Safer Radiotherapy
The radiotherapy newsletter of Public Health England

Supplementary Data Analysis
Issue 22 – Full radiotherapy error data analysis
December 2016 to March 2017
About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. It does this through world-class science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. PHE is an operationally autonomous executive agency of the Department of Health.
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Full radiotherapy error data analysis
December 2016 to March 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.

Between 2010 and 2014, 100% of NHS RT providers had submitted RTE reports using the TSRT9 trigger code with 98.3% (58 of 59) of RT providers reporting in 2014. During January to December 2015 the number of RT providers rose to 61, with 96.7% (n = 59) reporting that year; in 2016 only 95.1% (n = 58) providers reported. For this reporting period December 2016 to March 2017, 88.5% (n = 54) 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 616.5. This is a 17.1% decrease in the number of RTEs received from the last reporting period August to November 2016; however this pattern is consistent with 2014 and 2015 for this particular reporting period. 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 0 days to a maximum of 519 days for this reporting period, with a mean of 64.2 days. This is consistent with the last reporting period (mean = 64.5 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\textsuperscript{4} of Safer Radiotherapy provides further information on the frequency of reporting.

Figure 1 shows the number of RTE reported by providers during December 2016 to March 2017. The average number of reports per provider is 45.7 for this subset of data, indicating that over half of providers (66.7\%, n = 36) 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\textsuperscript{6} 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.

\textbf{Figure 1. Number of RTE reported per RT provider, December 2016 to March 2017 (n = 2466)}

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 2262 of the 2493 reports received from December 2016 to March 2017. This demonstrates a continuation of the high adoption rate (90.7%) 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. From the 2262 RTE reports classified and coded locally, a 77.8% level of consistency was achieved (Figure 2). The Good Practice in Radiotherapy Error Reporting – Supplementary Guidance Series gives examples of the application of the classification and process coding. In addition, 204 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.

Figure 2. Breakdown of reports, December 2016 to March 2017 (n = 2493)

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 0.76% (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. 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. Eight 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, 2466 RTE for the reporting period from December 2016 to March 2017 were included for analysis. The analysis is presented here.

**Breakdown of process codes**

The 2466 RTE reports were categorised by process code according to TSRT irrespective of classification, so that the main themes could be derived. The most frequently reported RTE were associated with treatment unit processes across all classifications of RTE except non-conformances where the majority of RTE reported were associated with the pretreatment planning process. Figure 3 shows 43.6% (n = 1074) of the RTE were reported to have occurred during treatment unit processes. 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 11.2% (n = 275) of all the reports; 89.1% (n = 245) of these reports were level 3 events. This was followed by ‘on-set imaging: approval process’ at 6.4% (n = 158) and ‘documentation of instructions’ 5.7% (n = 141). Of note, just over half (54.0%, n = 632) 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 2.3% (n = 27) 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, December 2016 to March 2017 (n = 2466)

Figure 4. Breakdown of RTE main themes by classification level reported, December 2016 to March 2017 (n = 1170/2466 subset of RTE)
Classification of radiotherapy errors

Each of the 2466 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, 97.5% (n = 2405) were minor radiation, near miss or other non-conformities with little or no impact on patient outcome. Of the remaining 2.5% (n = 61) RTE reports, only 1.1% (n = 27) were reportable under IR(ME)R³ to the appropriate authority. It was reported in a national survey⁵ 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.

Figure 5. Classification breakdown of RTE reports, December 2016 to March 2017 (n = 2466)

Reportable radiation incident

Reportable radiation incidents as defined in Towards Safer Radiotherapy² fall into the category of reportable under one of two statutory instruments – IR(ME)R⁹ or IRR99¹⁰. 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.

* It should be noted that IR(ME)R Regulation 4(5) requires all patient exposures deemed much greater than intended be reported to the appropriate authority.
There were 27 reportable radiation incidents submitted to the voluntary system between December 2016 to March 2017 (Figure 5), comprising 1.1% of the RTE reviewed; this is consistent with 1.0% (n = 31) for the previous four-monthly analysis.

Further analysis of the reports indicates the points in the pathway at which the reportable incidents occurred (Figure 6). ‘On-set imaging: approval process’ and ‘use of on-set imaging’ each comprised 11.1% (n = 3) of these reportable radiation incidents; these were the most frequently occurring process subcodes of all reportable radiation incidents reported for this time period. Examples of this type of RTE include 5 repeated verification images for 1 fraction and exceeding a departmental imaging threshold by 30% without appropriate authorisation.

Treatment unit process subcode ‘patient positioning’, data entry ‘accuracy of data entry’, pretreatment ‘documentation of instructions’ and referral for treatment ‘verification of diagnosis/extent/stage’ each comprised 7.4% (n = 2) of reportable RTE. The remaining reports were singular events spread across 13 different subcodes. They are grouped in Figure 6 as miscellaneous.

