  - Different at each hospital and dependent on the information systems and fail-safe methods employed to prevent errors
  - Types of technologist error at our institution
    - Study not completed in the radiology information system (RIS)
    - Study not entered into departmental workflow management system, RadStream

- Radiologist error
  - Failure of a radiologist to dictate a study on their individual worklist
    - Potential to cause delay in diagnosis
    - Study does not appear on other radiologists' worklists
    - Unless another radiologist is notified, the study remains unread
  - Failure to link a study
    - Does not affect patient care but does affect billing
    - Dictated report is available to clinicians but is not associated with all individual components of the study

- Hypothesis
  - A dashboard will decrease the turnaround time for radiology reports

Materials and Methods:

- A radiology dashboard was created
  - Dashboard obtains data from RIS and RadStream
  - Provides a graphical representation for each modality (Fig. 1)
    - Number of stat-cases to be read
    - Number of non-stat cases to be read
    - Number of cases where the time since end-exam is > 24 hours
  - Highlights studies completed in RIS but that have not been entered into RadStream for more than 30 minutes (Fig. 2)

- Retrospective study
  - Evaluate the utility of the dashboard in decreasing the average time between the end-exam step and study completion (dictated and signed by the staff radiologist)

Figure 1. Screen capture of the dashboard used in our department. The dashboard displays three key pieces of information. The largest and most visible information is the graph at the top of the image. This graph gives a snapshot of the outstanding work within the department. The outstanding studies are first separated by modality (CT, interventional, MRI, orthopedics clinic, radiography, ultrasound, and teleradiology). Within each modality, the number of outstanding studies is further broken down into stat cases (red), cases outstanding for over 24 hours (yellow), and non-stat cases (blue). On the bottom right side of the dashboard, the number of studies completed in the radiology information system but not entered on the radiologist's worklist is highlighted. If the user clicks on the red number, he or she is able to see the accession number of the offending study. This allows the technologist to correctly enter the study onto the worklist. Finally, on the bottom left side of the dashboard, there is an area for technologists to identify the patients who are currently checked in and waiting for their study to be performed. There is a drop-down field for each modality to identify individual patients. This last portion of the dashboard was not assessed in this study.

Figure 2. In the bottom right corner of the dashboard, the number of studies completed in the radiology information system but not entered into the radiologist's worklist are highlighted. If the user clicks on the red number, he or she is able to see the accession number of the offending study. This allows the technologist to correctly enter the study onto the worklist.

- All studies evaluated and reported using the same information systems
  - RIS (GE Centricity RIS v 1.0; GE, Milwaukee, WI)
  - PACS (GE Centricity v 2.1; GE, Milwaukee, WI)
  - Speech recognition software (PowerScribe SDK embedded for GE Centricity; Nuance, Boston, MA)

- Outcomes evaluated
  - Total number of studies dictated
  - Average time from end exam to the finalized status
  - Average number of studies per month with a turnaround time > 24 hours

- Three separate study periods
  - Between January 1, 2006, and December 31, 2006, before the dashboard was implemented
  - Between September 1, 2007, and August 31, 2008, immediately after the dashboard was implemented
  - Between September 1, 2008, and June 1, 2009, after a policy was implemented where technologist managers actively monitored the dashboard for problem cases
    - Problem case definition
    - Study not been dictated for > 24 hours
    - Study completed in RIS but not entered into RadStream

Results:

- Between January 1, 2006, and December 31, 2006
  - Before the dashboard was implemented
    - 204,022 studies read
    - 32 radiologists
    - 523 minutes (8.7 hours) between end exam and a finalized report
    - 696 studies per month with turnaround time > 24 hours

- Between September 1, 2007, and August 31, 2008
  - Immediately after the dashboard was implemented
    - 217,965 studies read
    - 34 radiologists
    - 426 minutes (7.1 hours) between end exam and a finalized report
    - 527 studies per month with turnaround time > 24 hours

- Between September 1, 2008, and June 1, 2009
  - After the implementation of the policy for technologist managers to check the dashboard actively for problem cases
    - 159,652 cases read
    - 35 radiologists
    - 237 minutes (3.9 hours) between end exam and a finalized report
    - 467 studies per month with turnaround time > 24 hours

- The number of studies read per month per radiologist compared to the average turnaround time is shown in Figure 3

- Average number of studies read per month compared to the average number of studies per month with a turnaround time > 24 hours is shown in Figure 4

Figure 3. Graph showing the average number of studies read per radiologist per month over the study period (purple bars) compared to the average number of minutes between the end-exam step and a finalized report (blue line). While the average number of studies read per month per radiologist stayed relatively stable, the turnaround time dropped by more than 50%.

