Safer Radiotherapy
The radiotherapy newsletter of Public Health England

Supplementary Data Analysis
Issue 20 – Full radiotherapy error data analysis
April to July 2016
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
April to July 2016

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 code1, and directly to PHE from providers in Northern Ireland and Scotland.

The classification and coding from Towards Safer Radiotherapy2 (TSRT) were employed for the analysis. Where appropriate, comparisons have been drawn with previous issues of Safer Radiotherapy3 and the PHE supplementary data analyses4. The analysis has been reviewed by the Patient Safety in Radiotherapy Steering Group, whose comments have been incorporated into this document.

The number of providers submitting RTE each year is illustrated in Figure 1. 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. To date in 2016, 93.4% (n = 57) of providers have submitted RTE reports, representing the vast majority of providers from across the UK. 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.

![Figure 1. Maximum number of RT providers contributing each year to Safer Radiotherapy and the supplementary data analysis](image)
Please note that providers contributing to the national analysis are allocated a unique identifier in order to anonymise the data received at PHE.

The average number of reports received by PHE each month for this reporting period was 686. For 2016 so far the average number of reports received each month is 681 (Figure 2), which is an increase from 2015 with an average of 545 reports. 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.

Figure 2. Average number of incident reports per month each year contributing to Safer Radiotherapy and the supplementary data analysis

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 one day to a maximum of 364 days for this reporting period, with a mean of 57.9 days. This is a smaller range, and mean, compared to the last reporting period (mean = 69.2 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 133 of Safer Radiotherapy provides further information on the frequency of reporting.
Figure 3. Number of incidents reported per RT provider, April to July 2016 (n = 1927/2732 subset of RTE)

Figure 3 shows the number of RTE reported by a subset of providers (55/57) during April to July 2016. The average number of reports per provider is 35.0 for this subset of data, indicating that over half of providers (61.8%, n = 34) are reporting less than the national average. The two providers not included in Figure 3 are outliers with one provider reporting 372 RTE and the other 433 RTE. 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\(^8\) 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 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 for activity or service specification. The RTE reports received at PHE are anonymised and received as part of a voluntary reporting scheme. 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 2429 of the 2750 reports received between April and July 2016. This demonstrates a continuation of the high adoption rate (88.3%) 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 four individual pathway codes can be allocated locally by RT providers to each RTE report. During consistency checking each of these pathway codes and the classification are reviewed. From the 2429 RTE reports classified and coded locally, a 79.7% level of consistency was achieved (Figure 4); this is similar to the previous analysis (79.0%). The Good Practice in Radiotherapy Error Reporting – Supplementary Guidance Series gives examples of the application of the classification and process coding. In addition, 303 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 4. Breakdown of reports, April to July 2016 (n = 2750)](image)

All providers are asked to apply a trigger code, classification and coding to their RTE reports to facilitate both local and national analysis.

Non-RTE reports submitted with the TSRT9 trigger code formed 0.6% (n = 17) 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. One report was not classified and coded and did not contain sufficient text for PHE staff to do so and was also excluded from the analysis.

In total, 2732 RTE for the reporting period from April to July 2016 were included for analysis. The analysis is presented here.

**Classification of radiotherapy errors**

Each of the 2732 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, 97.3% (n = 2659) were minor radiation, near miss or other non-conformities with little or no impact on patient outcome. Of the remaining 2.7% (n = 73) RTE reports, only 1.3% (n = 36) were reportable under IR(ME)R7* to the appropriate authority. It was reported in a national survey that providers are more likely to submit RTE reports of higher classification levels (levels 1 to 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.

![Classification breakdown of RTE reports, April to July 2016 (n = 2732)](image)

*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.*
remaining treatment fractions so the incident did not have a significant impact on the patient or the outcome of their treatment.

There were 36 reportable radiation incidents submitted to the voluntary system between April and July 2016, comprising 1.3% of the RTE reviewed; this is an increase from 0.9% (22) for the previous four-monthly analysis\(^4\). This could be due to an increase in radiation incidents reported during pre-treatment activities from 18.2% (\(n = 4\)) being the third most common primary code in the previous analysis to 41.7% (\(n = 15\)) and the most common primary code in this analysis (Figure 6).

