Safer Radiotherapy
The radiotherapy newsletter of Public Health England

Supplementary Data Analysis
Issue 27 – Full radiotherapy error data analysis
August to November 2018
About Public Health England

Public Health England exists to protect and improve the nation’s health and wellbeing, and reduce health inequalities. We do this through world-leading science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health and Social Care, and a distinct delivery organisation with operational autonomy. We provide government, local government, the NHS, Parliament, industry and the public with evidence-based professional, scientific and delivery expertise and support.

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Full radiotherapy error data analysis - August to November 2018

This analysis has been undertaken by Public Health England (PHE) on radiotherapy errors and near misses (RTE) reported voluntarily by NHS radiotherapy (RT) providers. Reports are submitted from England and Wales to the National Reporting and Learning System (NRLS) at NHS Improvement using the TSRT9 trigger code\(^1\) and directly to PHE from providers in Northern Ireland and Scotland.

The classification from *Towards Safer Radiotherapy*\(^2\) (TSRT) and the pathway coding from the *Development of learning from radiotherapy errors*\(^13\) (DoL) to include safety barriers and causative factor taxonomy was employed for the analysis. Where appropriate, comparisons have been drawn with previous issues of *Safer Radiotherapy*\(^14\) and the PHE supplementary data analyses\(^15\). The analysis has been reviewed by the Patient Safety in Radiotherapy Steering Group, whose comments have been incorporated into this document.

Due to merging of NHS Trusts there are now 61 NHS RT providers across the UK. For this reporting period, August to November 2018, 90.1% (\(n = 55\)) of providers have submitted RTE reports, leaving 6 providers who did not submit reports using the TSRT9 trigger code, this is reflective of the last reporting period\(^5\). The RTE reports received at PHE are anonymised and received as part of a voluntary reporting scheme. New and existing NHS and independent RT providers are welcome to contact PHE for advice on how to submit data for inclusion in these national analyses.

The average number of reports received by PHE each month for this reporting period was 845.8. This is a 15.9% increase in the number of reports received from the last reporting period April to July 2018 (\(n = 730.0\))\(^5\) and a 20.4% increase when comparing to the same reporting period in 2017 (\(n = 702.8\))\(^5\). A mature reporting culture is reflected in the continued participation by a large number of providers in national reporting. This continued commitment of providers demonstrates the community’s drive to improve patient safety in RT. The estimated number of attendances (prescriptions) in English NHS providers for this reporting period was 627,392 (58,796). 3,075 RTEs were detected and reported by English NHS providers, equating to 0.5% (5.2%) of all attendances (prescriptions) for this reporting period\(^6\). Similar activity data is not yet available for an estimated reported error rate to be calculated for Northern Ireland, Scotland and Wales. Again it is worth noting that the vast majority of these events do not impact on the patients planning, treatment or outcome.

It is clear that there is some disparity in frequency of reporting across providers, with a wide variance shown when comparing the incident date with the date reported to the national voluntary reporting scheme. This time lag ranges from a minimum of 1 day to a
maximum of 578 days for this reporting period, with a mean of 50.4 days. This is a decrease on the last reporting period (mean = 54.9 days). There were 13 reports received from 4 different providers which were reported with a time lag over 365 days; these did not contain text which could account for the lengthy time lag. To ensure timely learning from RTE reports continues to be shared nationally, providers are asked to make submissions at the earliest opportunity for inclusion in the monthly data uploads by PHE and four-monthly analyses. Issue 26 of Safer Radiotherapy provides further information on the frequency of reporting.

The overall analysis presented in this report will help providers to compare locally identified trends against the national picture. In doing so it is expected that these events might be minimised in the future. However, it should be noted this data is not adjusted to reflect individual provider activity or service specification. As with any voluntary reporting system, the data will only reflect those incidents that are reported and may not necessarily be representative of the actual level of occurrence. As such, this data needs interpreting with care.

If individual providers would like to comment on the analysis or can offer further advice in preventing any RTE please email the RT team at radiotherapy@phe.gov.uk.

Monitoring of TSRT classification and coding by radiotherapy providers

The TSRT\textsuperscript{2} classification, DoL\textsuperscript{3} pathway coding and causative factor taxonomies had been applied by local RT providers to 2,799 of the 3,383 reports received from August to November 2018. This demonstrates the high adoption rate (82.7\%) in the application of the TSRT\textsuperscript{2} and DoL\textsuperscript{3} taxonomies.

