Session K2

K2.1 Black box no more: a survey to explore AI governance and adoption in medical imaging in the UK

*Nikolaos Stogiannos[1,2], Lia Litosseliti[1], Dr Tracy O'Regan[3], Erica Scurr[4], Anna Barnes[5], Amrita Kumar[6], Rizwan Malik[7], Michael Pogose[8], Dr Hugh Harvey[8], **Professor Mark McEntee**[9], Dr Christina Malamateniou[1,10]*
[1]City, University of London, UK [2]Magnitiki Tomografia Kerkiras, Corfu, Greece, [3]Society of Radiographers, London, United Kingdom, [4]The Royal Marsden NHS Foundation Trust, London, United Kingdom, [5]King's College London, UK [6]Frimley Health NHS Foundation TrustUnited Kingdom, [7]The Royal Bolton NHS Foundation TrustUnited Kingdom, [8]Hardian HealthUnited Kingdom, [9]University College Cork, Cork, Ireland, [10]European Society of Medical Imaging InformaticsAustria

Background: Artificial Intelligence (AI) applications have shown an exponential increase in medical imaging and radiotherapy (MIRT). Successful adoption of AI tools requires specific procedures regarding AI governance, accreditation, validation and clinical evaluation. This study aims to understand any challenges, opportunities and future opportunities related to AI implementation as perceived by MIRT professionals in the UK.
Methods: An online survey was built on Qualtrics and distributed to UK-based MIRT professionals who had knowledge or made use of AI tools in their clinical practice. Radiographers, radiologists, medical physicists, biomedical engineers and other MIRT professionals were included in this sample. The instrument included both closed and open-ended questions. Descriptive statistics was used to analyse al quantitative data, whilst a content analysis approach was employed for all responses derived from the open-ended questions of the survey.
Results: A total of 245 valid responses were received. Participants highlighted the importance of specific governance frameworks, related training, effective leadership, and teamwork as vital components of successful AI adoption. A strong correlation was noted between prior training and knowledge of AI frameworks, with different professionals showing different affinity to certain frameworks. Lack of knowledge, lack of funding, data-related issues, and lack of explainability were highlighted as important challenges. Potential opportunities included time savings, increased diagnostic accuracy, more efficient reporting, and enhanced patient care.
Conclusion: AI implementation in MIRT is impeded by lack of knowledge/training. MIRT professionals are generally unaware of AI governance frameworks. Different professionals identify different priorities for AI adoption.

K2.2 Can artificial intelligence decrease the time to diagnosis of lung cancer – a retrospective-cohort study

__Dr Jenna Tugwell-Allsup__[1], Bethan Owen, Richard Hibbs, Dr Andrew England
[1]BCUHB, Bangor, United Kingdom

Introduction: Deep learning–based automatic detection (DLAD) algorithms for chest X-ray (CXR) interpretation have shown success in early detection of lung cancer (LC), however, there remains uncertainty related to 'real-world' clinical validation.
Method: CXRs and their corresponding chest-CT scans were retrospectively collated from a single institution between January 2019-2020. A commercially available, DLAD-algorithm was used to evaluate 320 CXRs (<6years prior to diagnosis) from 105 positive LC patients and 103 historic controls. Clinical reports were extracted and coded to correlate against DLAD findings.
Results: Of 105 LC patients, (57[55%] men, median[IQR] age 73[68-83] years), clinical reports identified LC in 64(61%) patients whereas DLAD identified 95(90%) cases. This resulted in diagnostic(image-level) and prognostic(patient-level) sensitivities of 57.6% and 90.0%, respectively. The DLAD detected 21% (22/105) of nodules on CXRs performed >12 months prior to diagnosis with 21 from 22 having negative clinical reports for lung nodule/mass. The potential average reduction in time-to-diagnosis whereby DLAD identified nodule(s) on previous CXR, but clinical report was negative, was 495 days (median[IQR] 193[42-598]days). Of the 103 'negative' controls (48[47%] men, median[IQR] age 69[61-77] years) 20 patients had a nodule abnormality score above threshold, generating a false-positive rate of 19%.
Conclusion: The DLAD showed excellent performance for detecting LCs that initially went undetected on the CXRs original clinical reports. This study demonstrates the algorithm's potential to increase sensitivity to the presence of lung nodule/mass whilst also reducing time-to-diagnosis of LC. Using the DLAD, in conjunction with a radiologist, could increase reporting accuracy and potentially improve clinical outcomes.

