INTRODUCTION

- The aim of radiology is to obtain adequate radiographs for radiologists to interpret results with minimum radiation dose to the patient.

- The term reject means to repeat patient radiographs because of clinically unacceptable images.

- The patients would get double radiation dose if repeated scan is required.
BACKGROUND

- Department of Radiology, Bumrungrad International Hospital provides more than 200,000 radiographs a year for Thai and International patients.

- The average of reject scan was more than 6% of total x-ray procedures performed.

- The radiology department has set up the Quality Improvement Team to improve quality of radiograph and to reduce reject scan for patient radiation safety.

OBJECTIVE

- To reduce the percentage of reject scan, from 6.8% to be ≤ 5% by radiograph quality improvement.
METHODS

- To set up the Continuous Quality Improvement (CQI) Team.
- To collect information of reject scan from computed radiography (CR) and digital radiography (DR) systems during year 2013-2014.
- To analyze the data by using the Pareto chart.
- The major causes of reject scan (84.98%) are:
  1. Positioning Error (35.34%)
  2. Poor Inspiration (30.65%)
  3. Clipped Anatomy (18.99%)
METHODS

- The Fish Bone Diagram was used to identify 3 root causes of reject scan.

- Clipped Anatomy
  - Radiology Staff
    - Knowledge of Surface anatomy
      - Experience/Expertise  
    - Communication  
    - Intention/Attention  
  - Patient
    - Human Habitus  
    - Condition of patient  
      - wheelchair/stretcher patients
    - Cooperation of patient  
  - Equipment
    - Quality of Equipment  
    - Position Tool

- Positioning Error
  - Radiology Staff
    - Knowledge of Radiographic positioning  
      - less skill
    - Experience/Expertise  
    - Communication  
    - Intention/Attention  
      - Responsibilities
  - Patient
    - Condition of patient  
    - wheelchair/stretcher patients
    - Cooperation of patient  
      - language barrier
  - Equipment
    - Quality of Equipment  
      - not perform daily QC
    - Position Tool

- Poor Inspiration
  - Cooperation of patient
  - No explanation  
    - Intention/Attention  
      - Responsibilities

ACTIONS HIGHLIGHT

- The improvement plan there are 2 dimensions.

  Dimension 1: Staffs development
  - A. Radiologic Technologist
  - B. Other staffs

  Dimension 2: Patient Information
**ACTIONS HIGHLIGHT**

**Dimension 1: Staffs development**

A. Radiologic Technologist (Increase efficiency and ability)

To analyze reject scan of 54 RTs by each RT, shown in Scatter Plot.

The results in Figure 2 show the positive correlation between the average number of reject scan and average scan per month.

But the number of reject scan is not correlated with the % reject scan.

![Figure 2: Number of reject scan versus total scan by individual RT](image)
**Dimension 1: Staffs development**

From the scatter plot between percentage of reject scan versus total scan by individual RT.

We found that it was not correlated between percentage of reject scan and total scan by individual RTs.

We can categories into 4 groups in Figure 3.

- **Group A**: High Volume, High Reject; take xGray ≥ average scan and % reject scan > 5
- **Group B**: Low Volume, High Reject; take xGray < average scan and % reject scan > 5
- **Group C**: Low Volume, Low Reject; take xGray < average scan and % reject scan ≤ 5
- **Group D**: High Volume, Low Reject; take xGray ≥ average scan and % reject scan ≤ 5

Figure 3: Percentage of reject scan versus total scan by individual RT

We reduce percentage of reject scan group A & B to group C & D by each group activities as following:
Group A: High experience/expertise and high number of x-ray, But reject scan > 5%

1. Motivation: To create activity “Star of the month” (give award to RTs who have highest x-ray & lowest reject scan).
2. After Action Review: to record and discuss a daily interesting cases among RTs which leaded by senior RTs.
3. To increase awareness: knowledge sharing and discuss as a group by senior RTs in monthly staff meeting which is supported by a radiologist.

Group B: Less experience/expertise, less number of x-ray and reject scan > 5%

1. Quick Guide & Quick Tip: To create a short guide x-ray for reminder.
2. X-Ray accessories: To provide tools to correct x-ray positioning.
3. Retrain Positioning: Set up training by anatomical part, lead by senior RTs who will be responsible for pre-post test and follow up to enhance technical skill.
A monthly feedback about percentage of reject scan was noticed individually, cause of reject and body part error are informed in order to develop RTs competency.

### Dimension 1: Staffs development

#### B. Other staffs (Assistant technician, Imaging officers)

- Create guideline for staffs to prepare the patients.
- Create checklist to evaluate patient preparation.
Dimension 2: Patient Information (Providing appropriate information by nationality).

1. Provide the flip chart in 5 languages which are consist of Burmese, Cambodian, Mandarin, Mongolian and Ethiopian.

2. Create the X-Ray Announcer which is the innovation of CQI Team. There are 8 languages; Burmese, Cambodian, Arabic, Mandarin, Japanese, Bangali, Mongolian, Ethiopia to explain chest x-ray instruction.

