About Public Health England

Public Health England exists to protect and improve the nation’s health and wellbeing, and reduce health inequalities. We do this through world-leading science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health and Social Care, and a distinct delivery organisation with operational autonomy. We provide government, local government, the NHS, Parliament, industry and the public with evidence-based professional, scientific and delivery expertise and support.

Public Health England
Wellington House
133-155 Waterloo Road
London SE1 8UG
Tel: 020 7654 8000
www.gov.uk/phe
Twitter: @PHE_uk
Facebook: www.facebook.com/PublicHealthEngland

For queries relating to this document, please contact:
radiotherapy@phe.gov.uk

© Crown copyright 2018
You may re-use this information (excluding logos) free of charge in any format or medium, under the terms of the Open Government Licence v3.0. To view this licence, visit OGL. Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned.

Published October 2018
PHE publications gateway number: 2018539
PHE supports the UN Sustainable Development Goals
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>About Public Health England</td>
<td>2</td>
</tr>
<tr>
<td>Contents</td>
<td>3</td>
</tr>
<tr>
<td>Full radiotherapy error data analysis – April to July 2018</td>
<td>4</td>
</tr>
<tr>
<td>Monitoring of TSRT classification and coding by radiotherapy providers</td>
<td>5</td>
</tr>
<tr>
<td>Number of reports per provider</td>
<td>6</td>
</tr>
<tr>
<td>Breakdown of process codes</td>
<td>7</td>
</tr>
<tr>
<td>Classification of radiotherapy errors</td>
<td>8</td>
</tr>
<tr>
<td>Reportable radiation incident</td>
<td>9</td>
</tr>
<tr>
<td>Non-reportable radiation incident</td>
<td>10</td>
</tr>
<tr>
<td>Minor radiation incident</td>
<td>11</td>
</tr>
<tr>
<td>Near miss</td>
<td>12</td>
</tr>
<tr>
<td>Other non-conformance</td>
<td>12</td>
</tr>
<tr>
<td>Safety barriers</td>
<td>13</td>
</tr>
<tr>
<td>Causative factors</td>
<td>15</td>
</tr>
<tr>
<td>Brachytherapy errors</td>
<td>16</td>
</tr>
<tr>
<td>References</td>
<td>18</td>
</tr>
</tbody>
</table>
Full radiotherapy error data analysis – April to July 2018

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 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 factor taxonomy. Where appropriate, comparisons have been drawn with previous issues of ‘Safer Radiotherapy’⁴ and the PHE supplementary data analyses⁵. The analysis has been reviewed by the Patient Safety in Radiotherapy Steering Group, whose comments have been incorporated into this document.

For this reporting period, April to July 2018, 88.7% (n = 55) of providers have submitted RTE reports, leaving 6 providers who did not submit reports using the TSRT9 trigger code. 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 national analyses.

The average number of reports received by PHE each month for this reporting period was 730.0. This is a 10.7% increase in the number of reports received from the last reporting period December 2017 to March 2018 (n = 659.5)⁵ and a 14.2% increase when comparing to the same reporting period in 2017 (n = 639.5)⁵. 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 frequency of reporting across providers, 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 658 days for this reporting period, with a mean of 54.9 days. This is an increase on the last reporting period (mean = 45.4 days)⁵. There were 10 reports received from 3 different providers which were reported with a time lag over 362 days, these did not contain text which could account for the lengthy time lag. 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 26⁶ of ‘Safer Radiotherapy’ provides further information on the frequency
of reporting. The overall analysis presented in this report will help providers to compare locally 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.

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.

Monitoring of TSRT classification and coding by radiotherapy providers

The TSRT\textsuperscript{2} classification, DoL\textsuperscript{3} pathway coding and causative factor taxonomies had been applied by local RT providers to 2,304 of the 2,920 reports received from April to July 2018. This demonstrates the high adoption rate (78.9\%) in the application of the TSRT\textsuperscript{2} and DoL\textsuperscript{3} taxonomies.

