Safer Radiotherapy
The radiotherapy newsletter of Public Health England

Supplementary Data Analysis
Issue 16 – Full radiotherapy error data analysis
December 2014 to March 2015
Safer Radiotherapy

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 2014 to March 2015

This analysis has been undertaken by Public Health England (PHE) on radiotherapy errors and near misses (RTEs) reported voluntarily by NHS radiotherapy (RT) departments. Reports are submitted from England and Wales to the National Reporting and Learning System (NRLS) using the TSRT9 trigger code, and directly to PHE from Northern Ireland and Scotland.

The classification and coding from *Towards Safer Radiotherapy* (TSRT) was employed for the analysis. Where appropriate, comparisons have been drawn with previous issues of *Safer Radiotherapy* and the PHE supplementary data analyses.

The analysis has been reviewed by the Patient Safety in Radiotherapy Steering Group whose comments have been incorporated into this document.

Between December 2014 and March 2015, 56 NHS RT departments submitted RTE reports using the TSRT9 trigger code, representing the vast majority of departments from across the UK. The percentage of participating departments has increased from 88.1% (n = 52 out of 59) at the last analysis (September to November 2014) to 93.3% (n = 56 out of 60) within this four-month reporting period. New radiotherapy providers are welcome to contact PHE for advice on how to submit data. This continued increase of departments reporting reflects the commitment of the community to improving patient safety in radiotherapy. However, it is clear that there is some disparity in the regularity of reporting, with 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 328 days, with a mean of 51 days. Issue 13 of *Safer Radiotherapy* provides further information on the frequency of reporting.

The number of departments contributing to each issue of *Safer Radiotherapy* and the supplementary data analysis series is illustrated in Figure 1. This will help local departments to compare identified trends against the national picture. A mature reporting culture is reflected in the increase in the number of departments reporting.

Although the number of departments reporting in this four-month period has increased, the average number of reports has reduced (n = 462) since the last reporting period (n = 564) (Figure 2). PHE will continue to monitor this trend.

NB. Departments contributing to the national analysis are allocated a unique identifier in order to anonymise the data shared with PHE.

If individual departments can offer further advice in preventing any RTEs please email the RT Team at radiotherapy@phe.gov.uk.
Figure 1. Number of radiotherapy departments contributing to each issue of *Safer Radiotherapy* and the supplementary data analysis

Figure 2. Monthly average number of incident reports contributing to each issue of *Safer Radiotherapy* and the supplementary data analysis
Monitoring of TSRT classification and coding by RT departments

The TSRT classification and coding had been applied by local RT departments to 1618 of the 1867 RTEs received between December 2014 and March 2015. This demonstrates a continuation of the high adoption rate in the application of the TSRT classification. All departments are asked to apply classification and coding to their RTE reports to facilitate both local and national analysis.

Consistency checking was undertaken by PHE staff on the application of the TSRT classification and coding system by RT departments. Up to four individual pathway codes can be allocated locally by RT departments to each RTE report. During consistency checking each of these pathway codes and the classification are reviewed. From the 1618 RTE reports classified and coded, a 90.2% level of consistency was achieved (Figure 3). The *Good Practice in Radiotherapy Error Reporting – Supplementary Guidance Series* gives examples of the application of the classification and process coding\(^5\). In addition, 233 RTEs were classified and coded by PHE staff using the supporting text supplied by the local departments. Issue 8 of *Safer Radiotherapy* provides top tips for the application of coding and classification\(^3\).

Non-RTE reports submitted with the TSRT9 trigger code formed 0.9% (n = 16) of the total number of reports for this reporting period. Data and accompanying text indicate that these were patient safety incidents (PSI). This is consistent with previous analyses. Further information on PSI can be found in issue 5 of *Safer Radiotherapy*\(^3\). The non-RTE reports were excluded from the detailed analysis.

In total, 1851 RTEs for the reporting period from December 2014 to March 2015 were included for analysis. The analysis is presented here.

![Figure 3. Breakdown of reports, December 2014 to March 2015 (n = 1867)](image-url)
Classification of radiotherapy errors

Each of the 1851 reports was classified as ‘other non-conformance’, ‘near miss’, ‘minor radiation incident’, ‘non-reportable radiation incident’ or ‘reportable radiation incident’ (Figure 4). Of the RTE reports, 95.7% (n = 1772) were minor radiation, near miss or other non-conformities with little or no impact on patient outcome. Of the remaining 79 RTE reports, only 46 were reportable under IR(ME)R6* to the appropriate authority. Clinical departments are more likely to submit reports of higher level RTE (level 1–3) to the national voluntary reporting system, this is reported to be due to resource constraints and is discussed further in the non-conformance section of this document7.

