Safer Radiotherapy
The radiotherapy newsletter of Public Health England

Supplementary Data Analysis
Issue 23 – Full radiotherapy error data analysis
April to July 2017
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-class 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 are a distinct delivery organisation with operational autonomy to advise and support government, local authorities and the NHS in a professionally independent manner.

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Full radiotherapy error data analysis
April to July 2017

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) was employed for the analysis and the pathway coding from the *Development of learning from radiotherapy errors*\(^3\) (DoL) to include safety barriers and causative factors. Where appropriate, comparisons have been drawn with previous issues of *Safer Radiotherapy*\(^4\) and the PHE supplementary data analyses\(^5\). The analysis has been reviewed by the Patient Safety in Radiotherapy Steering Group, whose comments have been incorporated into this document.

Since January 2017 the number of providers has now reached 62 and so far 56 departments (90.3%) have submitted reports using the TSRT9 trigger code, this is a reduction from 95.1% (n = 58) providers who reported in 2016. For this reporting period, April to July 2017, 82.3% (n = 51) of providers have submitted RTE reports, representing a majority of providers from across the UK. The RTE reports received at PHE are anonymised and received as part of a voluntary reporting scheme. New and existing NHS RT providers are welcome to contact PHE for advice on how to submit data for inclusion in these series of reports.

The average number of reports received by PHE each month for this reporting period was 639.5. This is a 3.7% increase in the number of RTEs received from the last reporting period December 2016 to March 2017(n = 616.5)\(^5\); however this is a 6.8% decrease when comparing to the same reporting period in 2016 (n = 686)\(^5\). 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.

It is clear that there is some disparity in the regularity of reporting, with a wide variance shown when comparing the incident date with the date when reported to the national voluntary reporting scheme. This time lag ranges from a minimum of 0 days to a maximum of 484 days for this reporting period, with a mean of 63.2 days. This is a slight improvement on the last reporting period (mean = 64.2 days)\(^5\). 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 4 monthly analyses. Issue 13 of *Safer Radiotherapy* provides further information on the frequency of reporting.

The overall analysis presented in this report will help local providers to compare 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.

**Monitoring of TSRT classification and coding by radiotherapy providers**

The TSRT classification and coding had been applied by local RT providers to 2352 of the 2558 reports received from April to July 2017. This demonstrates a continuation of the high adoption rate (91.9%) in the application of the TSRT taxonomies.

Consistency checking was undertaken by PHE staff on the application of the TSRT classification and coding system by RT providers. Up to 4 individual pathway codes can be allocated locally by RT providers to each RTE report. During consistency checking each of these pathway codes, classification and causative factors are reviewed for all RTE classified as reportable through to near miss (levels 1 – 4) and a percentage of non-conformances (level 5) RTE are audited. From the 2352 RTE reports classified and coded locally, an 84.1% level of consistency was achieved (Figure 1). The *Good Practice in Radiotherapy Error Reporting – Supplementary Guidance Series* gives examples of the application of the classification and process coding\(^7\). In addition, 179 RTE were classified or coded by PHE staff using the supporting text supplied by the local providers. Issue 8 of *Safer Radiotherapy* includes top tips for the application of coding and classification\(^4\).

![Figure 1. Breakdown of reports, April to July 2017 (n = 2558)](image-url)

All providers are asked to apply a trigger code, classification, coding and causative factor to their RTE reports to facilitate both local and national analysis.
Non-RTE reports submitted with the TSRT9 trigger code formed 0.86% (n = 22) 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. A PSI is defined by the NRLS as ‘any unintended or unexpected incident which could have or did lead to harm for one or more patients receiving care’; further information on PSI can be found in issue 5 of *Safer Radiotherapy*. Non-RTE reports were excluded from the detailed analysis. Five reports were not classified and coded and did not contain sufficient text for PHE staff to do so and were also excluded from the analysis.

In total, 2531 RTE for the reporting period from April to July 2017 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 April to July 2017. The average number of reports per provider is 49.6 for this subset of data, indicating that over half of providers reporting (74.5%, n = 38) are reporting less than the national average. 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. 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 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 providers will be able to benchmark themselves against other UK NHS providers.

![Number of RTE reported per RT provider, April to July 2017 (n = 2531)]
Breakdown of process codes

The 2531 RTE reports were categorised by process code according to TSRT irrespective of classification, so that the main themes could be derived. Figure 3 shows 37.3% (n = 943) of the RTE were reported to have occurred during treatment unit processes. This was true across all classifications of RTE except non-conformances where the majority of RTE reported were associated with the pretreatment planning process, this is consistent with the previous analysis\(^5\). It is expected the treatment unit process code 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.

