UK Health Security Agency

Safer Radiotherapy

Triannual RTE analysis and learning report

Issue 50: full radiotherapy event data analysis, April to July 2026

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Radiotherapy event data analysis

The Safer Radiotherapy publication series facilitates comparison of locally identified trends against the national picture. The Patient Safety in Radiotherapy Steering Group (PSRT) recommends implementing learning from this analysis locally. In doing so it is expected that these events might be mitigated in the future.

This analysis has been undertaken by the UK Health Security Agency (UKHSA) on anonymised radiotherapy events (RTE) reported voluntarily by UK radiotherapy (RT) providers.

As with any voluntary reporting system, the data will only reflect those events that are reported and may not necessarily be representative of the actual level of occurrence. As such, this data needs interpreting with care.

To facilitate timely analysis and learning both locally and nationally, all providers are asked to apply a trigger code (TSRT9), classification level, primary pathway subcode, additional pathway subcodes, method of detection (MD), contributory factors (CF) and modality code (D) to their RTE reports to facilitate both local and national analysis and submit data to UKHSA at the earliest opportunity, for example monthly.

Providers reporting through the LFPSE are encouraged to include the TSRT9 trigger code for all RTE once the required investigation is complete and RTE taxonomy has been applied. If a report does not contain the TSRT9 trigger code, it will not be shared by LFPSE with UKHSA.

More information, including the full taxonomy, case studies and recommendations for application, can be found in the National patient safety radiotherapy event taxonomy publication. Providers should refer to the national taxonomy for incident learning in clinical imaging user guidance, for patient safety events which occur within diagnostic imaging, MRI outside the radiotherapy department, and nuclear medicine including molecular radiotherapy

The World Health Organization world patient safety day took place on 17 September 2026. This year's campaign focussed on 'safe care for noncommunicable diseases', highlighting the importance of effective risk management and active patient engagement to improve safety.

Further information on the PSRT, the radiotherapy patient safety initiative and RTE reporting can be found online or accessed via the QR code located on this page. If individual providers would like to comment on the analysis or share experience of learning from RTE analysis, please email the RT team at radiotherapy@ukhsa.gov.uk

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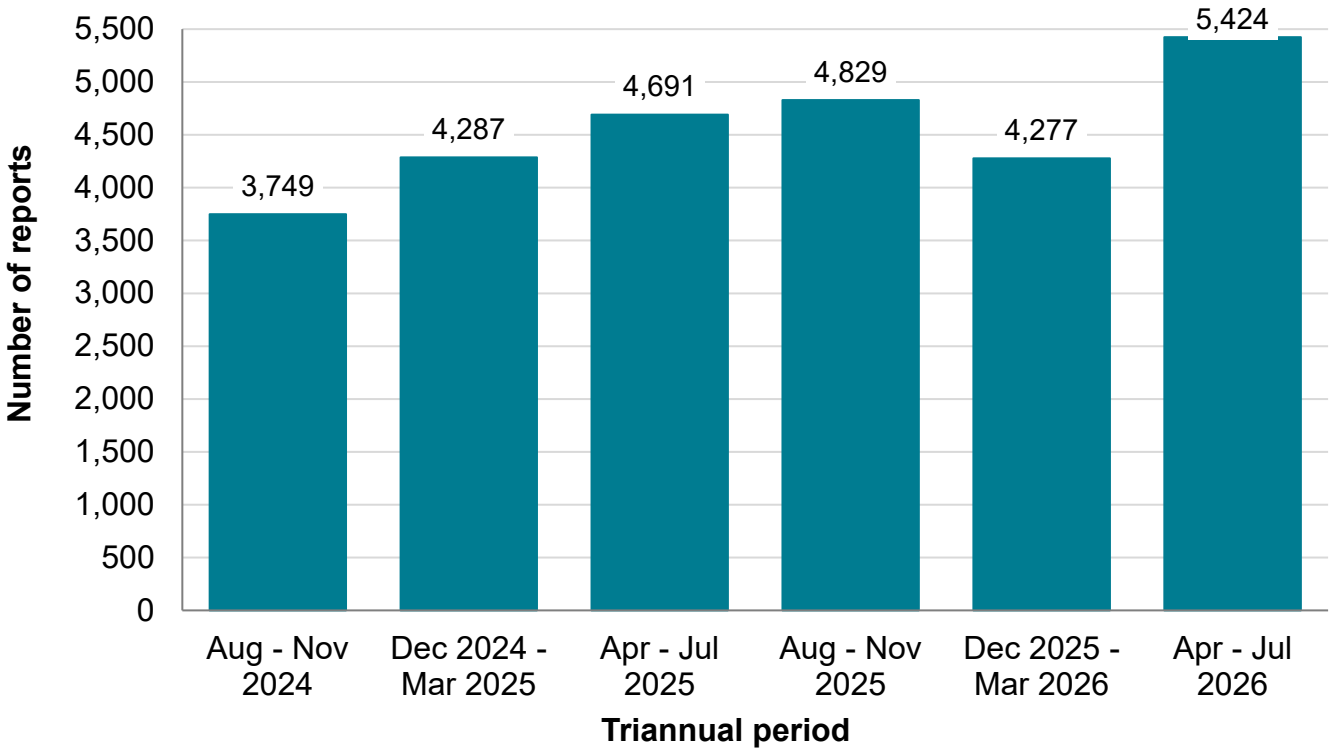
April to July 2026 national radiotherapy event (RTE) data analysis

