# Individualization of Exposure Parameters for In-Patients May Improve Accuracy of Comparison of X-Rays

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# Introduction

Inpatients in a tertiary care facility, most often require chest X-rays as a part of their diagnostic work-up. The X-rays are often repeated to assess progression or regression of pathology

The radiologist plays an important role in the diagnosis as well as monitoring of the patient's condition by accurate study and comparison of the patient's serial X-rays.

For accurate interpretation of X-rays, image quality must be optimal and comparable.

## Image Quality of an X ray

❑Image quality predominantly depends on the selection of following exposure factors :

- ✓ **Kilovoltage (KVp)**
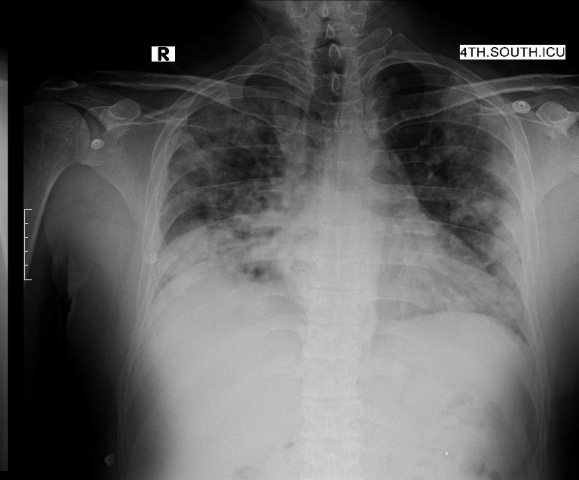- ✓ **Milliamperage (mA)**
- ✓ **Seconds(s)**

❑Radiographers have the responsibility of selecting the combination of exposure factors to produce a quality image of the relevant pathology.

❑The aim is to produce an image such that it provides maximum diagnostic information and allows accurate subsequent comparison

## But what happens?
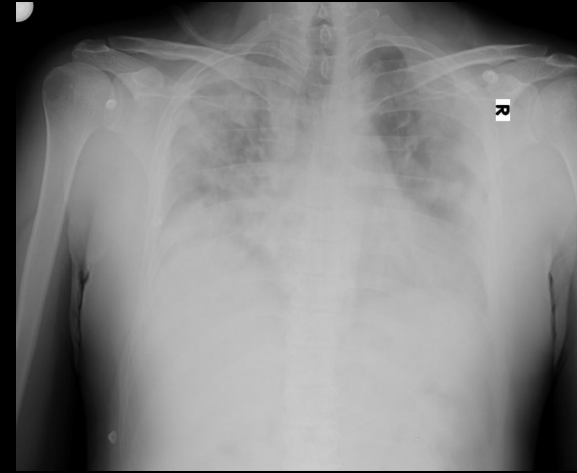


**X-ray 1**

**X-ray 2**

❑ **Same patient**
❑ **X-rays taken 6 hours apart**

- ○ **Different Radiographers**
- ○ **Different exposure factors**
- ○ **Inaccurate interpretation of patient condition**

