Safer Radiotherapy
The radiotherapy newsletter of Public Health England

Supplementary Data Analysis
Issue 21 – Full radiotherapy error data analysis
August to November 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
August to November 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 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 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, 95.1% (\(n = 58\)) of providers have submitted RTE reports, representing the vast 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 743.5. For 2016 so far (January – November 2016) the average number of reports received each month is 706 (Figure 1), which is an increase from a monthly average of 545 reports in 2015. 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 607 days for this reporting period, with a mean of 64.5 days. For the 607 day time lag, there was no identifiable reason for the 607 day time lag, this 24 centres reported a time lag of over 365 days. This is a larger range, and mean, compared to the last reporting period (mean = 57.9 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\(^3\) of *Safer Radiotherapy* provides further information on the frequency of reporting.
Figure 1. Average number of incident reports per month each year (or part of) contributing to *Safer Radiotherapy* and the supplementary data analysis

Figure 2. Number of incidents reported per RT provider, August to November 2016 (n = 2973/2974 subset of RTE)
Figure 2 shows the number of RTE reported by a subset of providers during August to November 2016. The average number of reports per provider is 52.2 for this subset of data, indicating that over half of providers (68.4%, n = 39) are reporting less than the national average. A report was submitted by a referral centre as opposed to RT provider during the current reporting period and is not represented on this graph. This report is discussed further below. 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.

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 2713 of the 2995 reports received between August and November 2016. This demonstrates a continuation of the high adoption rate (90.6%) 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 and the classification are reviewed. From the 2713 RTE reports classified and coded locally, an 81.1% level of consistency was achieved (Figure 3); this is similar to the previous analysis (79.7%). The *Good Practice in Radiotherapy Error Reporting – Supplementary Guidance Series* gives examples of the application of the classification and process coding. In addition, 261 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.
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 0.5% (n = 14) 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. Seven 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, 2974 RTE for the reporting period from August to November 2016 were included for analysis. The analysis is presented here.

Classification of radiotherapy errors

Each of the 2974 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, 96.6% (n = 2872) were minor radiation, near miss or other non-conformities with little or no impact on patient outcome. Of the remaining 3.4% (n = 102) RTE reports, only 1.0% (n = 31) 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

* 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.
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 4. Classification breakdown of RTE reports, August to November 2016 (n = 2974)

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 IRR99. 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 31 reportable radiation incidents submitted to the voluntary system between August and November 2016, comprising 1.0% of the RTE reviewed; this is a decrease from 1.3% (36) for the previous four-monthly analysis. This could be due to a decrease in radiation incidents reported during pretreatment activities from 41.7 % (n = 15) being the most common primary code in the previous analysis to 22.6% (n = 7) and joint third most common primary code in this analysis. The most frequently reported RTE in this group were associated with treatment unit processes (29.0%, n = 9) (Figure 5).
Figure 5. Breakdown of reportable radiation incidents (level 1) reported, August to November 2016 (n = 31)

Further analysis of the reports indicates the points in the pathway at which the reportable incidents occurred (Figure 6). ‘Setting of couch position/angle’ comprised 16.1% (n = 5) of the RTE; this was the most frequently occurring process subcode of all reportable radiation incidents reported for this time period. Examples of this type of RTE include not setting the correct FSD for extended FSD treatments and not setting the couch position to the correct setting after clearance of imaging panel.

Communication of intent ‘authorisation to irradiate’, pretreatment ‘localisation of intended volume’ and ‘production of images demonstrating correct detail’ each comprised 9.7% (n = 3) and ‘choice of dose and fractionation inputs’ comprised 6.5% (n = 2) of reportable RTE. The remaining reports were singular events spread across 15 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 2016 (n = 31)
Non-reportable radiation incident

*Radiation incident not reportable, but of potential or actual clinical significance*\(^2\)

Non-reportable radiation incidents comprised 2.4% \((n = 71)\) of the RTE reported between August and November 2016 (Figure 7); this is an increase from 1.4% \((37)\) for the previous four-monthly analysis\(^4\). Of these RTE, 50.7% \((n = 36)\) occurred during treatment unit processes, which is a slight decrease in percentage since the previous four month analysis\(^4\) from 54.1% \((n = 20)\). Of note the number of RTE occurring during pretreatment activities has increased from 13.5% \((n = 5)\) for the previous four-monthly analysis\(^4\) to 28.1% \((n = 20)\) at this analysis.

![Breakdown of non-reportable radiation incidents (level 2) reported, August to November 2016 (n = 71)\(^\text{3}\)](image)

**Figure 7.** Breakdown of non-reportable radiation incidents (level 2) reported, August to November 2016 \((n = 71)\)

Further analysis indicates the points in the pathway at which non-reportable radiation incidents occurred (Figure 8). The reports were spread across 32 different subcodes. ‘On-set imaging: approval process’ comprised 11.3% \((n = 8)\) and was the most frequently occurring event within the non-reportable radiation incidents, consistent with the previous 3 analyses. Guidance to minimise the likelihood of occurrence of this error can be found in issue 3 of *Safer Radiotherapy*\(^3\). ‘Production of images demonstrating correct detail’ comprised of 8.5% \((n = 6)\); ‘localisation of intended volume’ and ‘management of variations/unexpected events/errors’ each comprised of 7.0% \((n = 5)\) of these non-reportable events. There were 22 process subcodes reported which were made up of either 1 or 2 reports, these are grouped in Figure 8 as miscellaneous.
Figure 8. Breakdown of non-reportable radiation incidents (level 2) by process subcode reported, August to November 2016 (n = 71)

Minor radiation incident

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

Minor radiation incidents comprised 31.9% (n = 948) of the RTE reported between August and November 2016. Consistent with previously analysed data, the most frequently reported RTE in this group were associated with treatment unit processes (82.7%, n = 784). RTE reports included 13 different codes within this classification, 4 of which are represented in the miscellaneous category (Figure 9).

