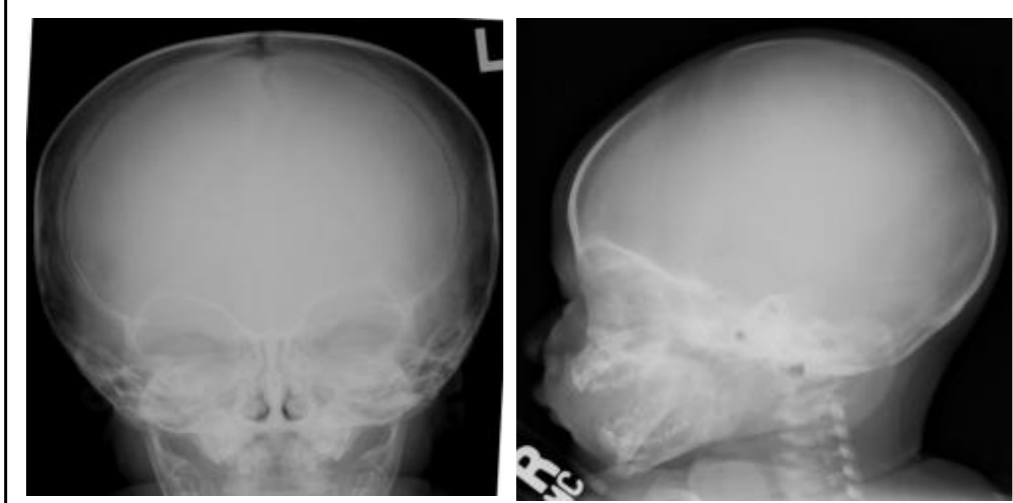


1. SELECTION OF OPPORTUNITIES FOR IMPROVEMENT

- Suboptimal radiograph is defined as radiograph that has slightly poor diagnostic quality, which provides insufficient information and resulting in increased risk of misdiagnosis and mismanagement.
- In radiology optimization of radiation protection, need to keep radiation doses As Low As Reasonable Achievable (ALARA).
 - Reducing the suboptimal skull radiograph will reduce the need of repeat examination; hence reduced the radiation dose in concordance with ALARA.
- Verification study shows 87.5% of the total paediatric skull radiograph were suboptimal.
- Aim of this study is to reduce the percentage of suboptimal skull radiograph consistent with ALARA.
 - To ensure the radiograph taken are of quality value, appropriate and adequate to obtain a proper diagnosis and subsequent management is in line with patient safety.
- Appropriate immobilization technique and paediatric skull immobilizer is crucial among paediatric patients in order to provide proper radiographic positioning and to reduce suboptimal images for skull radiograph examinations.

