The PSRT Team
From L-R Tony Murphy (lay rep), Helen Best (PHE), Maria Murray (SCoR), Martin Duxbury (SCoR Clinical rep), Tom Roque (RCR), Carl Rowbottom (IPEM) and Úna Findlay (PHE).

Welcome to Safer Radiotherapy (RT). The aim of the newsletter is to provide a regular update on the analysis by PHE of radiotherapy error (RTE) reports. These anonymised reports are submitted on a voluntary basis through the National Reporting and Learning System (NRLS) of NHS Improvement or directly to PHE, to promote learning and minimise recurrence of these events. Safer RT is designed to disseminate learning from RTE to professionals in the RT community to positively influence local practice and improve patient safety.

Published three times a year, Safer RT contains key messages and trends from the analysis of RTE reports. Any comments and suggestions for inclusion in the newsletter can be sent to radiotherapy@phe.gov.uk and would be gratefully received. Thanks to all contributors to this issue. The next issue of Safer Radiotherapy will be published in September 2018 and will be available at www.gov.uk/government/collections/medical-radiation-uses-dose-measurements-and-safety-advice

Helen Best, Editor

Editorial headline: learning from the clinical site visit (CSV)

PHE provides independent onsite advice on patient safety in clinical practice. These visits are at the department's invitation and intended to provide independent onsite support and reassurance on issues surrounding patient safety and process efficiency within the context of IR(ME)R. The site visit provides a vehicle to deliver key safety messages to all those involved in the delivery of radiotherapy to patients. This face to face interaction with clinical departments allows PHE to positively influence local safety cultures and help clinical departments understand the safety implications of their own processes.

Between December 2007 and November 2016 PHE have conducted 113 visits over 227 days to 54 RT departments across 50 healthcare providers. A review of these visits identified variation in service profile and delivery across RT providers with many common themes highlighted.

Common themes have been brought together into a single document which will shortly be published by PHE. Although this document highlights common themes where improvements could be made, it also shares examples of best practice observed across departments visited. Key findings include a requirement to continue streamlining of working processes to minimise the risk of RTE. It also emphasises a need to adhere to national guidance, which is imperative when implementing new technologies or improving old work flows

Content	

Development of learning workshop: Feedback on publications

PHE and the Patient Safety in Radiotherapy Steering Group (PSRT) hosted a workshop on the implementation of learning from the *"Development of learning from radiotherapy errors"* guidance document found at www.gov.uk/government/publications/development-of-learning-from-radiotherapy-errors on the 19th October 2017. During this workshop delegates were asked to feedback on the PHE publications, the following is a table of that feedback –

Workshop questions-	Workshop feedback
Safer RT Newsletter www.gov.uk/government/publications/safer-radiotherapy-error-data-analysis-report	
1. What information do you find useful?	Error of the month and the data analysis
2. How do you use the information?	Data analysis is used for benchmarking
3. Is there information you would like to see that PHE don't publish?	Relative comparison of what is coded and what PHE recode. More international consideration. Case study. Errors per linac/#.
4. Do you like the format of the newsletter?	Yes
5. How could we improve the format of the newsletter?	Include more scenarios. More manufacturer information. Overview of poor quality reports.
Supplementary analysis www.gov.uk/government/publications/safer-radiotherapy-error-data-analysis-report	
1. What information do you find most useful?	RTE per provider graph
2. How do you use the information to inform practice?	Data analysis is used for benchmarking
3. Is there information you would like to see that PHE don't publish?	Understand when SBs have been effective. Estimated reported error rate. Feedback on consistency checking. Compare manufacturer related reports.
2 Year report www.gov.uk/government/publications/radiotherapy-errors-and-near-misses-data-report	
1. What information do you find most useful?	Similar comments as per supplementary analysis. Comparison of voluntary to inspectorate
2. How do you use the information to inform practice?	Benchmarking and business planning. Used as reference for internal/external reports
3. Is there information you would like to see that PHE don't publish?	Historical trending. Expand on corrective actions. Comparison of activity.

In response to the feedback, the Safer Radiotherapy newsletter and the supplementary analysis now includes analysis of effective safety barriers, scenarios and/or case studies, information on international work, work has commenced on including an estimated reported error rate and overview of reported incidents which could be improved. Further updates will continue with your feedback, if you have any further feedback or suggestions please contact **radiotherapy@phe.gov.uk**

RTE Data analysis: December 2017 to March 2018

Submissions from 54 NHS UK providers out of 62 contributed to this issue's full data analysis, covering December 2017 to March 2018. Eight providers have not reported or not used the TSRT9 trigger code to report RTE through the NRLS for this reporting period. If any departments require support in reporting please contact PHE staff at **radiotherapy@phe.gov.uk.**

The full data analysis is available at www.gov.uk/government/collections/medical-radiation-uses-dose-measurements-and-safety-advice and includes data on primary process coding, safety barriers, causative factors and the severity classification of the RTE.

