Safer Radiotherapy
The radiotherapy newsletter of Public Health England

Supplementary Data Analysis
Issue 24 – Full radiotherapy error data analysis
August to November 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.

Public Health England
Wellington House
133-155 Waterloo Road
London SE1 8UG
Tel: 020 7654 8000
www.gov.uk/phe
Twitter: @PHE_uk
Facebook: www.facebook.com/PublicHealthEngland

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Full radiotherapy error data analysis
August to November 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 factor taxonomy. 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.

For this reporting period, August to November 2017, 88.7% (n = 55) of providers have submitted RTE reports, representing a majority of providers from across the UK. Since January 2017 the number of providers has now reached 62 and so far (January – November 2017) 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 the year 2016. 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 national analyses.

The average number of reports received by PHE each month for this reporting period was 702.8. This is a 9.9% increase in the number of reports received from the last reporting period April to July 2017 (n = 639.5)\(^5\). However, this is a 5.5% decrease when comparing to the same reporting period in 2016 (n = 743.5)\(^5\). 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 reported to the national voluntary reporting scheme. This time lag ranges from a minimum of 1 day to a maximum of 631 days for this reporting period, with a mean of 73.6 days. This is a slight increase on the last reporting period (mean = 63.2 days)\(^5\). However, we know that one provider reported a back log of reports covering a year’s reporting period, if this outlier is removed the time lag ranges from a minimum of 1 day to a maximum of 553, with a mean of 57.6 days. 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 13 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 classification and coding had been applied by local RT providers to 2601 of the 2811 reports received from August to November 2017. This demonstrates a continuation of the high adoption rate (92.5%) 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 and 3 causative factors 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 2601 RTE reports classified and coded locally, a 91.2% 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. In addition, 180 RTE were classified or coded by PHE staff using the supporting text supplied by the local providers. The document *Development of learning from radiotherapy errors* includes guidance on the application of coding and classification.

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. Failed and effective safety barriers and how to include them in report submissions are discussed further in Issue 24 of *Safer Radiotherapy*.

In total 1.0% (n = 30) of the reports received were not included in the final analysis. Non-RTE reports submitted with the TSRT9 trigger code formed 0.8% (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. Six 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. A further two reports were highlighted as duplicate reports and excluded from the analysis.

Figure 1. Breakdown of reports, August to November 2017 (n = 2811)

In total, 2781 RTE for the reporting period from August to November 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 August to November 2017. The average number of reports per provider was 50.6 for this subset of data, indicating that over half of providers reporting (65.5%, n = 36) reported 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.
Breakdown of process codes

The 2781 RTE reports were categorised by process code according to TSRT irrespective of classification, so that the main themes could be derived. Figure 3 shows 43.3% (n = 1203) of the RTE were reported to have occurred during treatment unit processes. This was true for all classifications of RTE except near misses where the majority of RTE reported were associated with the pretreatment planning process. Previous analyses have indicated that the majority of non-conformances were associated with pretreatment planning process. 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.

Figure 3. Breakdown of RTE main activity codes reported, August to November 2017 (n = 2781)
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 10.8% (n = 300) of all the reports; 88.7% (n = 266) of these reports were level 3 events. The second most commonly occurring RTE was ‘accuracy of data entry’ at 4.8% (n = 134) followed by ‘use of on-set imaging’ 4.8% (n = 133). Of note, 49.3% (n = 591) 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 0.8% (n = 9) of the most frequently reported subcodes were classified as a reportable or non-reportable radiation incident.

![Diagram of RTE reports by classification level](image)

**Figure 4. Breakdown of RTE main themes by classification level reported, August to November 2017 (n = 1198/2781 subset of RTE)**

### Classification of radiotherapy errors

Each of the 2781 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, 98.0% (n = 2726) were minor radiation, near miss or other non-conformities with little or no impact on patient outcome. Of the remaining 2.0% (n = 55) RTE reports, only 1.0% (n = 27) were reportable under IR(ME)R^8 to the appropriate authority. It was reported in a national survey^6 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 IRR2017. 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 the treatment.

There were 27 reportable radiation incidents submitted to the voluntary system from August to November 2017 (Figure 5), comprising 1.0% of the RTE reviewed; this is a slight increase from 16 (0.6%) 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’ and ‘on-set imaging: approval process’ each comprised 11.1% (n = 3) of these reportable radiation incidents and was the most frequently occurring process subcodes of all reportable radiation incidents reported for this time period. An example of the type of RTE associated with ‘choice of other current treatment of interventions and their sequencing and their timing’ included pretreatment exposures being authorised and performed on a patient who required other interventions, including surgical debulking, rendering the exposure unusable. This was also the most frequently occurring process subcode of all reportable radiation incidents in the previous four month analysis (18.8%, n = 3). RTE associated with ‘on-set imaging: approval process’ include the
mismatch of imaging examples included mismatching to the incorrect vertebrae for spine treatments.

‘Patient data ID process’, ‘localisation of intended volume’, ‘patient positioning’ and ‘setting of couch position/angle’ each comprised 7.4% (n = 2) of all reportable radiation incidents reported for this time period. The remaining reports were singular events spread across 13 different subcodes. They are grouped in Figure 6 as miscellaneous.