CRITERIA FOR OPTIMAL: SKULL AP/ LATERAL RADIOGRAPH

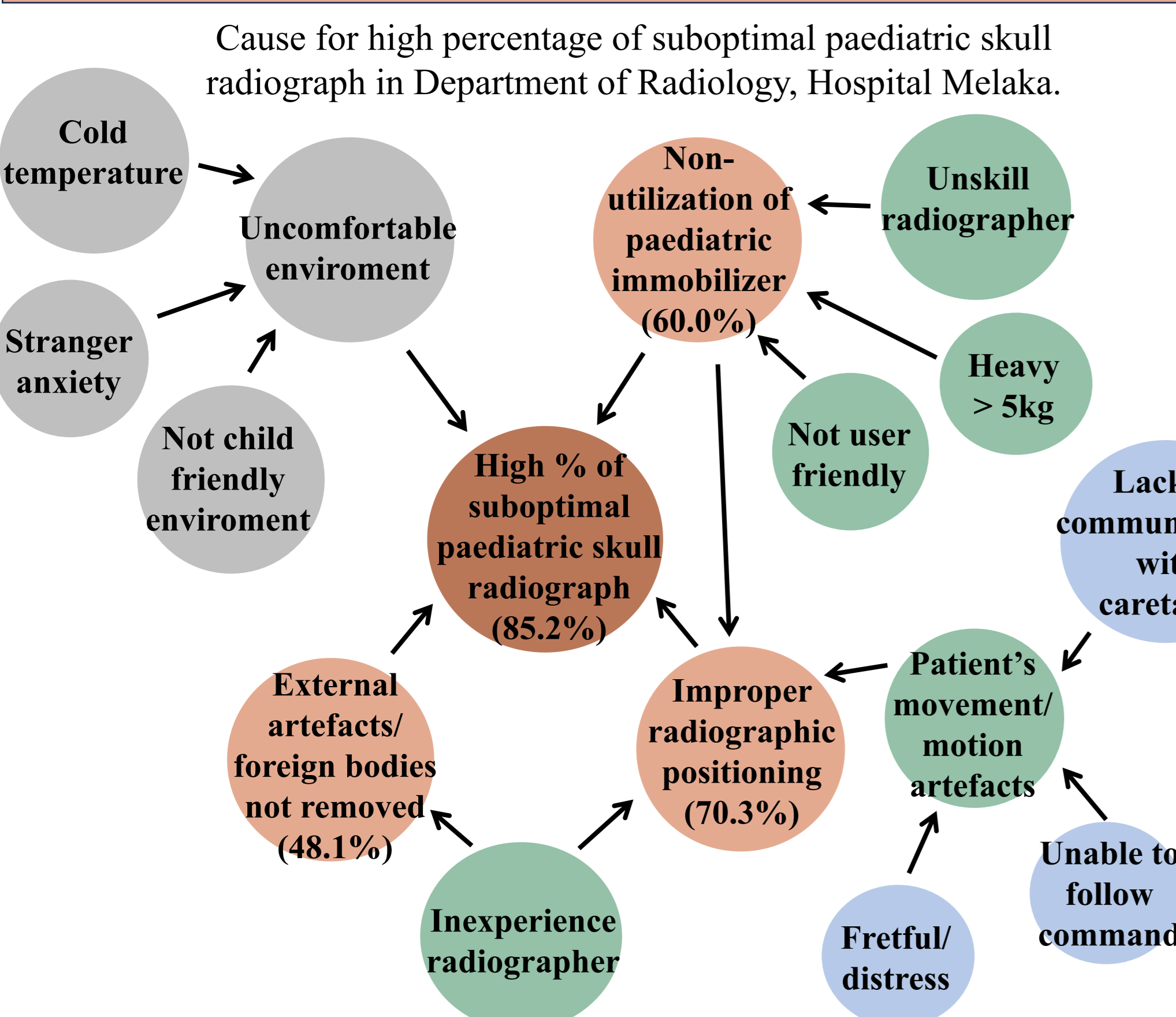
- Anatomy demonstrated: Adequate anatomy coverage
- Position: No rotation
- Exposure: No motion, sufficient penetration and exposure
- Artefact: No external artefact or foreign body



1.1 LITERATURE REVIEW

Retakes of X-ray examinations impose patients to unnecessary ionizing radiation, which have great risk in inducing cancer, even at protracted low-dose exposure. <i>Lin C-S (2016)</i>	Positioning error and anatomy cutoff was the most frequent factor causing image retake, followed by artifacts, body movement and improper exposure. <i>Foo DH (2009)</i>	Immobilizer devices and manual restraint may be used to keep pediatric patients motionless. <i>J Mari Beth (2017)</i>
---	---	--

1.2 PROBLEM ANALYSIS CHART



2. KEY MEASURE FOR IMPROVEMENT

2.1 OBJECTIVES

GENERAL OBJECTIVES:

To reduce percentage of suboptimal skull radiograph among pediatric patients.

SPECIFIC OBJECTIVES:

- To determine the existence/ magnitude of the quality problem
- To identify factors contributing to the problem.
- To formulate and implement appropriate remedial measures.
- To evaluate the effectiveness of remedial measure implement.

2.2 INDICATOR & STANDARD

STANDARD:

< 30% of suboptimal pediatric skull radiograph in Department of Radiology, Hospital Melaka. Based on reference (Queensland University of Technology 2023).