# Our Proposed Solution and Methodology

**Individualize exposure parameters (kV and mAs) for every patient**

Select a portable X ray machine and use the same machine for repeat Chest X rays of the patient → Obtain optimal AP X-ray using standard distance of 4 feet and centering at T7 → Select the appropriate exposure factors depending on the build and position of the patient → Once ideal exposure selected, issue X-ray film with kV and mAs mentioned on the film
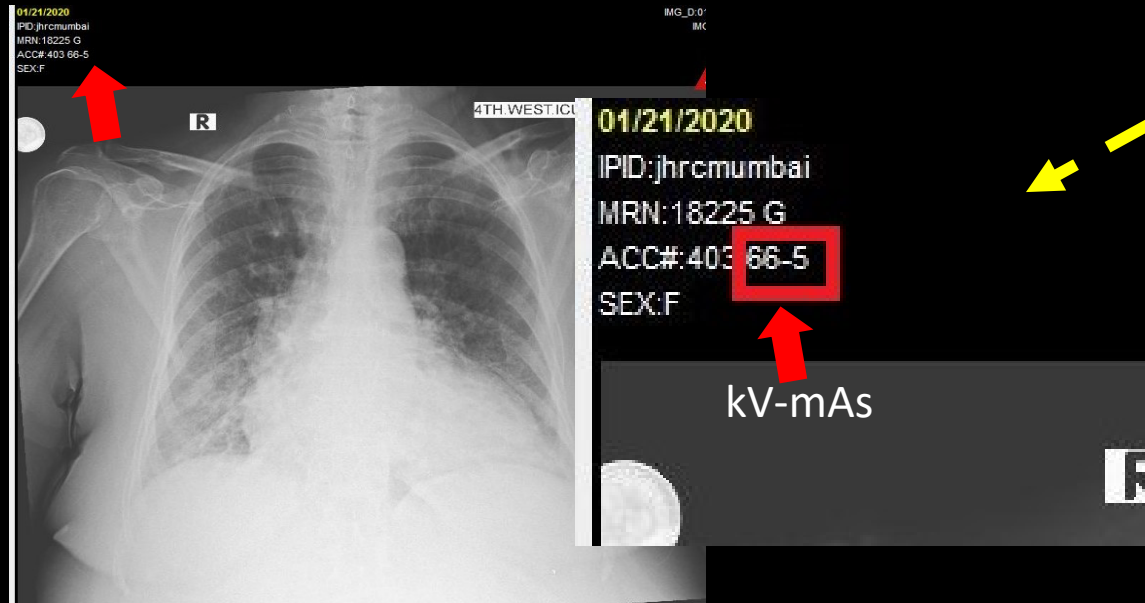
For repeat radiograph of the same patient , refer to previous X-ray and use the mentioned exposure parameters



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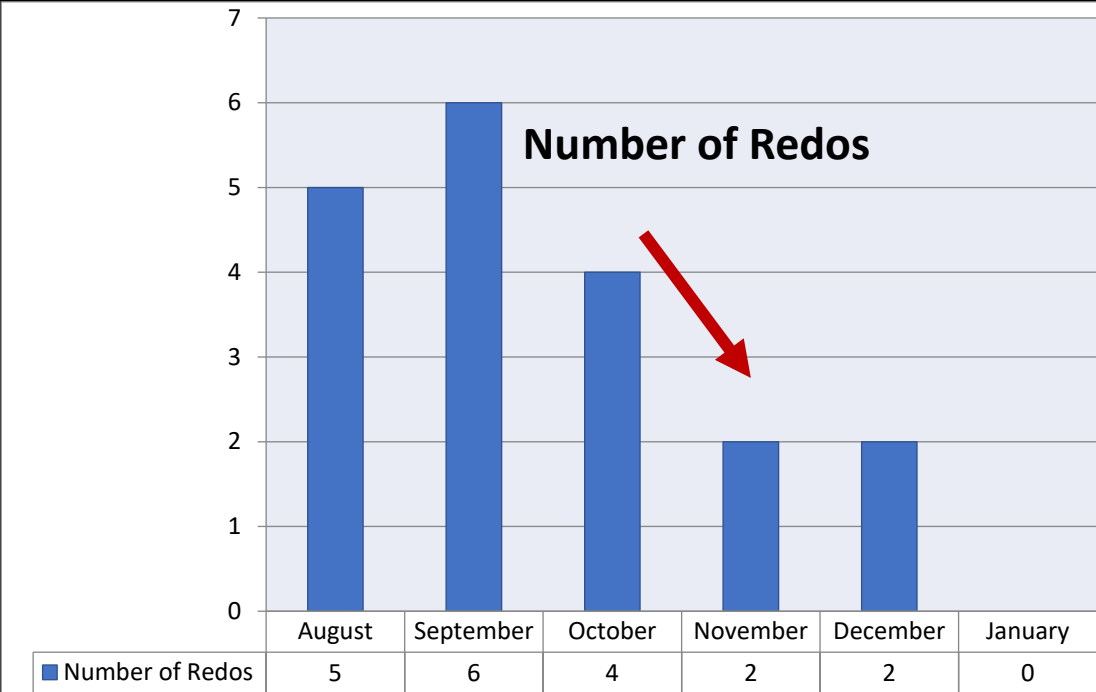
kV-mAs

