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# Improving Efficiency of Image Approval To Enhance Treatment Accuracy

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## INTRODUCTION

### Background

Patients undergoing radiation therapy treatment are mandatory to acquire verification image of treatment position. The images are taken by Radiation Therapists (RTs) while the Radiation Oncologists (ROs) are responsible for 'Final Approval' of the images. Image approval is essential in verifying treatment accuracy. At present, there is a low compliance rate in image approval.

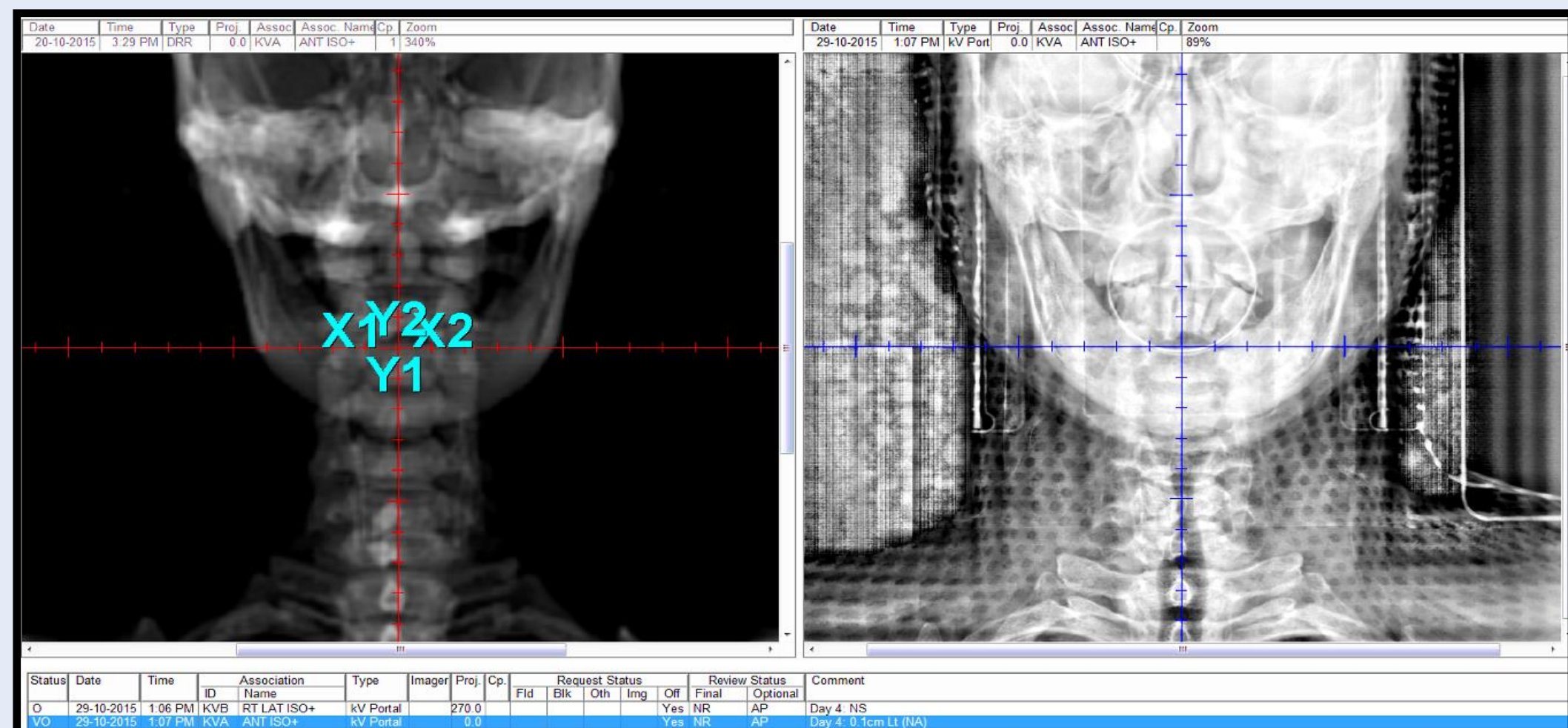


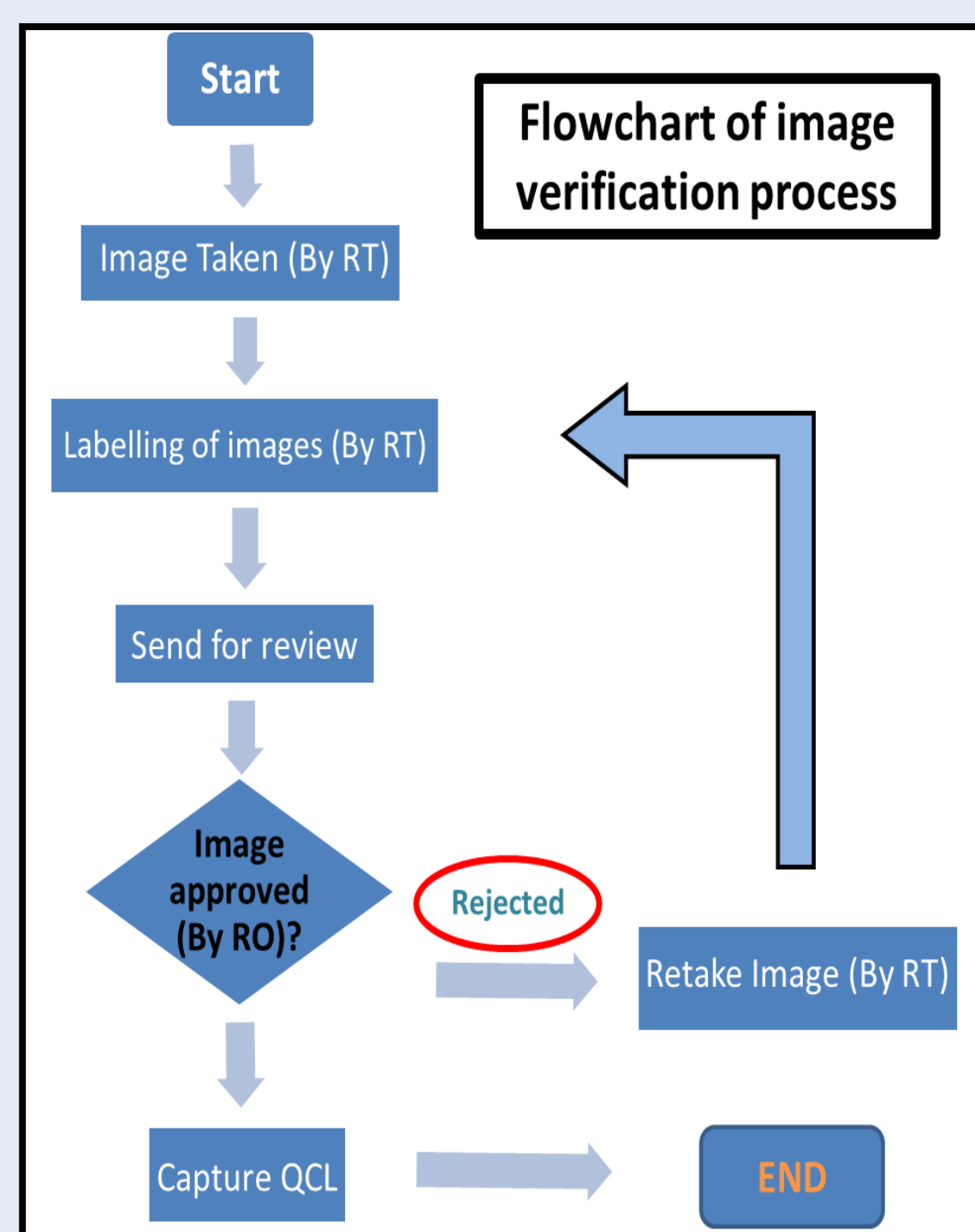
Figure 1: Comparison of Digital Reconstructed Radiograph (DRR) with KV imaging to verify treatment position

### Mission Statement

To increase the approval rate for Portal Images (PIs) to 90% within 5 days in accordance with the departmental protocol in Division of Radiation Oncology (DRO), National Cancer Centre Singapore (NCCS) within 9 months.

## METHODOLOGY

### 1. Understanding the problem



### Current situation

The verification images were left unapproved. Any treatment positioning errors that requires ROs' attention could not be identified and resolved more promptly. This may potentially affect the accuracy of the treatment delivery. Furthermore, RTs were unable to complete the quality checklist for the patients.

Date	Time	ID	Name	Association	Type	Imager	Prog	Co	Report Status	Final	Review Status	Comments