3. Create the short sentences in many languages that is frequently used for communication with patient in the karaoke format (for RTs) and the action images (for patients).
RESULT

- Result (Staff Development)
  Comparison of the scatter plot between pre implementation in 2013 and post implementation in 2014.

Figure 4: Comparison the scatter plot between pre and post implementation.

- Result (Staff Development)
  The percentage improvement by groups between pre implementation in 2013 and post implementation in 2014.

Figure 5: Improvement of 4 groups RTs.
The major causes of reject scan
Post implementation which was started from June to December in 2014.

1. Positioning Error
The average percentage of positioning error in 2014 from Jan-Jun and Jul-Dec were 1.78 and 1.24, respectively. The reduction percentage was 30.34.

To compare between Jan-Dec 2013 and Jan-Dec 2014, The reduction percentage was 40.

The percentage of positioning error has been reduced as shown in Figure 6.
2. Clipped Anatomy

The average percentage of clipped anatomy in 2014 from Jan-Jun and Jul-Dec were 1.32 and 0.96, respectively. The reduction percentage was 27.27.

Compare between Jan-Dec 2013 and Jan-Dec 2014. The reduction percentage was 10.68.

The percentage of clipped anatomy has been reduced as shown in Figure 7.
3. Poor Inspiration

The average percentage of poor inspiration in 2014 from Jan-Jun and Jul-Dec were 1.38 and 1.08, respectively. The reduction percentage was 21.74.

Compare between Jan-Dec 2013 and Jan-Dec 2014, The reduction percentage was 38.69.

The percentage of poor inspiration has been reduced as shown in Figure 8.
The average percentage of reject scan decreased from 6.81 (January-December 2013) to 4.83 (January – December 2014).
Summary of activities which directly solve the problem of reject scan

<table>
<thead>
<tr>
<th>Activity</th>
<th>Causes from Staff</th>
<th>Language Barrier</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve training &amp; evaluation new RTs</td>
<td>✓</td>
<td></td>
<td>Average % Reject scan new RTs decreased</td>
</tr>
<tr>
<td>Award for highest x-ray &amp; lowest % reject scan</td>
<td>✓</td>
<td>✓</td>
<td>% Reject scan of Department decreased</td>
</tr>
<tr>
<td>Flip chart multi-languages</td>
<td>✓</td>
<td>✓</td>
<td>% Poor inspiration decreased</td>
</tr>
<tr>
<td>Quick guide 20 procedures</td>
<td>✓</td>
<td></td>
<td>% Positioning error decreased</td>
</tr>
<tr>
<td>Feedback % Reject scan individually</td>
<td>✓</td>
<td></td>
<td>% Positioning error decreased &amp; % Reject scan of department decreased &amp;</td>
</tr>
<tr>
<td>Daily interesting cases</td>
<td>✓</td>
<td>✓</td>
<td>% Reject scan of department decreased &amp; the number of RTs Group A &amp; B decreased</td>
</tr>
<tr>
<td>Retrain positioning RTs</td>
<td>✓</td>
<td></td>
<td>% Poor inspiration &amp; % Reject scan of Department decreased</td>
</tr>
<tr>
<td>Knowledge sharing in monthly staff meeting</td>
<td>✓</td>
<td></td>
<td>% Poor inspiration &amp; % Reject scan of Department &amp; Positioning error decreased</td>
</tr>
<tr>
<td>Short sentences to frequently used</td>
<td>✓</td>
<td>✓</td>
<td>% Poor inspiration &amp; % Reject scan of Department decreased</td>
</tr>
<tr>
<td>Innovation X-Ray Announcer</td>
<td>✓</td>
<td>✓</td>
<td>% Positioning error &amp; Clipped anatomy decreased</td>
</tr>
<tr>
<td>X-Ray Positioning Tools</td>
<td>✓</td>
<td></td>
<td>% Reject scan of Department decreased</td>
</tr>
<tr>
<td>Improve data collection</td>
<td>✓</td>
<td></td>
<td>% Reject scan of Department decreased</td>
</tr>
<tr>
<td>Quick Tips</td>
<td>✓</td>
<td></td>
<td>% Reject scan of Department &amp; Positioning error decreased</td>
</tr>
</tbody>
</table>

LESSONS LEARNED

1. The success of quality improvement come from the cooperate of everyone through positive thinking, using motivation as an improvement tool.

2. The selection of appropriate quality tool can determine root cause analysis, leading to efficiency improvement.

3. The knowledge sharing from experienced staff is valuable to develop Tacit & Explicit knowledge for sustainable staffs development.

4. Brainstorming creates Innovation, Innovation solve the problems.
THANK YOU

ขอบคุณครับ

KHOB-KHUN-KRAB