![Figure 6. Breakdown of reportable radiation incidents (level 1) reported, April to July 2016 (n = 36)](image)

Further analysis of the reports indicates the points in the pathway at which the reportable incidents occurred (Figure 7). ‘Localisation of intended volume’ comprised 22.2% (\(n = 8\)) of the RTE. This was the most frequently occurring process subcode of all reportable radiation incidents reported for this time period.

Pre-treatment ‘Production of images demonstrating correct detail’ comprised 8.3% (\(n = 3\)). Treatment ‘on-set imaging: approval process’, ‘patient data ID process’, ‘ID of reference marks’, ‘setting of couch position/angle’ communication of intent ‘authorisation to irradiate’ and referral for treatment ‘verification of diagnosis/extent/stage’ each comprised 5.6% (\(n = 2\)) of reportable RTE. The remaining reports were singular events spread across 13 different subcodes. They are grouped in Figure 7 as miscellaneous.
Non-reportable radiation incident

Radiation incident not reportable, but of potential or actual clinical significance²

Non-reportable radiation incidents comprised 1.4% (n = 37) of the RTE reported between April and July 2016 (Figure 8); this is an increase from 0.8% (19) for the previous four-monthly analysis⁴. Of these RTE, 54.1% (n = 20) occurred during treatment unit processes, an increase of 40% in errors attributed to this process code.
Further analysis indicates the points in the pathway at which non-reportable radiation incidents occurred (Figure 9). The reports were spread across 23 different subcodes. ‘On-set imaging: approval process’ comprised 16.2% (n = 6) and was the most frequently occurring event within the non-reportable radiation incidents, consistent with the previous two analyses. Guidance to minimise the likelihood of occurrence of this error can be found in issue 3 of *Safer Radiotherapy*²: ‘Production of images demonstrating correct detail’ and ‘Movements from reference marks’ each comprised 10.8% (n = 4); ‘Use of immobilisation devices’, ‘Completion of request for treatment’ and ‘Recording of non-standard information’ each comprised 5.4% (n = 2) and the remaining reports were spread across 17 different subcodes, all of which were singular events. They are grouped in Figure 9 as miscellaneous.

![Figure 9. Breakdown of non-reportable radiation incidents (level 2) by process subcode reported, April to July 2016 (n = 37)](image)

**Minor radiation incident**

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

Minor radiation incidents comprised 32.6% (n = 890) of the RTE reported between April and July 2016. Consistent with previously analysed data, the most frequently reported RTE in this group were associated with treatment unit processes (80.6%, n = 717). RTE reports included 15 different codes within this classification, 5 of which are represented in the miscellaneous category (Figure 10).
Figure 10. Breakdown of minor radiation incidents (level 3) reported, April to July 2016 (n = 890)

The top 10 most frequently occurring level three process subcodes (Figure 11) incorporated mostly treatment unit processes, with one subcode from treatment data entry ‘accuracy of data entry’ (2.3%, n = 20) and one subcode from pre-treatment ‘documentation of instructions’ (2.0%, n = 18). Issues two and eight, respectively, of Safer Radiotherapy 3 include guidance on minimising the risk of occurrence of these RTE.

The three most frequently occurring events within the treatment subset of minor radiation incidents were imaging associated errors. ‘On-set imaging: production process’ was the most frequently occurring event (38.4%, n = 342). The second most frequently occurring event within this subset was ‘on-set imaging: approval process’ (8.0%, n = 71), followed by ‘use of on-set imaging’ (5.8%, n = 52). In parallel to the previous four-monthly analysis 4, 56.0% (n = 497) of the reports in this classification were related to on-set imaging. A number of level three RTE (22.0%, n = 196) 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 3.
Figure 11. Breakdown of most frequently occurring minor radiation incidents (level 3) by process subcode reported, April to July 2016 (n = 673/890 subset of RTE)

Near miss

Potential radiation incident that was detected and prevented before treatment delivery

Near misses comprised 25.0% (n = 683) of the RTE reported between April and July 2016. RTE reports included 19 different codes within this classification, 10 of which are represented in the miscellaneous category (Figure 12).

