

# RADIOLOGY WORK FLOW ASSESSMENT AND IMPLEMENTATION IN A HIGH VOLUME TERTIARY CARE PUBLIC SECTOR HOSPITAL IN PESHAWAR KPK

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## ABSTRACT

**OBJECTIVE:** The aim of this study is to emphasize the importance of implementation of an efficient radiology work flow management system (WMS) in order to develop a time efficient, filmless radiology work flow.

**METHODOLOGY:** This qualitative study was carried out in radiology department of Lady Reading Hospital Peshawar from 01.03.2015 to 30.04.2018 to analyze the radiology work flow and its contributing factors, which play a pivotal role towards better patient service delivery with optimum quality, end user and patient satisfaction. Performa was designed comprising essential measureable tools of radiology work flow. The questionnaire once filled was compiled and statistically analyzed.

**RESULTS:** The results showed that radiology work flow efficiency has increased considerably with the introduction of various supporting factors with P values < 0.0000001.

**CONCLUSION:** The study revealed that a modern up to-date radiology workflow system is the requirement for a time efficient smooth patient service delivery with the challenge of best practice application keeping the patient, radiologist, radiographer and above all the referring physicians satisfaction as the aim. This involves an imaging cycle starting from patient data to conducting an imaging examination according to protocols and data processing and image viewing.

**Keywords:** Radiology Work flow, PACS, Filmless Radiology

## Introduction

An efficient radiology work flow is an integral part of any healthcare system. An inefficient work flow, not only adversely affects the outcome of radiology department; it has an impact on all other referring departments, physicians, the patients and their families. To streamline radiology work flow the following road blocks need to be addressed.

Radiology department has broad based patient pool to serve, ranging from outpatient to in-patients and to emergency department patients. This requires multiple lines of communication with different departments, with the goal of optimizing service delivery.<sup>1</sup>

Types of work flows: First step is the technologist

workflow followed by radiologist work flow. This requires a multimodality work flow in a time efficient manner. The optimization of work flow is integral to maximize the efficiency of reporting scans by radiologist which affects the overall optimization of the capacity of health care system. The key is to balance the work flow optimization in both areas. This requires a good management, administrative support and team work.<sup>2</sup>

Variable/unpredictable work flow: During the span of a week, work flow varies in volume from modality to modality having a higher patient volume linked to certain specific out patient days. The relevant staff is

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then sensitized to address the requirements. Additional half reporting sessions on Saturday's are required to pre-empt piling-up of cases, followed by weekend on call duties targeted towards emergency reporting. Fully equipped reporting stations located on different floors/buildings to be integrated for radiology work flow.<sup>2</sup> Merger of radiology work flow system (RWFS) with all departments and other hospitals.<sup>4</sup>

In-order to implement "Best practice Radiology workflow" with the aim to reduce operational costs, involves electronic report delivery. This requires combining the clinical and image record for improvement of productivity both for radiologists and physicians.

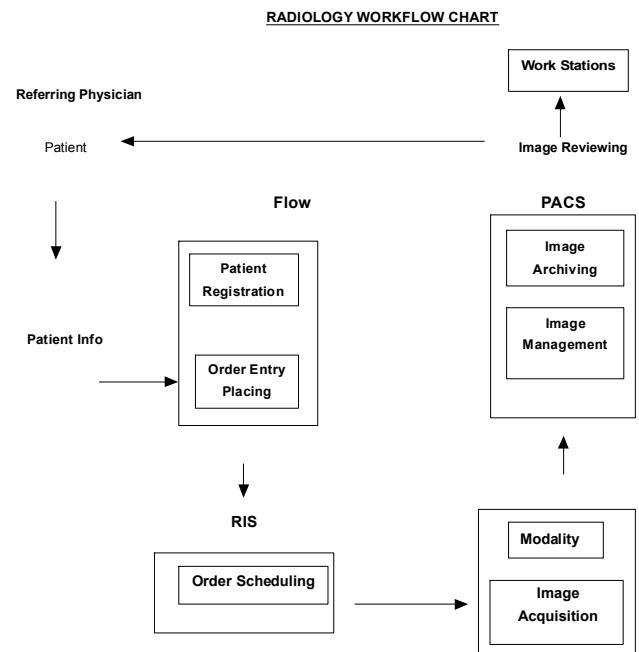
Another important factor in radiology workflow is targeted towards optimizing patient satisfaction in the form of service delivery and reducing patient waiting time. This starts from the time patient enters the radiology department, queues up for registration, to the performance of their imaging test and report delivery time.<sup>3</sup>

Radiology workflow is initiated in the referring physician clinic for outpatient and in the ward for inpatients. An online request is generated by the referring physician. The patient is asked to present at the radiology registration counter with the medical registration/record number which is entered at the registration counter in order to display the online request. The next step is entry of the patient into radiology work list of individual modality as per request.

