Safer Radiotherapy
The radiotherapy newsletter of Public Health England

Supplementary Data Analysis
Issue 19 – Full radiotherapy error data analysis
December 2015 to March 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
December 2015 to March 2016

This analysis has been undertaken by Public Health England (PHE) on radiotherapy errors and near misses (RTEs) 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 and coding from *Towards Safer Radiotherapy*\(^2\) (TSRT) were employed for the analysis. Where appropriate, comparisons have been drawn with previous issues of *Safer Radiotherapy*\(^3\) and the PHE supplementary data analyses\(^4\). The analysis has been reviewed by the Patient Safety in Radiotherapy Steering Group, whose comments have been incorporated into this document.

Between December 2015 and March 2016, 55 NHS RT providers submitted RTE reports using the TSRT9 trigger code, representing the vast majority of providers from across the UK. The percentage of participating providers at 91.7% (\(n = 55\) out of 60) is identical to the previous two reporting periods. The number of providers contributing to each issue of *Safer Radiotherapy* and the supplementary data analysis series is illustrated in Figure 1. New and existing NHS radiotherapy providers are welcome to contact PHE for advice on how to submit data for inclusion in these series of reports.

![Figure 1. Number of radiotherapy providers contributing to each issue of *Safer Radiotherapy* and the supplementary data analysis](image-url)
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 was 593 for this reporting period (Figure 2), which is a decrease from the previous analysis for which an average of 622 reports were received each month. This difference may be due to a larger number of reports being received by PHE in November 2015 (839) and a lower number of reports in December 2015 (355). A mature reporting culture is reflected in the continued participation in reporting by the large number of providers. This continued commitment of providers demonstrates the community’s drive to improve patient safety in radiotherapy.

However, 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 377 days for this reporting period, with a mean of 69.2 days. This is a larger range, and mean, compared to the last reporting period (mean = 60 days); it may be due to receiving data annually from one department. 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.

![Figure 2. Monthly average number of incident reports contributing to each issue of Safer Radiotherapy and the supplementary data analysis](image-url)
The analysis presented in this report will help local departments to compare identified trends against the national picture. In doing so it is expected that these events might be minimised in the future.

Monitoring of TSRT classification and coding by radiotherapy providers

The TSRT classification and coding had been applied by local radiotherapy providers to 2051 of the 2372 reports received between December 2015 and March 2016. This demonstrates a continuation of the high adoption rate (86.5%) 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 radiotherapy providers. Up to 4 individual pathway codes can be allocated locally by radiotherapy departments to each RTE report. During consistency checking each of these pathway codes and the classification are reviewed. From the 2051 RTE reports classified and coded locally, a 79.0% level of consistency was achieved (Figure 3); this is similar to the previous analysis (80.5%)\textsuperscript{3}. The Good Practice in Radiotherapy Error Reporting – Supplementary Guidance Series gives examples of the application of the classification and process coding\textsuperscript{5}. In addition, 295 RTEs were classified or 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\textsuperscript{3}.

![Figure 3. Breakdown of reports, December 2015 to March 2016 (n = 2372)](image-url)
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 0.9% (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. The non-RTE reports were excluded from the detailed analysis. Four 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, 2346 RTEs for the reporting period from December 2015 to March 2016 were included for analysis. The analysis is presented here.

**Classification of radiotherapy errors**

Each of the 2346 RTE 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, 98.3% (n = 2305) were minor radiation, near miss or other non-conformities with little or no impact on patient outcome. Of the remaining 1.7% (n = 41) RTE reports, only 0.9% (n = 22) were reportable under IR(ME)R 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 1–3) to the national voluntary reporting system. RTE reports of lower classification are less likely to be shared due to resource constraints.

![Classification breakdown of RTE reports, December 2015 to March 2016 (n = 2346)](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.
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)R\(^7\) or IRR99\(^9\). 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 22 reportable radiation incidents submitted to the voluntary system between December 2015 and March 2016, comprising 0.9% of the RTEs reviewed; this is a decrease from 2.2% (55) for the previous four-monthly analysis\(^4\). Of these radiation incidents, 10 (45.5%) occurred during treatment unit processes (Figure 5).

