Public Health England

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Safer Radiotherapy

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The PSRT Team
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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 January 2018 and will be available at www.gov.uk/government/collections/medical-radiation-uses-dose-measurements-and-safety-advice

Madeleine Ottrey, Interim Editor

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Editorial headline: Development of learning workshop

The PSRT are holding a workshop on the 19th October on the application of the refined pathway coding and new taxonomies from the Development of Learning guidance document at the Novotel, Birmingham City Centre. The document can be found here: www.gov.uk/government/publications/development-of-learning-from-radiotherapy-errors Workshop and feedback sessions will provide opportunities for sharing between the RT community and the PSRT on the analysis of radiotherapy errors and it is hoped the event will allow consistency in the uptake of the new and amended taxonomies. Registration for the event has now closed, further information can be found here: www.phe-events.org.uk/DOLFR17

Update on BSSD, Steve Ebdon Jackson

During a consultation process the views of the Medical Exposure Working Group (MEWG) and over 130 responses from across the community were received. The Regulations are a little longer than previously and include Schedules relating to Licensing and to MPE activities, but in general they are expected to be familiar in format and content. A well-developed version of IR(ME)R 2018 has been submitted for assessment to the European Commission, as required under Article 33 of the Euratom Treaty.

Revised IRMER guidance on MGTI for radiotherapy: partial geographical misses

Guidance on investigation and notification of medical exposures much greater than intended was published by the Department of Health in January 2017. The BIR has produced a podcast of an interview conducted by Keith Langmack with David Eaton on the guidance with specific application to RT exposures.

During the podcast, RT geographical errors are discussed, in particular, partial geographical errors. Within the guidance a partial geographical miss is described as a miss that 'exceeds the locally defined error margin AND the guideline dose factor for the tissue unintentionally exposed'. A locally defined error margin is as suggested, defined at a local level and David proposes the document 'On target: ensuring geometric accuracy in radiotherapy' could be used as a guide in setting these within a RT department. Guideline dose factors for unintentionally exposed tissue are 1.1 times (whole course) or 1.2 times (any fraction) of the intended dose. The BIR podcast can be found here:
www.bir.org.uk/education-and-events/podcasts-and-postercasts/

The Directory of Radiotherapy Centres (DIRAC)

DIRAC is a register of clinical institutions containing radionuclide and radiotherapy equipment, maintained by the IAEA. The Directory is continually updated, based on replies to questionnaires circulated by the IAEA among its Member States. It includes data on teletherapy machines, sources and devices used in brachytherapy, and on equipment for dosimetry, patient dose calculation and quality assurance. The data contained within DIRAC can be used for a number of tasks including planning RT services, research and benchmarking of resources. The database relies on voluntary information from RT departments and service leads are encouraged to coordinate local efforts to visit the website and update the database for their department at: https://dirac.iaea.org/ **It is important that a single submission is made per department and the Head of Medical Physics is involved.**

Dates for the diary

12th Oct	BIR, Proton therapy for non-protoneers
19th Oct	PSRT, Development of Learning Workshop, Birmingham
8th Dec	BIR, Update on the management of head and neck cancer
Jan 2018	Safer Radiotherapy Issue 24

RTE Data analysis: April to July 2017

Submissions from 51 NHS UK providers out of 62 contributed to this issue's full data analysis, covering April to July 2017. Eleven departments 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 analysis is available at **www.gov.uk/government/collections/medical-radiation-uses-dose-measurements-and-safety-advice** and includes data on primary process coding and severity classification of the RTE.

Brachytherapy errors – After feedback from the radiotherapy community, a section on errors reported within the brachytherapy pathway has now been included in the supplementary analysis.