The patient queues up for image acquisition. After image acquisition immediate PACS transfer is performed followed by referral back of the patient to the physician for online image and report viewing.

## Materials and Method

This study was carried out in radiology department of LRH Peshawar (01.03.2015 to 30.04.2018), to analyze the radiology work flow and its contributing factors, which play a pivotal role towards better patient service with optimum quality and staff satisfaction. Performa was designed comprising essential measurable tools of radiology work flow. It entailed a comprehensive assessment between age old redun-



**Table 1:** Radiology Workflow

dant radiology workflow comprising of darkrooms to digital and filmless radiology. It was duly filled by up-to 50 radiographers only and who had worked in the old system and became part of the transition to digital and filmless radiology work flow. The participants were briefed about the questionnaire in-order to facilitate them to make accurate judgment while their identity was kept anonymous. The questionnaire once filled were compiled and statistically analyzed.

## Results

The results showed that efficiency of radiology work flow has increased considerably with the introduction of various supporting factors with P values <0.0000001. Majority of the staffs who participated in this study were in favor of the various steps and new facilities added in order to increase the efficiency of work flow with fast patient service delivery and staff satisfaction.

94% agreed that structured duty Rota helped to increase the efficiency of work flow, 82% accepted that structured duty Rota helped them in skill building and knowledge sharing, 94% agreed that efficiency of work flow has increased with the introduction of

digital radiography (DR), 60% were happy with PACS system and with its contribution to work flow, 96% were satisfied with the radiation protection measures taken for patients and their safety, 90% were in favor of the safety rounds being performed for the implementation of radiation protection principals, 74% were in favor of equal work distribution, 62% agreed that filmless radiology has positively impacted the work flow pattern and introduction of DR system has contributed towards efficient radiology work flow with fast service delivery.

## Discussion

In the current age of technological advancement, Radiology workflow management system is the need of the day, as it is becoming difficult for radiologists to cope with the ever increasing patient load. A workplace management system not only sets everything in order but also makes sure that the technical staff, machinery at hand and other available resources are being effectively utilized to its true potential.<sup>5</sup> Most of the radiology departments in hospitals around the world are changing their approach towards workflow management by switching to filmless/digital reporting.<sup>6</sup> Transition from paper to a digital electronic health record system has forced the management team of radiology department Lady Reading Hospital to re evaluate their workflow specifically the radiology research infrastructure.<sup>7</sup> Advantage of radiology information system (RIS) and picture archiving and communication system (PACS) allows integration of filmless and paperless system to speech recognition system which is an integral part of an efficient radiology workflow.<sup>8</sup>

Radiology work flow is influenced by many contributing factors which are part of radiology infrastructure, decision making, staff satisfaction and management policy implementation. In recent times, few major improvements and facilities have been part of the radiology department which is playing an important role towards improving radiology work flow with an aim to enhance patient care, better system delivery with high efficiency and better staff satisfaction.

The newly introduced facilities and steps are structured duty Rota, radiation protection mechanism both for the staff and patients, introduction of Integrated DR System replacing the dark room and CR system, filmless radiology with introduction of PACS system, daily safety rounds for enforcement of radiation protection principles, replacement of manual counter by computerized radiology counter and evaluation of patient service delivery time.

A total of 47 (94%) staff was satisfied with the structured duty Rota which helped to improve the radiology work flow efficiency. The duty Rota is aimed to give a balanced rotation keeping radiation exposure/safety measures in mind and to develop skilled teams having the capacity to provide optimum quality services.

Forty one technicians (82%) were aware of the fact that the initiation of structured duty Rota has helped them to increase their skills, experience in different modalities i.e. CT scan, MRI and Fluoroscopy etc. An exposure not experienced previously in a consolidated manner.

Forty seven (94 %) staff was of the view that digital radiography (DR) has improved the radiology work flow with respect to Computed Radiography and darkroom as DR is fast, user friendly and time efficient, offering a streamlined and smooth patient service delivery with high quality patient care and significant patient dose reduction.