All providers are asked to apply a trigger code, classification, coding, including failed safety barriers, causative factor and where applicable effective safety barrier (detection method) to their RTE reports to facilitate both local and national analysis, for example TSRT\textsuperscript{9}/ Level 4/ 13c/ 13l/ MD13hh/ CF1c/ CF2c. Failed and effective safety barriers and how to include them in report submissions are discussed further in Issue 24 of Safer Radiotherapy\textsuperscript{4}.

Consistency checking was undertaken by PHE staff on the application of the TSRT\textsuperscript{2} classification and DoL\textsuperscript{3} coding system by RT providers. During consistency checking the coding is reviewed for all RTE classified as reportable through to near miss (levels 1 – 4) and 10\% of non-conformances (level 5) RTE are audited. A complete report (Figure 1) contains the classification, pathway code, including safety barriers and causative factor taxonomies. From the 2,384 RTE reports classified and coded locally, 417 were amended (complete fixed in Figure 1); an 82.5\% level of consistency was achieved. The Good Practice in Radiotherapy Error Reporting – Supplementary Guidance Series gives examples of the application of the classification and process coding. In addition, 563 RTE were classified or coded by PHE staff using the
supporting text supplied by the local providers, (incomplete fixed in Figure 1). The DoL\textsuperscript{3} includes guidance on the application of coding and classification\textsuperscript{3}. A further 2 reports contained classification and pathway coding, however they did not contain sufficient information within the text to allocate a causative factor taxonomy, (incomplete within Figure 1).

Non-RTE reports submitted with the TSRT9 trigger code formed 0.6% (n = 19) of all the reports for this reporting period. Data and accompanying text indicate that these were patient safety incidents (PSI). This is consistent with previous analyses\textsuperscript{5}. A PSI is defined by the NRLS as ‘any unintended or unexpected incident which could have or did lead to harm for 1 or more patients receiving care\textsuperscript{8}; further information on PSI can be found in issue 5 of Safer Radiotherapy\textsuperscript{4}. Non-RTE reports were excluded from the detailed analysis.

Figure 1. Breakdown of reports, August to November 2018 (n = 3,383)

In total, 3,364 RTE for the reporting period from August to November 2018 were included for analysis. The analysis is presented here.

Number of reports per provider

Figure 2 shows the number of RTE reported by providers during August to November 2018. The number of reports per provider ranged from 3 to 308 reports with an average 61.5 reports for this subset of data, indicating that over half of providers reporting (67.2%, n = 41) reported less than the national average, 6 of which did not submit a report. It should be noted that those centres reporting higher numbers of RTE represent providers with mature reporting cultures and should be encouraged to continue reporting. These centres report all classifications of reports including levels 1 to 5. Furthermore, it is essential that the local reporting and learning system is readily accessible and offers an efficient solution to enable reporting. The third in a series of
surveys of UK RT providers in 2014\textsuperscript{9} on reporting culture demonstrated that those departments with fully electronic single reporting and learning solutions, which were accessible in all areas of the clinical department, were most likely to submit greater numbers of RTE. The intention in sharing this data is to allow providers to benchmark themselves against other UK NHS radiotherapy providers. Furthermore a survey on the current reporting culture can be seen in issue 27 of \textit{Safer Radiotherapy}\textsuperscript{4}.

\textbf{Figure 2. Number of RTE reported per RT provider, August to November 2018 (n = 3,364)}

\textbf{Breakdown of process codes}

The 3,364 RTE reports were categorised by process code according to DoL\textsuperscript{3} irrespective of classification, so that the main themes could be derived. Figure 3 shows 37.5\% (n = 1,263) of the RTE were reported to have occurred during treatment unit processes. The most frequently reported RTE activity codes were associated with treatment unit processes for all classifications of RTE except near miss (Level 4) and other non-conformances (Level 5), where the most frequently reported RTE within this subgroup were associated with treatment data entry process and pretreatment planning respectively. It is expected that the treatment unit process code is to be the most frequently reported code as RT treatments can span a number of visits, providing many opportunities during the treatment unit process for RTE to occur.
Figure 3. Breakdown of RTE main activity codes reported, August to November 2018 (n = 3,199/3,364 subset of RTE)

The ten most frequently reported process subcodes in the RT pathway are presented in Figure 4. This subset of data was also broken down by classification. The most frequently occurring RTE reported was ‘on-set imaging: production process’ at 13.4% (n = 452) of all the reports; as a subset 94.5% (n = 427) of these reports were level 3 events. The second most frequently occurring RTE was ‘accuracy of data entry’ at 4.9% (n = 168) followed by ‘documentation of instructions/information’ at 4.3% (n = 159). The top 5 most frequently reported process subcodes for this reporting period are the same top 5 most frequently reported process subcodes as in the previous reporting period.