The most frequently occurring process subcodes across this level of RTE were ‘accuracy of data entry’ (12.3%, n = 84), followed by pre-treatment ‘documentation of instructions’ (7.6%, n = 52), consistent with the previous four-monthly analysis (Figure 13).
Figure 12. Breakdown of near misses (level 4) reported, April to July 2016 (n = 683)

Figure 13. Breakdown of the most frequently occurring near misses (level 4) by process subcode reported, April to July 2016 (n = 336/683 subset of RTE)
Other non-conformance

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

‘Other non-conformance’ comprised 39.7% (\(n = 1086\)) of the RTE reported between April and July 2016. RTE reports varied across the patient pathway including 19 different codes within this classification, 10 of which are represented in the miscellaneous category (Figure 14). The most frequently occurring process code was ‘pre-treatment planning process’, accounting for 19.2% (\(n = 208\)) of the reports in this classification, which is consistent with the previous four-monthly analysis\(^4\). ‘Treatment unit process’ is the second most frequently occurring process code, comprising 17.1% (\(n = 186\)), which is an increase from the previous data analysis\(^4\) (14.5%, \(n = 125\)), where the second most frequently occurring process code was ‘Booking process’.

![Figure 14. Breakdown of non-conformances (level 5) reported, April to July 2016 (\(n = 1086\))](image)

The most frequently occurring subcode was ‘documentation of instructions’ (6.5%, \(n = 70\)) closely followed by ‘bookings made according to protocol’ (6.4%, \(n = 69\)) (Figure 15). Issues 17 of *Safer Radiotherapy*\(^3\) includes guidance on minimising the occurrence of RTE associated with ‘bookings made according to protocol’.
Figure 15. Breakdown of the most frequently occurring non-conformances (level 5) by process subcode reported, April to July 2016 (n = 376/1086 subset of RTE)

Breakdown of process codes

The 2732 RTE reports were categorised by process code (Figure 16) according to TSRT irrespective of classification, so that the main themes could be derived. Figure 16 shows 40.8% (n = 1115) of the RTE reported were associated with treatment unit processes, this is consistent with the previous analysis. It is expected this 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 17. This subset of data was also broken down by classification. The most commonly occurring RTE reported was ‘on-set imaging: production process’ at 13.7% (n = 373) of all the reports; 91.7% (n = 342) of these reports were level three events. This was followed by ‘on-set imaging: approval process’ at 5.3% (n = 144) ‘documentation of instructions’ 5.2% (n = 141) and ‘accuracy of data entry’ at 5.1% (n = 139). Of note, over half (54.6%, n = 694) of the most frequently reported subcodes were classified as ‘near misses’ (level four) or ‘other non-conformances’ (level five) with no impact on patient outcome. Only 1.1% (n = 14) of the most frequently reported subcodes were classified as a reportable or non-reportable radiation incident.
Figure 16. Breakdown of RTE main activity codes reported, April to July 2016 (n = 2732)

Figure 17. Breakdown of RTE main themes by classification level reported, April to July 2016 (n = 1270/2732 subset of RTE)
Secondary process coding

A total of 30.2% (n = 823) of RTE submitted contained secondary process coding, indicating a second point in the pathway where the original error had gone undetected. This is consistent with the previous analysis\(^4\). ‘End of process checks’ on the treatment unit processes was the most commonly reported secondary process code at 17.6% (n = 145) (Figure 18). The introduction of the use of safety barriers, as part of the refinement of the TSRT pathway coding, will encourage the reporting of sequential process codes to provide information about failing and successful safety barriers within RT. It is expected that this will contribute to the development of learning from RTE.

Figure 18. Breakdown of the most frequently occurring secondary process codes reported, April to July 2016 (n = 547/823 subset of RTE)

End of process checks

The ‘end of process check’ subcode is repeated across the radiotherapy pathway. A breakdown of the dataset by ‘end of process check’ process subcode was undertaken. It includes process subcodes 9k, 10l, 11t, 12g and 13hh (Figure 19).

Advice on minimising the occurrence of RTE related to end of process checking is given in issue 4 of *Safer Radiotherapy*\(^3\). A total of 26.9% (n = 735) of the RTE reported were not captured during ‘end of process checks’, occurring most frequently at the treatment unit processes.
Figure 19. Breakdown of ‘end of process checks’ by point in the radiotherapy pathway reported, April to July 2016 (n = 735)

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