References
1. Chutivanidchayakul, F., Suwatanapongched, T., Petnak, T. (2023). Clinical and chest radiographic features of missed lung cancer and their association with patient outcomes. Clin Imaging 99:73-81. doi:10.1016/j.clinimag.2023.03.017
2. Dwyer-Hemmings, L., Fairhead, C. (2021). The diagnostic performance of chest radiographs for lung malignancy in symptomatic primary-care populations: A systematic review and meta-analysis. BJR Open 3(1):20210005. doi:10.1259/bjro.20210005
3. Ellis, P.M., Vandermeer, R. (2011). Delays in the diagnosis of lung cancer. J Thorac Dis. Sep 3(3):183-8. doi:10.3978/j.issn.2072-1439.2011.01.01

4. Gavelli, G., Giampalma, E. (2000). Sensitivity and specificity of chest X-ray screening for lung cancer: review article. Cancer. 89(11 Suppl):2453-6. doi:10.1002/1097-0142(20001201)89:11+<2453::aid-cncr21>3.3.co;2-d
5. Homayounieh, F., Digumarthy, S., Ebrahimian, S., et al. (2021). An Artificial Intelligence-Based Chest X-ray Model on Human Nodule Detection Accuracy From a Multicenter Study. JAMA Netw Open. 4(12):e2141096. doi:10.1001/jamanetworkopen.2021.41096
6. Jang, S., Song, H., Shin, Y.J., et al. (2020). Deep Learning-based Automatic Detection Algorithm for Reducing Overlooked Lung Cancers on Chest Radiographs. Radiology. 296(3):652-661. doi:10.1148/radiol.2020200165
7. Nam, J.G., Park, S., Hwang, E.J, et al. (2019). Development and Validation of Deep Learning-based Automatic Detection Algorithm for Malignant Pulmonary Nodules on Chest Radiographs. Radiology. 290(1):218-228. doi:10.1148/radiol.2018180237
8. The Royal College of Radiologists. (2019). Standards for radiology events and learning meetings.
9. The Society of Radiographers (SOR). (2021). New safety recommendations to avoid lung cancer being missed on chest X-rays; Independent HSIB investigation calls for more research into the use of CT scans.

K2.3 R-AI-diographers: exploring the changing professional role and identity of radiographers in Europe in the era of artificial intelligence (AI)

Gemma Walsh[1], *Professor Mark McEntee*[2], *Professor Yiannis Kyratsis*[3], *Charlotte Beardmore*[4], *Dr Christina Malamateniou*[1]
[1]City, University Of London, UK [2]University College Cork, Cork, Ireland, [3]Erasmus University, Rotterdam, The Netherlands, [4]The Society and College of Radiographers, London, United Kingdom

While many radiographers report excitement about the capabilities of new AI technologies to revolutionise practice, they are also worried about the implications this change might have on their professional roles and identity, their learned skills and their career progression(1-3). This study aims to gain insights into the changing roles and identities of radiographers in the era of AI. The objective is to propose ways to better support the workforce in the face of fast technological changes.

A European-wide, cross-sectional study utilising a mixed methods online survey was designed and translated from English into eight languages. Snowball sampling was used for distribution via social media. All European radiographers were eligible to participate. The survey collected data on the following areas: a) demographics, b) the perceived short-term impact of AI on radiographer roles, c) the potential medium-to-long-term impact of AI, d) perceived opportunities and threats of AI implementation for radiographers' roles and careers, and e) the preparedness of radiographers to work with AI.

A total of 2,258 responses from 38 European countries were received. Despite some concerns around job security, survey responses were collectively projecting a feeling of optimism for the future of radiographer careers and professional identity. Knowledge, additional training, job satisfaction, better patient care, financial compensation and career advancement were presented as key motivators to professional engagement with AI.