All providers are asked to apply a trigger code, classification, coding, including failed safety barriers, causative factor and where applicable effective safety barrier (detection method) to their RTE reports to facilitate both local and national analysis, for example TSRT9/ Level 4/ 13c/ 13i/ MD13hh/ CF1c/ CF2c. Failed and effective safety barriers and how to include them in report submissions are discussed further in Issue 24 of ‘Safer Radiotherapy’\textsuperscript{4}.

New terminology for the breakdown of reports has been adopted (Figure1); these are explained in the text below. Consistency-checking was undertaken by PHE staff on the application of the TSRT\textsuperscript{2} classification and DoL\textsuperscript{3} coding system by RT providers. During consistency checking the coding is reviewed for all RTE classified as reportable through to near miss (levels 1-4) and 10\% of non-conformances (level 5) RTE are audited. A complete report (Figure 1) contains the classification, pathway code, including safety barriers and causative factor taxonomies. From the 2,304 RTE reports classified and coded locally, 262 were amended (complete fixed in Figure 1) an 88.6\% level of consistency was achieved. The ‘Good Practice in Radiotherapy Error Reporting – Supplementary Guidance Series’ gives examples of the application of the classification and process coding\textsuperscript{6}. In addition, 600 RTE were classified or coded by PHE staff using the supporting text supplied by the local providers (incomplete fixed in Figure 1). The document ‘Development of learning from radiotherapy errors’ includes guidance on the application of coding and classification\textsuperscript{3}. A further 3 reports contained classification and pathway coding; however, they did not contain sufficient information within the text to allocate a causative factor taxonomy (incomplete within Figure 1).

Non-RTE reports submitted with the TSRT9 trigger code formed 0.4\% (n = 13) 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”\(^7\); further information on PSI can be found in issue 5 of “Safer Radiotherapy”\(^4\). Non-RTE reports were excluded from the detailed analysis.

**Figure 1. Breakdown of reports, April to July 2018 (n = 2,920)**

In total, 2,907 RTE for the reporting period from April to July 2018 were included for analysis. The analysis is presented here.

**Number of reports per provider**

Figure 2 shows the number of RTE reported by providers during April to July 2018. The number of reports per provider ranged from 1 to 234 reports with an average 47.8 reports for this subset of data, indicating that over half of providers reporting (62.9%, n = 39) reported less than the national average, 6 of which reported 0. 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. These centres report all classifications of reports including levels 1 to 5. 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 intention in sharing this data is to allow providers to benchmark themselves against other UK NHS radiotherapy providers.
Figure 2. Number of RTE reported per RT provider, April to July 2018 (n = 2907)

Breakdown of process codes

The 2,907 RTE reports were categorised by process code according to DoL\(^3\) irrespective of classification, so that the main themes could be derived. Figure 3 shows 39.1% (n = 1,139) of the RTE were reported to have occurred during treatment unit processes. The most frequently reported RTE activity codes were associated with treatment unit processes for all classifications of RTE except other non-conformances (Level 5), where the most frequently reported RTE within this subgroup were associated with pretreatment planning. Previous analyses have indicated that treatment unit processes were most frequent across all levels of RTE\(^5\). It is expected that the treatment unit process code is 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.

Figure 3. Breakdown of RTE main activity codes reported, April to July 2018 (n = 2,714/2,907 subset of RTE)
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 frequently occurring RTE reported was ‘on-set imaging: production process’ at 10.8% (n = 315) of all the reports; as a subset 90.8% (n = 286) of these reports were level 3 events. The second most frequently occurring RTE was ‘accuracy of data entry’ at 5.2% (n = 150) followed by ‘documentation of instructions/information’ at 4.4% (n = 129).