Classification of RTE

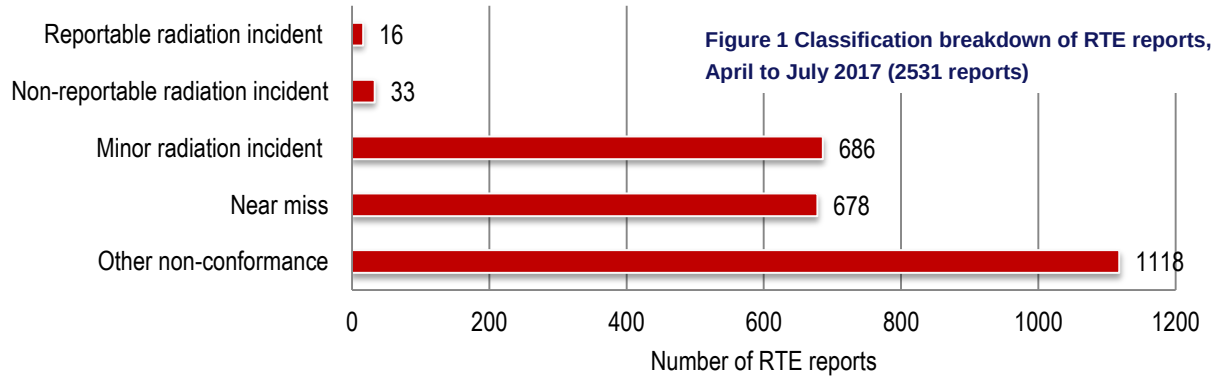


Figure 1 Classification breakdown of RTE reports, April to July 2017 (2531 reports)

Of those RTE reported for the period April to July 2017, 2482 out of 2531 reports (98.1%) were classified as minor radiation incidents, near misses or other non-conformances (see Figure 1). 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 16 (0.6%) of all reports. 'Choice of other current treatment or interventions and their sequencing or timing' was the most common level 1 RTE (18.8%, n = 3). Non-reportable radiation incident reports (level 2) made up 33 of all reports (1.3%). 'Localisation of intended volume' comprised 5 (15.2%) of all level 2 RTE. Level 1 and level 2 reports made up 49 (1.9%) for this reporting period which is a decrease from the previous analysis (2.5%, n = 61).

Of the 686 minor radiation incidents (level 3) reported, 180 (26.2%) of this subset were related to the 'on set imaging: production process', making it the most frequently occurring code in this classification, consistent with previous analysis. The most commonly occurring RTE process code in the near miss (level 4) classification was 'accuracy of data entry' with 59 reports (8.7%). Within the non-conformance (level 5) classification 'management of process flow within planning' had 82 reports (7.3%) making this the most frequently occurring RTE in this classification, consistent with the previous analysis (9.3%, n = 90).

Primary process code

The main themes (points in the patient pathway where the majority of reported RTE occurred) for this dataset are shown in Figure 2. On-set imaging process codes contributed 507 of the reports in main themes (48.3%), making up 20.0% of all reports for this reporting period. Consistent with the previous 10 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.

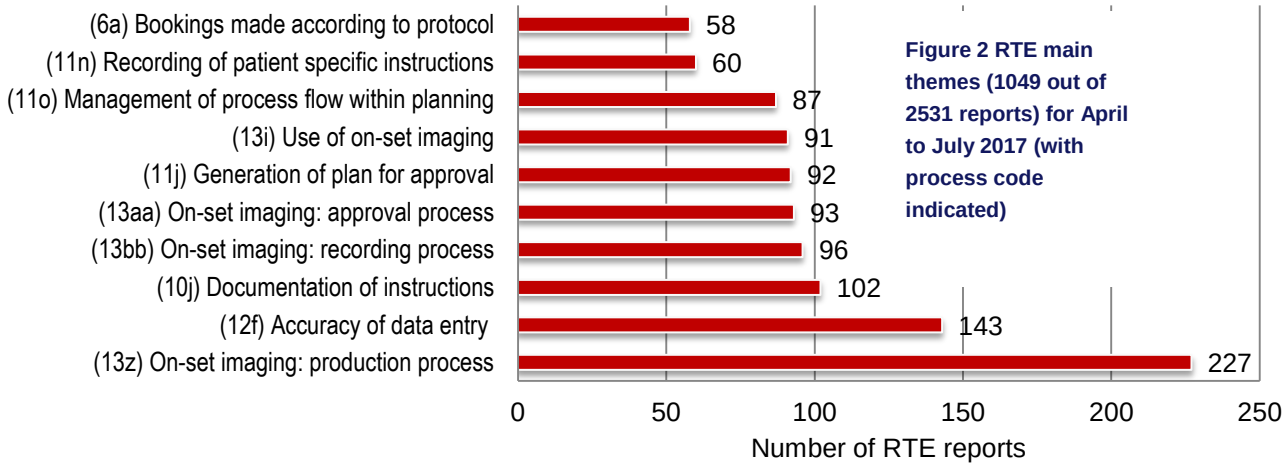


Figure 2 RTE main themes (1049 out of 2531 reports) for April to July 2017 (with process code indicated)

Safety Barriers (SB)

All subcodes from primary to quarterly were analysed across the 2531 RTE reports for the reporting period April to July 2017 and 1547 subcodes were identified as safety barriers (SB). Only 44 of these RTE led to Level 1 or 2 errors where the SB had failed. The most common SB's are represented in Figure 3 and are broken down by classification. Treatment data entry process 'end of process checks' was the most commonly reported failed SB (11.5%, n = 178) and 'end of process checks' at pretreatment planning, treatment unit, pretreatment activities, mould room/workshop activities and brachytherapy account for 20.9% (n = 324) of all reported failed SBs.