Figure 9. Breakdown of minor radiation incidents (level 3) reported, August to November 2016 (n = 948)
The most frequently occurring level 3 process subcodes (Figure 10) incorporated mostly treatment unit processes, with one subcode from pretreatment ‘documentation of instructions’ (2.6%, n = 25) and one from treatment data entry ‘accuracy of data entry’ (2.1%, n = 20). Issues 8 and 2, 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 (36.9%, n = 349). The second most frequently occurring event within this subset was ‘use of on-set imaging’ (8.0%, n = 76), followed by ‘on-set imaging: approval process’ (7.5%, n = 71). In parallel to the previous four-monthly analysis\(^4\), 55.2% (n = 523) of the reports in this classification were related to on-set imaging. A number of level 3 RTE (24.2%, n = 229) 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, August to November 2016 (n = 734/948 subset of RTE)
Near miss

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

Near misses comprised 23.7% (n = 705) of the RTE reported between August and November 2016. RTE reports included 17 different codes within this classification, 7 of which are represented in the miscellaneous category (Figure 11). The most frequently reported RTE in this group were associated with treatment unit processes (24.4%, n = 172).

The most frequently occurring process subcodes across this level of RTE were ‘accuracy of data entry’ (9.4%, n = 66), followed by pretreatment ‘documentation of instructions’ (8.2%, n = 58), consistent with the previous four-monthly analysis⁴ (Figure 12).

![Figure 11. Breakdown of near misses (level 4) reported, August to November 2016 (n = 705)](image-url)
Other non-conformance

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

‘Other non-conformance’ comprised 41.0% (n = 1219) of the RTE reported between August and November 2016. RTE reports varied across the patient pathway including 19 different codes within this classification, 9 of which are represented in the miscellaneous category (Figure 13). The most frequently occurring process code was ‘pretreatment planning process’, accounting for 22.2% (n = 271) of the reports in this classification, which is consistent with the previous four-monthly analysis⁴. ‘Treatment unit process’ is the second most frequently occurring process code, comprising 18.3% (n = 223).

The most frequently occurring subcode was ‘management of process flow within planning’ (8.8%, n = 107), (Figure 14). This is a large increase (2.2%, n = 24) since the previous four-monthly analysis⁴. This increase is due to a large proportion of this type of report from a single department (88.8% n = 95). Issue 5 of Safer Radiotherapy³ includes guidance on minimising the occurrence of RTE associated with ‘management of process flow within planning’.

Within the non-conformances reported a report was submitted by a referral centre as opposed to a RT provider. The primary process subcode was ‘consent process’, the text associated with this report highlighted that the consent process procedures had not been followed in a timely manner.
Figure 13. Breakdown of non-conformances (level 5) reported, August to November 2016 (n = 1219)

Figure 14. Breakdown of the most frequently occurring non-conformances (level 5) by process subcode reported, August to November 2016 (n = 497/1219 subset of RTE)
Breakdown of process codes

The 2974 RTE reports were categorised by process code according to TSRT irrespective of classification, so that the main themes could be derived. Figure 15 shows 41.2% (n = 1224) 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 16. This subset of data was also broken down by classification. The most commonly occurring RTE reported was ‘on-set imaging: production process’ at 12.7% (n = 377) of all the reports; 92.6% (n = 349) of these reports were level 3 events. This was followed by ‘documentation of instructions’ at 4.9% (n = 146) and ‘accuracy of data entry’ 4.3% (n = 128). Of note, just over half (50.3%, n = 672) 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 1.8% (n = 24) 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, August to November 2016 (n = 2974)](image-url)
Secondary process coding

A total of 33.8% (n = 1006) 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. ‘End of process checks’ on the treatment unit processes was the most commonly reported secondary process code at 17.9% (n = 180) (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 RT. It is expected that this will contribute to the development of learning from RTE.

Figure 16. Breakdown of RTE main themes by classification level reported, August to November 2016 (n = 1336/2974 subset of RTE)

Figure 17. Breakdown of the most frequently occurring secondary process codes reported, August to November 2016 (n = 667/1006 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 18).

Advice on minimising the occurrence of RTE related to end of process checking is given in issue 4 of *Safer Radiotherapy*\(^2\). A total of 21.5\% (n = 639) of the RTE reported were not captured during ‘end of process checks’, occurring most frequently at the treatment unit processes (33.0\%, n = 211).

![Figure 18. Breakdown of ‘end of process checks’ by point in the radiotherapy pathway reported, August to November 2016 (n = 639)](image)

*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