**Figure 4. Breakdown of RTE main themes by classification level reported, April to July 2018 (n = 1,217/2,907 subset of RTE)**

**Classification of radiotherapy errors**

Each of the 2,907 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, 98.2% (n = 2856) were minor radiation, near miss or other non-conformities with little or no impact on patient outcome. Of the remaining 1.8% (n = 51) RTE reports, only 1.0% (n = 28) 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 than reports of a lower classification 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, April to July 2018 (n = 2,907)

**Reportable radiation incident**

Reportable radiation incidents as defined in ‘Towards Safer Radiotherapy’² fall into the category of reportable under 1 of 2 statutory instruments – IR(ME)R⁹ or IRR2017¹⁰. 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 28 reportable radiation incidents submitted to the voluntary system from April to July 2018 (Figure 5), comprising 1.0% of the RTE reviewed; this is a slight increase from 20 (0.8%) reportable radiation incidents in the previous 4-monthly analysis⁵.

Further analysis of the reports indicates the points in the pathway at which the reportable incidents occurred (Figure 6). ‘On-set imaging: approval process’ comprised 32.1% (n = 9) of these reportable radiation incidents and was the most frequently occurring process subcode of all reportable radiation incidents reported for this time period. An example of this type of RTE includes an image match discrepancy leading to missing the target volume for 1 fraction. The second most frequently occurring event within this subset was jointly ‘movements from reference marks’ and ‘completion of request for treatment’ comprising 7.1% (n = 2) each of all reportable radiation incidents for this time period. Neither was included as one of the most frequently occurring subcode in the previous 4 month analyses⁵. An example of the type of RTE associated with ‘movement from reference marks’ includes treating a patient in the incorrect position due to moving incorrectly in direction or magnitude. An example of the type of RTE associated with ‘completion of request for treatment’ can include a request for a clinical mark-up which has been completed incorrectly leading to an unrequired CT planning scan. The remaining reports were singular events spread across 15 different subcodes.
Figure 6. Breakdown of reportable radiation incidents (level 1) by process subcode reported, April to July 2018 (n = 13/28 subset of RTE)

Non-reportable radiation incident

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

Non-reportable radiation incidents comprised 0.8% (n = 23) of the RTE reported from April to July 2018 (Figure 5); this is consistent with the previous 4-monthly analysis\(^5\).

Further analysis indicates the points in the pathway at which non-reportable radiation incidents occurred (Figure 7). The reports were spread across 16 different subcodes. ‘On-set imaging: approval process’ comprised 13.0% (n = 3) and was the most frequently occurring event within the non-reportable radiation incidents. An example of RTE associated with ‘on-set imaging: approval process’ includes the mismatch of imaging. This was also the most frequently occurring event within the reportable radiation incidents. This was also the most frequently occurring non-reportable radiation incident in the previous 4 month analyses (12.0%, n = 3)\(^5\). Further guidance on reducing this type of event can be seen in issue 3\(^4\) of ‘Safer Radiotherapy’. Singular events reported are spread across 10 different subcodes.

Figure 7. Breakdown of non-reportable radiation incidents (level 2) by process subcode reported, April to July 2018 (n = 13/23 subset of RTE)
Minor radiation incident

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

Minor radiation incidents comprised 34.1% (n = 990) of the RTE reported from April to July 2018 (Figure 5); this is a slight decrease from 982 (37.5%) minor radiation incidents in the previous 4-monthly analysis\(^5\).

The most frequently occurring level 3 process subcodes (Figure 8) consisted mainly of treatment unit processes 75.8% (n = 750). ‘On-set imaging: production process’ was the most frequently occurring event (28.9%, n = 286) within this subset. Examples of this type of minor radiation incident included using the incorrect filter for a CBCT. The second most frequently occurring event within this classification was ‘on-set imaging: approval process’ (7.2%, n = 71), followed by ‘use of on-set imaging’ (5.4%, n = 53).