![Figure 4. Classification breakdown of RTE reports, December 2014 to March 2015 (n = 1851)](image)

**Reportable radiation incident**

Reportable radiation incidents as defined in *Towards Safer Radiotherapy*2 fall into the category of reportable under one of two statutory instruments – IR(ME)R6 or IRR998. 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 fraction of treatment. 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 46 reportable radiation incidents submitted to the voluntary system between December 2014 and March 2015, comprising 2.5% of the RTEs reviewed. This is a slight increase from 1.6% (n = 27) at the previous three-month analysis. Of these radiation incidents, 18 (39.1%) occurred during treatment unit processes (Figure 5).

*NB. IR(ME)R Regulation 4(5) requires all patient exposures deemed much greater than intended be reported to the appropriate authority.*

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Figure 5. Breakdown of reportable radiation incidents (level 1) reported, December 2014 to March 2015 (n = 46)

Further analysis of the reports indicates the points in the pathway at which the reportable incidents occurred (Figure 6). Pretreatment ‘positioning of patient’ comprised 13.0% (n = 6) and was the most frequently occurring process subcode of all reportable radiation incidents reported for this time period. Treatment ‘on-set imaging: approval process’ comprised 10.9% (n = 5) reports. An example of a report containing ‘positioning of patient’ includes the need to complete additional CT planning scans due to incorrect patient positioning and ‘on-set imaging: approval process’ includes incorrect on-set image approval leading to a geographical miss. Issue 3 of Safer Radiotherapy\(^3\) includes guidance on minimising the risk of occurrence of this RTE. The remaining reports were spread across 21 different subcodes and are grouped below as miscellaneous.

Figure 6. Breakdown of reportable radiation incidents (level 1) by process subcode reported, December 2014 to March 2015 (n = 46)
Non-reportable radiation incident

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

Non-reportable radiation incidents comprised 1.8% (n = 33) of the RTEs reported between December 2014 and March 2015 (Figure 7). Of these RTEs, 66.7% (n = 22) occurred during treatment unit processes.

Further analysis indicates the points in the pathway at which non-reportable radiation incidents occurred (Figure 8). ‘On-set imaging: approval process’ and ‘movements from reference marks’ at 12.1% (n = 4) were equally the most frequently occurring events within the non-reportable radiation incidents. An example of a report containing ‘on-set imaging: approval process’ includes an incorrect online image match leading to digital moves in an incorrect direction. A report containing ‘movements from reference marks’ includes scenarios where the incorrect digital move is carried out. Issue 1 of Safer Radiotherapy includes guidance on minimising the risk of occurrence of this RTE. The remaining reports were spread across 17 different subcodes and are grouped below as miscellaneous.
Figure 8. Breakdown of non-reportable radiation incidents (level 2) by process subcode reported, December 2014 to March 2015 (n = 33)

Minor radiation incident

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

Minor radiation incidents comprised 28.9% (n = 536) of the RTEs reported between December 2014 and March 2015. Consistent with previously analysed data, the most frequently reported RTEs in this group were associated with treatment unit processes (74.6%, n = 400). RTE reports included 13 different codes within this classification, three of which are represented in the miscellaneous category (Figure 9).

The top ten most frequently occurring level 3 process subcodes (Figure 10) incorporated mainly treatment unit processes, with one subcode from pretreatment ‘recording of patient-specific instructions’ (2.6%, n = 14) and one from data entry ‘accuracy of data entry’ (2.6%, n = 14). Issues 10 and 2, respectively, of *Safer Radiotherapy*\(^3\) include guidance on minimising the risk of occurrence of these RTEs.