Classification of RTE

Classification breakdown of RTE reports, December 2017 to March 2018 (2621 reports)

Of those RTE reported for the period December 2017 to March 2018, 2576 out of 2621 reports (98.3%) were classified as minor radiation incidents, near misses or other non-conformances. These are lower-level incidents which would have no significant effect on the planning or delivery of individual patient treatments.

Reportable radiation incidents (level 1) made up 20 (0.8%) of all reports. 'Verification of diagnosis/extent/stage' was the most frequently reported level 1 RTE (25.0%, n = 5). Non-reportable radiation incident reports (level 2) made up 25 of all reports (1.0%). 'On-set imaging: approval process' comprised 3 (12.0%) of all level 2 RTE. Level 1 and 2 reports made up 45 (1.8%) for this reporting period which is consistent with the previous analysis (2.0%, n = 55).
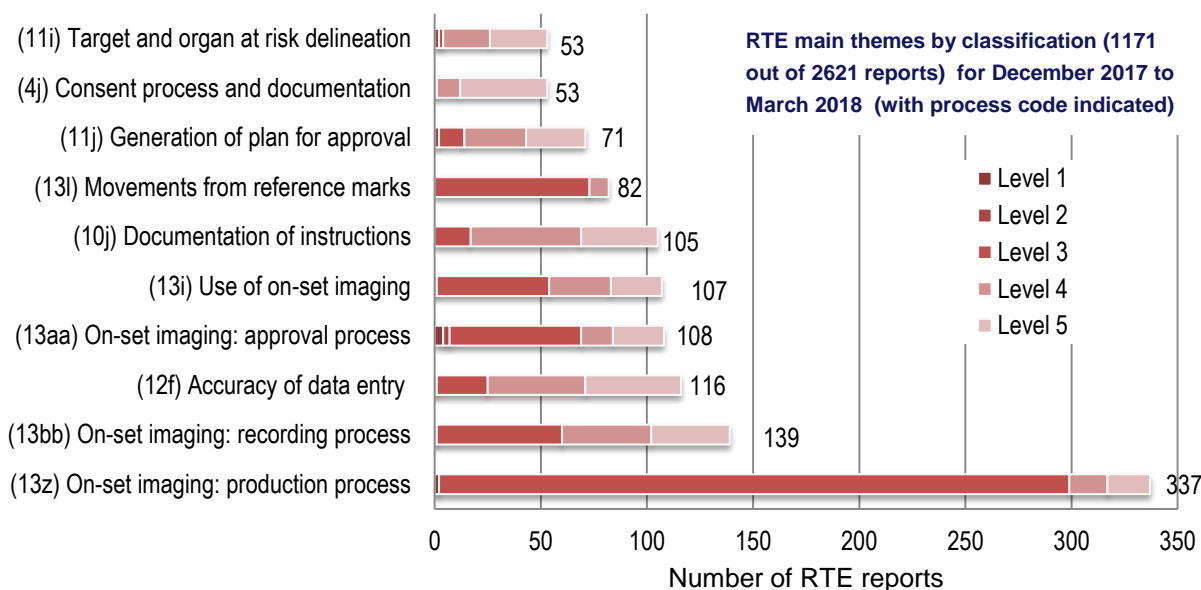
Of the 982 minor radiation incidents (level 3) reported, 297 (30.2%) of this subset were related to the 'on set imaging: production process', making it the most frequently reported code in this classification, consistent with previous analyses.