INDICATOR:

Percentage (%) of suboptimal pediatric skull radiograph in Department of Radiology, Hospital Melaka.

FORMULA:

$$\frac{\text{Total number of suboptimal pediatric skull radiograph}}{\text{Total number of pediatric skull radiograph performed}} \times 100\%$$

3. PROCESS OF GATHERING INFORMATION

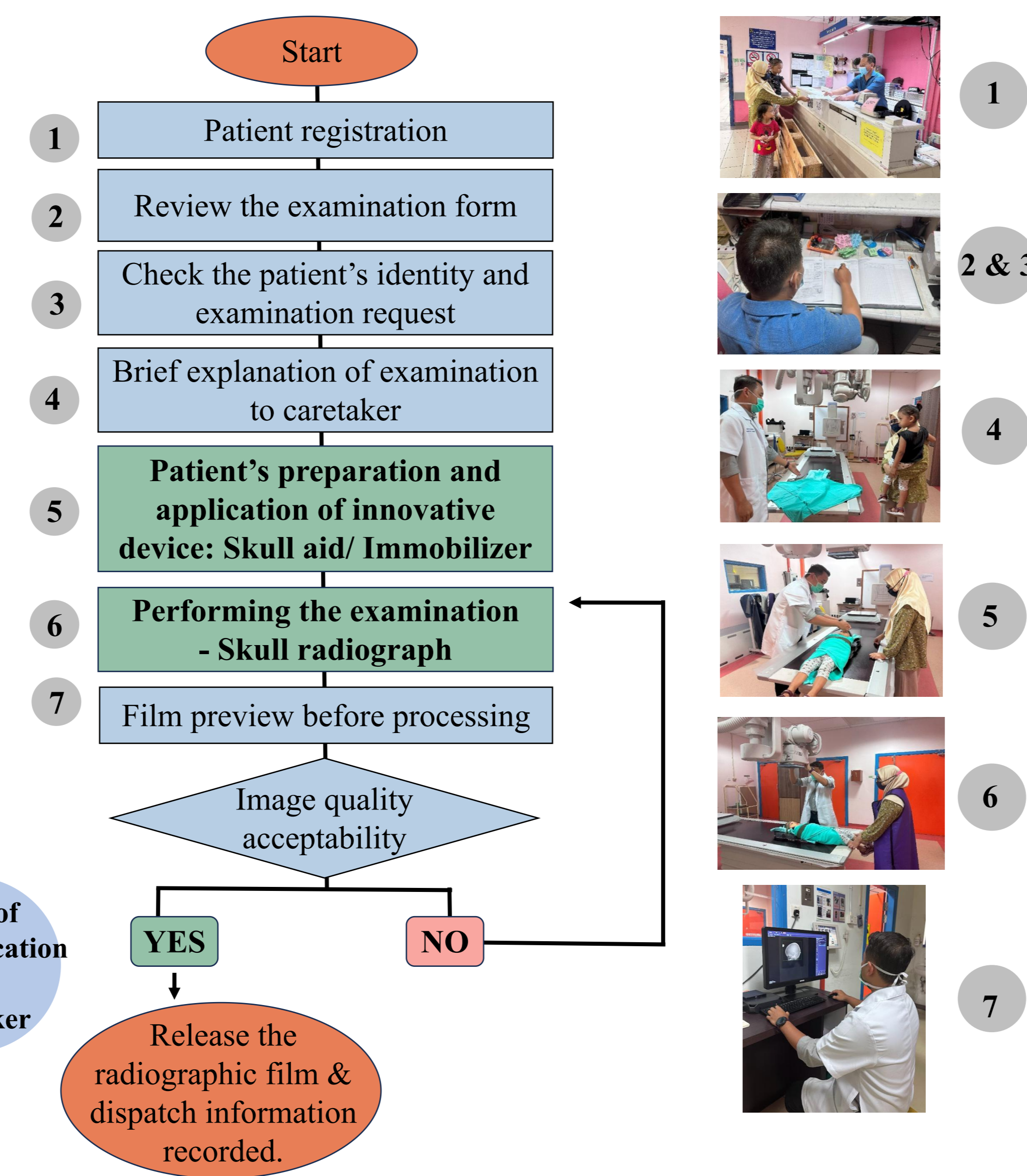
3.1 METHODOLOGY

STUDY DESIGN	Quality Improvement Study.
STUDY SETTING	Department of Radiology, Hospital Melaka.
SAMPLING TECHNIQUE	Universal sampling.
STUDY PERIOD	June Year 2022 till December Year 2023.
INCLUSION CRITERIA	<ul style="list-style-type: none"> Trauma and non-trauma cases. Age Group: <ul style="list-style-type: none"> Pre-remedial <12 years old Post-remedial <7 years old.
EXCLUSION CRITERIA	Portable pediatric skull radiograph done outside from the radiology departments (e.g in the wards, SCN and NICU).

3.2 DATA COLLECTION TOOL

NO	TOOL	AIM
1	Radiology Imaging request form	To collect patient's data via "Borang Permohonan Pemeriksaan Radiologi - Per.Ss-ra301"
2	Registration book	To collect numbers of paediatric skull radiograph sample.
3	Observational Checklist	To determine percentage of suboptimal skull radiograph according to acceptability criteria.

