Reference Organ and Effective Dose Coefficients for Common Radiographic Examinations:

Projections Considered and Definition of Fields

Workshop

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Overview

Aims:

- To select radiographic examinations for modelling
- To define field coordinates for each examination to be used as inputs for Monte Carlo dose calculations
  - Based on ICRP phantom development which has allowed for determination of dose coefficients using voxel computational phantoms

- Selection of radiographic examinations

Selection of Radiographic Examinations

- Both adult and paediatric exams were modeled
- Exams chosen primarily to reflect those that are commonly performed
  - Extremity and dental radiography were not considered because of their low contribution to effective dose

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Selection of Adult Radiographic Examinations

- Examinations for adult radiography selected based on annual examination frequencies in the UK, Europe, the USA and UNSCEAR Health Care Level 1 countries

Frequency of radiographic examinations per 1000 adult population per year (in decreasing order)

Examination Type	UK	European Average	United States	UNSCEAR HCL 1
Chest/ Thorax	146.7	194	341.8	168
Pelvis & hip	39.0	48.7	63.2	40
Abdomen	20.1	22.5	37.9	45
Lumbar spine (inc. LSJ)	14.9	33.6	34.8	31
Cervical spine	9.3	16.9	15.1	32
Thoracic spine	4.4	9.8	7.8	16

Adult Projections Modelled

Adult projections modelled

Examination Type	Projections Modelled
Chest/ Thorax	PA, AP, Left & Right Lat
Pelvis & hip	AP
Abdomen	AP
Lumbar spine (inc. LSJ)	AP, LLat, RLat, RObl
Cervical spine	AP, LLat, RLat
Thoracic spine	AP, RLat, LLat

PA: posterior-anterior; AP: anterior-posterior; Lat: lateral; RObl: Right Oblique; RLat: Right Lateral; LLat: Left Lateral; LSJ: Lumbar-Sacral Joint

Selection of Paediatric Radiographic Examinations

- Examinations selected for paediatric radiography included those commonly performed (similar to adult radiography)
- Also included were examinations performed reasonably often in infants or adolescents that result in high exposures or exposures to the more radiosensitive organs:
  - Skull
  - Scoliosis full-spine radiographs

Selection of Paediatric Radiographic Examinations

- Frequencies of paediatric examinations were determined from the literature:
  - Dorfman, A.L., Fazel, R., Einstein, A.J., et al., 2011. Use of medical imaging procedures with ionizing radiation in children: a population-based study. Arch Pediatr Adolesc Med 165(5), 458-464.
  - European Commission, 2018. European guidelines on diagnostic reference levels for paediatric imaging. Report Nr 185. EU Publications.

Paediatric examinations selected

Examination Type
Chest
Pelvis
Abdomen
Lumbar Spine
Thoraco-Lumbar Spine (only for newborn, 1 year old)
Scoliosis
Skull

Projections Modelled

Paediatric projections modelled

Examination Type	Projections Modelled
Chest	PA and AP
Pelvis	AP
Abdomen	AP
Lumbar Spine	AP, LLat, RLat
Thoraco-Lumbar Spine (only newborn, 1 year old)	RLat, LLat
Scoliosis	AP (newborn, 1 year old), PA (all other ages), RLat, LLat
Skull	AP, PA, RLat, LLat

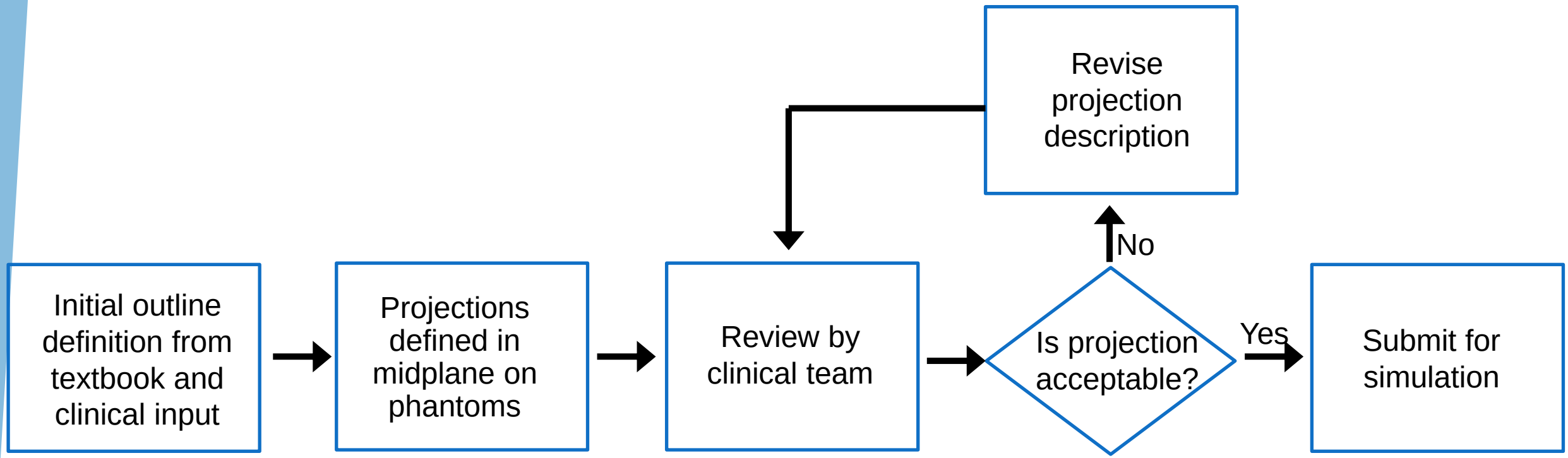
PA: posterior-anterior; AP: anterior-posterior; Lat: lateral;
RLat: Right Lateral; LLat: Left Lateral

- Definition of radiographic projections

Definition of Radiographic Projections

- Each projection was modelled based on typical, optimised field sizes, positioning, and anatomy expected to be visualized based on a standard textbook of radiography with illustrations intended to show student radiographers what the radiograph should depict
- The model was reviewed by two radiologists, each with more than 20 years of experience, and adjusted in an iterative fashion
- The radiologists referred to the radiographs in the textbook, radiographs from a UK hospital, and their own experience

Definition of Radiographic Projections

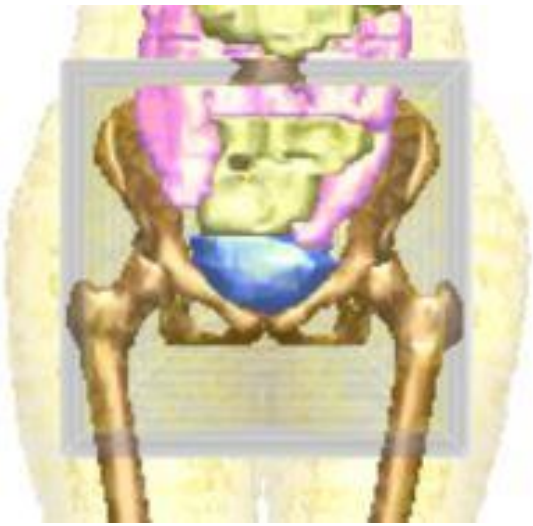


Definition of Radiographic Projections

- Example—AP pelvis, adult female

Textbook

UK hospital



Phantom with all organs

Phantom with bones

Definition of Radiographic Projections

- Example—PA chest, adult male

Textbook

UK hospital

Phantom with all organs

Phantom with bones

Thank you!

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