A large proportion of the reports in this classification were related to on-set imaging, these included ‘use of on-set imaging’, ‘on-set imaging: production process’, ‘on-set imaging: approval process’ and ‘on-set imaging: recording process’ (46.6%, n = 461). Which is a minor decrease since the previous 4-monthly analysis\(^5\) when 48.0% (n = 471) of minor radiation incidents were associated with on-set imaging. A number of minor radiation incidents with the primary code ‘on-set imaging: production process’ were attributed to equipment malfunction, (46.9%, n = 134), examples of this type of RTE includes CBCT faults during acquisition. Malfunction of equipment and on-set imaging: production process is discussed further in issue 18 of ‘Safer Radiotherapy’\(^4\).

![Figure 8. Breakdown of most frequently occurring minor radiation incidents (level 3) by process subcode reported, April to July 2018 (n = 677/990 subset of RTE)](image-url)
Near miss

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

Near misses comprised 25.2% (n = 733) of the RTE reported from April to July 2018 (Figure 5). Figure 9 shows the most frequently occurring process subcodes across this level of RTE. ‘Accuracy of data entry’ comprised of 8.9% (n = 65) followed by ‘documentation of instructions’ 7.1% (n = 52), these were also the most frequently occurring subcodes within the previous 4-month period⁵. An example of RTE associated with ‘Accuracy of data entry’ includes the incorrect entry of information into the oncology management system. Further details on the error ‘accuracy of data entry’ can be found in issue 2 of ‘Safer Radiotherapy’⁴ and issue 8 contained further details on ‘documentation of instruction’.

Figure 9. Breakdown of the most frequently occurring near misses (level 4) by process subcode reported, April to July 2018 (n = 312/733 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 39.0% (n = 1,133) of the RTE reported from April to July 2018 (Figure 5). The most frequently occurring subcode was ‘accuracy of data entry’ (4.9%, n = 56), (Figure 10) within this classification. This was also the most frequently reported subcode within the near miss classification. This was closely followed by ‘documentation of instructions/information’ (4.9%, n = 55) and ‘communication of appointments to patient’ (4.1%, n = 47). ‘Accuracy of data entry’ (4.7%, n = 45), ‘documentation of instructions/information’ (3.8%, n = 36) and ‘communication of
appointments to patient’ (4.5%, n = 43) were included in the most frequently occurring non-conformance subcode in the previous 4-monthly analysis.\textsuperscript{5}

\textbf{Figure 10. Breakdown of the most frequently occurring non-conformances (level 5) by process subcode reported, April to July 2018 (n = 404/1,133 subset of RTE)}

\textbf{Safety barriers}

\textit{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}

A number of safety barriers (SB) embedded in the pathway coding\textsuperscript{3} 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 2,907 RTE reports for the reporting period April to July 2018, a total of 2,120 subcodes were identified as failed (SB). Only 3.4% (n = 72) of failed SB led to a Level 1 or 2 RTE. SBs associated with treatment unit processes were attributed to 36.3% (n = 770) of all failed SB. The most frequently failed SB are represented in Figure 11. Treatment data entry process ‘end of process checks’ and ‘use of on-set imaging’ were equally the most frequently reported failed SB (10.8%, n = 230). ‘End of process checks’ across the pathway account for 33.3% (n = 705) of all reported failed SBs. Issue 4 of Safer Radiotherapy\textsuperscript{4} includes guidance on minimising the occurrence of RTE associated with ‘end of process checks’.
Effective safety barriers or methods of detection (MD) can now be identified utilising the safety barrier taxonomy. For the reporting period April to July 2018, 20 providers indicated MD in 13.2% (n = 384) reports. This is a significant increase from the previous 4-month reporting period where 9 providers indicated MD in 2.5% (n = 66) reports. Issue 24 of ‘Safer Radiotherapy’ includes guidance on the application of MD coding. The most frequently reported effective safety barrier for this reporting period was ‘on-set imaging: approval process’ (22.9%, n = 88). Of note 3.9% (n = 15) MD were coded as on treatment process ‘other’, the associated text did not contain sufficient information to assign a more applicable MD code.