The most commonly reported RTE process code in the near miss (level 4) classification was 'documentation of instructions' with 52 reports each (8.1%). Within the non-conformance (level 5) classification 'accuracy of data entry' comprised 45 reports (4.7%) making this the most frequently reported RTE in this classification.
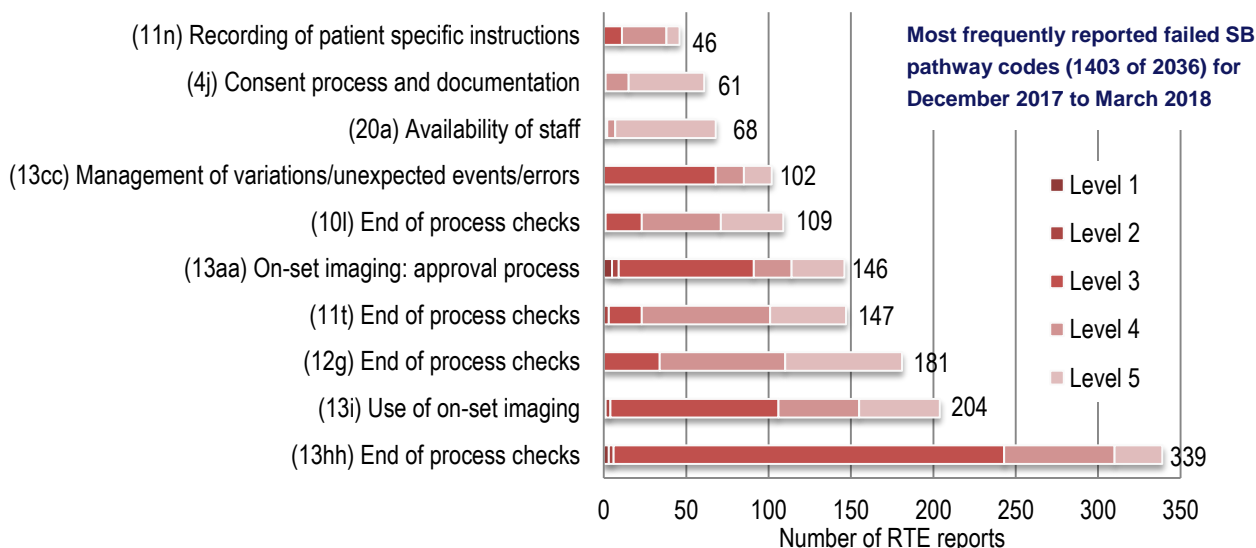
Primary process code

The main themes (points in the patient pathway where the majority of reported RTE occurred) for this dataset are shown below. On-set imaging process codes

contributed 26.4% (n = 691) of all reports for this reporting period. Consistent with the previous 11 analyses 'on-set imaging: production process' is the most commonly occurring process code, examples of this include selecting the incorrect pre-set for an exposure. Guidance on this error can be found in issues 7 and 18 of Safer RT.

RTE main themes by classification (1171 out of 2621 reports) for December 2017 to March 2018 (with process code indicated)

Process code	Number of RTE reports
(11i) Target and organ at risk delineation	53
(4j) Consent process and documentation	53
(11j) Generation of plan for approval	71
(13l) Movements from reference marks	82
(10j) Documentation of instructions	105
(13i) Use of on-set imaging	107
(13aa) On-set imaging: approval process	108
(12f) Accuracy of data entry	116
(13bb) On-set imaging: recording process	139
(13z) On-set imaging: production process	337

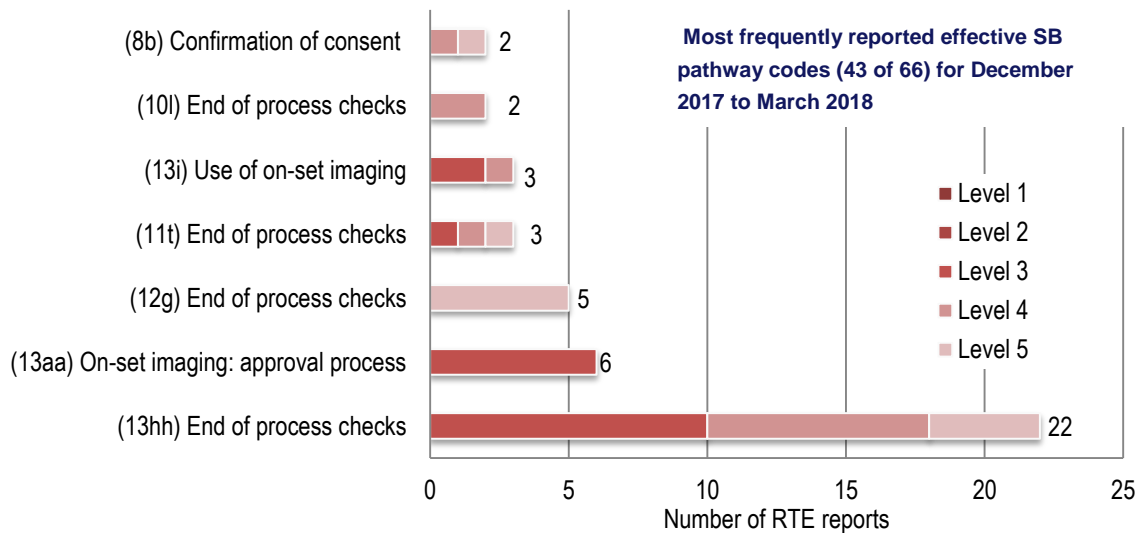Legend: Level 1, Level 2, Level 3, Level 4, Level 5