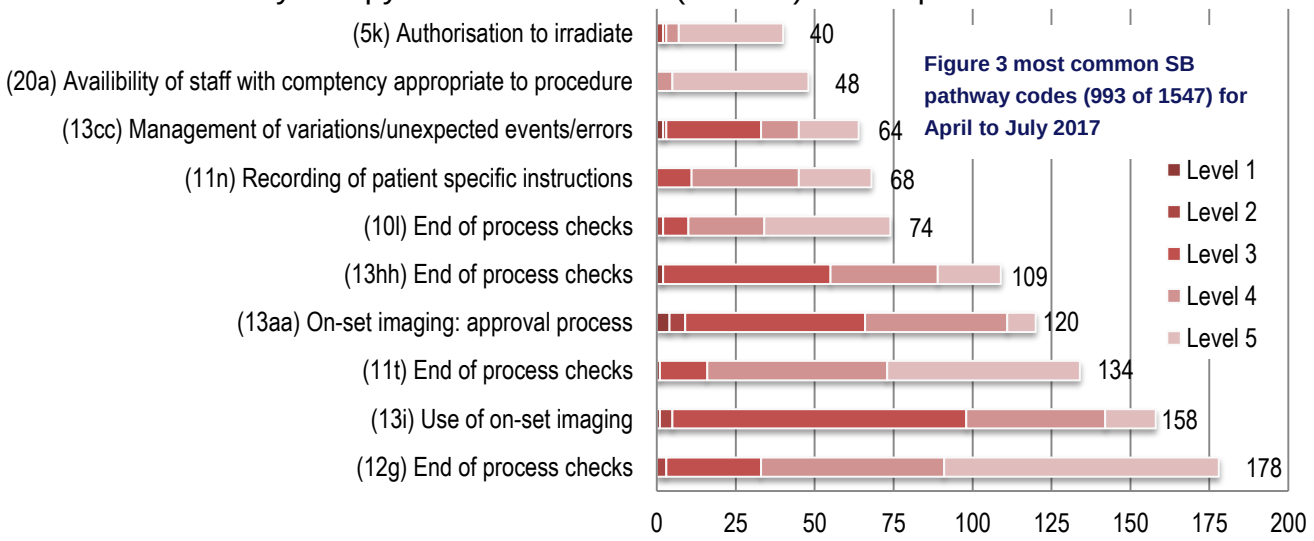


Figure 3 most common SB pathway codes (993 of 1547) for April to July 2017

Causative Factor Taxonomy (CF)

CFs have been applied locally to 955 RTE during the reporting period April to July 2017 by 32 RT departments. PHE were able to code a further 100 reports with CFs and a total of 1277 CFs were applied to 1055 reports. The most common CFs are shown in Figure 4. The most commonly occurring CF was individual 'slips and

lapses' (25.5%, n=326), closely followed by 'adherence to protocols/procedures' (25.4%, n=324). Guidance on 'slips and lapses' can be found in issue 22 of Safer RT.