Non-reportable radiation incident

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

Non-reportable radiation incidents comprised 1.4% (n = 34) of the RTE reported between December 2016 to March 2017 (Figure 5); this is a decrease from 2.4% (71) for 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. ‘On-set imaging: approval process’ comprised 29.4% (n = 10) and was the most
frequently occurring event within the non-reportable radiation incidents, consistent with the previous four analyses. Guidance to minimise the likelihood of occurrence of this error can be found in issue 3 of *Safer Radiotherapy*\(^4\). ‘Management of variations/unexpected events/errors’ comprised of 8.8% (n = 3) of these non-reportable events. ‘Accuracy of data entry’, ‘positioning of patient’ and ‘localisation of intended volume’ each comprised 5.9% (n = 2) of non-reportable radiation incidents. The remaining reports were singular events spread across 15 different subcodes. They are grouped in Figure 7 as miscellaneous.

**Figure 7. Breakdown of non-reportable radiation incidents (level 2) by process subcode reported, December 2016 to March 2017 (n = 34)**

**Minor radiation incident**

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

Minor radiation incidents comprised 33.3% (n = 820) of the RTE reported between December 2016 and March 2017 (Figure 5). The most frequently occurring level 3 process subcodes (Figure 8) consisted of only treatment unit processes. ‘On-set imaging: production process’ was the most frequently occurring event (29.9%, n = 245). The second most frequently occurring event within this subset was ‘on-set imaging: approval process’ (9.8%, n = 80), followed by ‘use of on-set imaging’ (7.3%, n = 60). In parallel to the previous four-monthly analysis\(^5\), 51.2% (n = 420) of the reports in this classification were related to on-set imaging. A number of level 3 RTE (12.4%, n = 102) with the primary code ‘on-set imaging: production process’ were attributed to equipment malfunction, this is approximately half of the amount from the previous analysis\(^5\) (24.2%, n = 229). Malfunction of equipment 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 25.2% (n = 621) of the RTE reported between December 2016 and March 2017 (Figure 5). The most frequently occurring process subcodes across this level of RTE were pretreatment ‘documentation of instructions’ (10.3%, n = 64), followed by ‘accuracy of data entry’ (8.9%, n = 55), consistent with the previous four-monthly analysis⁵ (Figure 9).

Figure 8. Breakdown of most frequently occurring minor radiation incidents (level 3) by process subcode reported, December 2016 to March 2017 (n = 596/820 subset of RTE)

Figure 9. Breakdown of the most frequently occurring near misses (level 4) by process subcode reported, December 2016 to March 2017 (n = 319/621 subset of RTE)
Other non-conformance

Non-compliance with some other aspect of a documented procedure, but not directly affecting radiotherapy delivery\textsuperscript{2}

Other non-conformance comprised 39.1\% (n = 964) of the RTE reported between December 2016 and March 2017 (Figure 5). The most frequently occurring subcode was ‘management of process flow within planning’ (9.3\%, n = 90), (Figure 10) which is consistent with the previous four-monthly analysis\textsuperscript{4}. Issue 5 of Safer Radiotherapy\textsuperscript{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, December 2016 to March 2017 (n = 385/964 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{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 2466 RTE reports for the reporting period December 2016 to March 2017, 1655 subcodes were identified as safety barriers (SB). Of note only 1.9\% (n = 31) SBs failed and led to a Level 1 or 2 RTE, 71.0\% (n = 22) of these were attributed to treatment unit processes and 59.1\% (n = 13) of these errors related to ‘on-set imaging: approval process’. The most common SBs are represented in Figure 11. Treatment unit ‘end of process checks’ is the most commonly reported failed SB (14.4\%, n=238) and ‘end of process checks’ at data entry, pretreatment planning and pretreatment activities account for 23.7\% (n=392) of all reported failed SBs in this subset of data. Issue 19 of
Safer Radiotherapy\(^4\) includes guidance on minimising the occurrence of RTE associated with treatment unit ‘end of process checks’.

**Figure 11. Breakdown of safety barriers reported, December 2016 to March 2017 (n = 1240/1655 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*\(^{12}\)

The new causative factor (CF) taxonomy has been adopted by 17 (31.5%) out of 54 RT departments and has been applied to 276 (14.7%) RTE reports out of 1878 during the period January to March 2017 (Figure 12). Data received for the month of December 2016 (n = 588) was not included in the analysis of CFs as the DoL\(^3\) was published at the end of December 2016. Of the 324 CF attributed to the 276 RTE reports, the most commonly occurring CF was individual ‘slips and lapses’ (36.7%, n = 119) and was most frequently attributed to errors related to ‘completion of request for treatment’ (14.3%, n = 17). The second most commonly occurring CF was procedural ‘adherence to procedures/protocols’ (24.1%, n = 78) and was reported in 8 process codes across the pathway, with the majority within treatment unit processes (29.5%, n= 23). The third most reported CF was individual ‘communication’ (17.3%, n = 56) and was most frequently attributed to pretreatment ‘documentation of instructions/information’ (14.3%, n = 8).
Figure 12. Breakdown of causative factors, January to March 2017 (n = 324)

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

