Library Current Awareness Bulletin
Radiology – October 2021

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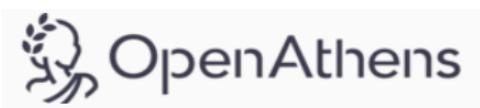
News

A New Deal for Radiographers and Allied Health Professionals: What would help recruitment and retention?
The Society of Radiographers
August 2021
[Dean Rogers, Director of Industrial Strategy and Member Relations, considers what pay and reward package could help recruit and retain radiographers.]

AI machine learning becomes world first to treat Covid patients
National Health Executive
September 2021
[Addenbrooke's Hospital NHS Trust along with 20 other hospitals from across the world have used AI in a study to predict the oxygen needs of Covid patients, on a global scale]

[First UK patients treated for liver cancer using ultrasound technology](#)
National Health Executive
September 2021
["Two patients have become the first in the UK to undergo a pioneering new treatment for liver cancer as part of a US-based study"]

Guidance

[Artificial intelligence: Guidance for clinical imaging and therapeutic radiography workforce professionals](#)
The Society of Radiographers
August 2021
[The recommendations provided in this guidance document are focused on the different areas of radiographic practice in both clinical imaging and therapeutic services.]

[Blood bottle shortage: Advice for radiographers using PGDs for administration of contrast agents](#)
The Society of Radiographers
September 2021
[Guidance published for radiographers across the UK]

[Clinical Academic Radiographer: guidance for the support of new and established roles.](#)
The Society of Radiographers
September 2021
[This guidance document offers support for the development of clinical academic roles in clinical imaging and radiotherapy.]

[Updated guidance for image-guided radiotherapy](#)
The Society of Radiographers
[The Radiotherapy Board has published new guidance to support the continued application of image-guided radiotherapy (IGRT) and enable the future implementation of four-dimensional adaptive radiotherapy (ART)]

Reports

[Radiological dose issues with interventional radiology in the UK](#)
Department of Health and Social Care
August 2021

[Timely detection and treatment of cauda equina syndrome](#)
Healthcare Safety Investigation Branch
August 2021

Statistics

[Diagnostic Imaging Dataset 2021-22 Data](#)
NHS England
June 2021
[The Diagnostic Imaging Dataset (DID) is a central collection of detailed information about diagnostic imaging tests carried out on NHS patients, extracted from local Radiology Information Systems (RISs) and submitted monthly.]

Artificial Intelligence

[Automatic detection of actionable radiology reports using bidirectional encoder representations from transformers](#)
Nakamura Y., Hanaoka S., Nomura Y., Nakao T., Miki S., Watadani T., Yoshikawa T., Hayashi N. and Abe O.
BMC Medical Informatics and Decision Making, vol. 21(1)
September 2021

[**Background:** It is essential for radiologists to communicate actionable findings to the referring clinicians reliably. Natural language processing (NLP) has been shown to help identify free-text radiology reports including actionable findings. However, the application of recent deep learning techniques to radiology reports, which can improve the detection performance, has not been thoroughly examined. Moreover, free-text that clinicians input in the ordering form (order information) has seldom been used to identify actionable reports. This study aims to evaluate the benefits of two new approaches: (1) bidirectional encoder representations from transformers (BERT), a recent deep learning architecture in NLP, and (2) using order information in addition to radiology reports. **Methods**: We performed a binary classification to distinguish actionable reports (i.e., radiology reports tagged as actionable in actual radiological practice) from non-actionable ones (those without an actionable tag). 90,923 Japanese radiology reports in our hospital were used, of which 788 (0.87%) were actionable. We evaluated four methods, statistical machine learning with logistic regression (LR) and with gradient boosting decision tree (GBDT), and deep learning with a bidirectional long short-term memory (LSTM) model and a publicly available Japanese BERT model. Each method was used with two different inputs, radiology reports alone and pairs of order information and radiology reports. Thus, eight experiments were conducted to examine the performance. **Results:** Without order information, BERT achieved the highest area under the precision-recall curve (AUPRC) of 0.5138, which showed a statistically significant improvement over LR, GBDT, and LSTM, and the highest area under the receiver operating characteristic curve (AUROC) of 0.9516. Simply coupling the order information with the radiology reports slightly increased the AUPRC of BERT but did not lead to a statistically significant improvement. This may be due to the complexity of clinical decisions made by radiologists. **Conclusions:** BERT was assumed to be useful to detect actionable reports. More sophisticated methods are required to use order information effectively.]

