Hypothesis

The daily modality quality control (QC) checklist performed on CT scanners was in compliance 57 percent of the time. We hypothesize that applying quality improvement methodology to this process will lead to improvement of the completed checklist items to more than 90 percent each day.

Introduction

Imaging acquisition devices (modalities) used for radiology studies are required to be monitored for proper performance. Typically, these quality control (QC) practices are established in the department based on a combination of vendor guidelines, regulatory guidelines and radiologists and physicists recommendations. The QC checks are important for patient care as they help to determine if the equipment is functioning properly. Maintaining documentation that the QC processes are regularly carried out is required by state agencies or The Joint Commission and is subject to audits. Therefore, it is important to maintain an organized system and process to capture this information.

At our hospital, we have outlined procedures and practices for monitoring each type modality used for patient care. The technologists, who operate the equipment, are responsible for running QC tests at specified intervals depending on the QC test and the modality type. The technologists track the QC process by running the tests on the equipment and documenting the results on paper or in an electronic spreadsheet. The images created during the tests are sent to the PACS for documentation and long-term storage.

The radiology informatics team noticed that the QC images coming to PACS were fraught with errors and frequently required a manual intervention to ensure data consistency. The purpose of this project was to perform a quality improvement project focusing on standardizing the daily modality QC process.

Methods

A prospective quality improvement project was performed under the guidance of a quality improvement course offered at our hospital. As a quality improvement project, the study was exempt from IRB approval.

We began by establishing a five member team comprised of a radiology informatics leader, an informatics workflow specialist, a CT technologist manager, a nuclear medicine technologist manager, and an MRI technologist who also works on the quality improvement team. The project team began by defining the scope of the project. They decided to begin by focusing on improving the consistency of daily QC checks for the CT scanners in the department. The CT scanners were chosen because the QC process is performed daily providing many data points with which to measure baseline data and show improvement.
The team began by documenting the current process as well as the root causes of system failures. Once the process was documented, the quality improvement team then established 7 criteria required for a complete QC study in CT: 1) perform the QC on the modality; 2) Enter all of the established data requirements and naming conventions; 3) measure the appropriate size and positions of the regions of interest; 4) Send the data to PACS; 5) Mark the study as a “reference only” in PACS; 6) record/document the region of interest data; and 7) track the measured data by comparing it to the standard values. These 7 criteria were tracked for each scanner on a daily basis throughout the study. Thus, for each day there was a total possible score of 28 (7 items x 4 scanners).

Over the course of the study, the quality improvement team performed five small tests of change. The changes were either adopted, adapted or abandoned depending on the outcome and included: 1) establishing a standard naming convention for the QC study; 2) implementing laminated reminder cards with the QC guidelines placed at the scanners; 3) modifying the technologist worklists on PACS so the QC study was present; 4) implementing an Excel spreadsheet for data collection at each scanner; 5) implementing the new process on the PET/CT scanner.

Results

At baseline, the standardized QC process was only performed on CT scanners 57% of the time. Figure 1 shows a run chart of the data collected and the progress achieved through the tests of change. Following a number of tests of change (each indicated by the yellow boxes), the median percentage of QC steps increased from 57% to 96%. This change was significant as it met the accepted rules for identifying special cause variation (1).

Figure 1
Discussion

Performing regular quality control checks on the modalities is a universal process that is required in radiology departments and imaging centers. It is important to track and store the necessary data for the required documentation. By examining our processes, it was clear that there were opportunities to make significant improvements. Using quality improvement methodology, we were able to identify the problems in our process and address the specific failures before we started implementing interventions.

At the start of the process, we believed that the majority of issues were with the downstream system (PACS) because that is where we saw the data integrity problems. However, as we investigated the process and the different methods of failure, it became clear that the problems originated with the upstream process.

One common cause of errors was due to the manual entry of study information such as “patient” name and procedure name. Ideally, this data could be standardized with an automated order or a fixed entry on the DICOM modality worklist. However, in the 120 day time frame of this project, designing an automated order with all of the necessary data elements was not achievable. Therefore, we had to design and optimize a manual process to reduce errors as much as possible. While we were successful, we felt that we had to settle on a suboptimal solution because the process relies on humans to remember what needs to be done. Future improvements could implement automatic reminders or automated checks for each step of the process.

Conclusion

Through the use of quality improvement methodology, we were able to implement a daily QC process for CT scanners and increase compliance from 57% at baseline to 96% at the completion of the study.

References


Keywords

Quality Control Monitoring, Modality Quality Control Monitoring