13/01/2015	12:34 AM	516	MAN, CLOTIS	PI Setup	EPN Portal	NA	NA	NA	NA	NA	NA	
19/01/2015	3:38 PM	B	RT LAT	EPN Portal	EPN Portal	Yes	NA	NA	NA	NA	DAVY PR @ SCM RIF (NA) @ 2CM ANTENNA	
19/01/2015	3:39 PM	A	ANT ISO	EPN Portal	EPN Portal	Yes	NA	NA	NA	NA	DAVY PR @ SCM RIF (NA)	
20/01/2015	8:37 AM	B	RT LAT	EPN Portal	EPN Portal	Yes	NA	NA	NA	NA	DAVY PR @ 2CM RIF (NA)	
20/01/2015	8:46 AM	A	ANT ISO	EPN Portal	EPN Portal	Yes	NA	NA	NA	NA	DAVY PR @ 2CM L (NA)	
21/01/2015	8:05 AM	B	RT LAT	EPN Portal	EPN Portal	Yes	NA	NA	NA	NA	DAVY PR @ 2CM RIF (NA)	
21/01/2015	8:13 AM	A	ANT ISO	EPN Portal	EPN Portal	Yes	NA	NA	NA	NA	DAVY PR @ 2CM RIF (NA)	
22/01/2015	8:16 AM	B	RT LAT	EPN Portal	EPN Portal	Yes	NA	NA	NA	NA	DAVY PR @ 2CM RIF (NA)	
22/01/2015	8:23 AM	A	ANT ISO	EPN Portal	EPN Portal	Yes	NA	NA	NA	NA	DAVY PR @ 2CM RIF (NA)	
24/01/2015	12:02 PM	C	24-01-2015	Unit 1B1	Photo ID Check	TL_Rm_BA	TL_Rm_BA	TL_Rm_BA	Not Row	Not Row	Not Row	
25/01/2015	12:02 PM	C	25-01-2015	Unit 2ND	Photo ID Check	TL_Rm_BA	TL_Rm_BA	TL_Rm_BA	Not Row	Not Row	Not Row	
31-Oct-2015	C	31-Oct-2015	Security Check	TL_Rm_BA	TL_Rm_BA	TL_Rm_BA	TL_Rm_BA	TL_Rm_BA	Not Row	Not Row	Not Row	
31-Nov-2015	C	31-Nov-2015	Approve Port Film	TL_Rm_BA	TL_Rm_BA	TL_Rm_BA	TL_Rm_BA	TL_Rm_BA	Not Row	Not Row	Not Row	
02-Nov-2015	C	04-Nov-2015	Unit 3rd	TL_Rm_BA	TL_Rm_BA	TL_Rm_BA	TL_Rm_BA	TL_Rm_BA	Not Row	Not Row	Not Row	

Figure 2: Status of portal images that are not completed & incomplete quality checklist