[Chest radiograph-based artificial intelligence predictive model for mortality in community-acquired pneumonia](#)
Quah J., Jin Yee Liew C., Zou L., Han Koh X., Alsuwaigh R. Narayan V., Yi Lu T., Ngoh C., Wang Z., Zhen Koh J. et al
BMJ Open Respiratory Research, vol. 8(1)
August 2021

[**Background:** Chest radiograph (CXR) is a basic diagnostic test in community-acquired pneumonia (CAP) with prognostic value. We developed a CXR-based artificial intelligence (AI) model (CAP AI predictive Engine: CAPE) and prospectively evaluated its discrimination for 30-day mortality. **Methods:** Deep-learning model using convolutional neural network (CNN) was trained with a retrospective cohort of 2235 CXRs from 1966 unique adult patients admitted for CAP from 1 January 2019 to 31 December 2019. A single centre prospective cohort between 11 May 2020 and 15 June 2020 was analysed for model performance. CAPE mortality risk score based on CNN analysis of the first CXR performed for CAP was used to determine the area under the receiver operating characteristic curve (AUC) for 30- day mortality. **Results:** 315 inpatient episodes for CAP occurred, with 30-day mortality of 19.4% (n=61/315). Non-survivors were older than survivors (mean (SD)age, 80.4 (10.3) vs 69.2 (18.7)); more likely to have dementia (n=27/61 vs n=58/254) and malignancies (n=16/61 vs n=18/254); demonstrate higher serum C reactive protein (mean (SD), 109mg/L (98.6) vs 59.3mg/L (69.7)) and serum procalcitonin (mean (SD), 11.3 (27.8) μg/L vs 1.4 (5.9) μg/L). The AUC for CAPE mortality risk score for 30-day mortality was 0.79 (95% CI 0.73 to 0.85, p<0.001); Pneumonia Severity Index (PSI) 0.80 (95% CI 0.74 to 0.86, p<0.001); Confusion of new onset, blood Urea nitrogen, Respiratory rate, Blood pressure, 65 (CURB-65) score 0.76 (95% CI 0.70 to 0.81, p<0.001), respectively. CAPE combined with CURB-65 model has an AUC of 0.83 (95% CI 0.77 to 0.88, p<0.001). The best performing model was CAPE incorporated with PSI, with an AUC of 0.84 (95% CI 0.79 to 0.89, p<0.001). **Conclusion:** CXR-based CAPE mortality risk score was comparable to traditional pneumonia severity scores and improved its discrimination when combined.]

[Machine learning based natural language processing of radiology reports in orthopaedic trauma](#)
Olthof A.W., Shouche P., Fennema E.M., Ijpma F.F.A., Koolstra R.H.C., Stirler V.M.A., van Ooijen P.M.A et al
Computer Methods and Programs in Biomedicine, vol. 208
September 2021