The 10 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 commonly occurring RTE reported was ‘on-set imaging: production process’ at 9.0% (n = 227) of all the reports; 79.3% (n = 180) of these reports were level 3 events. The second most commonly occurring RTE was ‘accuracy of data entry’ at 5.6% (n = 143) and ‘documentation of instructions’ 4.0% (n = 102). Of note, 64.5% (n = 677) of the most frequently reported subcodes were classified as ‘near misses’ (level 4) or ‘other non-conformances’ (level 5) with no impact on patient outcome. Only 1.0% (n = 11) of the most frequently reported subcodes were classified as a reportable or non-reportable radiation incident.

Figure 3. Breakdown of RTE main activity codes reported, April to July 2017 (n = 2531)
Safer Radiotherapy

Figure 4. Breakdown of RTE main themes by classification level reported, April to July 2017 (n = 1049/2531 subset of RTE)

Classification of radiotherapy errors

Each of the 2531 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, 98.1% (n = 2482) were minor radiation, near miss or other non-conformities with little or no impact on patient outcome. Of the remaining 1.9% (n = 49) RTE reports, only 0.6% (n = 16) were reportable under IR(ME)R\(^5\) to the appropriate authority. It was reported in a national survey\(^5\) 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 are less likely to be shared due to resource constraints and inefficient reporting and learning systems.
Reportable radiation incident

Reportable radiation incidents as defined in *Towards Safer Radiotherapy* fall into the category of reportable under one of two statutory instruments – IR(ME)R or IRR99. 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 16 reportable radiation incidents submitted to the voluntary system between April to July 2017 (Figure 5), comprising 0.6% of the RTE reviewed; this is a decrease from 27 reportable radiation incidents in the previous four-monthly analysis.

Further analysis of the reports indicates the points in the pathway at which the reportable incidents occurred (Figure 6). ‘Choice of other current treatment or interventions and their sequencing or timing’ comprised 18.8% (n = 3) of these reportable radiation incidents and was the most frequently occurring process subcode of all reportable radiation incidents reported for this time period. An example of this type of RTE included pretreatment exposures being authorised and performed on a patient who required other interventions, including debulking, rendering the exposure unusable.

Treatment unit process subcode ‘setting of couch position/angle’, comprised 12.5% (n = 2) of reportable RTE. The remaining reports were singular events spread across 11 different subcodes. They are grouped in Figure 6 as miscellaneous.

![Figure 6. Breakdown of reportable radiation incidents (level 1) by process subcode reported, April to July 2017 (n = 16)](image-url)
Non-reportable radiation incident

*Radiation incident not reportable, but of potential or actual clinical significance*

Non-reportable radiation incidents comprised 1.3% (n = 33) of the RTE reported between April to July 2017 (Figure 5); this is consistent with the previous four-monthly analysis.

Further analysis indicates the points in the pathway at which non-reportable radiation incidents occurred (Figure 7). The reports were spread across 20 different subcodes. ‘Localisation of intended volume’ comprised 15.2% (n = 5) and was the most frequently occurring event within the non-reportable radiation incidents, in contrast to the previous 4 analyses where ‘on-set imaging: approval process’ was the most common non-reportable radiation incident. An example of a RTE associated with ‘localisation of intended volume’ includes when a patient requires a rescan due to there being insufficient scan length to localise the intended volume. Singular events reported are spread across 10 different subcodes and grouped in Figure 7 as miscellaneous.

**Figure 7. Breakdown of non-reportable radiation incidents (level 2) by process subcode reported, April to July 2017 (n = 33)**

Minor radiation incident

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

Minor radiation incidents comprised 27.1% (n = 686) of the RTE reported between April to July 2017 (Figure 5). The most frequently occurring level 3 process subcodes (Figure 8) consisted mainly of treatment unit processes. ‘On-set imaging: production process’ was the most frequently occurring event (26.2%, n = 180). The second most frequently occurring event within this subset was ‘on-set imaging: approval process’ (6.6%, n = 45), followed by ‘use of on-set imaging’ (6.1%, n = 42). In parallel to the previous four-monthly
analysis\(^5\), a large proportion of the reports in this classification were related to on-set imaging (43.6\%, \(n = 299\)). A number of level 3 RTE (9.6\%, \(n = 66\)) with the primary code ‘on-set imaging: production process’ were attributed to equipment malfunction. Malfunction of equipment and on-set imaging: production process are discussed further in issue 18 of *Safer Radiotherapy*\(^4\).