### 2. Baseline data – Percentage of image approval rates within 5 days from January-August 2015

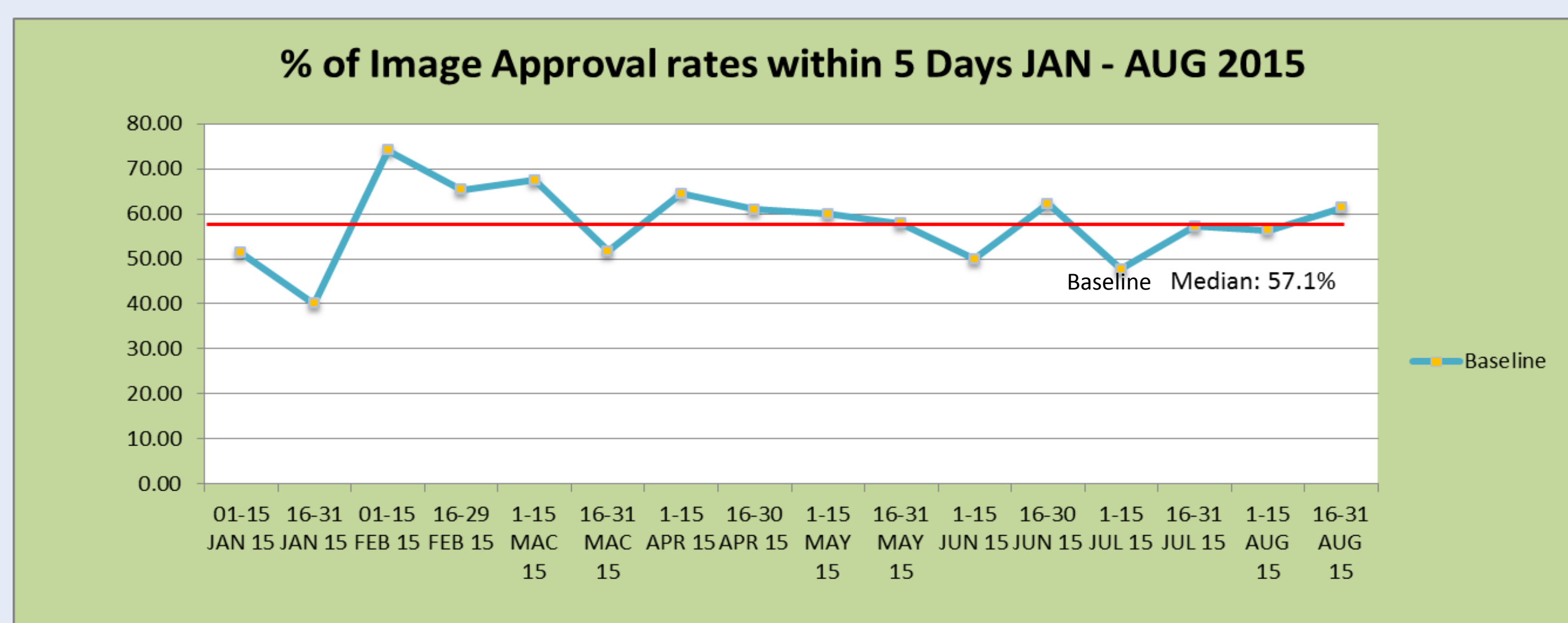
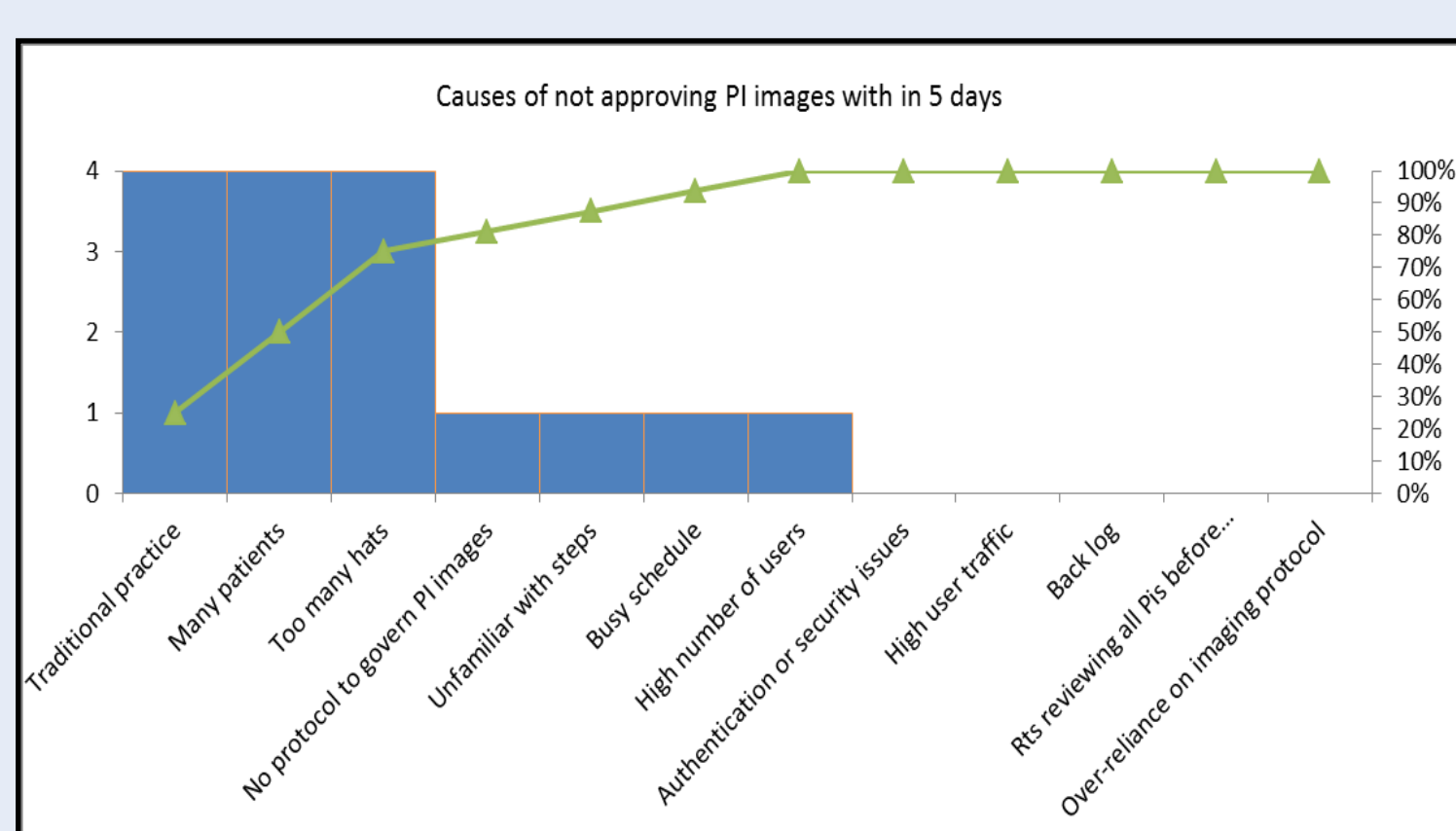
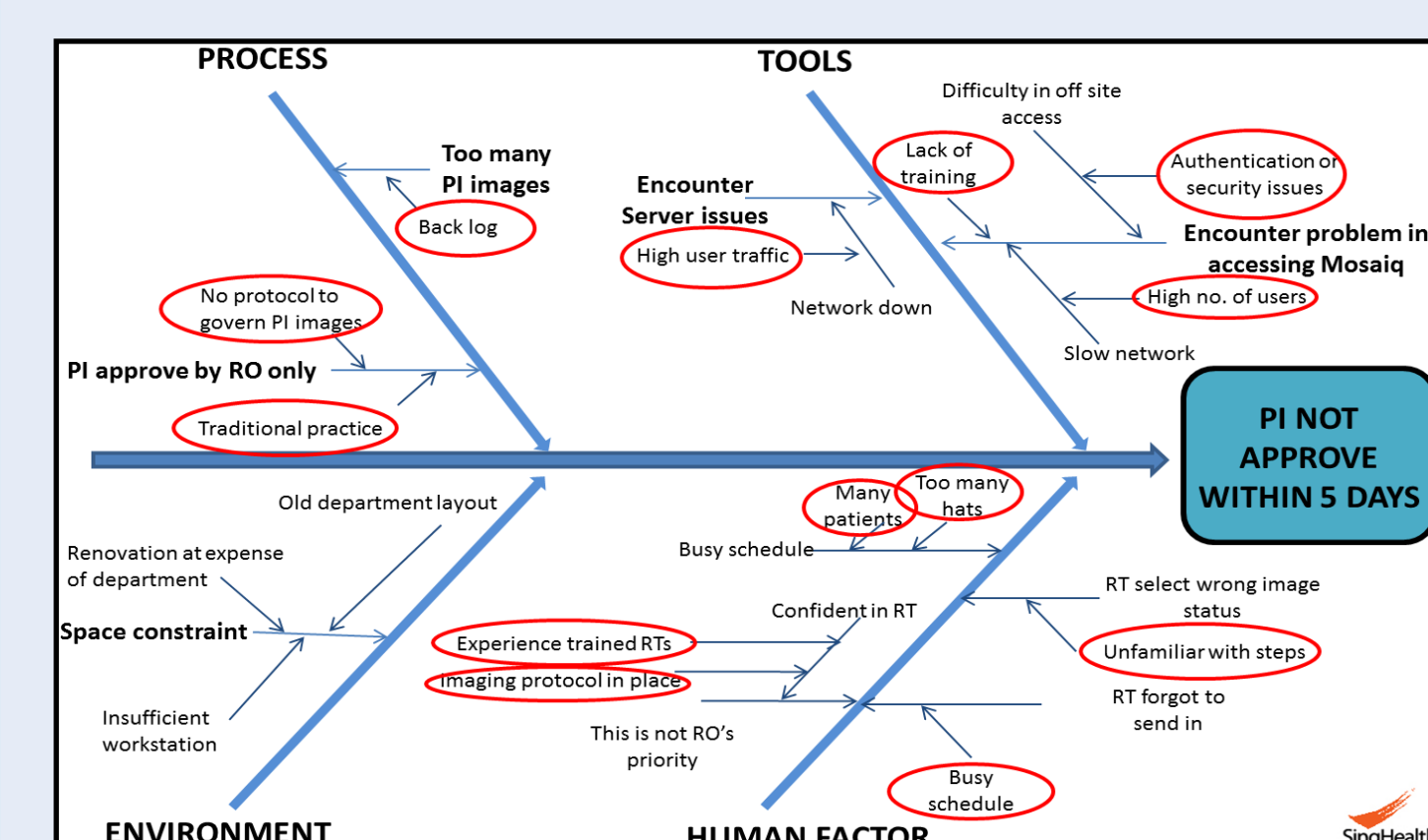