Safety Barriers (SB)

All pathway subcodes from primary to quarterly were analysed across the 2621 RTE for the reporting period and 2036 failed SB were identified. Only 47 of these RTE were Level 1 or 2 errors where the SB had failed. The most common failed SB reported is represented below and are broken down by classification. Treatment unit process 'end of process checks' is the most commonly reported failed SB (16.7%, n=339). 'End of process checks' across the entire pathway account for 16.7% (n = 790) of all reported failed SB.

Most frequently reported failed SB pathway codes (1403 of 2036) for December 2017 to March 2018

Process code	Number of RTE reports
(11n) Recording of patient specific instructions	46
(4j) Consent process and documentation	61
(20a) Availability of staff	68
(13cc) Management of variations/unexpected events/errors	102
(10l) End of process checks	109
(13aa) On-set imaging: approval process	146
(11t) End of process checks	147
(12g) End of process checks	181
(13i) Use of on-set imaging	204
(13hh) End of process checks	339

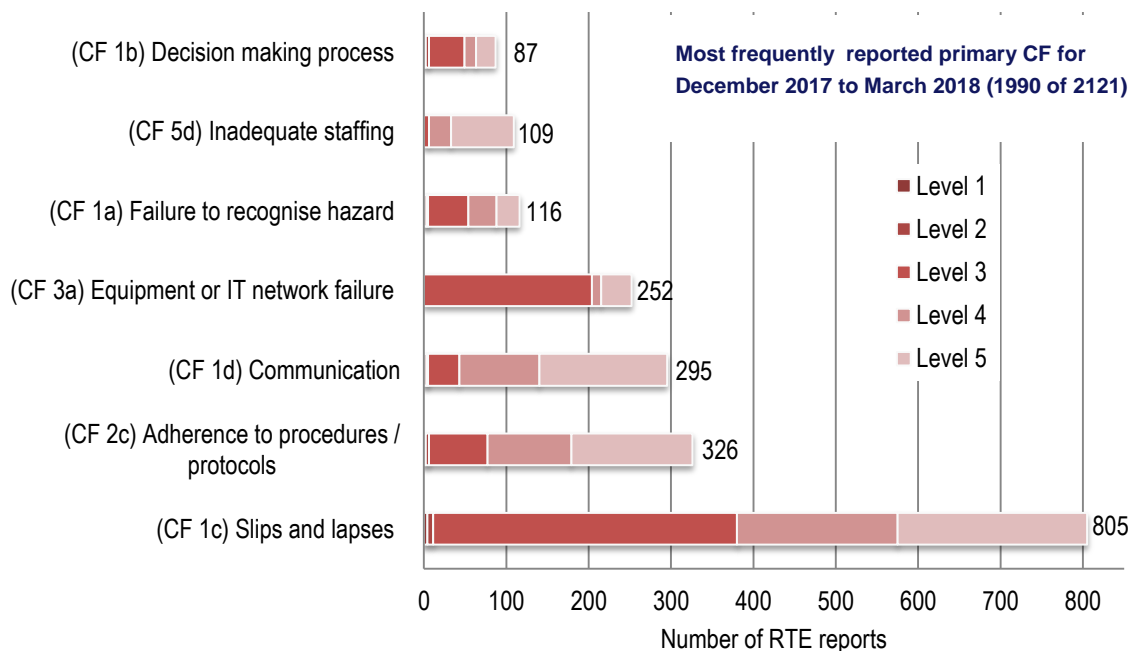Legend: Level 1, Level 2, Level 3, Level 4, Level 5

Effective safety barriers or methods of detection (MD) can now be identified utilising the safety barrier taxonomy. For the reporting period December 2017 to March 2018 9 different providers indicated MD across 66 incidents. A further 11 incidents contained the letters MD; however it was unclear which process code indicated the MD therefore they have not been included in this analysis. The most commonly reported effective safety barrier for this reporting period was treatment unit 'end of process checks' (33.3%, n = 22).

