Original Article

Root cause analysis of Report Turnaround Time prolongation in cross-sectional imaging at a tertiary care hospital

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Objective: To determines the causes of delay in the generation of CT and MRI reports.

Methodology: We analyzed 9883 cases of CT and MRI at Dow Institute of Radiology, Dow University of Health Sciences, Karachi, Pakistan during February 2020. The saved Patients' electronic data on MISSION PACS were retrieved through 24 hour functional IT team. Data were gathered from main center University campus, as well as from peripheral branches. Report Turnaround Time (RTAT) was noted for each case. The institutional bench mark (IBM) for the University was set to 60 hours.

Results: We found that 1604 CT scans had RTAT of more than 60 hour out of which, 738(46.0%) were delayed due to typing delay by Medical Transcriptionists, 499(31.1%) delayed due to PACS issues, 305(19.0%) had their invoice generated in the weekend days i.e. Saturday and Sunday and the faculty held 62(3.9%) cases. A total of 1299 MRI scans had RTAT >60 hour out of which, 545(41.9%) were delayed due to Medical Transcriptionists (MTs), 397(30.5%) had their invoice generated in weekend days, 221(17.0%) were delayed due to PACS issues and the faculty held 138(10.6%) cases.

Conclusion: Intermittent PACS malware and the MT issues were the major factors for delay in RTAT. (Rawal Med J 202;46:473-476).

Keywords: Report Turnaround Time (RTAT), magnetic resonance imaging, CT scan.

INTRODUCTION

Report Turnaround Time (RTAT) is an important indicator of quality health care. PACS (Picture Archiving and communication system) has revolutionized radiology world by improving the department efficiency.[1-3] RTATs are being measured in minutes or hours instead of days.[4] Expedited RTAT is one of the key expectations of stake holders from radiologists.[5] Streamlining transcription service has been an important quality measure for expediting RTAT.[6] During term times versus term breaks, a total of 192,984 radiological examinations (ICU) were analyzed in terms of teaching duties, unplanned absence, vacation days, and days away from work for education and training. It was concluded that RTAT increased during the period when the reformed curriculum for undergraduate medical education was implemented, but increased teaching duties alone cannot serve as a sole causal explanation.[7]

In 2015, England et al compared resident workload from the Emergency Department (ED) studies before and after the implementation of a required 1-hour RTAT and assessed resident and faculty perception of TAT on resident education. and concluded that Residents were exposed to fewer ED studies after the implementation of a required 1-hour RTAT.[8] The prolongation of RTAT has been a major agenda in our Departmental Clinical Audit meetings.[9,10] The aim of this study was to determines the causes of delay in the generation of CT and MRI reports at our tertiary care institution.

METHODOLOGY

This study included 9883 cases of CT and MRI at the University Hospital in single month. The IRB approval was sought in this study; (IRB-1439/ DUHS /Approval/2020). Ultrasound and general radiography/fluoroscopy modalities were not included. To meet the demand of timely generation of reports, there is an integrated coordinated chain of receptionist dealing with the entry of patients, technologist for performing scans, IT personnel for dealing with PACS malfunctioning, transcriptionist and staff radiologists.

Cases are conducted round the clock each day at the main center and at other 2 peripheral branches and then they are sent to MISSION (Medical Investigation and Support Solution), PACS with system of Tele-radiology and LAN. CT scans were done on SIEMENS 16 slice, GE 128 slice and HITACHI 16 slice scanner. MRI scans were done on GE 1.5 tesla, HITACHI 0.25 tesla and 0.4 tesla scanner. CT cases were further categorized into CT short cases, CT contrast studies and CT angiography. CT Short cases imply brain, KUB and extremities. MRI cases are further categorized into short cases, plain studies, and contrast studies. MR Short cases imply screening brain and spine studies. After receiving the cassettes they transcribe them and send back to the Consultants. The working hours of staff radiologist extend from 9:00 AM to 9:00 PM; He/she edits and signs reports at his or her own Workstation; it is then released into the hospital EMR system and PACS. The saved electronic medical data (EMR) of patients on MISSION PACS were retrieved. Data were collected during off-peak hours to avoid interference with patient's procedures. The institutional bench mark (IBM) is the specific range of time set by Director of Institute for generating reports. It was 60 h, including the working days only. In case of holidays, it automatically shifts to 72 h. RTAT is defined as time (in hours) from the study ordered to the receptionist to electronically final sign off by Radiologist.

Statistical Analysis: All data analysis was performed using SPSS version 20.

RESULTS

During a single month, 9883 studies were done out of which 5864 were CT scans and 4019 were MRI. Out of total 5864 CT scans, the number of contrast studies was highest i.e. 3391 (57.8%). Out of total 4019 MRI, the number of short studies was highest i.e.1906 (47.4%) (Table 1). Mean RTAT for total studies was 53.67±69.50 h. Total 6980 studies (70.6%) had RTAT of ≤60 h, whereas 2903 (29.4%) had RTAT >60 h. Mean RTAT for CT was 54.26±87.38h and for MRI was 52.8±27.16 h (Table 2). CT plain (short studies) had the shortest mean RTAT of 33.9 h, whereas CT contrast studies had longest mean RTAT of 68.9 h (Table 1).