Table 1: Image verification approval rates from January to August 2015 at Division of Radiation Oncology (DRO). The data collection was at a fortnightly period.

### 3. Analysing & Identifying the Cause & Effect



12 causes were identified from the Ishikawa diagram and 3 main factors were voted

- ROs have multiple roles besides clinical practices
- ROs have too many patients
- Traditional practice of having the ROs to approve the PIs

Interventions were focused on to remind ROs in approving PIs due to their busy workload and to revise the traditional practice, since we will not be able to reduce RO's workload.

## INTERVENTIONS

### PDSA 1

- Monthly data for percentage of unapproved PIs will be sent to ROs to notify their low compliancy rates in PI review.
- No visible improvement because it is a general reminder
- Modify to sending email in PDSA 2.

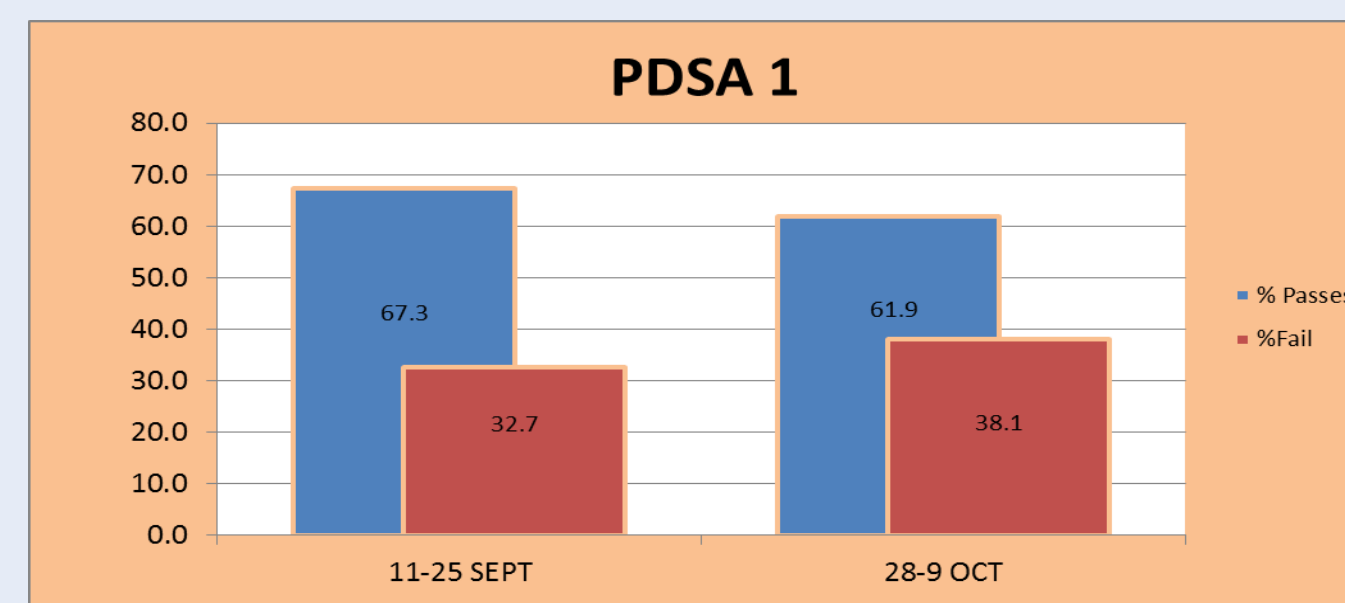


Table 2: % of patients' image approved within 5 days vs more than 5 days with PDSA 1 intervention

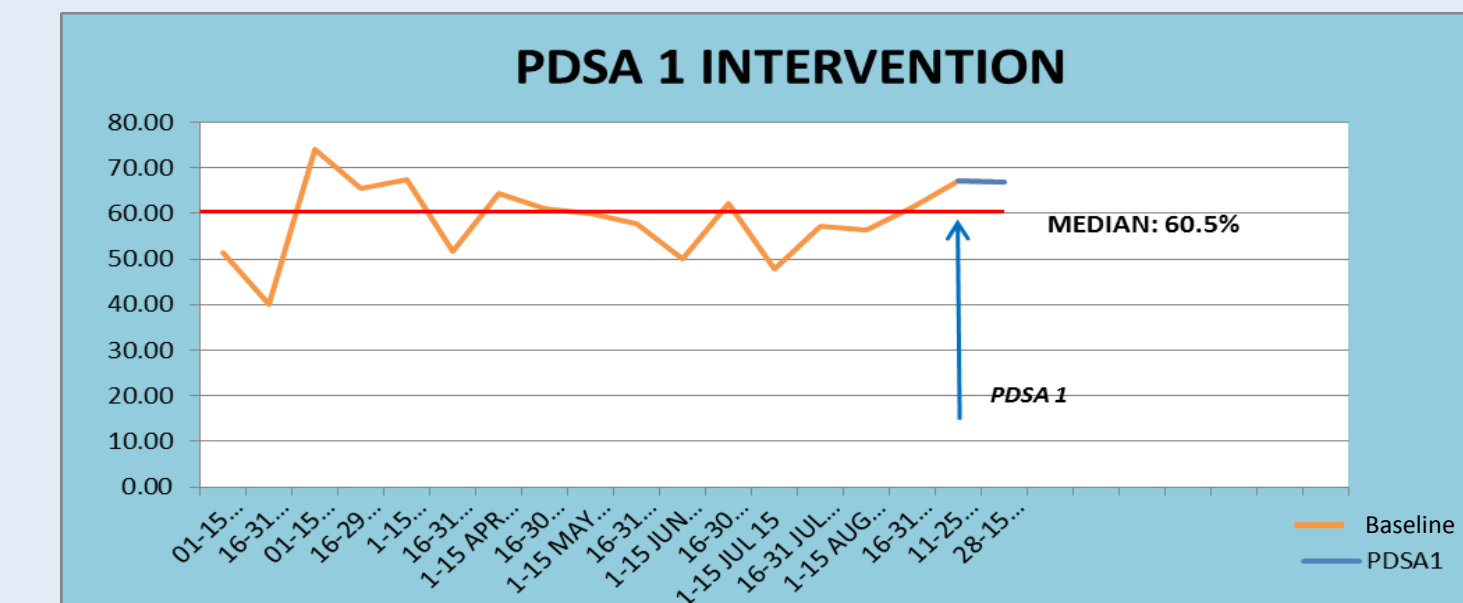


Table 3: % of image approval rates within 5 days with PDSA 1 intervention from 11th September to 9th October 2015

### PDSA 2

- RTs Senior in-Charge of treatment machine to send email reminders via MOSAIQ to ROs
- ROs access the MOSAIQ everyday, thus able to read email
- ROs rejected the idea due to constant prompting from MOSAIQ