## Patient population and Study Duration

This method was implemented for Chest X-rays of all inpatients in the ICU for 3 months and using defined outcome parameters, data was compared before and after implementation
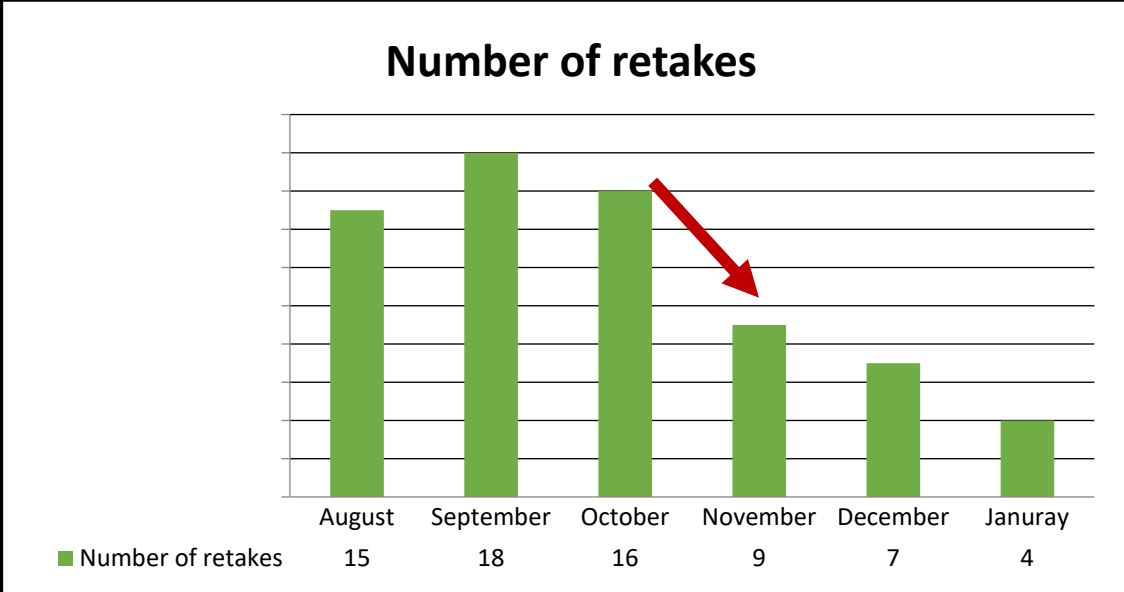
## Outcome Parameters

❑**X-ray Redos**: Those X-rays, where the X-ray is repeated again, usually on request by the radiologist for either inaccurate positioning or exposure

❑**X ray retakes :**Those X-rays that were repeated at the bedside, when the latent image viewed on the portable X-ray machine screen was found unsatisfactory by the clinician or the technician. These generally amount to increased radiation exposure for the patient