![Figure 8. Breakdown of most frequently occurring minor radiation incidents (level 3) by process subcode reported, April to July 2017 (\(n = 465/686\) subset of RTE)](image)

**Near miss**

*Potential radiation incident that was detected and prevented before treatment delivery*\(^2\)

Near misses comprised 26.8\% (\(n = 678\)) of the RTE reported between April to July 2017 (Figure 5). Figure 9 shows the most frequently occurring process subcodes across this level of RTE were treatment data entry process ‘accuracy of data entry’ (8.7\%, \(n = 59\)), followed by ‘generation of plan for approval’ (7.2\%, \(n = 49\)). Further details on the error ‘accuracy of data entry’ can be found in issue 2 of *Safer Radiotherapy*\(^4\).

![Figure 9. Breakdown of the most frequently occurring near misses (level 4) by process subcode reported, April to July 2017 (\(n = 346/678\) subset of RTE)](image)
Other non-conformance

Non-compliance with some other aspect of a documented procedure, but not directly affecting radiotherapy delivery\(^2\)

Other non-conformance comprised 44.2\% (n = 1118) of the RTE reported between April to July 2017 (Figure 5). The most frequently occurring subcode was ‘management of process flow within planning’ (7.3\%, n = 82), (Figure 10) which is consistent with the previous four-monthly analysis\(^5\). Issue 5 of *Safer Radiotherapy*\(^4\) includes guidance on minimising the occurrence of RTE associated with ‘management of process flow within planning’.

![Figure 10. Breakdown of the most frequently occurring non-conformances (level 5) by process subcode reported, April to July 2017 (n = 407/1118 subset of RTE)](image)

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*\(^11\)

Up to 4 individual pathway codes can be allocated to each RTE report to identify all points in the pathway where the error was not picked up. All subcodes were analysed across the 2531 RTE reports for the reporting period April to July 2017, 1547 subcodes were identified as safety barriers (SB). Only 2.8\% (n = 44) SBs failed and led to a Level 1 or 2 RTE. Of note, 54.5\% (n = 24) of these were attributed to treatment unit processes and 37.5\% (n = 9) of these RTE related to ‘on-set imaging: approval process’. The most common SBs are represented in Figure 11. Treatment data entry process ‘end of process checks’ is the most commonly reported failed SB (11.5\%, n=178) and ‘end of process checks’ at pretreatment planning, treatment unit processes and pretreatment activities, account for 20.5\% (n = 317) of all reported failed SBs in this subset of data. Issue 4 of *Safer Radiotherapy*\(^4\) includes guidance on minimising the occurrence of RTE associated with ‘end of process checks’.
Figure 11. Breakdown of safety barriers by classification level reported, April to July 2017 (n = 993/1547 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\textsuperscript{12}

The new causative factor (CF) taxonomy has been adopted by 32 (62.7\%) out of 51 RT departments and has been applied to 955 (37.7\%) RTE reports for this reporting period. This is a 99.0\% increase in the percentage of departments using CF taxonomy and a 183.7\% increase in the percentage of reports that contain CF taxonomy from the previous reporting period included in the CF analysis (January to March 2017). Following consistency checking, PHE coded a further 100 reports with CF taxonomy, resulting in 1055 reports containing CF taxonomy for the analysis. Up to three CF codes can be attributed to each individual RTE, all CF codes are used within this analysis. Across the 1055 RTE analysed 1277 CF were identified. Figure 12 shows the top ten CFs and consistent with the previous analysis, the most commonly occurring CF was individual ‘slips and lapses’ (25.5\%, n = 326), closely followed by ‘adherence to procedures/protocols’ (25.4\%, n= 324) and both were most frequently attributed to errors related to ‘treatment data entry process’ (3.3\%, n = 42). Issue 22 of Safer Radiotherapy\textsuperscript{4} includes guidance on minimising the occurrence of RTE caused by a slip or lapse of an individual. Consistent with the previous analysis the third most reported CF was individual ‘communication’ (16.3\%, n = 208) and was most frequently attributed to pretreatment ‘documentation of instructions/information’ (1.7\%, n = 22).
Brachytherapy errors

Errors coded with brachytherapy process codes as the primary code account for 0.6% (n = 15) of radiotherapy errors for the reporting period April to July 2017. The majority of the brachytherapy errors reported were near misses or non-conformances (86.7%, n = 13) with the remaining errors being a minor radiation incident (13.3%, n = 2). The most frequently occurring subcode was ‘planning of treatment’ (21.4%, n = 3) (Figure 13). An example of this type of error included the incorrect plan being selected for the intended treatment from a library of plans. Issue 20 of *Safer Radiotherapy* includes guidance on minimising errors associated with ‘planning of treatment’ within the brachytherapy pathway⁴.

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*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.*
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