[**Objectives:** To compare different Machine Learning (ML) Natural Language Processing (NLP) methods to classify radiology reports in orthopaedic trauma for the presence of injuries. Assessing NLP performance is a prerequisite for downstream tasks and therefore of importance from a clinical perspective (avoiding missed injuries, quality check, insight in diagnostic yield) as well as from a research perspective (identification of patient cohorts, annotation of radiographs). **Methods:** Datasets of Dutch radiology reports of injured extremities (n = 2469, 33% fractures) and chest radiographs (n = 799, 20% pneumothorax) were collected in two different hospitals and labeled by radiologists and trauma surgeons for the presence or absence of injuries. NLP classification was applied and optimized by testing different preprocessing steps and different classifiers (Rule-based, ML, and Bidirectional Encoder Representations from Transformers (BERT)). Performance was assessed by F1-score, AUC, sensitivity, specificity and accuracy. **Results:** The deep learning based BERT model outperforms all other classification methods which were assessed. The model achieved an F1-score of (95 ± 2)% and accuracy of (96 ± 1)% on a dataset of simple reports (n= 2469), and an F1 of (83 ± 7)% with accuracy (93 ± 2)% on a dataset of complex reports (n= 799). **Conclusion:** BERT NLP outperforms traditional ML and rule-base classifiers when applied to Dutch radiology reports in orthopaedic trauma.]

[Predicting fracture outcomes from clinical registry data using artificial intelligence supplemented models for evidence-informed treatment (PRAISE) study protocol](#)
Dipnall J.F., Page R., Du L., Costa M., Lyons R.A., Cameron P., de Steiger R., Hau R., Bucknill A., Oppy A. et al

[**Background**: Distal radius (wrist) fractures are the second most common fracture admitted to hospital. The anatomical pattern of these types of injuries is diverse, with variation in clinical management, guidelines for management remain inconclusive, and the uptake of findings from clinical trials into routine practice limited. Robust predictive modelling, which considers both the characteristics of the fracture and patient, provides the best opportunity to reduce variation in care and improve patient outcomes. This type of data is housed in unstructured data sources with no particular format or schema. The "Predicting fracture outcomes from clinical Registry data using Artificial Intelligence (AI) Supplemented models for Evidence-informed treatment (PRAISE)" study aims to use AI methods on unstructured data to describe the fracture characteristics and test if using this information improves identification of key fracture characteristics and prediction of patient-reported outcome measures and clinical outcomes following wrist fractures compared to prediction models based on standard registry data. **Methods and design**: Adult (16+ years) patients presenting to the emergency department, treated in a short stay unit, or admitted to hospital for >24h for management of a wrist fracture in four Victorian hospitals will be included in this study. The study will use routine registry data from the Victorian Orthopaedic Trauma Outcomes Registry (VOTOR), and electronic medical record (EMR) information (e.g. X-rays, surgical reports, radiology reports, images). A multimodal deep learning fracture reasoning system (DLFRS) will be developed that reasons on EMR information. Machine learning prediction models will test the performance with/without output from the DLFRS. **Discussion**: The PRAISE study will establish the use of AI techniques to provide enhanced information about fracture characteristics in people with wrist fractures. Prediction models using AI derived characteristics are expected to provide better prediction of clinical and patient-reported outcomes following distal radius fracture.]

COVID-19: Impact on Radiology Services

[Interventional Radiology in the Coronavirus Disease 2019 Pandemic: Impact on Practices and Wellbeing](#)
Woerner A., Forris Beecham Chick J., Monroe E.J., Ingraham C.R., Pereira K., Lee E., Hage A.N., Makary M. et al

[**Purpose**: To report the impact of the coronavirus disease 2019 (COVID-19) pandemic on interventional radiology (IR). **Materials and Methods**: A 78-question survey was distributed to practicing interventional radiologists and IR trainees. The survey consisted of demographic and practice environment queries. Anxiety symptoms were evaluated using the Generalized Anxiety Disorder-7 (GAD-7) screener, and coping strategies were assessed using the Brief-Coping Orientation to Problems Experienced (Brief-COPE) questionnaire. **Results**: There were 422 respondents including 333 (78.9%) attending interventional radiologists and 89 (21.1%) interventional radiologists-in-training from 15 counties. Most respondents were from academic medical centers (n = 218; 51.7%). A large majority (n = 391; 92.7%) performed a procedure on a patient with confirmed COVID-19 infection. An N95 mask was the most common (n = 366; 93.6%) safety measure employed. Cancellation or limitation of elective procedures were reported