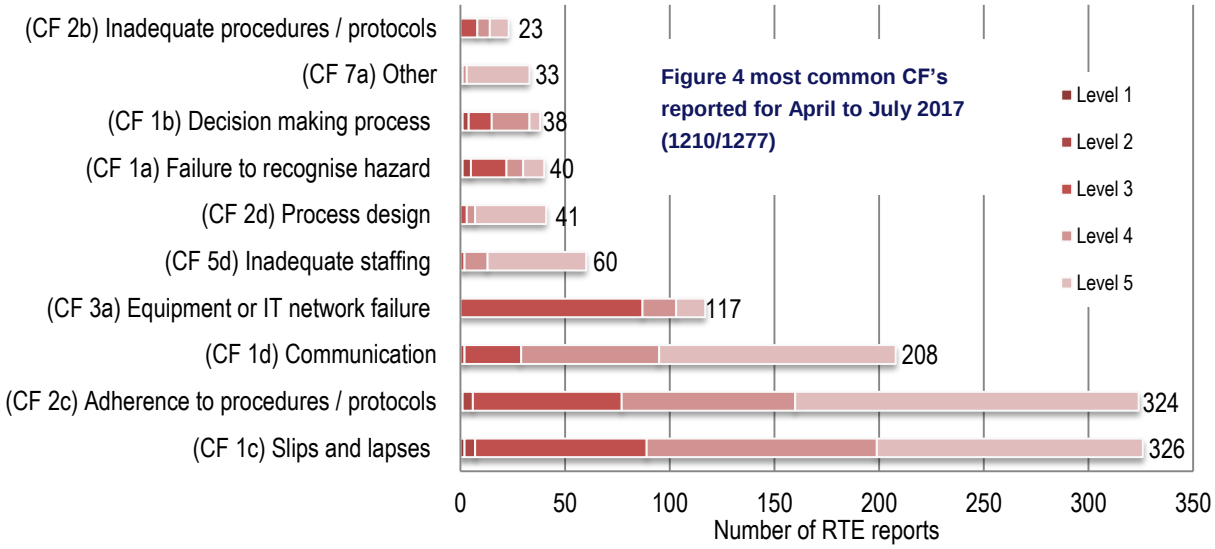


Figure 4 most common CF's reported for April to July 2017 (1210/1277)

Error of the Month

Pretreatment planning (including virtual simulation and replans)
TSRT Process Code: Target and organ at risk delineation **(11i)**

How can we minimise the risk of this RTE occurring?
Points to consider

1. Produce and follow clearly defined and up to date procedures and site specific protocols, including the optimum screen resolution and standard nomenclature.
2. Check all slices from the pre-treatment data have been sent / received within the planning system.
3. Ensure primary source data is available to confirm site and laterality for outlining.
4. Ensure all documentation needed for outlining is available, e.g. surgical findings, imaging results etc.
5. Ensure the operator carrying out the task of outlining has adequate training and up to date competencies. Training records should be maintained and be specific to particular tasks.
6. Ensure checks are in place to confirm correct outlining and growing of volumes. Site specific peer review may be considered.
7. Create an appropriate environment with minimal distractions for staff (TSRT pages 5, 10 and 35).
8. Monitor locally reported RTE to identify common occurrences and introduce preventative action

RCR Contouring Survey, Tom Roques

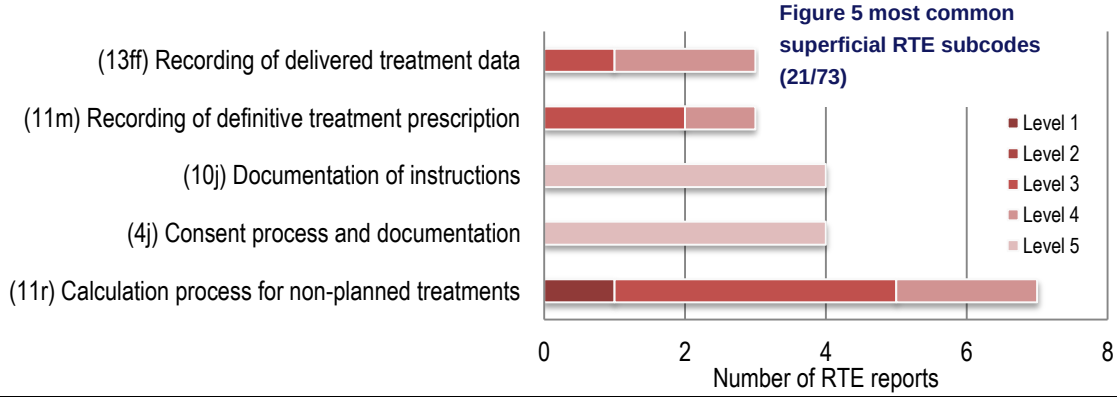
RT contouring is a complex decision-making process involving many uncertainties and careful judgement. It is therefore highly likely to benefit from a peer review (PR) process. PR is standard in much of Canada but is more haphazard in the UK. The RCR guideline on PR of RT contours has the potential to reduce contouring variation and improve clinical outcomes. The document can be found here: **www.rcr.ac.uk/system/files/publication/field_publication_files/bfco172_peer_review_outlining.pdf** It sets out minimum standards for contouring and PR, from using standard nomenclature to stating which contours should have review. It also contains practical advice on how to start a PR program, including a sample template to record contouring and PR decisions and real-world examples from UK providers with different solutions for incorporating PR into already busy timetables. Research suggests 5-10% of all contours will be changed by PR. The RT community owes it to those patients to put this new guidance into practice.