A further breakdown of the treatment unit processes indicates the points in the pathway where the minor radiation incidents occurred. The top three most frequently occurring events within this treatment subset of minor radiation incidents were imaging associated errors. ‘On-set imaging: production process’ was the most frequently occurring event (22.2%, n = 119). The second most frequently occurring event within this subset was ‘use of on-set imaging’ (11.9%, n = 64), followed by ‘on-set imaging: approval process’ (9.1%, n = 49). Issue 7 of *Safer Radiotherapy*\(^3\) includes guidance on the application of the on-set imaging process coding. An example of an ‘on-set imaging: production process’ report was the incorrect setting of jaws, not capturing the anatomy required for image matching, resulting in the need to carry out an additional exposure.
Figure 9. Breakdown of minor radiation incidents (level 3) reported, December 2014 to March 2015 (n = 536)

Figure 10. Breakdown of most frequently occurring minor radiation incidents (level 3) by process subcode reported, December 2014 to March 2015 (n = 383/536 subset of RTEs)

Near miss

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

Near misses comprised 30.4% (n = 563) of the RTEs reported between December 2014 and March 2015. RTE reports included 16 different codes within this classification, seven of which are represented in the miscellaneous category (Figure 11).
Figure 11. Breakdown of near misses (level 4) reported, December 2014 to March 2015 (n = 563)

The top most frequently occurring subcodes are presented in Figure 12. The most frequently occurring process subcodes across this level of RTE were treatment ‘on-set imaging: approval process’ (8.1%, n = 46) followed by pretreatment ‘documentation of instructions’ (7.8%, n = 44). An example of a report containing ‘on-set imaging: approval
process’ includes not completing the second approval of on-set imaging as per departmental procedure.

A total of 23 different treatment unit subcodes from process code 13 were reported in this classification. Imaging associated errors made up 64.7% (n = 121) of these treatment unit process subcodes.

Other non-conformance

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

‘Other non-conformance’ comprised 36.4% (n = 673) of the RTEs reported between December 2014 and March 2015. The supplementary survey analysis, published in December 2014, highlighted that only 34.8% (n = 15) of departments submit non-conformances externally to the NRLS or directly to PHE. RTE reports varied across the patient pathway including 20 different codes within this classification, ten of which are represented in the miscellaneous category.

The most frequently occurring process code was the treatment unit process, accounting for 19.9% (n = 134) of the reports in this classification (Figure 13).

![Figure 13. Breakdown of non-conformances (level 5) reported, December 2014 to March 2015 (n = 673)](chart.png)
The most frequently occurring subcodes are presented in Figure 14, the most frequently occurring subcode being ‘bookings made according to protocol’ (7.3%, n = 49) followed by ‘management of process flow within planning’ (5.9%, n = 40). Issue 5 of Safer Radiotherapy\(^3\) includes guidance on minimising the risk of occurrence of this RTE. An example of a report containing ‘booking made according to protocol’ includes the incorrect booking of associated tasks within the oncology management system.

**Secondary process coding**

A total of 28.2% (n = 521) of RTE reports submitted contained secondary process coding, indicating a second point in the pathway where the original error had gone undetected. This is similar to previous analyses. Some 42.4% (n = 221) of these RTEs were coded as ‘end of process checks’, as shown in Figure 15.
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 10l, 11t, 12g and 13hh (Figure 16). Advice on minimising the occurrence of RTEs related to end of process checking is given in issue 4 of Safer Radiotherapy. A total of 16.0% (n = 298) of the RTEs reported were not captured during ‘end of process checks’. This would seem to suggest that the ‘end of process checks’ are failing to detect RTEs in some cases. The introduction of the use of safety barriers as part of the refinement of the TSRT pathway coding, might help identify where ‘end of process checks’ can be strengthened.

Figure 16. Breakdown of ‘end of process checks’ by point in the radiotherapy pathway reported, December 2014 to March 2015 (n = 298)

Breakdown of process codes

The 1851 RTE reports were categorised by process code (Figure 17) according to TSRT irrespective of classification, so that the main themes could be derived.

Figure 17 shows 40% (n = 761) of the RTEs reported were associated with treatment unit processes. This is to be expected as some radiotherapy treatments may span a number of visits providing many opportunities during the treatment unit process for RTEs to occur.

The ten most frequently reported process subcodes in the radiotherapy pathway are presented in Figure 18. The most commonly occurring RTE reported was ‘on-set imaging: production process’ at 7.7% (n = 143) of the total number of reports, of note a number these reports were associated with equipment malfunction (45.0%, n = 64). This was followed by ‘use of on-set imaging’ at 6.5% (n = 121) and ‘on-set imaging: approval process’ at 6.4% (n = 118).
Figure 17. Breakdown of RTE main activity codes reported, December 2014 to March 2015 (n = 1851)

Figure 18. Breakdown of RTE main themes by classification level reported, December 2014 to March 2015 (n = 817/1851 subset of RTEs)
References


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