3.3 PROCESS OF GOOD CARE



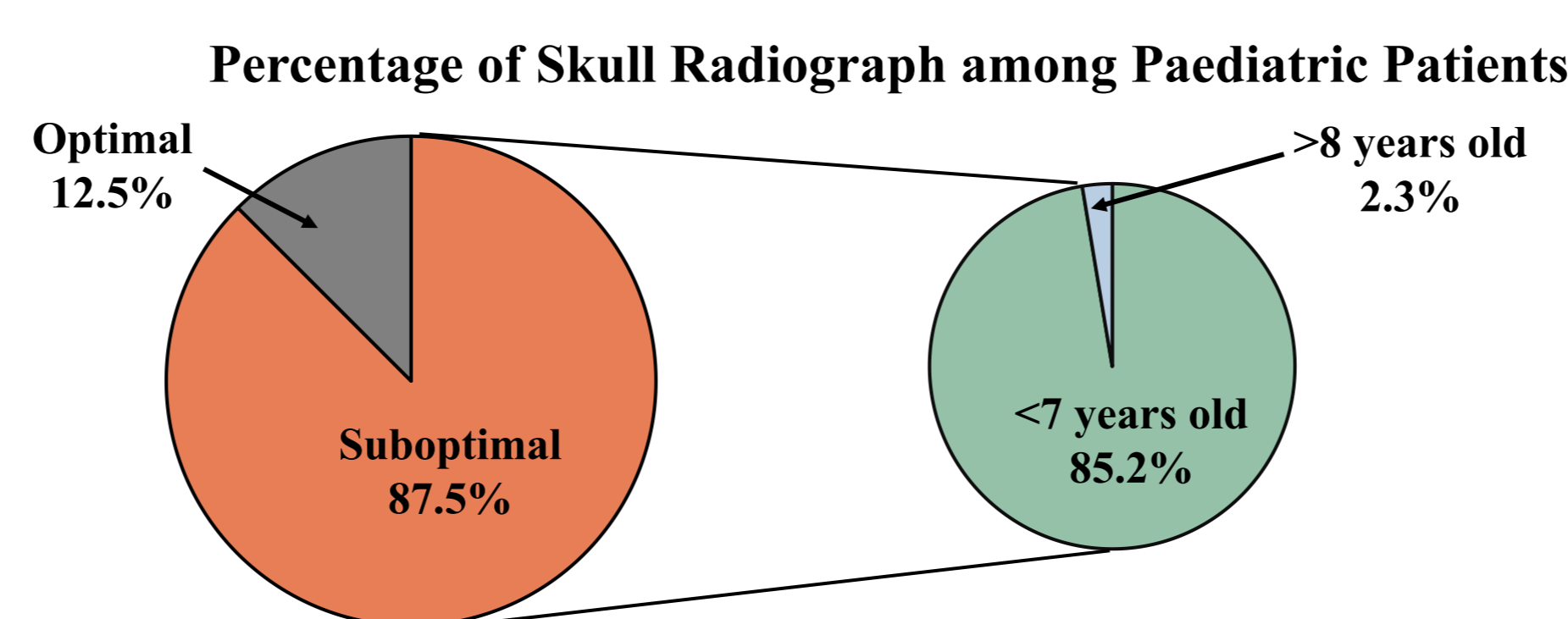
4. ANALYSIS AND INTERPRETATION

4.1 PRE-REMEDIAL STUDY