by 276 (65.4%) respondents. Many respondents (n = 177; 41.9%) had self-reported anxiety (GAD-7 score >5) with an overall mean GAD-7 score of 4.64 § 4.63 (range: 0-21). Factors associated with reporting anxiety included female gender (p = 0.045), increased call coverage (p = 0.048), lack of adequate departmental adjustments (p 125% with adoption of dysfunctional strategies. **Conclusion**: The COVID-19 pandemic induced practice alterations and high rates of self-reported anxiety in IR. Female gender, increased call coverage, and lack of adequate or timely departmental adjustments were associated with increased anxiety levels.]

Diagnostic Radiology

An analysis of radiographer preliminary image evaluation – A focus on common false negatives
Alexander-Bates I., Neep M.J., Davis B., and Starkey D.
Journal of Medical Radiation Sciences, vol. 68(3) pp. 237-244
September 2021
[**Introduction**: Preliminary image evaluation (PIE) is a mechanism whereby radiographers provide a preliminary evaluation of whether pathology is present in their radiographs, typically acquired within the emergency department (ED). PIE provides referrers with a timely communication of pathology prior to the availability of a radiology report. The purpose of this study was to determine the most common radiographer PIE false-negative interpretations. **Methods**: Each month over a two-year period, 100 PIEs of adult and paediatric patients were randomly reviewed in a metropolitan hospital ED. The radiographer's PIE was compared with the radiologist's report and categorised into basic quality indicators; true positive, true negative, false positive and false negative. The anatomical regions which most commonly indicated a false-negative interpretation were further analysed. **Results**: 2402 cases were reviewed which resulted in an overall PIE accuracy of 88.7%. Wrists, hands, phalanges (upper), ankles, feet and phalanges (lower) reporting the highest false-negative or false-negative/true-positive interpretations (60/116). Of the 60 false-negative PIEs, 68 pathologies were identified. 41.1% (28/68) of the pathology not identified were in the phalanges. Within these regions, examinations with multiple injuries commonly reported false negatives (17/60). **Conclusions**: This study demonstrated the most common false-negative radiographer PIEs were within the upper and lower distal extremities. Specifically, the phalanges and examinations demonstrating multiple injuries reported high levels of misinterpretation. The misinterpretation in multi-injury examinations could be attributed to 'Subsequent Search Miss (SSM)' error. These results provide valuable insights into areas of emphasis when providing image interpretation education.]

Computerized tomography of the Thorax for surgical patients during the COVID-19 pandemic: Was it useful?
Ismail A., Sarkar P., Muthiah B., and Yassin N.
The International Journal of Clinical Practice, Early View
September 2021
[**Objectives**: Diagnostic challenges during the corona virus disease (COVID-19) pandemic forced the radiology regulating body to adopt the use of CT Chest as a triage and diagnostic tool, which was subsequently abandoned. The Royal Wolverhampton hospital followed both protocols. Here, we investigate the evidence behind this decision within the context of surgical admissions during the COVID-19 peak in our hospital. **Methods**: Retrospective data collection and analysis of all surgical admissions between the 1st of March to the 31st of May. Data were collected from the radiology and electronic portal looking into patients undergoing CT chest to diagnose the presence of COVID-19 as well as swab results. **Results:** Seventy-eight patients fulfilled our inclusion criteria. The scan either confirmed the presence or absence (4, 63 patients) of COVID-19 but was sometimes inconclusive (11 patients). Comparing these to the results of the swabs; CT showed sensitivity 42.86%, Specificity 97.92%, and accuracy 90.91%. In the inconclusive CT report group, chances of having a positive swab result were 45%: None of the scan results changed any of the surgical planning. Lymphocyte count in the context of surgical presentation did not have any statistical significance to predict the presence of COVID-19 (P = .7). Cost implications on our cohort of patients for adding the chest CT is estimated to be around £31 000. **Conclusion:** CT Thorax during the pandemic was a good negative predictor but had limited diagnostic value and did not change patient management. Newer, faster techniques of PCR swabs and antibody testing would be a better and cheaper alternative.]