![Figure 5. Breakdown of reportable radiation incidents (level 1) reported, December 2015 to March 2016 (n = 22)](image)

Further analysis of the reports indicates the points in the pathway at which the reportable incidents occurred (Figure 6). ‘Authorisation to irradiate’ comprised 18.2% (n = 4) of the RTEs; this was the most frequently occurring process subcodes of all reportable radiation incidents reported for this time period, and is also consistent with the previous four-monthly analysis\(^4\). Guidance on minimising errors associated with authorisation to irradiate is discussed in issue 18\(^3\) of Safer Radiotherapy.

Treatment ‘movements from reference marks’ comprised 13.6% (n = 3). Pretreatment ‘positioning of patient’, ‘localisation of intended volume’ and treatment ‘on-set imaging: approval process’ each comprised 9.0% (n = 2) of reportable RTEs. The remaining
reports were singular events spread across 9 different subcodes. They are grouped in Figure 6 as miscellaneous.

Figure 6. Breakdown of reportable radiation incidents (level 1) by process subcode reported, December 2015 to March 2016 (n = 22)

Non-reportable radiation incident

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

Non-reportable radiation incidents comprised 0.8% (n = 19) of the RTEs reported between December 2015 and March 2016 (Figure 7); this is a decrease from 1.4% (34) for the previous four-monthly analysis. Of these RTEs, 63.2% (n = 12) occurred during treatment unit processes.

Further analysis indicates the points in the pathway at which non-reportable radiation incidents occurred (Figure 8). The reports were spread across 14 different subcodes. ‘On-set imaging: approval process’ comprised 26.3% (n = 5) and was the most frequently occurring event within the non-reportable radiation incidents, consistent with the previous analysis. Guidance to minimise the likelihood of occurrence of this error can be found in issue 3 of Safer Radiotherapy. ‘ID of reference marks’ comprised 10.5% (n = 2); the remaining reports were spread across 12 different subcodes, all of which were singular events. They are grouped in Figure 8 as miscellaneous.
Figure 7. Breakdown of non-reportable radiation incidents (level 2) reported, December 2015 to March 2016 (n = 19)

Figure 8. Breakdown of non-reportable radiation incidents (level 2) by process subcode reported, December 2015 to March 2016 (n = 19)

Minor radiation incident

Radiation incident in the technical sense, but of no potential or actual clinical significance²

Minor radiation incidents comprised 32.2% (n = 754) of the RTEs reported between December 2015 and March 2016. Consistent with previously analysed data, the most frequently reported RTEs in this group were associated with treatment unit processes (78.6%, n = 593). RTE reports included 15 different codes within this classification, 5 of which are represented in the miscellaneous category (Figure 9).
The top 10 most frequently occurring level 3 process subcodes (Figure 10) incorporated mostly treatment unit processes, with 1 subcode from treatment data entry ‘accuracy of data entry’ (3.3%, n = 25) and 1 subcode from pretreatment ‘production of images demonstrating correct detail’ (3.1%, n = 23). Issues 2 and 12, respectively, of *Safer Radiotherapy*³ include guidance on minimising the risk of occurrence of these RTEs.

The 3 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 (31.4%, n = 237). The second most frequently occurring event within this subset was ‘on-set imaging: approval process’ (10.2%, n = 77), followed by ‘use of on-set imaging’ (5.0%, n = 38). Of interest, 51.0% (n = 385) of the reports in this classification were related to on-set imaging. A number of level 3 RTEs (15.4%, n = 116) 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 10. Breakdown of most frequently occurring minor radiation incidents (level 3) by process subcode reported, December 2015 to March 2016 (n = 543/754 subset of RTEs)

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

Near misses comprised 29.4% (n = 689) of the RTEs reported between December 2015 and March 2016. RTE reports included 16 different codes within this classification, 5 of which are represented in the miscellaneous category (Figure 11).