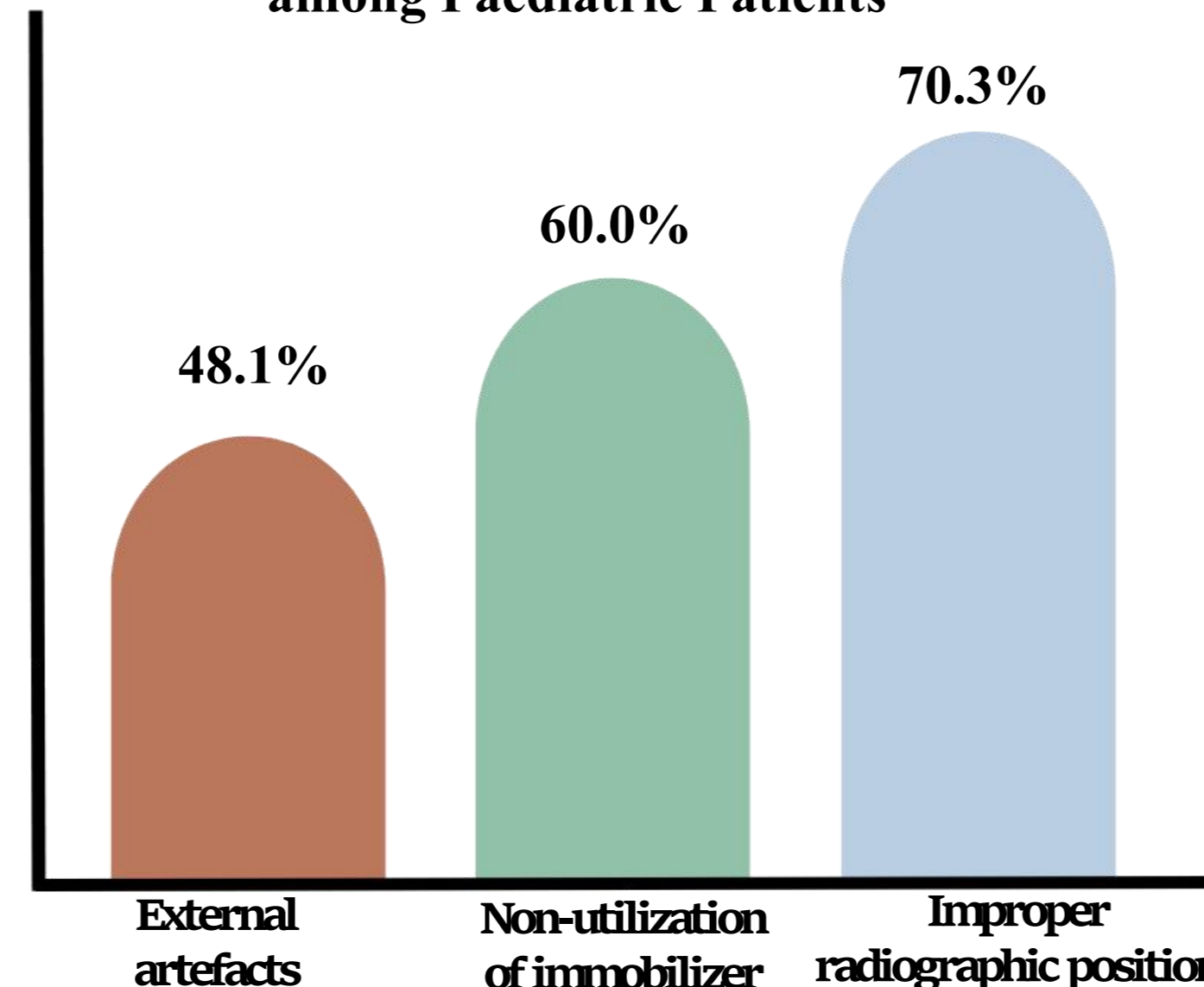
A total sample of 152 pediatric patients were collected during the study period:

- 12.5% were optimal paediatric skull radiographs.
- 87.5% were sub-optimal paediatric skull radiographs.

4.2 CHART/ GRAPH



Factors for Suboptimal Skull Radiographs among Paediatric Patients



5. STRATEGY FOR CHANGE

5.1 INNOVATIVE IMMOBILIZER SKULL DEVICE



Innovation from 3R: "Skull Immobilizer" from Waste

5.2 INSTRUCTION MANUAL/ USER GUIDELINE



Instruction manual/ user guideline: step-by-step instructions.

5.3 CONTINUOUS MEDICAL EDUCATION (CME)

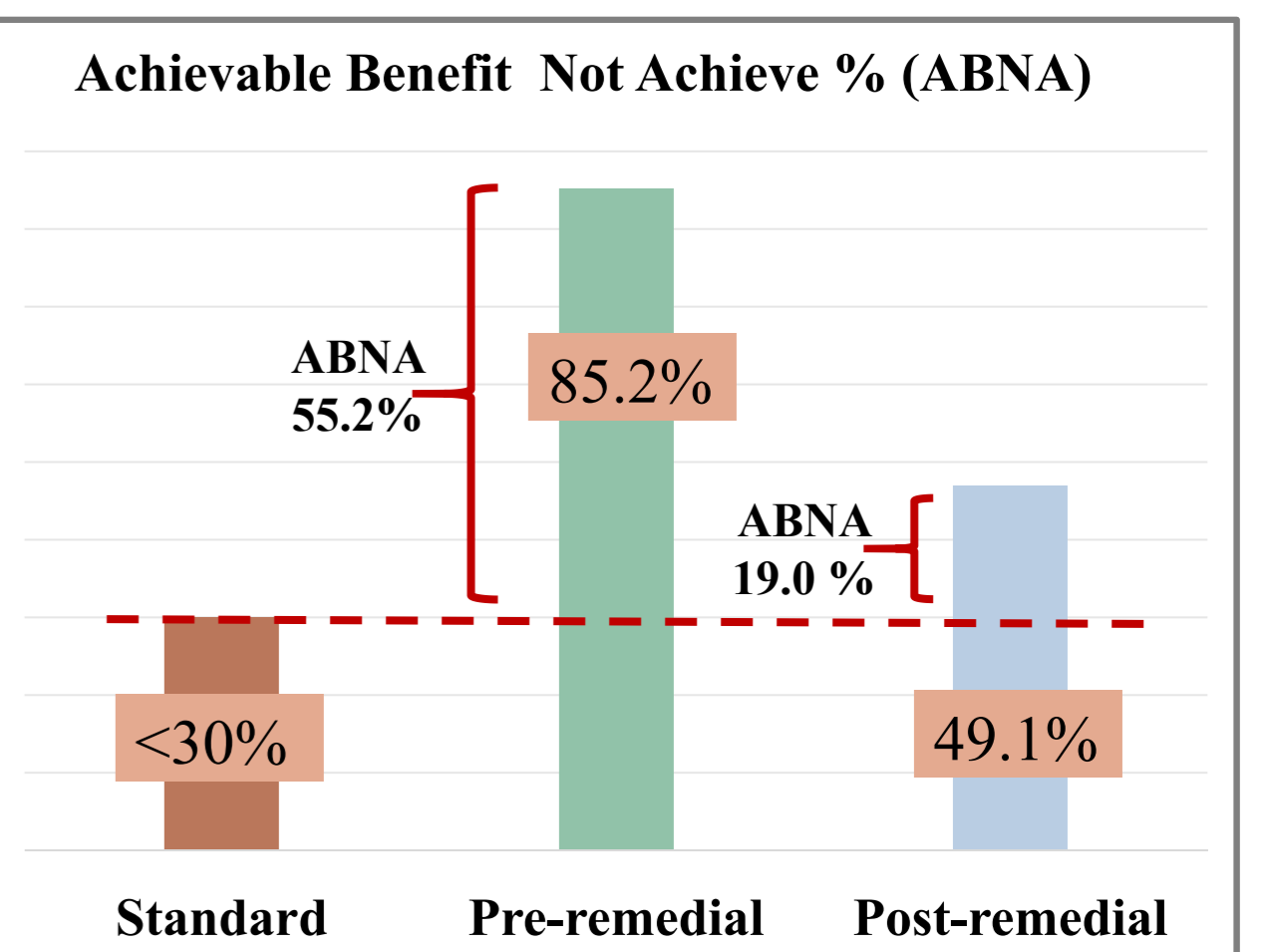


- In-house education program such as simulated user training and hands-on sessions conducted among the radiographers.
- Briefing and reminder reinforce during department monthly assembly.

6. EFFECT OF CHANGE

6.1 MODEL OF GOOD CARE

NO	PROCESS	CRITERIA	STANDARD	PRE-REMEDIAL	POST-REMEDIAL
1	Patient's registration.	Documentation in registration book	100%	100%	100%
2	Review request form.	Complete request form is review.	100%	100%	100%
3	Check patient patient's identity & examination request.	Ensure correct patient, site and examination prior to procedure.	100%	100%	100%
4	Brief explanation of examination to caretaker	Patient or caretaker is acknowledge regarding indication & examination.	100%	100%	100%
5	Patient's preparation	External artefacts are removed.	100%	48.1%	100%
6	Performing skull radiograph	Proper positioning for image acquisition. Application paediatric skull aid.	100% 100%	70.3% 40%	53.8% 100%
7	Film review prior processing	Acceptability criteria is reviewed.	100%	100%	100%
8	Images acceptability and dispatch	Final images dispatch accordingly.	100%	100%	100%