[Digital radiography reject analysis of examinations with multiple rejects: an Australian emergency imaging department clinical audit](#)
Stephenson-Smith B., Neep M.J., and Rowntree P.
Journal of Medical Radiation Sciences, vol. 68(3)
September 2021
[**Introduction**: The largest source of manmade ionising radiation exposure to the public stems from diagnostic medical imaging examinations. Reject analysis, a form of quality assurance, was introduced to minimise repeat exposures. The purpose of this study was to analyse projection-specific reject rates and radiographic examinations with multiple rejects. **Methods**: A retrospective audit of rejected radiographs was undertaken in a busy Australian metropolitan emergency digital X-ray room from March to June 2018. The data were collected by reject analysis software embedded within the X-ray unit. Reject rates, and reasons for rejection for each X-ray projection were analysed. **Results**: Data from 11, 596 images showed overall reject rate was 10.3% and the overall multiple reject rate was 1.3%. The projections with both a high number and high percentage of rejects were antero-posterior (AP) chest (175, 18.1%), AP pelvis (78, 22.5%), horizontal beam hip (61, 33.5%) and horizontal beam knee (116, 30.5%). The projections with both a high frequency and multiple reject rate were horizontal beam knee (32, 8.4%) and horizontal beam hip (17, 9.3%). The top reasons for multiple rejects were positioning (67.1%) and anatomy cut-off (8.4%). **Conclusions**: The findings of this study demonstrated that projection-specific reject and multiple reject analysis in digital radiography is necessary in identifying areas for quality improvement which will reduce radiation exposure to patients. Projections that were frequently repeated in this study were horizontal beam knee and horizontal beam hip. Future research could involve re-auditing the department following the implementation of improvement strategies to reduce unnecessary radiation exposure.]

[Point-of-Care Ultrasound predicts clinical outcomes in patients with COVID-19](#)
Kumar A., Weng I., Graglia S., Lew T., Gandhi K., Lalani F. Chia D., Duanmu Y., Jensen T., Lobo V., Nahn J. et al
Journal of Ultrasound in Medicine, Early View
September 2021
[**Objectives**: Point-of-care ultrasound (POCUS) detects the pulmonary manifestations of COVID-19 and may predict patient outcomes. **Methods**: We conducted a prospective cohort study at four hospitals from March 2020 to January 2021 to evaluate lung POCUS and clinical outcomes of COVID-19. Inclusion criteria included adult patients hospitalized for COVID-19 who received lung POCUS with a 12-zone protocol. Each image was interpreted by two reviewers blinded to clinical outcomes. Our primary outcome was the need for intensive care unit (ICU) admission versus no ICU admission. Secondary outcomes included intubation and supplemental oxygen usage. **Results**: N = 160 patients were included. Among critically ill patients, B-lines (94 vs 76%; P < .01) and consolidations (70 vs 46%; P < .01) were more common. For scans collected within 24 hours of admission (N = 101 patients), early B-lines (odds ratio [OR] 4.41 [95% confidence interval, CI: 1.71–14.30]; P < .01) or consolidations (OR 2.49 [95% CI: 1.35–4.86]; P < .01) were predictive of ICU admission. Early consolidations were associated with oxygen usage after discharge (OR 2.16 [95% CI: 1.01–4.70]; P = .047). Patients with a normal scan within 24 hours of admission were less likely to require ICU admission (OR 0.28 [95% CI: 0.09–0.75]; P < .01) or supplemental oxygen (OR 0.26 [95% CI: 0.11–0.61]; P < .01). Ultrasound findings did not dynamically change over a 28-day scanning window after symptom onset. **Conclusions**: Lung POCUS findings detected within 24 hours of admission may provide expedient risk stratification for important COVID-19 clinical outcomes, including future ICU admission or need for supplemental oxygen. Conversely, a normal scan within 24 hours of admission appears protective. POCUS findings appeared stable over a 28-day scanning window, suggesting that these findings, regardless of their timing, may have clinical implications.]