Figure 4. Breakdown of RTE main themes by classification level reported, August to November 2018 (n = 1,501/3,364 subset of RTE)
Classification of radiotherapy errors

Each of the 3,364 RTE reports was classified as ‘other non-conformance’, ‘near miss’, ‘minor radiation incident’, ‘non-reportable radiation incident’ or ‘reportable radiation incident’ (Figure 5). Of the RTE reports, 98.3% (n = 3,309) were minor radiation, near miss or other non-conformities with little or no impact on patient outcome. Of the remaining 1.7% (n = 55) RTE reports, only 0.7% (n = 23) were reportable under IR(ME)R\textsuperscript{10} to the appropriate authority. The national survey on reporting culture in issue 27 of Safer Radiotherapy\textsuperscript{4} indicates that providers are more likely to submit RTE reports of higher classification levels (levels 1 – 3) to the national voluntary reporting system, RTE reports of lower classification (level 4 – 5) are less likely to be shared due to resource constraints and inefficient reporting and learning systems.

![Classification breakdown of RTE reports, August to November 2018 (n = 3,664)](image)

**Figure 5. Classification breakdown of RTE reports, August to November 2018 (n = 3,664)**

Reportable radiation incident

Reportable radiation incidents as defined in Towards Safer Radiotherapy\textsuperscript{2} fall into the category of reportable under 1 of 2 statutory instruments – IR(ME)R\textsuperscript{10} or IRR2017\textsuperscript{11}. These incidents will generally be clinically significant, although they may be correctable within the course of treatment. The majority of these higher level incident reports affected a single exposure. This meant that corrective action could be taken over the remaining treatment fractions so the incident did not have a significant impact on the patient or the outcome of their treatment.

There were 23 reportable radiation incidents submitted to the voluntary system from August to November 2018 (Figure 5), comprising 0.7% of the RTE reviewed; this is a slight decrease from 28 (1.0%) reportable radiation incidents in the previous four-monthly analysis\textsuperscript{5}. Further analysis of the reports indicates the points in the pathway at which the reportable incidents occurred. Unusually these were all singular events across 23 different process subcodes; these are listed below –
(4b) Verification of diagnosis/extent/stage
(4c) Choice of dose
(4i) Choice of other concurrent treatment
(5d) Completion of tumour-specific information
(5h) Recording of previous radiotherapy
(6b) Bookings made according to request details
(9e) Production of other accessories
(10k) Marking of patient or immobilisation device
(11i) Target and organ at risk delineation
(11r) Recording of definitive treatment prescription
(11m) Calculation process for non-planned treatments
(13b) Patient ID process
(13c) Patient data ID process
(13cc) Management of variations
(13e) Confirmation of pregnancy/fertility status
(13g) Patient positioning
(13hh) End of process checks
(13k) ID of reference marks
(13l) Movements from reference marks
(13w) Availability of treatment accessories
(13z) On-set imaging: production process
(15g) Initial positioning of applicators / sources
(15o) Use of on-set imaging

There were 2 reportable radiation incidents associated with patient ID, ‘patient ID process’ and ‘patient data ID process’. Examples of incorrect patient ID include the incorrect exposure of a verification image due to incorrect patient ID. Examples of RTE associated with ‘patient data ID process’ includes the incorrect ID of a treatment plan leading to the incorrect treatment of a patient.

Non-reportable radiation incident

Radiation incident not reportable, but of potential or actual clinical significance\(^2\)

Non-reportable radiation incidents comprised 1.0 % (n = 32) of the RTE reported from August to November 2018 (Figure 5); this is consistent with the previous four-monthly analysis\(^5\).

Further analysis indicates the points in the pathway at which non-reportable radiation incidents occurred (Figure 6). The reports were spread across 21 different subcodes. ‘On-set imaging: approval process comprised 18.8% (n = 6) and was the most frequently occurring event within the non-reportable radiation incidents. An example of RTE associated with ‘on-set imaging: approval process’ includes the mismatch of imaging. This was also the most frequently occurring non-reportable radiation incident in the previous four-monthly analysis (13.0%, n = 3)\(^5\). Further guidance on reducing this
type of event can be seen in issue 3 of *Safer Radiotherapy*. Singular events reported are spread across 10 different subcodes.