Most frequently reported effective SB pathway codes (43 of 66) for December 2017 to March 2018

Causative Factors (CF)

CF have been applied to 2121 RTE during the reporting period December 2017 to March 2018 by 46 RT departments. The most commonly reported primary CF was individual 'slips and lapses' (37.9%, n = 805). Multiple CF can be associated with each RTE, the primary CF is the root cause and the subsequent CF are the contributor factors associated with an incident. There were a total of 999 contributory factors reported during this time period, the most frequently reported was 'adherence to procedures/protocols' (43.0%, n = 50).

Most frequently reported primary CF for December 2017 to March 2018 (1990 of 2121)

Risk assessments templates –

The new IR(ME)R legislation requires employers to include a study of the risk of accidental or unintended exposures. To inform a piece of work being undertaken by the PSRT on risk assessment templates, we would like to learn more about the approaches that already exist in clinical departments. If you are willing or able we would be grateful if you would share the risk assessment template currently used in your clinical department. Please send to the following email address **radiotherapy@phe.gov.uk**

How are you coding your reports?

RTE reports are received from providers across the UK. Data is sent to the NRLS and directly to PHE using the TSRT9 trigger code. All reports should contain the trigger code, a classification, pathway code and when applicable the failed and effective safety barrier, and causative factors. During import of this data and consistency checking by PHE 21.9% (n = 574) required further manipulation due to the incorrect format of the report. The following are examples of reports which have been interpreted.

Original report coding	Interpreted coding
TSRT9 3 13 13cc	TSRT9/ Level 3/ 13cc/ no MD or CF
TSRT09 , Lvl 4 , 13L & 1c	TSRT9/ Level 4/ 13l/ CF1c
TSRT 9 L5 / 13cc or 13jj / CF1b and / or CF2b	TSRT9/ Level 5/ 13cc/ 13jj/ CF1b/ CF2b
TSRT9 Level 2 / 8C / 10L (MD) Cf1c / Cf5d	TSRT9/ Level 2/ 8c/ MD10l/ CF1c/ CF5d

We would ask all providers to follow the guidance in the DoL document to reduce the requirement for manipulation. The DoL guidance document can be found www.gov.uk/government/publications/development-of-learning-from-radiotherapy-errors. Further guidance on the application of methods of detection (MD) can be seen in Issue 24 of Safer RT.

Spotlight on: On-set imaging: production process (13z)

The process subcode 'on-set imaging: production process' was associated with 12.9% (n = 337) of all reported RTE from December 2017 to March 2018. This type of RTE can be split into two main categories, human error (57.6%, n = 194) or machine malfunction (42.4%, n = 143).

Scenario example of human error –
Whilst taking an online verification image the panel was in the incorrect position, this lead to the image not giving enough information to accurately verify the patients' position. Therefore the image had to be repeated resulting in the patient receiving an additional radiation exposure.
 Or
Patient required Cone Beam CT. The incorrect filter was selected and consequently the image was inadequate to correctly verify the patients' position and could not be used, a further CBCT using the correct filter was required.

TSRT9/ Level 3/ 13z/ 13hh/ MD13aa/ CF1c

Scenario example of machine malfunction –
Ca Lung 60Gy / 30# VMAT technique. On #23 patient was imaged to verify position using CBCT. Half fan used. Scan started at gantry angle 178 and ' cut out ' at gantry angle 195. Unable to resume CBCT. A further exposure was required.
Or
Right Chest Wall 30Gy / 10#. On #8 - Took a portal image of a field on a breast which was out of tolerance. Following procedure the couch was manually adjusted to the appropriate position to correct for the displacement. The image was retaken to verify the position but the image did not capture. The patient received an unnecessary dose of 3MU.

TSRT9/ Level 3/13z/ MD13i/ CF3a

All RTE associated with machine malfunction should also be reported to the MHRA. Further information on the MHRA can be found here www.gov.uk/government/organisations/medicines-and-healthcare-products-regulatory-agency. Recommendations on how to reduce these types of events can be seen in issue 16 of Safer RT. This includes the requirement to investigate repeat incidents.