This study provides insights into radiographers' attitudes towards AI implementation on the future of their professional identity. It proposes ways to better support the workforce in harnessing the benefits of AI.

References

1.Rainey C, O'Regan T, Matthew J, Skelton E, Woznitza N, Chu KY, Goodman S, McConnell J, Hughes C, Bond R, McFadden S, Malamateniou C. Beauty Is in the AI of the Beholder: Are We Ready for the Clinical Integration of Artificial Intelligence in Radiography? An Exploratory Analysis of Perceived AI Knowledge, Skills, Confidence, and Education Perspectives of UK Radiographers. Front Digit Health. 2021 Nov 11;3:739327. doi: 10.3389/fdgth.2021.739327. PMID: 34859245; PMCID: PMC8631824.
2.Antwi WK, Akudjedu TN, Botwe BO. Artificial intelligence in medical imaging practice in Africa: a qualitative content analysis study of radiographers' perspectives. Insights Imaging. 2021 Jun 16;12(1):80. doi: 10.1186/s13244-021-01028-z. PMID: 34132910; PMCID: PMC8206887.
3.Malamateniou C, McFadden S, McQuinlan Y, England A, Woznitza N, Goldsworthy S, Currie C, Skelton E, Chu KY, Alware N, Matthews P, Hawkesford R, Tucker R, Town W, Matthew J, Kalinka C, O'Regan T. (2021) Artificial Intelligence: Guidance for clinical imaging and therapeutic radiography professionals, a summary by the Society of Radiographers AI working group. Radiography (Lond). 2021 Aug 19:S1078-8174

K2.4 AI-Assisted Pediatric Fracture Detection

Sahil Sahil, *Ravi Kumar Kushwaha, Manoj Tadepalli*
[1]Qure Ai Pvt Limited, Bengaluru, India

Introduction: Fractures in pediatric patients are frequently encountered, necessitating prompt diagnosis for effective treatment. However, interpreting pediatric radiographs presents unique challenges due to evolving bone structures and growth plates, compounded by the difficulty in eliciting clear symptoms from young patients. Here, we introduce our AI model, qMSK, designed for fracture classification and segmentation, showcasing promising performance on the GRAZPEDWRI-DX dataset, focusing on pediatric trauma wrist radiographs.

Method: Our AI model employs an EffnetV2 encoder, coupled with SpinalnetFC for classification and Unet++ for segmentation. Training data comprising 450,000 X-rays across 15 body parts, including the wrist, were meticulously labeled by expert radiologists to ensure precise annotations. Performance metrics including AUC, AP, sensitivity, and specificity were computed on pediatric datasets.

Results: Evaluation on the GRAZPEDWRI-DX pediatric dataset, comprising 6,091 patients treated at the University Hospital Graz between 2008 and 2018, revealed promising outcomes. Across 10,643 studies (20,327 images), the model

achieved an AUC of 0.8593 (CI 0.8544 - 0.8642) and AP of 0.9315, with sensitivity and specificity reaching 0.7918. Stratified by gender, the model exhibited robust performance, yielding an AUC of 0.8522 (CI 0.8442 - 0.8602) and AP of 0.9053 for female patients, and an AUC of 0.8596 (CI 0.8532 - 0.8661) and AP of 0.9451 for male patients.
Conclusion: qMSK offers valuable assistance to pediatricians and clinicians in identifying and managing pediatric fractures, aiding in early detection for improved treatment outcomes, and minimizing post-healing complications. Its reliability in fracture detection from pediatric radiographs enhances clinical decision-making and patient care.