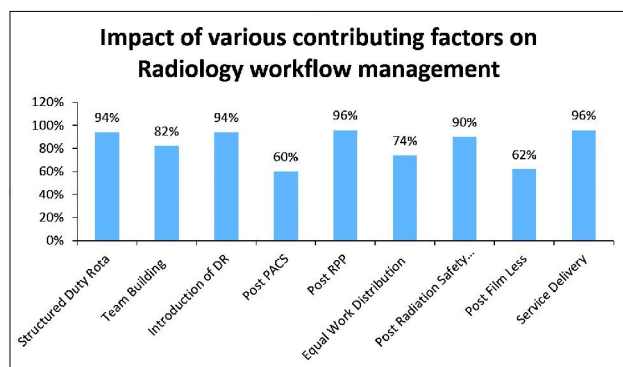
Thirty one (62%) staff agreed that filmless radiology has positively impacted the work flow to a high extent offering fast patient service delivery. However, nineteen (38%) opposed filmless radiology as it created a lot of problem in the form of demand for films by both the patients and doctors who are not familiar with the new system. This results in hindrance in workflow. The former group comprised of highly skilled computer literate staff who are independently working on the PACS system and finding it user friendly and have contributed to the efficiency of Radiology work flow significantly. The latter group mostly comprised of staffs who were not highly qualified and computer literate and they were finding it hard to work on PACS system, interpretation of images processing and sending it to various work stations. This group had to undergo skill enhancement regarding use of the new system.

Forty eight (96%) staff was happy with the various

radiation protection measures which have been taken for both their safety and for the patients i.e. introduction of personnel dosimetry of radiation workers and provision of lead aprons and highly protected consoles ensuring their safety and satisfaction resulting in better performance of their duties in a safe environment while forty five (90%) staffs were satisfied with the daily safety rounds and on the spot trouble shooting of various radiation protection issues as well as other departmental issues. The daily safety rounds made each individual accountable to comply with the radiation protection rules and made them vigilant to take every step for efficient work flow in a smooth manner under the umbrella of radiation safety rules.

Thirty seven (74%) staffs were in favor of equal work distribution i.e. that every kind of x-ray procedure is being done in every available x-ray imaging room while the prior practice was that specific procedures were performed in dedicated x-ray rooms which created long queues in front of one room disturbing the entire work pattern while the patient influx in other room was considerably less thus an unequal work load effected the performance and satisfaction level of staff which again had a negative impact on the efficiency of work flow and service delivery.

With the introduction of advanced technologies such as World Wide Web, wireless connectivity etc. huge progress has been made in the approach of radiologic service delivery in the form of “e-Health”, electronic health record (EER) etc.<sup>9</sup> Technology expansion is evident worldwide in all medical fields, but the specialty which is most affected is Radiology, the only medical specialty that is 100% technology driven. With the advancement in technologies, the expectations concerning the time efficiency of service delivery,



**Graph 1:** Graphical representation of various contributing factors in assessment and implementation of radiology workflow.

Sr#	Contributing factors towards radiology work flow	Positive	Negative	Significance P Value (2-tail)
1	Impact of structured duty rota on radiology work flow?	47 (94%)	03 (6%)	< 0.0000001
2	Team Building and skill development through a structured duty Rota?	41 (82%)	09 (18%)	< 0.0000001
3	Work flow efficiency has increased with (DR, CR/Darkroom)?	47 (94%)	03 (06%)	< 0.0000001
4	Work flow efficiency (Post-PACS/Pre-PACS)?	30 (60%)	20 (40%)	< 0.045
5	Quality of worker efficiency, safety and comfort pre and post radiation protection Program?	48 (96%)	02 (04%)	< 0.0000001
6	Impact of equal work distribution in X-ray stations on work flow?	37 (74%)	13 (26%)	< 0.0000001
7	Impact of radiology safety rounds on workflow efficiency and on the spot trouble Shooting?	45 (90%)	05 (10%)	< 0.0000001
8	Concept of Filmless radiology service on impact of work flow?	31 (62%)	19 (38%)	< 0.016
9	Time efficiency of service delivery after introduction of DR and filmless radiology service?	48 (96%)	02 (04%)	< 0.0000001

**Table 2:** Comparison of various contributing factor and their significance towards efficiency of radiology work flow.

accuracy of radiologic diagnosis and standard of patient care in practice of radiology are heightened.<sup>10</sup>

## Conclusion

The challenge of best practice application in radiology workflow is looking at the bigger picture. This involves an imaging cycle starting from patient data to conducting an imaging examination according to protocols and data processing in a time efficient way. In other words it starts with physician's order to when the physician views the report to the time when the report is issued to the patient. There is room for improvement in radiology workflow in the department with integrated RIS-PACS. The added essentials for improvements are in the form of speech recognition system for reporting and Quematic for streamlining the service in an optimum manner with patient satisfaction and quality service as the ultimate goal, keeping the patient and radiation workers safety as a hallmark.

Secondary benefits are in the form of documentation and archiving. The work management system is able

to increase productivity and improves services to patients while maintaining staff morale.

**Conflict of Interest:** None

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