Figure 11. Breakdown of failed safety barriers by classification level reported, April to July 2018 (n = 1,896/2,120 subset of RTE data)

Figure 12. Breakdown of effective safety barriers by classification level reported, April to July 2018 (n = 276/384 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

The new causative factor (CF) taxonomy has been applied to 2,304 (78.3%) RTE reports by 48 (87.3%) providers for this reporting period. This is similar to the last reporting period when RT providers applied the CF taxonomy to 2,051 (78.3%) RTE. Following consistency checking, PHE coded a further 600 reports with CF taxonomy, resulting in 2,904 reports containing CF taxonomy for the analysis; only 3 RTE did not contain sufficient information to assign a CF taxonomy.

Figure 13 shows the most frequently occurring primary CFs which are seen as the root cause of an incident. Consistent with the previous analysis, the most frequently occurring primary CF was individual ‘slips and lapses’ (41.4%, n = 1,203), followed by ‘communication’ (17.1%, n = 496). ‘Slips and lapses’ was most frequently attributed to ‘on-set imaging: production process’ (10.3%, n = 124), and ‘communication’ was most frequently attributed to ‘documentation of instruction’ (9.7%, n = 48) and ‘accuracy of data entry’ (8.2%, n = 41). Issue 22 of ‘Safer Radiotherapy’ includes guidance on minimising the occurrence of RTE caused by a slip or lapse of an individual.

![Figure 13. Breakdown of most frequent primary causative factors by classification level, April to July 2018 (n = 2,797/2,904 subset of data)](image)

A number of CF codes can be attributed to each individual RTE. A review of the second to fifth CF codes indicate the contributory factors associated with an incident. Contributory factors were indicated across 850 reports; 156 of these contained multiple CF leading to
1,033 contributory factors. Figure 14 shows the most frequently occurring contributory factors. The most frequently occurring was ‘adherence to procedures/protocols’ (40.9%, n = 422); these were most frequently attributed to ‘on-set imaging: recording process’ (10.7%, n = 45).

![Graph showing contributory factors](image)

**Figure 14. Breakdown of most frequent contributory factors by classification level, April to July 2018 (n = 946/1,033 subset of data)**

**Brachytherapy errors**

Errors coded with brachytherapy process codes as the primary code account for 1.0% (n = 30) of radiotherapy errors for the reporting period April to July 2018. This is consistent with the previous 4-monthly report\(^5\) (0.8%, n = 21). Brachytherapy is a small specialised practice within radiotherapy, therefore the number of brachytherapy associated RTE would be expected to be low. The majority of the brachytherapy errors reported were near misses or non-conformances (90.0%, n = 27) and only 3.3% (n = 1) were classified as a reportable radiation incident (Figure 15).

‘Delivery of sources’, comprised 40.0% (n = 12) of all brachytherapy incidents; these were all classified as other non-conformances (Level 5). An example of this type of RTE includes missing the order for radiopharmaceuticals and delaying a patient’s treatment. Issue 20 of ‘Safer Radiotherapy’ includes further guidance on brachytherapy RTE\(^4\).
A total of 37 subcodes were identified across the 30 brachytherapy associated RTE reports; only 9 different subcodes were identified as failed (SB).

Figure 15. Breakdown of brachytherapy errors coded ‘15’ by classification level, April to July 2018 (n = 30)

The CF were reviewed within this dataset; all 30 brachytherapy associated RTE were attributed to 10 different CF as shown in Figure 16. The most frequently reported CF associated with brachytherapy RTE was ‘slips and lapses’ (30.0%, n = 9) which is consistent with the general analysis of RTE.

Figure 16. Breakdown of brachytherapy primary causative factors, April to July 2018 (n = 30)
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