**Figure 6. Breakdown of non-reportable radiation incidents (level 2) by process subcode reported, August to November 2018 (n = 17/32 subset of RTE)**

**Minor radiation incident**

*Radiation incident in the technical sense, but of no potential or actual clinical significance*²

Minor radiation incidents comprised 36.5% (n = 1,227) of the RTE reported from August to November 2018 (Figure 5); this is a slight increase from 990 (34.1%) minor radiation incidents in the previous four-monthly analysis⁵.

The most frequently occurring level 3 process subcodes (Figure 7) consisted mainly of treatment unit processes 69.6% (n = 854). ‘On-set imaging: production process’ was the most frequently occurring event (34.8%, n = 427) within this subset. Examples of this type of minor radiation incident included using the incorrect filter for a CBCT. The second most frequently occurring event within this classification was ‘use of on-set imaging’ (5.5%, n = 67), followed by ‘on-set imaging: approval process’ (5.3%, n = 65). This is consistent with the previous four-monthly analysis⁵.

A large proportion of the reports in this classification were related to on-set imaging, these included ‘use of on-set imaging’, ‘on-set imaging: production process’, ‘on-set imaging: approval process’ and ‘on-set imaging: recording process’ (49.5%, n = 607). Which is a minor increase since the previous four-monthly analysis⁵ when 46.6% (n = 461) of minor radiation incidents were associated with on-set imaging. A number of minor radiation incidents with the primary code ‘on-set imaging: production process’ were attributed to equipment malfunction, (49.4%, n = 211), examples of this type of RTE includes CBCT faults during acquisition. Equipment malfunction and on-set imaging: production process are discussed further in issue 18 of *Safer Radiotherapy*⁴.
Near miss

*Potential radiation incident that was detected and prevented before treatment delivery*²

Near misses comprised 24.3% (n = 819) of the RTE reported from August to November 2018 (Figure 5). This is a slight decrease from 733 (25.2%) near misses in the previous four-month analysis⁵

Figure 8 shows the most frequently occurring process subcodes across this level of RTE. ‘Accuracy of data entry’ comprised of 8.3% (n = 68) followed by ‘documentation of instructions’ 7.6% (n = 62); these were also the most frequently occurring subcodes within the previous four-month period⁵. An example of RTE associated with ‘Accuracy of data entry’ includes the incorrect entry of information into the oncology management system. Further details on the error ‘accuracy of data entry’ can be found in issue 2 of *Safer Radiotherapy*⁴ and issue 8 contained further details on ‘documentation of instruction’.
Figure 8. Breakdown of the most frequently occurring near misses (level 4) by process subcode reported, August to November 2018 (n = 403/819 subset of RTE)

Other non-conformance

Non-compliance with some other aspect of a documented procedure, but not directly affecting radiotherapy delivery

Other non-conformance comprised 37.5% (n = 1,263) of the RTE reported from August to November 2018 (Figure 5). This is a slight decrease from 1,133 (39.0%) near misses in the previous four-monthly analysis.

The most frequently occurring subcode was ‘management of process flow within planning’ (7.8%, n = 98), (Figure 9) within this classification. This was followed by ‘accuracy of data entry’ and ‘documentation of instructions/information’ (each 5.5%, n = 69). The previous four-monthly analysis did not include ‘management of process flow within planning’ (2.0%, n = 23).
Figure 9. Breakdown of the most frequently occurring non-conformances (level 5) by process subcode reported, August to November 2018 (n = 534/1,263 subset of RTE)

Safety barriers

Critical control points, detection methods or defence in depth, are any process steps whose primary function is to prevent errors occurring or propagating through the RT workflow\textsuperscript{12}

A number of safety barriers (SB) embedded in the pathway coding\textsuperscript{3} can be allocated to each RTE report to identify all points in the pathway where the error was not detected (failed SB). All subcodes were analysed across the 3,364 RTE reports for the reporting period August to November 2018, a total of 1,016 subcodes were identified as failed (SB). Only 2.5\% (n = 25) of failed SB led to a Level 1 or 2 RTE. SBs associated with treatment unit processes were attributed to 40.8\% (n = 416) of all failed SB. The most frequently failed SB are represented in Figure 10. Treatment process ‘use of on-set imaging’ was the most frequently reported failed SB (12.0\%, n = 122).
Effective safety barriers or methods of detection (MD) can now be identified also utilising the safety barrier taxonomy. For the reporting period August to November 2018, 29 providers indicated MD in 15.3% (n = 516) reports. This is an increase from the previous four-month reporting period where 20 providers indicated MD in 13.2% (n = 384) reports. Issue 24 of Safer Radiotherapy includes guidance on the application of MD coding. The most frequently reported effective safety barrier can be seen in Figure 11, for this reporting period the most frequently reported effective safety barrier was 'on-set imaging: approval process' (22.3%, n = 115).