[The Diagnostic Accuracy of Abbreviated Breast Magnetic Resonance Imaging (Abbreviated Breast MRI)](#)
Ikizceli T. and Gulsen G.
Dicle Medical Journal, vol. 48(3) pp. 468-477
September 2021
[**Objective**: Abbreviated Breast Magnetic Resonance Imaging (MRI) is a fast and a selected scan, used for screening women at high risk of breast cancer. The objective of this study is to assess the diagnostic accuracy of a new shortened Abbreviated Protocol (AP) relative to Full Diagnostic Protocol (FDP). **Methods**: 206 breast MRIs were evaluated, respectively. AP was derived from the FDP and re-recorded. The new report was compared with the report of the previous FDP. The interpretation time of the shortened protocol was recorded. The results of the two protocols in terms of finding the lesion were compared using sensitivity, specificity, NPV, and PPV according to the histopathology results. **Results**: 124 of 206 MRIs were malignant and 82 of 206 MRIs were benign. The average

interpretation time was 58±35s with AP. The MIP sequence evaluation time was only 17±12s. The PPV, NPV, sensitivity and specificity values for AP MRI were 93.0%, 94.8%, 96.77%, 96.8% and 89.0% respectively. The PPV, NPV, sensitivity and specificity values for FDP MRI were 94.5%, 96.2%, 97.6% and 91.5% respectively. There was no significant difference in sensitivity and specificity for both protocols ($p < 0.05$). **Conclusion**: AP is a new and shorter version of a Breast MRI. The diagnostic accuracy of abbreviated breast MRI for the detection of breast lesions shows a high level of sensitivity and specificity, with the advantages of shortening both the exam time and the interpretation time.]

Education, Training and Workforce Development

The role of quality improvement in radiography
Nocum D.J., Robinson J., and Reed W.
Journal of Medical Radiation Sciences, vol. 68(3) pp. 214-216
September 2021
[This editorial discusses the importance of quality improvement and quality assurance in the provision of medical imaging services, by exploring two studies which aim to improve the quality of practice in emergency departments (ED). The quality of work by ED radiographers are continually planned, measured, assessed, and improved to enhance patient care outcomes – from the accurate diagnosis of patients, maintaining the consistency of diagnostic images, and to minimising radiation exposure to patients.]

Interventional Radiology

Patients' Radiation Shielding in Interventional Radiology Settings: A Systematic Review
El-Diasty M.T., Olfat A.A., Mufti A.S., Alqurashi A.R., and Alghamdi M.J.
Cureus, vol. 13(8)
August 2021
[As a result of the increasing risk of developing radiation-related complications, many approaches aimed at reducing this risk and enhancing the outcomes of the patient, doctor or device operator have been developed. In this systematic review, we aim to discuss previous investigations that studied patient shielding or protection within the context of selected interventional radiology procedures. We included original studies that used $K_{a,r}$ and P_{KA} for the assessment of the outcomes of two procedures: transjugular intrahepatic portosystemic shunt creation (TIPS) and hepatic arterial chemoembolization (HAE). A thorough search strategy was conducted on relevant databases to identify all relevant studies. We included 13 investigations, including 12 cross-sectional studies and one randomized controlled trial. Significant diversity was found among all these studies in terms of the used modalities, which made them hard to compare. However, almost all studies agreed that using novel imaging and interventional modalities is useful when obtaining better outcomes and reducing patient radiation exposure. The use of ultrasound-guided procedures and providing adequate lead curtains has also been recommended by the identified studies in order to minimize the frequency of radiation exposure. The reported $K_{a,r}$ and P_{KA} were also variable between studies and were discussed within this study. Our findings indicate that unified guidelines for patient radiation shielding should be urgently investigated.]