Figure 6. Breakdown of reportable radiation incidents (level 1) by process subcode reported, August to November 2017 (n = 27)

Non-reportable radiation incident

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

Non-reportable radiation incidents comprised 1.0% (n = 28) of the RTE reported from August to November 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 18 different subcodes. ‘Patient positioning’ comprised 14.3% (n = 4) and was the most frequently occurring event within the non-reportable radiation incidents, in contrast to the previous 4 month analyses where ‘localisation of intended volume’ was the most common non-reportable radiation incident (15.2%, n = 5). An example of a RTE associated with ‘patient positioning’ included arms positioned by patients sides instead of above the head as planned. Singular events reported are spread across 12 different subcodes and grouped in Figure 7 as miscellaneous.
Figure 7. Breakdown of non-reportable radiation incidents (level 2) by process subcode reported, August to November 2017 (n = 28)

Minor radiation incident

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

Minor radiation incidents comprised 33.7% (n = 937) of the RTE reported from August to November 2017 (Figure 5); this is consistent with the previous four month analysis⁵.

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 (28.3%, n = 266). Examples of this type of minor radiation incident included using the incorrect filter for a CBCT. The second most frequently occurring event within this subset was ‘use of on-set imaging’ (6.6%, n = 62), followed by ‘on-set imaging: approval process’ (6.4%, n = 60).

A large proportion of the reports in this classification were related to on-set imaging (45.8%, n = 429). Which is consistent with the previous four-monthly analysis⁵ when 43.6% (n = 299) 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, (11.8%, n = 111), examples of this type of RTE includes CBCT faults or CBCT fault during acquisition. 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, August to November 2017 (n = 660/937 subset of RTE)

Near miss

Potential radiation incident that was detected and prevented before treatment delivery

Near misses comprised 24.5% (n = 682) of the RTE reported from August to November 2017 (Figure 5). Figure 9 shows the most frequently occurring process subcodes across this level of RTE. ‘Accuracy of data entry’ and ‘documentation of instructions’ each comprised of (7.9%, n = 54). Further details on the error ‘accuracy of data entry’ can be found in issue 2 of Safer Radiotherapy and issue 8 contained further details on ‘documentation of instruction’.

Figure 9. Breakdown of the most frequently occurring near misses (level 4) by process subcode reported, August to November 2017 (n = 321/682 subset of RTE)
Other non-conformance

Non-compliance with some other aspect of a documented procedure, but not directly affecting radiotherapy delivery²

Other non-conformance comprised 39.8% (n = 1107) of the RTE reported from August to November 2017 (Figure 5). The most frequently occurring subcode was ‘accuracy of data entry’ (5.0%, n = 55), (Figure 10). Followed by ‘on-set imaging: approval process’ (4.2%, n = 47) and ‘management of process flow within planning’ (4.1%, n = 45). Both ‘accuracy of data entry’ and ‘management of process flow within planning’ were included in the most frequently occurring non-conformances for the previous four-monthly analysis⁵, however ‘on-set imaging: approval process’ was not included in the previous four-monthly analysis.

Figure 10. Breakdown of the most frequently occurring non-conformances (level 5) by process subcode reported, August to November 2017 (n = 393/1107 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 workflow¹⁰

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 2781 RTE reports for the reporting period August to November 2017, 2020 subcodes were identified as safety barriers (SB). Only 1.4% (n = 29) of SBs failed and led to a Level 1 or 2 RTE. Treatment unit processes were attributed to 41.0% (n = 830) of all SBs. The most common SBs are represented in Figure 11. Treatment unit process ‘end of process checks’ was the most commonly reported failed SB (11.9%, n = 241). ‘End of process checks’ across the pathway account for 35.4% (n = 716) of all reported failed SBs. Issue 4 of Safer Radiotherapy⁴ includes guidance on minimising the occurrence of RTE associated with ‘end of process checks’.
Causative factors

Use of causative factor taxonomy enables identification of system problems or root causes that could precipitate a range of different incidents. The new causative factor (CF) taxonomy has been adopted by 47 (85.4%) out of 55 RT departments and has been applied to 1322 (47.5%) RTE reports for this reporting period. This is a marked increase since the last reporting period when 32 (62.7%) out of 51 RT providers applied the CF taxonomy to 955 (37.7%) RTE. Following consistency checking, PHE coded a further 140 reports with CF taxonomy, resulting in 1462 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 1462 RTE analysed 1891 CF were identified.

Figure 12 shows the most commonly occurring CFs and consistent with the previous analysis, the most commonly occurring CF was individual ‘slips and lapses’ (28.0%, n = 530), closely followed by ‘adherence to procedures/protocols’ (19.1%, n= 362). ‘Slips and lapses’ were most frequently attributed to ‘on-set imaging: production process’ (9.4%, n = 50), and ‘adherence to procedures/protocols’ were most frequently attributed to ‘use of on-set imaging’ ( 8.5%, n = 31). Issue 22 of Safer Radiotherapy 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’ (16.9%, n = 319). This was most frequently attributed to pretreatment ‘documentation of instructions/information’ (10.0%, n = 32).
Figure 12. Breakdown of most common causative factors by classification level, August to November 2017 (n = 1787/1891 subset of data)

**Brachytherapy errors**

Errors coded with brachytherapy process codes as the primary code account for 0.9% (n = 25) of radiotherapy errors for the reporting period August to November 2017, this is a slight increase from the previous four-monthly report (0.6%, n = 15). Brachytherapy is a small specialised practice within radiotherapy, therefore we would expect the number of brachytherapy associated RTE to be low. The majority of the brachytherapy errors reported were near misses or non-conformances (84.0%, n = 21) with the remaining errors being minor radiation incidents (16.0%, n = 4). The most frequently occurring subcode was ‘initial positioning of applicators/sources’ (28.0%, n = 7) (Figure 13). An example of this type of error included the applicator not sitting in the correct position at time of MRI scan.

Issue 20 of *Safer Radiotherapy* includes further guidance on brachytherapy RTE^4^.

Figure 13. Breakdown of brachytherapy errors coded ‘15’ by classification level, August to November 2017 (n = 25)
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