Superficial treatments

After feedback from the RT community a search of the entire database (n = 36,790 errors) was conducted to identify the number of voluntary errors reported in the superficial pathway between December 2009 and July 2017. The search revealed that the number of errors related to superficial treatments was extremely small (n = 73, 0.2%), the majority were minor radiation incidents, near misses and other non-conformances (n = 70, 95.9%). When comparing the amount of attendances for superficial treatments in England in 2016 across 40 English NHS providers (26,725) to the number of errors voluntarily reported that year (22) it shows that an error occurred in 0.08% of attendances.

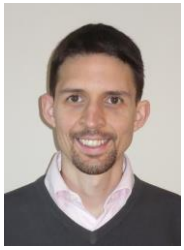
Figure 5 shows the most common subcode related to superficial treatments between December 2009 and July 2017 was 'calculation process for non-planned treatments' (n = 7, 9.6 %) and of these errors, 1 was a reportable radiation incident. This indicates manual calculations are used in the planning process for superficial treatments and it is suggested that software checks should be incorporated and an independent calculation checking method employed to ensure the process is robust.

Figure 5 most common superficial RTE subcodes (21/73)



CONCERT Public survey

The CONCERT European Joint Programme (EJP) for the Integration of Radiation Protection Research under Horizon 2020 are asking members of the public to take part in their survey aiming to gauge the perception of nuclear and radiological risk amongst a wide range of people and their opinion on related issues such as communication and information received by different factors. The deadline to complete the survey is 31st October 2017, which you can find here: **http://www.concert-h2020.eu/en/Stakeholders/Public_survey**



Guest Editorial

Current status of kilovoltage (kV) radiotherapy in the UK

David Eaton, IPEM Radiotherapy Special Interest Group

Kilovoltage (kV) x-rays were the first method of RT, used for treatment within a year of their discovery over 120 years ago. Since then, units operating at superficial (~50–150 kV) and orthovoltage energies (~150–300 kV) have become an established part of most RT departments. They are straight-forward and reliable to use, and the sharp penumbra of the beam is advantageous when treating small and irregular shapes, compared to electron beams or high-dose-rate brachytherapy. However, working on 'skins' may seem like a niche or dwindling role, and it was suspected that practices varied around the country.

Therefore, last year a working party of IPEM surveyed all UK centres to investigate their installed equipment base, patient numbers and indications, quality control tests, treatment planning and radiation dosimetry. Full results were published later in 2016[1] and are summarised as follows. Three-quarters of centres have at least one kV unit, with 58 in total across the UK. A sizeable minority of these were low energy portable units, sometimes called 'electronic brachytherapy'[2]. Most machines were less than 10 years old and 39% were installed in the last five years, countering the notion that demand is waning for these devices. About 6000 patients were treated with kV x-rays in 2015, but there was a very wide variation in numbers between centres (mean 134, or 5% of total workload, range 10 – 450). This probably depends more on access pathways and clinicians with an established specialist practice, rather than capacity, although a third of centres restricted their treatments to certain days or weeks in a month. Treating very few patients per year with any modality risks the maintenance of skill and ability, so a review of resource use and referral patterns may be warranted.

In terms of potential for errors, superficial treatments are heavily dependent on manual calculation of treatment parameters and accuracy of positioning the patient and the applicators. Most centres used published values for depth doses and correction factors, but an increasing minority measured their own data. Caution is advised regarding the use of appropriate detectors and materials for these measurements, and it is recommended that data such as BJR supplement 25[3] is used at least to verify local values. Independent dosimetry audit is also recommended for all new installations, and every 3-5 years, for example as part of the regional IPEM programme.

Secondly, only a third of centres use a software-based calculation for either primary calculation or second check. This would increase the risk in linac-based treatments, where manual calculations are rare, but having specialised staff, adequate training and regular experience can mitigate these risks in kV treatments. Further good practice for non-planned treatments was described in *Safer Radiotherapy* issue 21.

Finally, only half the reported units possessed a record-and-verify system and just 16% were integrated with the rest of the department. To reduce transcription issues and streamline resources, it is recommended that both manufacturers and users invest in this development.

References

1. Palmer AL, Pearson M, Whittard P, McHugh KE, Eaton DJ (2016). Current status of kilovoltage (kV) radiotherapy in the UK: installed equipment, clinical workload, physics quality control and radiation dosimetry. *Br J Radiol* 89: 20160641.
2. Eaton DJ (2015). Electronic brachytherapy—current status and future directions. *Br J Radiol* 88: 20150002.

3. British Institute of Radiology (1996). *Central axis depth dose data for use in radiotherapy: BJR supplement 25.* London, UK: BIR; 1996.