Radiation Therapy

Effect of computed tomography value error on dose calculation in adaptive radiotherapy with Elekta X-ray volume imaging cone beam computed tomography
Taniguchi T., Hara T., Shimozato T., Hyodo F., Ono K., Nakaya S., Noda Y., Kato H., Tanaka O., and Matsuo M.
Journal of Applied Clinical Medical Physics, vol. 22(9) pp. 271-279
August 2021
[**Purpose**: We evaluated the effect of changing the scan mode of the Elekta X-ray volume imaging cone beam computed tomography (CBCT) on the accuracy of dose calculation, which may be affected by computed tomography (CT) value errors in three dimensions. **Methods**: We used the electron density phantom and measured the CT values in three dimensions. CT values were compared with planning computed tomography (pCT) values for various materials. The evaluated scan modes were for head and neck (S-scan), chest (M-scan), and pelvis (L-scan) with

various collimators and filter systems. To evaluate the effects of the CT value error of the CBCT on dose error, Monte Carlo calculations of dosimetry were performed using pCT and CBCT images. **Results**: The L-scan had a CT value error of approximately 800 HU at the isocenter compared with the pCT. Furthermore, inhomogeneity in the longitudinal CT value profile was observed in the bone material. The dose error for ±100 HU difference in CT values for the S-scan and M-scan was within ±2%. The center of the L-scan had a CT error of approximately 800 HU and a dose error of approximately 6%. The dose error of the L-scan occurred in the beam path in the case of both single field and two parallel opposed fields, and the maximum error occurred at the center of the phantom in the case of both the 4-field box and single-arc techniques. **Conclusions**: We demonstrated the three-dimensional CT value characteristics of the CBCT by evaluating the CT value error obtained under various imaging conditions. It was found that the L-scan is considerably affected by not having a unique bowtie filter, and the S-scan without the bowtie filter causes CT value errors in the longitudinal direction. Moreover, the CBCT dose errors for the 4-field box and single-arc irradiation techniques converge to the isocenter.]

[Intrafraction stability using full head mask for brain stereotactic radiotherapy](#)
Tomihara J., Takatsu J., Sugimoto S., Shikama N., and Sasai K.
Journal of Applied Clinical Medical Physics, vol. 22(9) pp. 360-370
August 2021
[**Purpose**: We investigated the immobilization accuracy of a new type of thermoplastic mask—the Double Shell Positioning System (DSPS)—in terms of geometry and dose delivery. **Methods**: Thirty-one consecutive patients with 1–5 brain metastases treated with stereotactic radiotherapy (SRT) were selected and divided into two groups. Patients were divided into two groups. One group of patients was immobilized by the DSPS (n = 9). Another group of patients was immobilized by a combination of the DSPS and a mouthpiece (n = 22). Patient repositioning was performed with cone beam computed tomography (CBCT) and six-degree of freedom couch. Additionally, CBCT images were acquired before and after treatment. Registration errors were analyzed with off-line review. The inter- and intrafractional setup errors, and planning target volume (PTV) margin were also calculated. Delivered doses were calculated by shifting the isocenter according to inter- and intrafractional setup errors. Dose differences of GTV D99% were compared between planned and delivered doses against the modified PTV margin of 1 mm. **Results:** Interfractional setup errors associated with the mouthpiece group were significantly smaller than the translation errors in another group (p = 0.03). Intrafractional setup errors for the two groups were almost the same in all directions. PTV margins were 0.89 mm, 0.75 mm, and 0.90 mm for the DSPS combined with the mouthpiece in lateral, vertical, and longitudinal directions, respectively. Similarly, PTV margins were 1.20 mm, 0.72 mm, and 1.37 mm for the DSPS in the lateral, vertical, and longitudinal directions, respectively. Dose differences between planned and delivered doses were small enough to be within 1% for both groups. **Conclusions:** The geometric and dosimetric assessments revealed that the DSPS provides sufficient immobilization accuracy. Higher accuracy can be expected when the immobilization is combined with the use of a mouthpiece.]