Number of RTE reports

A total of 5,424 classified RTE reports were received between April and July 2026, an increase of 26.8% (n=4,277) when compared to the previous analysis (December 2025 to March 2026) and an increase of 15.6% when compared to the same reporting period (n=4,691) between April and July 2025 (issue 47). This increase may reflect, in part, enhanced reporting following engagement with the radiotherapy community at the National Radiotherapy Event Workshop. Further information on the Workshop can be found in this month's E-Bulletin (issue 20). During the review period, 72 reported events involved multiple patients (ranging from 2 to 16 patients), accounting for 208 RTE reports. In addition, 22 RTE reports were received without coding and did not contain sufficient information for classification or taxonomy assignment. Figure 1 shows the numbers of classified reports received over the past 6 triannual analysis periods.

Figure 1. Number of voluntary RTE reports received by UKHSA over time

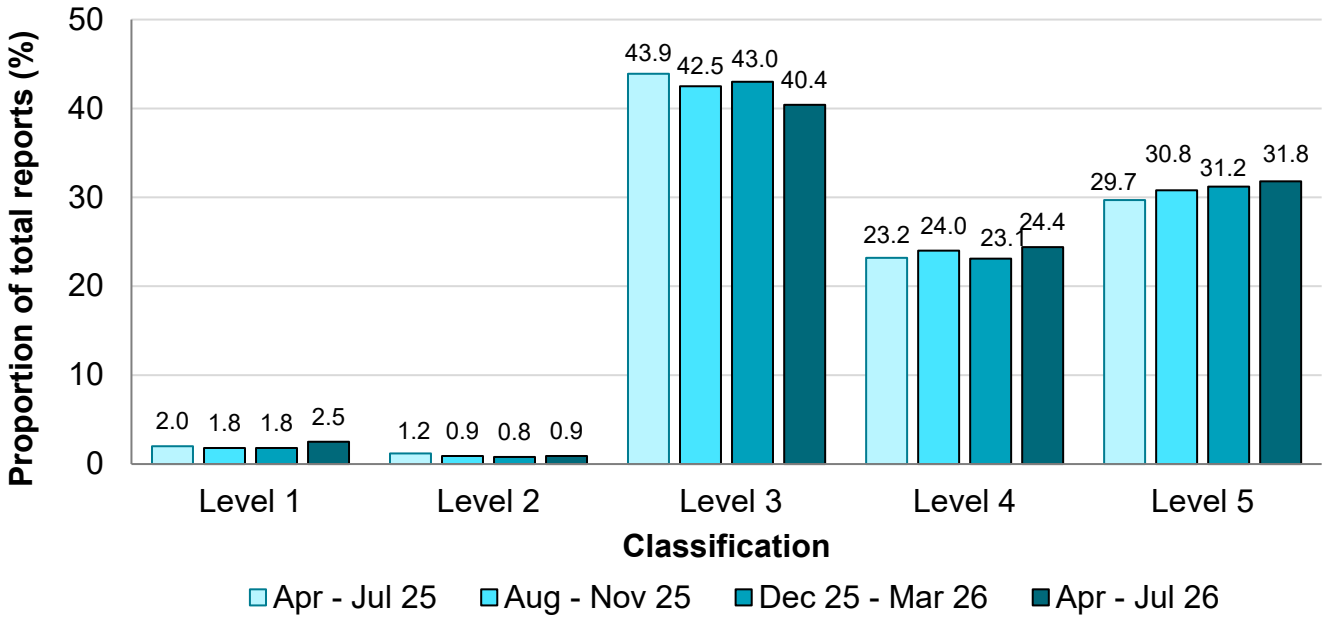


For this reporting period, data was received from 57 providers, including the NHS and independent sector. An average of 93 reports were received by providers, reflecting an increase of 24.0% (n=75) from the previous analysis. It should be noted that this increase does not mean every individual provider experience an increase in reporting. Finally, those reporting higher numbers of RTE represent providers with mature reporting cultures and should be encouraged to continue reporting. The national analysis of reported RTE data is presented below.

Classification (level) of RTE

Each RTE report was classified either as Level 5 ‘other non-conformance’ (31.8%, n=1,725), Level 4 ‘good catch’ (24.4%, n=1,325), Level 3 ‘non-reportable (minor) radiation or MRI incident’ (40.4%, n=2,189), Level 2 ‘non-reportable (moderate) radiation or MRI incident’ (0.9%, n=47), or Level 1 ‘reportable radiation incident or other notifiable event’ (2.5%, n=138).

Figure 2. Classification (level) of RTE reports over last 4 triannual periods



The majority of reports (96.6%, n=5,239) were Level 3 to 5 events, indicating they had little or no impact on patient outcome. Of the remaining 3.4% (n=185) reports, 2.5% (n=138) were reportable under IR(ME)R to the appropriate enforcing authority (Level 1). This represents an increase in the proportion compared to the previous reporting period. The proportion of reports for each classification level across the 4 most recent triannual periods is shown in Figure 2.

Given the increase in the proportion of Level 1 RTEs, further analysis was undertaken. The Level 1 RTE were grouped into four categories, as shown in Table 1. It is reassuring to note that the majority of Level 1 events (79.0 %, n=109) had little or no impact on treatment delivery. They were related to planning processes or verification imaging and picked up prior to treatment delivery. A further 17.4% (n=24) of Level 1 events occurred during treatment delivery.