Figure 10. Breakdown of failed safety barriers by classification level reported, August to November 2018 (n = 644/1,016 subset of RTE data)

Figure 11. Breakdown of effective safety barriers by classification level reported, August to November 2018 (n = 377/516 subset of RTE data)
Causative factors

Use of causative factor taxonomy enables identification of system problems or root causes that could precipitate a range of different incidents.\(^3\)

The new causative factor (CF) taxonomy has been applied to 2,825 (84.0%) RTE reports by 47 (85.5%) providers for this reporting period. This is an increase since the last reporting period when RT providers applied the CF taxonomy to 2,304 (78.3%) RTE. Following consistency checking, PHE coded a further 537 reports with CF taxonomy, resulting in 3,362 reports containing CF taxonomy for the analysis; only 2 RTE did not contain sufficient information to assign a CF taxonomy.

Figure 12 shows the most frequently occurring primary CFs which are seen as the root cause of an incident. Consistent with the previous analysis, the most frequently occurring primary CF was individual ‘slips and lapses’ (43.5%, n = 1,463), followed by ‘communication’ (14.1%, n= 475). ‘Slips and lapses’ was most frequently attributed to ‘on-set imaging: production process’ (11.8%, n = 173), and ‘communication’ was most frequently attributed to ‘documentation of instruction’ (10.1%, n = 48). Issue 22 of Safer Radiotherapy\(^4\) includes guidance on minimising the occurrence of RTE caused by a slip or lapse of an individual.

Figure 12. Breakdown of most frequent primary causative factors by classification level, August to November 2018 (n = 3,256/3,362 subset of data)

A number of CF codes can be attributed to each individual RTE. A review of the second to fifth CF codes indicate the contributory factors associated with an incident. Contributory factors were indicated across 893 reports; 177 of these contained multiple CF leading to 1,210 contributory factors. Figure 13 shows the most frequently occurring contributory factors. The most frequently occurring was ‘adherence to procedures/protocols’ (33.1%, n = 400).
Brachytherapy errors

Errors coded with brachytherapy process codes as the primary code account for 0.5% (n = 18) of radiotherapy errors for the reporting period August to November 2018 this is slightly decreased since the previous four-monthly report\(^5\) (1.0%, n = 30). Brachytherapy is a small specialised practice within radiotherapy, therefore the number of brachytherapy associated RTE would be expected to be low. The majority of the brachytherapy errors reported were near misses or non-conformances (77.8%, n = 14) and only 11.1% (n = 2) were classified as a reportable radiation incident (Figure 14).

The most frequently occurring subcode associated with brachytherapy incidents was ‘initial positioning of applicators/sources’, comprising 16.7% (n = 3) of all brachytherapy incidents. An example of this type of RTE included the application of seeds in the incorrect position. This was followed by ‘sterility of sources’, ‘correct applicator/sources’ and ‘planning of treatment’ each equally comprising 11.1% (n = 2). ‘Issue 20 of Safer Radiotherapy includes further guidance on brachytherapy RTE\(^4\).

A total of 24 subcodes were identified across the 18 brachytherapy associated RTE reports; only 10 different subcodes were identified as failed (SB). Only 1 of the 18 brachytherapy associated RTE contained a method of detection which was ‘on-set imaging: approval process’.
Figure 14. Breakdown of brachytherapy errors coded ‘15’ by classification level, August to November 2018 (n = 9/18 subset of data)

The CF were reviewed within this dataset; all 18 brachytherapy associated RTE were attributed to 8 different CF as shown in Figure 15. The most frequently reported CF associated with brachytherapy RTE was ‘slips and lapses’ (44.4%, n = 8) which is consistent with the general analysis of RTE.

Figure 15. Breakdown of brachytherapy primary causative factors, August to November 2018 (n = 18)
References

1. Implementing Towards Safer Radiotherapy: guidance on reporting radiotherapy errors and near misses effectively. Available at www.nrls.npsa.nhs.uk/resources/clinical-specialty/radiology-and-radiotherapy

2. Towards Safer Radiotherapy. Available at www.rcr.ac.uk/towards-safer-radiotherapy