[Radiological and pathological assessment of response to neoadjuvant CDK4/6 inhibitor and endocrine treatments in a real-life setting—initial results](#)
Moisander M., Salminen A., Jukkola A., Sassi A., Tervo M., Maenpaa N., Tiainen L., Rinita-Kiikka I., Tolonen T. et al
Acta Radiologica Open, vol. 10(8)
August 2021
[**Background**: Neoadjuvant endocrine therapy is an alternative to neoadjuvant chemotherapy in women with inoperable luminal-like breast cancers. Neoadjuvant cyclin-dependent kinase 4/6 inhibitor treatment combined with endocrine treatment (CDK4/6I + E) is interesting given the combination's utility in the treatment of metastatic breast cancer. Currently, the literature on the radiological response evaluation of patients treated with neoadjuvant CDK4/6I + E in a real-life setting is scarce. **Purpose**: To conduct a radiological response evaluation of patients treated with neoadjuvant CDK4/6I + E in a real-life setting. **Material and methods**: We retrospectively reviewed clinical, pathological, and radiological findings of six patients with luminal-like breast cancers treated with neoadjuvant CDK4/6I + E treatment. The radiological neoadjuvant CDK4/6I + E response was evaluated with the RECIST 1.1 criteria and the pathological residual disease was assessed using the Residual Cancer Burden (RBC) criteria. **Results**: None of the patients achieved a complete radiological magnetic resonance imaging (MRI)–determined response or a complete pathological response; three (50%) patients had a partial radiological response; in the three others, the disease remained stable radiologically. All of the tumors were rendered susceptible to surgical treatment. Two out of six (33.3%) patients had a moderate response (RBC-II); four (66.7%) had an extensive residual disease (RBC-III) in the final surgical sample. **Conclusion**: Although none of the patients achieved a pathologically complete response,

neoadjuvant CDK4/6I + E treatment rendered all tumors operable. MRI appears to be reliable in the assessment of the neoadjuvant CDK4/6I + E treatment response in a real-life setting. Larger studies are warranted to confirm these results.]

Radiology Departments & Quality Improvement

[Dynamic capacity allocation in a radiology service considering different types of patients, individual no-show probabilities, and overbooking](#)
da Silva R.B.Z, Fogliatto F.S., Krindges A., and dos Santos Cecconello M.
BMC Health Services Research, vol. 21(1) pp. 1-24
September 2021
[**Background:** We propose a mathematical model formulated as a finite-horizon Markov Decision Process (MDP) to allocate capacity in a radiology department that serves different types of patients. To the best of our knowledge, this is the first attempt at considering radiology resources with different capacities and individual no-show probabilities of ambulatory patients in an MDP model. To mitigate the negative impacts of no-show, overbooking rules are also investigated. **Methods:** The model's main objective is to identify an optimal policy for allocating the available capacity such that waiting, overtime, and penalty costs are minimized. Optimization is carried out using traditional dynamic programming (DP). The model was applied to real data from a radiology department of a large Brazilian public hospital. The optimal policy is compared with five alternative policies, one of which resembles the one currently used by the department. We identify among alternative policies the one that performs closest to the optimal. **Results:** The optimal policy presented the best performance (smallest total daily cost) in the majority of analyzed scenarios (212 out of 216). Numerical analyses allowed us to recommend the use of the optimal policy for capacity allocation with a double overbooking rule and two resources available in overtime periods. An alternative policy in which outpatients are prioritized for service (rather than inpatients) displayed results closest to the optimal policy, being also recommended due to its easy implementation. **Conclusions:** Based on such recommendation and observing the state of the system at any given period (representing the number of patients waiting for service), radiology department managers should be able to make a decision (i.e., define number and type of patients) that should be selected for service such that the system's cost is minimized.]

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