The most frequently occurring process subcodes across this level of RTE were ‘accuracy of data entry’ (11.9%, n = 82), followed by pretreatment ‘documentation of instructions’ (8.5%, n = 59) (Figure 12).
Figure 11. Breakdown of near misses (level 4) reported, December 2015 to March 2016 (n = 689)

Figure 12. Breakdown of the most frequently occurring near misses (level 4) by process subcode reported, December 2015 to March 2016 (n = 392/689 subset of RTEs)
Other non-conformance

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

‘Other non-conformance’ comprised 36.7% (n = 862) of the RTEs reported between December 2015 and March 2016. RTE reports varied across the patient pathway including 20 different codes within this classification, 10 of which are represented in the miscellaneous category (Figure 13). The most frequently occurring process code was ‘pretreatment planning process’, accounting for 20.0% (n = 172) of the reports in this classification, which is consistent with the previous four-monthly analysis. ‘Booking process’ is the second most frequently occurring process code, comprising 18.2% (n = 157), which is an increase from the previous data analysis (13.8%, n = 124), where the second most frequently occurring process code was ‘treatment unit process’.

![Figure 13. Breakdown of non-conformances (level 5) reported, December 2015 to March 2016 (n = 862)](image)

The most frequently occurring subcodes were ‘bookings made according to protocol’ (8.5%, n = 73), followed by ‘generation of plan for approval’ (4.5%, n = 39) (Figure 14). Issues 17 and 15, respectively, of Safer Radiotherapy includes guidance on minimising the occurrence of RTEs associated with ‘bookings made according to protocol’ and ‘generation of plan for approval’.
Figure 14. Breakdown of the most frequently occurring non-conformances (level 5) by process subcode reported, December 2015 to March 2016 (n = 350/862 subset of RTEs)

Breakdown of process codes

The 2346 RTE reports were categorised by process code (Figure 15) according to TSRT irrespective of classification, so that the main themes could be derived. Figure 15 shows 40.9% (n = 959) of the RTEs reported were associated with treatment unit processes, this is consistent with the previous analysis. 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 10 most frequently reported process subcodes in the radiotherapy pathway are presented in Figure 16. This subset of data was also broken down by classification. The most commonly occurring RTE reported was ‘on-set imaging: production process’ at 11.7% (n = 274) of all the reports; 86.5% (n = 237) of these reports were level 3 events. This was followed by ‘on-set imaging: approval process’ at 6.4% (n = 150) and ‘accuracy of data entry’ at 6.0% (n = 141). Of note, over half (59.7%, n = 662) 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 0.9% (n = 10) of the most frequently reported subcodes were classified as a reportable or non-reportable radiation incident.
Figure 15. Breakdown of RTE main activity codes reported, December 2015 to March 2016 (n = 2346)

Figure 16. Breakdown of RTE main themes by classification level reported, December 2015 to March 2016 (n = 1109/2346 subset of RTEs)
Secondary process coding

A total of 33.5% (n = 786) of RTEs submitted contained secondary process coding, indicating a second point in the pathway where the original error had gone undetected. This is a decrease from the previous analysis (48.4%, n = 1191). ‘End of process checks’ on the treatment unit processes was the most commonly reported secondary process code at 23.5% (n = 185) (Figure 17). 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 radiotherapy. It is expected that this will contribute to the development of learning from RTEs.

Figure 17. Breakdown of the most frequently occurring secondary process codes reported, December 2015 to March 2016 (n = 538/786 subset of RTEs)

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 18).

Advice on minimising the occurrence of RTEs related to end of process checking is given in issue 4 of Safer Radiotherapy. A total of 22.0% (n = 515) of the RTEs reported were not captured during ‘end of process checks’, occurring most frequently at the treatment unit processes.

If individual providers would like to comment on the analysis or can offer further advice in preventing any RTEs please email the RT team at radiotherapy@phe.gov.uk.
Figure 18. Breakdown of ‘end of process checks’ by point in the radiotherapy pathway reported, December 2015 to March 2016 (n = 515)

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