- The ABNA was narrowed down from 55.2% to 19.1%.
- Transition to the innovative immobilizer skull device shown improvement in reducing the numbers of suboptimal skull radiographs among paediatric patients.

7. NEXT STEP

To widen the implementation of innovative immobilizer skull device to all cluster hospitals in Melaka including Hospital Alor Gajah and Hospital Jasin as well as other primary health care centres.

8. REFERENCE

- An Exploration of Radiographer Decision-Making Regarding Rejected or Sub-Optimal Plain X-Ray, Images School of Clinical Sciences Faculty of Health, Queensland University of Technology 2023
- 8th edition of the Textbook of Radiographic Positioning and Related Anatomy, Authors Kenneth L.Bontrager and John P.Lampignsno.
- Foos DH, et al. Digital radiography reject analysis: data collection methodology, results, and recommendations from an in-depth investigation at two hospitals. J Digit Imaging. 2009 Mar;22(1):89-98. 2008 Apr 30.
- J. Mari Beth Linder, Safety Considerations in Immobilizing Paediatric Clients for Radiographic Procedures, Journal of Radiology Nursing, Volume 36, Issue 1, 2017, Pages 55-58, ISSN 1546-0843.
- Lin C-Set al. Guidelines for reducing image retakes of general digital radiography. Advances in Mechanical Engineering. 2016;8(4).
- Graham P, Hardy M. The immobilisation and restraint of paediatric patients during plain film radiographic examinations. (2004) Radiography. 10 (1): 23-31.

Acknowledgement: Dr Shahrum Bin Hj Arshad (Director of Hospital Melaka) and Dr Sri Idayu Binti Mohamad (Head of Radiology Department, Hospital Melaka).