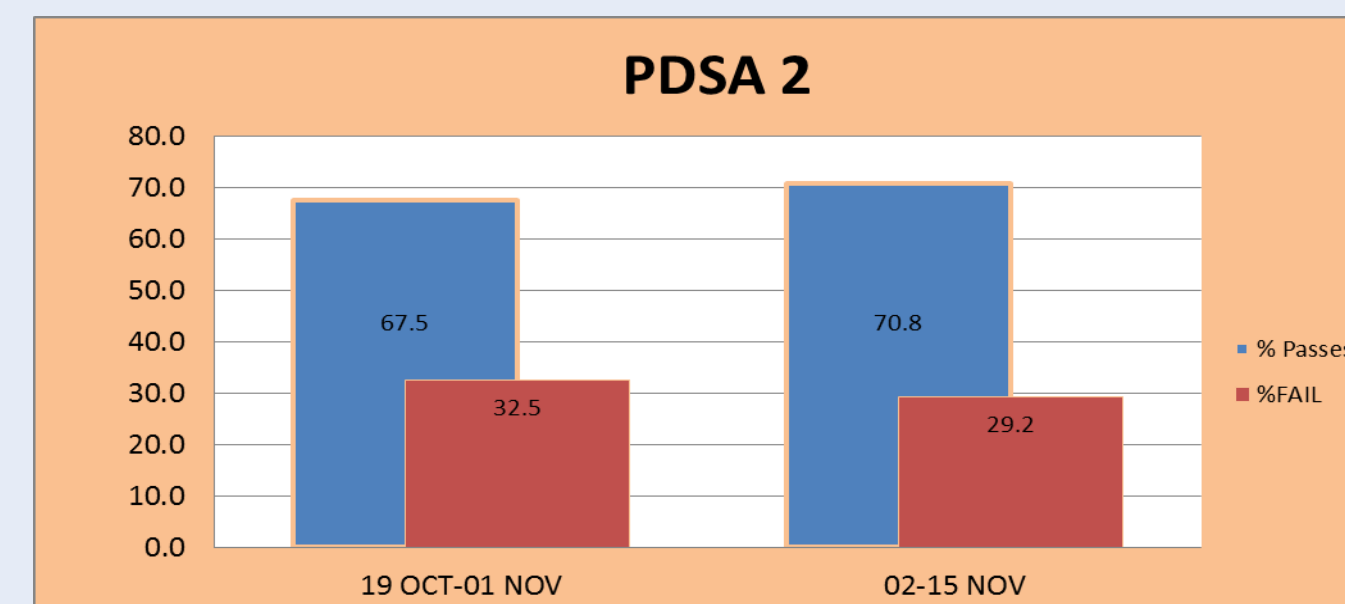


Table 4: % of patients' image approved within 5 days vs more than 5 days with PDSA 2 intervention

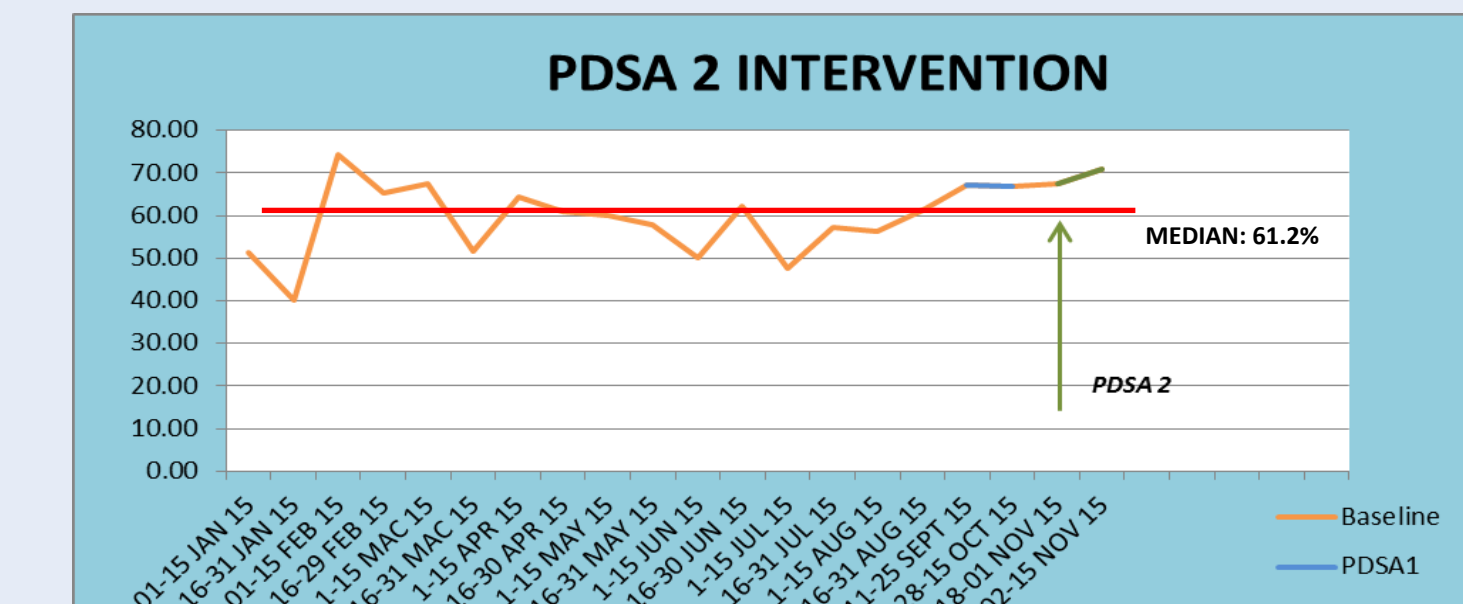


Table 5: % of image approval rates within 5 days with PDSA 2 intervention from 19th October to 15th November 2015

### PDSA 3

- Only the Head and Neck (H & N) site was tested since the H & N group has established the imaging protocol and H & N Advanced Practitioner Radiation Therapist (APRT).
- H & N APRT and RO designed training and competency in approving PI images.
- H & N APRT underwent proper training to ensure competency in image verification.
- The results of approval rate from H & N APRT and the H & N ROs were collated and compared.