K2.5 Simulating radiotherapy induced skin reactions with moulage on all skin types, Phase 2 findings

Dr Bridget Porritt[1], *Jessica Nelson*
[1]University Of Liverpool, Liverpool, United Kingdom

This project draws on local expertise from tutors and students at the City of Liverpool College who use theatrical special effects make-up techniques to create realistic radiotherapy skin reactions. The project **aims** were:
1. To develop a written and video guide explaining how to mimic radiotherapy radiation reactions of different grades on all skin types
2. To gain clinical staff evaluation of realism and validation of simulated reactions on all skin types
3. To create a sustainable resource pack for the simulation of radiotherapy radiation skin reactions of different grades on all skin types.
Results Pre-reg radiotherapy students and clinical staff felt simulated skin reactions were realistic.
Liverpool make up students were very positive about the effects they created and enjoyed working collaboratively with radiotherapy students and academic staff.
Conclusion Within the fields of nursing, medicine and other health professions, simulation of pathologies and injuries provides realistic training and a range of wearable “moulage” resources are commercially available. Within the field of radiotherapy, however, there is no guidance supporting the creation of simulated skin reactions on all skin types.
There is an unacceptable lack of representation of the diverse patient population in educational imagery and skin care guidance currently used in radiotherapy practice. We want to change this and ensure that inclusive imagery and skin toxicity descriptors are available as a teaching resource. We hope our simulation work will be a catalyst for change.
Ensuring that radiotherapy skin toxicity educational resources are inclusive and representative of the diverse patient population.

References

Stokes-Parish, J.B., Duvivier, R. and Jolly, B. (2018) ‘Investigating the impact of moulage on simulation engagement — A systematic review’, Nurse education today, 64, pp. 49–55. Available at: https://doi.org/10.1016/j.nedt.2018.01.003.
Sezgunsay, E. and Basak, T. (2020) ‘Is Moulage effective in improving clinical skills of nursing students for the assessment of pressure injury?’, Nurse education today, 94, pp. 104572–104572. Available at: https://doi.org/10.1016/j.nedt.2020.104572.
Shiner, N. and Howard, M.L. (2019) ‘The use of simulation and moulage in undergraduate diagnostic radiography education: A burns scenario’, Radiography (London, England. 1995), 25(3), pp. 194–201. Available at: https://doi.org/10.1016/j.radi.2018.12.015.

K2.5 The use of an AI communication skills simulation for therapeutic radiographer education

Ms Sarah-Jane Ketterer[1], *Christian Corcoran, Pete Bridge*
[1]University Of Liverpool, Liverpool, United Kingdom

Background Formal communication specific teaching is integral to pre-registration healthcare programmes, but translating approaches to clinical practice can prove challenging. Simulation offers an opportunity to practice communicating in a professional context, and to develop skills in a supportive, low-pressure environment. The aim of this study was to evaluate the value of using an AI communication simulation as a complementary resource, prior to students embarking on their first clinical placement.
Method Bespoke radiotherapy-specific communication scenarios were developed with an AI software provider. The software runs on a laptop, allowing students to have real-time simulated conversations with AI patients. Transcripts for each conversation can be downloaded for debriefing.
A cohort of 21 first year therapeutic radiography students were randomised to either peer role play, or to complete three AI “patient” interactions, prior to completion of a formative assessment. Anonymised formative scores were compared between standard and AI intervention arms. Students were also invited to complete an anonymous online survey related to their experience.
Results Equivalence of learning was demonstrated across the standard and intervention groups. 85% of participants indicated they found AI simulation enjoyable and useful for skills development. Students valued the accessibility and low-pressure environment, highlighting the advantages of knowledge application, confidence-building, instant feedback and reflection.

Conclusion A foundational AI communication simulation can be an accessible learning tool to facilitate development of skills and confidence, prior to students embarking on clinical placement. Future work will aim to expand the range and complexity of scenarios to evaluate use with more advanced learners.

References

1. Ketterer S-J, Callender J, Warren M, Al-Samarraie F, Ball B et al. (2020) 'Simulated versus traditional therapeutic radiography placements: A randomised controlled trial', Radiography, 26 (2),140-146.
2. Rosenbaum M.E. (2017) 'Dis-integration of communication in healthcare education: Workplace learning challenges and opportunities', Patient Education and Counselling, 100 (11), 2054-2061.
3. Silverman J, Kurtz S, Draper J. (2013) Skills for Communicating with Patients. 3rd edn. Milton: Taylor & Francis Group; 2013.