SHORT PAPER SESSION M2

M2.1 Universal bone structure phantoms with bone mineral density modeling

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Background
Modern oncologic radiology has demand for easy manufactured, high reproducible anthropomorphic multi proposal phantom. It is allowed modeling normal and pathological bone structures for different x-ray modalities visualization including photon counting CT.
Materials
The proposed methodology comprises three components: the anthropomorphic base, trabecular and cortical parts. The anatomical base is made using LCD printing. The trabecular and cortical parts are modeled by a composite material correct simulating the X-ray density of water, with added specified amounts of hydroxyapatite and calcium carbonate, respectively.
Results
As a prototype, anthropomorphic models of lumbar vertebrae (L1-L4) and the proximal femur were made using the proposed methodology. The osteopenia condition of trabecular bone (Bone mineral density, BMD 100 mg/ml, according to the ACR classification, 2023) was modeled with mean absolute error for three tube voltages (100, 120, 140 kV) 7.4 mg/ml, and the mean relative error was 7.3% (coefficient of variation). The correction factor for mineral density conversion was 7 mg/ml. The mean absolute error was 0.4 mg/ml, and the mean relative error was 0.4%. Additional DXA measurements showed that the photopolymer material used for the anthropomorphic base has a BMD equals zero and X-ray density 150 HU. The 1-cm-thick cortical bone-simulating material has a BMD of 1,084±0,008 g/cm2, enabling DXA auto-segmentation of vertebral contours and automated BMD measurements.
Conclusions
A method for fabricating bone phantom models with anatomical similarity and BMD corresponding to trabecular and cortical bone is proposed for imaging evaluation, calibration, and comparison of mono- and multi-energy BMD assessment techniques.

1. American College of Radiology (2023) ACR-SPR-SSR practice parameter for the performance of quantitative computed tomography (QCT) bone mineral density. Available at: https://gravitas.acr.org/PPTS/GetDocumentView?docId=11
2. Pickhardt, P.J., Lee, S.J., Liu, J., Yao, J., Lay, N., Graffy, P.M. and Summers, R.M. (2019) Population-based opportunistic osteoporosis screening: validation of a fully automated CT tool for assessing longitudinal BMD changes. Br. J. Radiol. 92(1094), 20180726. https://doi.org/10.1259/bjr.20180726.

M2.2 A regional masterclass model to enhance diagnostic radiology physics and radiation protection training

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A recent IPEM workforce census[1] estimated the overall vacancy rate within diagnostic radiology physics and radiation protection departments at 15%, with establishment levels far below professional body recommendations[2 3]. Significant expansion in recruitment and training is required[1], but lack of funding and limited staff capacity to deliver training are cited as factors restricting the number of trainees. IPEM advocates for the development of regional training solutions to address some of these barriers. Here we describe one such successful initiative.
A programme of online masterclasses (group classes) was delivered by regional Imaging Training Academy Faculty and Practice Educators, building on previous work. The range of topics included those that lent themselves to a virtual classroom-based approach, as well as those relating to tasks that may occur infrequently. Pre- and post-workshop questionnaires were used to evaluate the quality and impact of the workshops.
This collaborative approach offered an economy of scale and reduced the overall training overhead. The trainee self-reported understanding of topics increased from mean 2.8/5 to 4.5/5 following the masterclass. Attendees found the classes enjoyable (mean 4.4/5) and stated that expectations had been met or exceeded (4.6/5).
Regional masterclasses are an efficient and effective way to deliver training to medical physicists across various training routes. They enable trainees to be exposed to a broader range of scenarios, and learn from a greater number of other centres, than is possible with localised training alone. Regional masterclasses complement local training whilst reducing burden on local clinical staff time.

1. IPEM (2024), Diagnostic Radiology and Radiation Protection Workforce Census Report, [Online] Available from https://www.ipem.ac.uk/ipem-workforce-resources/workforce-intelligence/diagnostic-radiology-radiation-protection-resources/ (Accessed 28/01/2026)

2. European Commission (2014) Radiation Protection No. 174: European Guidelines on Medical Physics Expert. Luxembourg: Publications Office of the European Union, 2014 108p
3. Evans S, Christofides S, Brambilla M. (2016) The European Federation of Organisations for Medical Physics. Policy Statement No. 7.1: The roles, responsibilities and status of the medical physicist including the criteria for the staffing levels in a Medical Physics Department approved by EFOMP Council on 5th February 2016. Physica Medica. 2016 Apr 1;32(4):533-40.