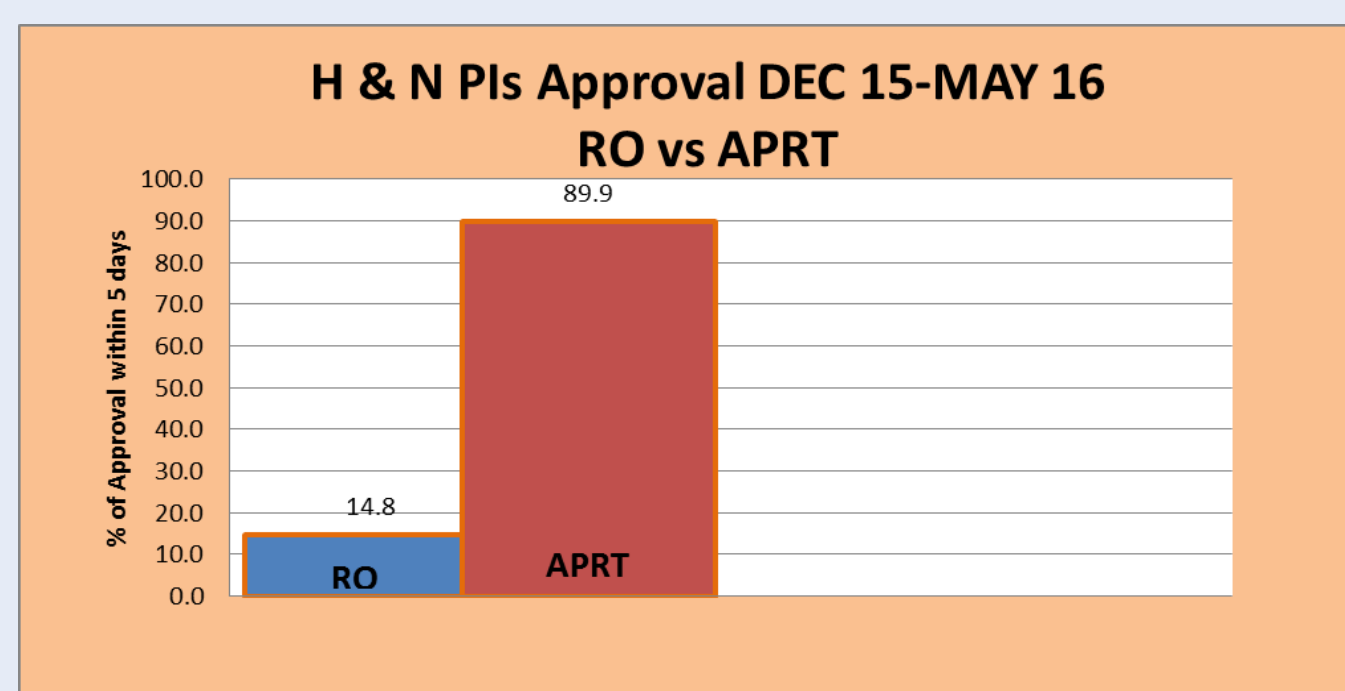


Table 6: % of patients' images approved within 5 days for RO vs APRT with PDSA 3 intervention