❑**Clinician requisition**:  Clinicians' request for repeat radiographs to clarify any clinico-radiological discrepancy.
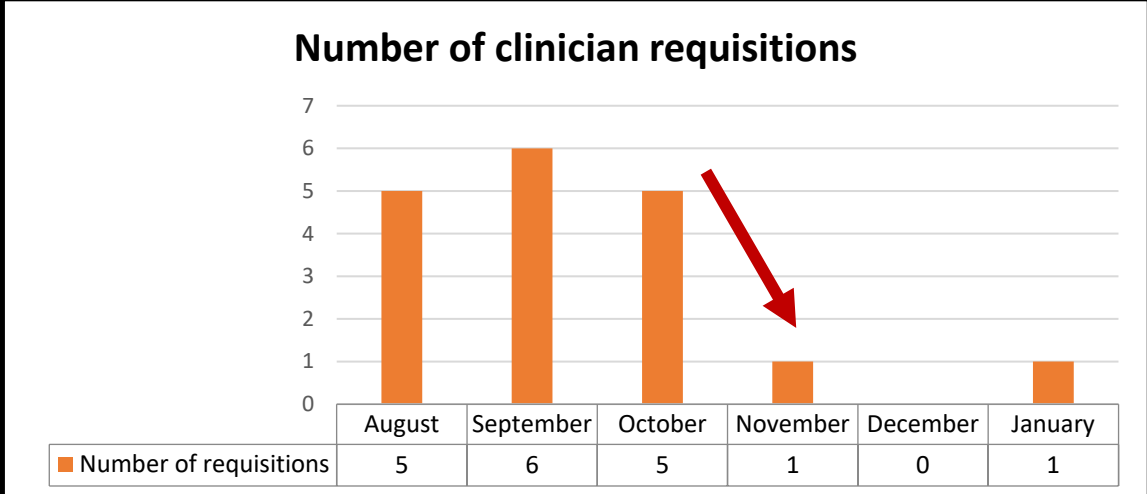
# Results

**Comparing data 3 months prior to implementation August - October AND 3 months after : November-January**

## Number of Redos

| | August | September | October | November | December | January |
|---|---|---|---|---|---|---|
| Number of Redos | 5 | 6 | 4 | 2 | 2 | 0 |

**79 % reduction in redos**

## Number of retakes

| | August | September | October | November | December | Januray |
|---|---|---|---|---|---|---|
| Number of retakes | 15 | 18 | 16 | 9 | 7 | 4 |

**59 % reduction in retakes**

## Number of clinician requisitions

| | August | September | October | November | December | January |
|---|---|---|---|---|---|---|
| Number of requisitions | 5 | 6 | 5 | 1 | 0 | 1 |

**46 % reduction in clinician requisition**

## Feedback from the intensivists

- "Honestly, this has improved our speed of assessment and diagnosis of the patient. We are able to compare the subsequent X-rays ourselves and understand the progress of the patient's condtion better "

- "It is a good initiative. There is a significant reduction in the patient's radiation exposure plus in the times of COVID, the radiographer also spends lesser time in the wards and limits his contact period with the COVID patients"

## Feedback from the radiologist

- "The radiographer is less exposed, the clinicians' are happy and we are able to give better comparison reports! The seriel X-rays now show improved clinicoradiological correlation"

## Long Term Implications

Our pilot study indicates that comparison between consecutive X-rays will become more accurate by standardising exposure factors for a patient during the course of their hospital stay, with resultant improvement in patient management

Additionally,

- Reduced operator bias
- Reduced patient exposure to radiation
- Better delineation of subtle change in pathology
- Saves time and X-ray film print

As recent studies indicate that the X-ray findings of COVID 19 which include peripheral ground glass opacities, are subtle ; image quality is of paramount importance. We believe our initiative would prove useful in these times of crisis and will contribute significantly to the battle against COVID 19.

# Conclusion

- The standardisation of X-ray parameters will make comparison between X-rays accurate.

- Additionally it reduces patient exposure to radiation due to decreased requirement for repeat radiographs.

- Our study is small scale with limited data and time frame. However it is a proposed initiative which is simple and incurs no extra cost or effort.

- It was initiated during the onset of the pandemic and has been a learning process. The sample space is still at the lower end of the statistical significance spectrum. However we expect similar results from a year long detailed study as well.

- In today's times, bedside chest X-rays are indispensable , and every step towards improving accuracy of the X-ray will contribute to faster diagnosis and improved management of the patient.

# Thank you!