New legislation and guidance

The Ionising Radiation (Medical Exposure) Regulations 2017 were laid on 6 February 2018. The GB legislation, 2018 amendments and Northern Ireland regulations can be found at:

www.legislation.gov.uk/all?title=ionising%20radiation%20medical%20exposures

The following guidance documents are under development to support the community –

- Department of Health and Social Care guidance on the Ionising Radiation (Medical Exposure) Regulations 2017
- Radiotherapy Board, update to ' A guide to understanding the implications of IR(ME)R in radiotherapy'
- Clinical Imaging Board, update to ' A guide to understanding the implications of IR(ME)R in diagnostic and interventional radiology'
- Inspectorate guidance on accidental and unintended exposures
- IPEM, update to 'Medical and dental guidance notes'

Links to international patient safety resources

ASTRO and AAPM RO-ILS Quarterly report Q3 2017

Autorité De Sûreté Nucléaire (French Nuclear Safety Authority) Publications for Professionals

IAEA, SAFRON Updates

Patient Safety in Radiotherapy Steering Group (PSRT) update

The primary objective of the PSRT is to improve patient safety in radiotherapy across the UK. Its membership includes representatives from PHE, Royal College of Radiologists (RCR), Society and College of Radiographers, Institute of Physics and Engineering in Medicine and a patient representative.

Tom Roques, Consultant Clinical Oncologist and Clinical Lead, Norfolk and Norwich University Hospital and RCR representative on the PSRT since 2010 has stepped down from the group. Tom has been dedicated to improving patient safety and has been an advocate for the RCR target volume definition peer review guidance.

The PSRT welcomes Marianne Illsley, Consultant Clinical Oncologist and Medical Director, Royal Surrey County Hospital NHS Foundation Trust as the RCR representative on the PSRT. Marianne's knowledge and experience alongside her interest in patient safety is very much welcomed in the future development of the PSRT's work programme.

Guest Editorial

Doses to patients from x-ray imaging in radiotherapy; an update from the IPEM working party

Tim Wood, Principal physicist, Castle Hill Hospital, Chair of IPEM RT imaging working party

In June 2016, a working party was formed by the Institute of Physics and Engineering in Medicine (IPEM) to audit imaging doses for a range of common X-ray imaging procedures undertaken in radiotherapy departments. This group was formed from a collaboration of the Radiotherapy and Diagnostic Radiology Special Interest Groups, and is working in consultation with Public Health England and Radiotherapy Board. In early 2017, the group circulated a questionnaire to all UK radiotherapy centres (both NHS and private providers) to collect information on the types of imaging equipment, protocols and optimisation strategies that are currently used. This also proved a useful guide as to the level of engagement we could expect, with around 80% of UK centres responding.

The first phase of data collection on CT planning scans is now complete. Based on the pre-audit questionnaire, data for seven clinical indications were requested. In total, data sets for sixty-eight different CT systems were submitted. The most common scans undertaken were prostate (64 data sets) and breast (62), and the least common were gynaecological (36) and lung 4D (41). Median dose indices for each clinical indication on each scanner were determined, and have been used to propose national reference values for volume CT dose index (CTDIvol), dose-length-product (DLP) and scan length. The results demonstrate a wide range of practice across the UK, with up to a factor of five to nine difference in median dose indices between scanners for most clinical indications; however, in the case of head & neck and lung 4D scans, this variation was found to be a factor of eighteen! It has also been noted that for nominally the same clinical indication, a factor of three to five difference between centres with the same model of CT scanner is not uncommon. Hence, it is clear that there is significant scope for optimisation of imaging practice in CT planning scans; it is hoped that making this data available to the UK radiotherapy community will aid in this process.

The working party are now finalising a publication on this work which will be submitted to a peer-reviewed journal very soon. This will include the proposed UK reference levels and a range of data that centres may use to evaluate and benchmark their imaging practice. The working party will also be contacting centres that contributed data with individual feedback.

The next phase of the working party will evaluate typical dose indices for on-treatment verification imaging with cone-beam CT systems. This will include capturing information on how the systems are used, and whether any optimisation from the manufacturer default protocols has been undertaken. Watch this space for further developments and requests for more data!

I would like to conclude with a thank you to all centres that provided data to the working party. I would also like to thank my colleagues for their efforts so far, namely; Anne Davis, James Earley, Sue Edyvean, Una Findlay, Rebecca Lindsay, Andrew Nisbet, Antony Palmer, Rosaleen Plaistow and Matthew Williams.

Dates for the diary	
26 June	RCR, Gold standard radiotherapy: Clinical oncology quality improvement and audit conference, London
2-4 July	UKRCO, Liverpool
5 September	BIR, IRMER update 2018, London
27-28 September	Success of satellites and remote working in radiotherapy, London
September	Safer Radiotherapy Issue 26