M2.3 An evaluation of pregnancy/breastfeeding procedures in uk diagnostic radiology departments

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Background
The Ionising Radiation (Medical Exposure) Regulations (IR(ME)R) require pregnancy and breastfeeding enquiries prior to ionising radiation exposure in the UK. While IR(ME)R 2000[1] directed enquiries to “females of childbearing age,” IR(ME)R 2017[2] omits sex-specific language, referring instead to “individuals of childbearing potential.” Additionally, the Care Quality Commission and Society of Radiographers have made recommendations to make enquiries inclusive of transgender patients.
Methods
FOI requests were sent to 210 NHS trusts across the UK October-December 2024 requesting pregnancy and breastfeeding enquiry standard operating procedures and associated patient materials. These were analysed to assess how health services had responded to legislation language changes and subsequent recommendations for transgender inclusivity.
Results
SOPs and patient materials were received from 162 health services. Of these, 55% directed pregnancy enquiries to individuals/females of childbearing potential, 32% first confirmed a patient’s sex before making enquiries of females, and 13% made enquiries regardless of recorded sex. >90% of health services partially or wholly replaced sex-specific language with desexed alternatives; 15% incorporated “chestfeeding.”
Conclusion
Procedural changes to make pregnancy enquiries inclusive of transgender patients demonstrated widespread variance across UK radiology departments. Many procedures (44%) incorporated males, (57%) employers sought information from females beyond what is recommended in IR(ME)R implementation guidance 2020[3] and (55%) of services did not mitigate the risk posed to female patients who are transgender.
Recommendations
To ensure patient safety; clear language should be used in legislation, guidance, procedures and messaging. Accurate sex markers on patient records. Consider targeted messaging for female patients who are transgender.

1. UK government (2000) IR(ME)R 2000
2. UK government (2017) IR(ME)R 2017
3. RCR (2020, June) IR(ME)R Implications For Clinical Practice In Diagnostic Imaging, Interventional Radiology And Diagnostic Nuclear Medicine. RCR Publications 129.

M2.4 Pregnancy screening before X ray exposure: document analysis of responses to a national FOI survey

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Introduction
Pregnancy screening before ionising radiation exposure is essential for patient, and foetal, safety. Pre-examination checks help minimize radiation risks and support safe, patient-centred care. With a focus on inclusion there has been a move in the UK to introduce inclusive pregnancy status (IPS) forms instead of detail regarding last menstrual period (LMP) [2]. Screening processes are known to be inconsistent [1], although the extent of variation is not known.
Method
As part of a larger study examining pre-examination screening a survey of imaging providers in England was conducted. A freedom of information (FOI) approach was utilised, and a request was submitted electronically in summer 2025. Confirmation of screening for pregnancy status was sought with return of any paper screening forms. Document analysis included form structure, reading age[3], question content and expected signatories.

Results

115 paper forms were returned by 95 organisations with all English NHS regions represented. Three distinct categories of screening were evident, including Yes/No triage (n=22; 19.1%), IPS (n=52; 45.2%), LMP (n=35.7%) forms. All forms required patient signature with 73.9% expecting a staff member to countersign. The average reading age was 14.7years. Inconsistency in content of the LMP and IPS forms was evident around period date and reasons for exclusion of pregnancy including previous surgery, ongoing treatment, contraception, celibacy and relationship status.

Conclusion

Inconsistency in the approach to pregnancy screening is evident across the UK with inherent risks to patient safety. Opportunities to implement digital screening including improving accessibility should be explored.

1. Care Quality Commission. (2025). IR(ME)R annual report 2024/25. Available at: https://www.cqc.org.uk/publications/irmer-annual-report/2024-2025
2. Lim JJ, Wellington J, Morrow K, Mackay S. (2025) Inclusive pregnancy status checks in medical imaging: a vital measure for enhancing patient safety and equity in healthcare, Postgrad Med J 101(1197), 658–659.
3. NHS England. (n.d.) NHS Medical Readability Tool. Available at: https://readability.ncldata.dev/.