Figure 3. Graph showing the average number of studies per month over the study period (purple bars) compared to the average number of studies per month with a turnaround time greater than 24 hours (blue line). While the average number of studies read per month increased slightly with a turnaround time over 24 hours decreased.

Discussion:

- Turnaround time for reports decreased nearly 55% over the study period.
  - No other improvements on workflow efficiency were implemented

- Improvement can be attributed to three major factors
  - Increased awareness of a delayed turnaround time
  - Decrease in the number of outstanding problem cases
  - Increased focus of departmental leadership to improve the turnaround time

- Methods by which the dashboard improved departmental awareness
  - Continuous display in the main reading room in our department (Fig. 5).
    - Central location
    - Visible to everyone passing through the department
    - Provides up-to-the-minute snapshot of outstanding work
  - Accessible through the hospital intranet
  - Allows reading room assistants to gauge the status of the department
    - If a radiologist is behind by > 40 studies, the reading room assistant pages all radiologists to help read studies

Figure 5. Photograph showing the central location of the main dashboard within the central reading room in the department. This central location allows radiologists, technologists, reading room assistants, and administrators to obtain an up-to-the-minute snapshot of activity in the department.

- Decrease in problem cases significantly decreased turnaround time
  - Largest improvement in turnaround time occurred after the technologist managers began actively monitoring the dashboard
  - Dashboard was designed to identify the main sources of undictated studies
    - Technologist error (Fig. 2)
      - Cases not entered into RadStream identified by a large red number next to the modality
      - Technologist manager identifies the offending study by clicking the number on the dashboard
    - Radiologist error (Fig. 6)
      - Studies undictated for > 24 hours
      - Investigated by clicking the yellow bar on the dashboard
      - Technologist contacts radiologist to read delinquent study

Figure 6. Studies that have not been dictated in over 24 hours (yellow bars on the dashboard) can be investigated as to the source of the delayed dictation. The technologist clicks on the yellow bar and the offending cases and their information are displayed (shown in the lower half of the figure).

- Increased attention from departmental leaders
  - The dashboard helped to identify the problem and increase awareness
    - Central location of dashboard
    - Highlighted problem of unread studies
    - Made problem a high priority in the department
  - Continued policy changes based on problems identified by the dashboard
    - Instituted policy for technologist managers to check the dashboard actively for problem cases
    - Instituted policy for reading room assistants to page all radiologists if the number of unread studies was > 40

- Improvement in turnaround times related to the dashboard rival gains seen with implementation of PACS and speech recognition systems [1–5]

- One other report of improved turnaround time through implementation of a dashboard [6]
  - Dashboard differed in several respects
    - Metrics measured
      - Our dashboard
        - Number of unread studies in different categories
        - Number of studies not available to read
        - Patients waiting for their imaging studies
      - Previously reported dashboard
        - Individual notifications
        - Divisional notifications
        - System-wide notifications
      - Differences attributed to size and needs of two departments
      - For a dashboard to be successful, each department must determine the bottleneck steps that slow turnaround times
    - Cause of improved turnaround time
      - Our dashboard
        - Identification of problem studies
      - Previously reported dashboard
        - Notification of number of reports ready to be signed
      - Highlights importance of each individual department identifying bottleneck steps
    - Location of dashboard
      - Our dashboard
        - Internet based
        - Large monitor in a central location
      - Previously described dashboard
        - Integrated into PACS
        - Visible to each radiologist while working
      - Integrated dashboard is ideal but not possible with most PACS
  - Commonality between the two dashboards
    - Increased awareness of a problem
      - Provides a snapshot of the system and identifies bottlenecks
    - Increased awareness of monitoring by departmental leadership

- Limitations of our study
  - Retrospective nature
    - Hard to ensure that all gains were truly a result of the dashboard
      - Possible that other policy changes affected turnaround time
      - No other systems installed to improve workflow efficiency
  - Does not take into account the change in staffing over the study period
    - Possible change in reading rates of different radiologists
    - Overall increase in radiologists over study period
    - Not thought to be main source of improved turnaround time
      - Increased number of radiologists was used to free radiologists for more research time
      - Day-to-day schedule was not significantly affected
      - Average number of studies read per radiologist per month did not change significantly (Fig. 3)
      - During the time when the largest gains were noted only one additional staff member was added

- Largest gains were attributed to policy requiring technologist managers to actively monitor the dashboard for problem cases
  - Combination of technology and human intervention is often needed to work in concert to affect the largest change

Conclusion:

- Dashboard was successful in decreasing the turnaround time for radiology reports

- Causes of improvements in turnaround
  - Implementation of dashboard
  - Implementation of a policy where technologist managers actively identify problem cases on the dashboard
  - Increased awareness of a problem

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