Table 1. Total procedures and quantification of CT and MRI scans in the single month (n= 9883).

Mean Report Turnaround Time (Hours) Mean ±Sd		**Mean Report Turnaround Time (Hours)** Mean ±Sd	
Ct Scans	5864 (59.3%)	**Ct Scans**	54.26 ± 87.38
CT Contrast Studies	3391 (34.3%)	CT Contrast Studies	68.95 ± 112.12
CT Short Studies	2422 (24.5%)	CT Short Studies	33.99 ± 13.00
CT Angiographies	51 (0.5%)	CT Angiographies	40.62 ± 13.09
MRI Scans	4019 (40.7%)	**MRI Scans**	52.8 ± 27.16
MRI Short Studies	1906 (19.3%)	MRI Short Studies	51.13 ± 25.56
MRI Plain Studies	1345 (13.6%)	MRI Plain Studies	53.98 ± 28.81
MRI Contrast Studies	768 (7.8%)	MRIContrast Studies	54.94 ± 27.83

Table 2. Mean RTAT of all procedures within and outside IBM (n=9883)

Mean RTAT	**CT procedures**	**MR procedures**
Within IBM (Group A)	4260 (72.6%)	2720 (67.7%)
Outside IBM (Group B)	1604 (27.3%)	1299 (32.2%)
Total	5864 (100%)	4019 (100%)

Table 3. Subcategories and cause of RTAT delay.

	Medical Transciptionist (N)	**Pacs Issues (N)**	**Hold By Faculty (N)**	**Weekend Invoice (N)**
CT Contrast Studies	46.0% (738)	31.1% (499)	3.9% (62)	19.0% (305)
MRI Contrast Studies	8.0% (105)	3.3% (44)	3.0% (39)	5.8% (76)
MRI Plain Studies	15.4% (200)	6.5% (85)	3.3% (44)	10% (129)
MRI Short Studies	18.4% (240)	7.0% (92)	4.2% (55)	14.7% (192)

Total 1604 CT scans had RTAT of more than 60 h out of which 738 (46.0%) were delayed due to typing delay by Medical Transcriptionists, 499 (31.1%) were delayed due to PACS issues, 305 (19.0%) had their invoice generated in the weekend days i.e. Saturday and Sunday and 62 (3.9%) cases were held by faculty (Table 3). Total 1299 MRI scans had

turnaround time more than 60 h out of which 545 (41.9%) were delayed due to Medical Transcriptionists, 397 (30.5%) had their invoice generated in weekend days, 221 (17.0%) were delayed due to PACS issues and 138 (10.6%) were held by faculty. Figure displays the causes of delay of MRI and CT, respectively.

DISCUSSION

In 2016, Heitkamp et al warned that Institutional Pressure to reduce RTAT can damage the Educational Mission, academic radiologists work hard to support many important professional missions like excellence in patient care, research and education.[11] Boland et al calculated RTAT from 11 sub specialties of Radiology and found the interesting fact that when funds were paid to the staff radiologists apart from their salary, substantial decrement in RTAT was brought out.[12]

Drawing the inference, total 2903/9883 (29.4%) studies suffered from prolonged RTAT (group B). Weekends and other holidays have been excluded as a 'justified' cause of RTAT delay in 24.7% of cases. PACS malware was the issue for 24% of the cases. The technology for acquiring, storing, retrieving, displaying, and distributing images defines PACS; it transmits images from the site of image acquisition to remote workstation.[13]

The radiology information system (RIS) and digital imaging and communications in medicine (DICOM) are two components of PACS. RIS is a database used to store, change, and distribute copies of the radiological records of patients. DICOM defines a file format for images and related information.[14-16] The MISSION PACS was international software selected by University, based on a criteria survey of PACS administrators. Like any software, it has few system bugs, compatibility issues as well as operating broker and business related issues, causing some turbulence in workflow, due to which cases are not timely performed, causing delay in RTAT.[17,18]

Mean RTAT was 54 h in the current study; it was bit different compared with international reports showing RTAT of 42.7 h, which was the time from 'examination completion' to 'finalized time' whereas in this research, it extends from 'invoice time' to 'finalized time' This change was made to include 'examination performed time' to specify Root cause.[12] In a recent study from Pakistan, the institutional IBM was 24 h for nuclear medicine modality, 97% of RTAT were in the range, whereas in our study, it was 60 h and 70% were in the range.[19]

Our study has limitations. Research duration was less compared to other studies, this is because to counterbalance heavy load of procedures per day. Another issue was the lack of urgent preliminary cross-sectional report system for A & E cases; the international IBM for this category is 30–60 minutes.[20]

Boland et a highlighted the fact that Radiology stakeholders are now demanding faster RTATs' and anything that delays the delivery of the finalized report will undermine the value of a radiology department.[21]Further research needs to be done in this domain.

CONCLUSION

Intermittent PACS malware and the MT issues were the major factors for delay in RTAT.

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