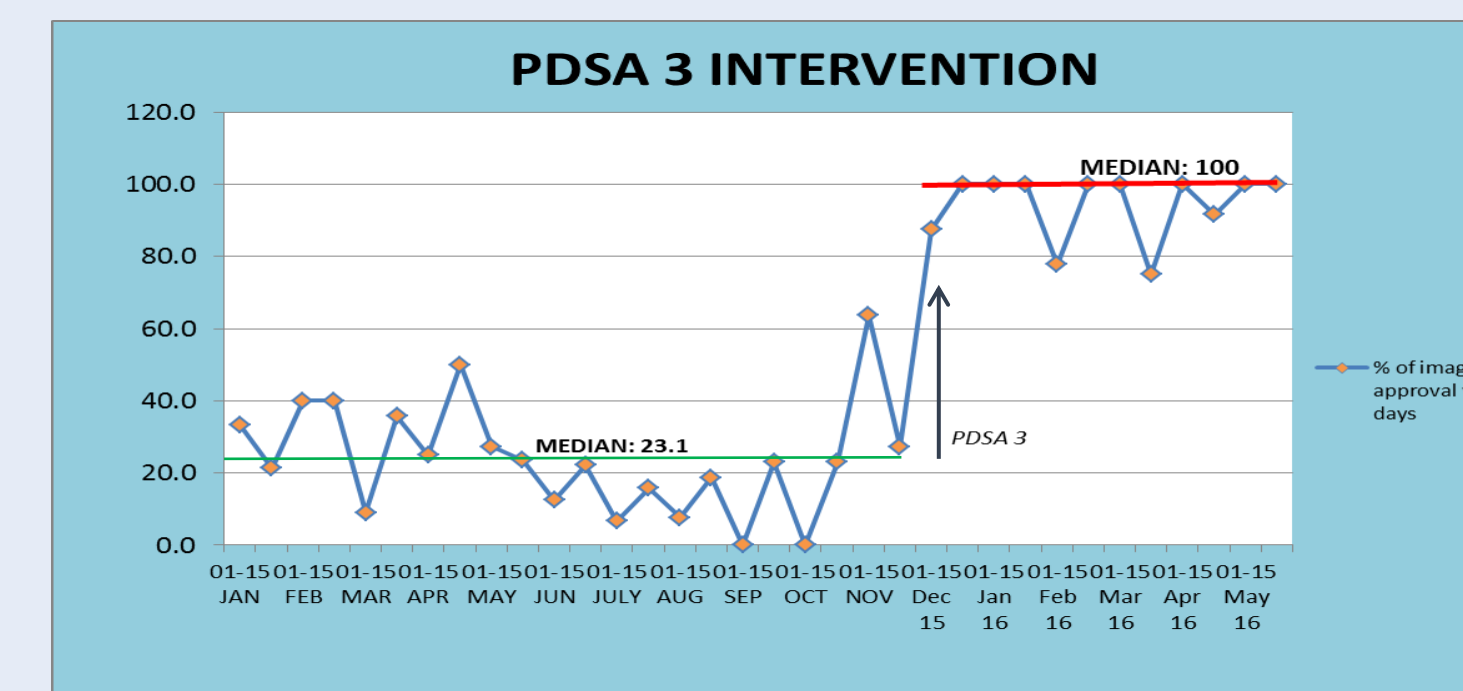


Table 7: % of image approval rates for H & N cases within 5 days with PDSA 3 intervention from 1st December 2015 to 31st May 2016

## RESULTS

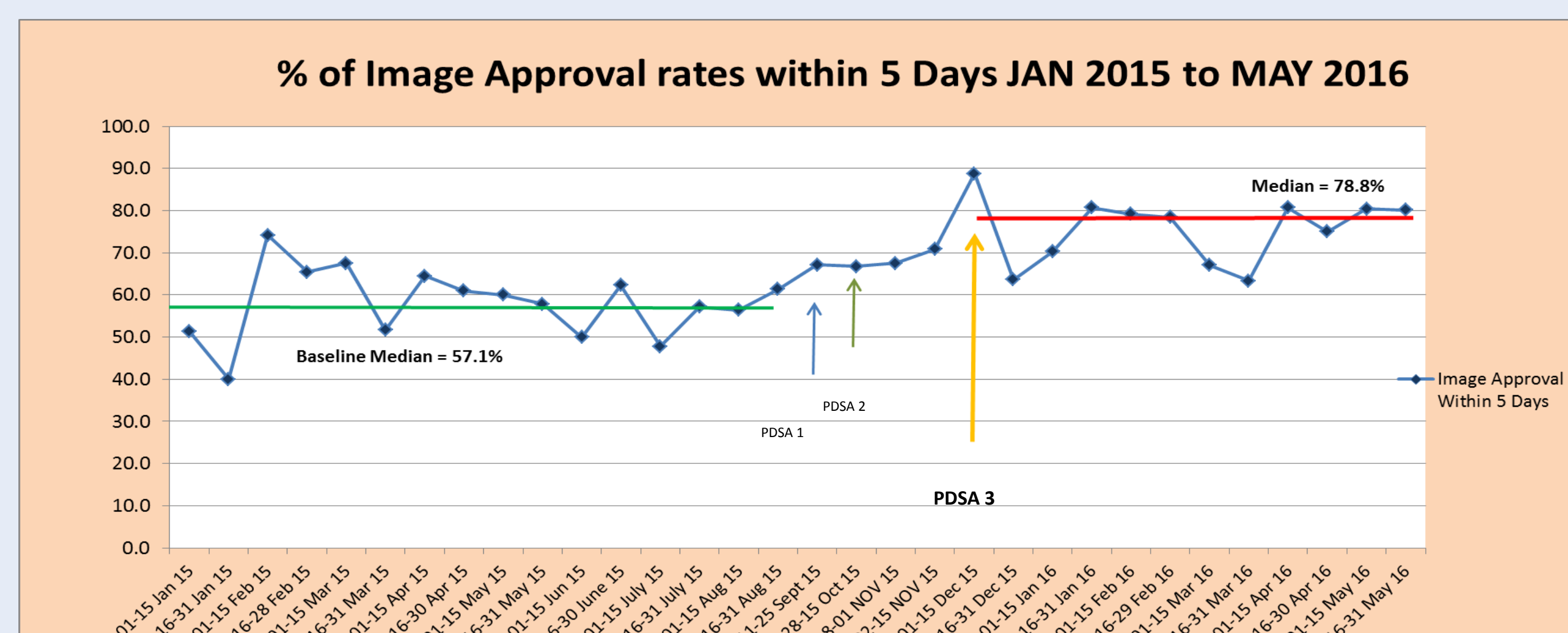


Table 8: Image verification approval rates from January 2015 to May 2016 for all cases at DRO. The Runchart showed a significant shift of Median from 57.1% to 78.8% after PDSA 3 intervention.

From PDSA 1, there was a minimal improvement of median from 57.1% to 60.5%. As for PDSA 2, there was an additional of 4.1% of improvement in the PI approval rate.

PDSA 3 results were based on PI approval for H & N images only. Based on the 6 months study, 177 patients were submitted for image review and the results were favorable to the APRT. The approval rate for APRT was 90% while the H & N ROs' was 15%. It was evident that after the APRT take on the role of image approval, there was a remarkable overall improvement of median 23.1% to 100% for the H & N cases. Overall, the Runchart for PI approval rate shows an upward trend with a median shift from Baseline 57.1% to 78.8% for all cases at DRO.

## CONCLUSION

As part of the departmental staff development plan and to benchmark with international standard, approving PIs has become one of the vital role expansions for RTs. With the shared responsibility of H & N APRT along with the H & N ROs in PI approval, the issue of timely approval of PIs has been resolved. Ultimately, through proper training and assessments, this role can then be rolled out to other sites beyond H & N region and hence, will guarantee sustainability. As H & N is the most challenging and complicated site, the success will be an assurance that we will succeed with other sites. This ensures safe treatment delivery, which is in line with the NCCS's common purpose of providing the best care for the patients with the best practice.