Table 1. Report category

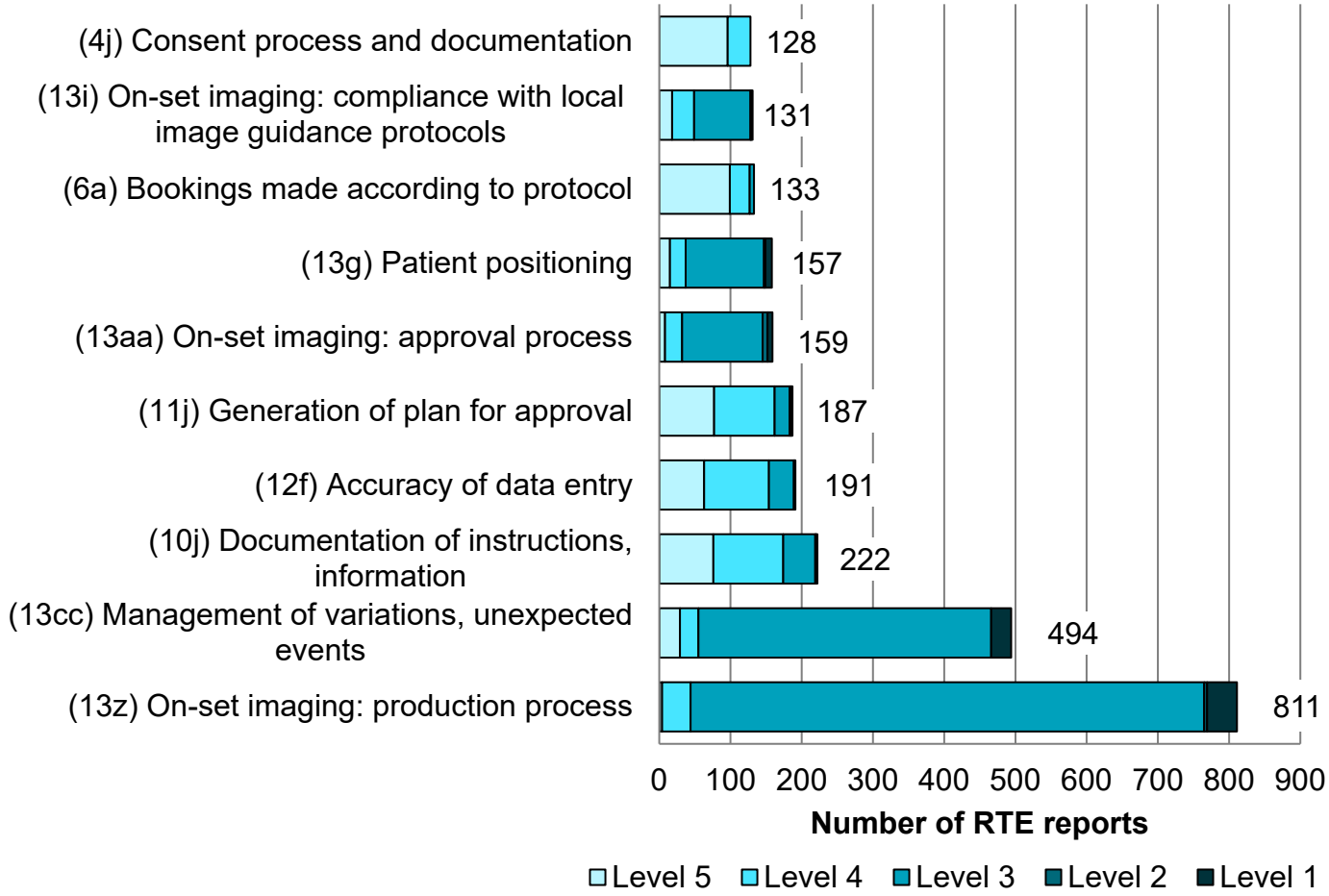
Report category	Proportion and number of notifications
Additional pretreatment (planning) imaging	8.0%, n=11
Additional treatment verification imaging	71.0%, n=98
Affected treatment delivery	17.4%, n=24
Other	3.6%, n=5

Breakdown of primary pathway subcodes

The most frequently reported primary pathway subcodes are presented in Figure 3. This data was further stratified by classification level to identify the principal themes within each pathway subcode.

The most frequently reported RTE was ‘on-set imaging: production process’ at 15.0% (n=811) of all reports. This represents a slight decrease in proportion from 15.6% (n=667) in the previous analysis. Within this pathway subcode, 94.3% (n=765) of reports were classified as minor radiation or MRI incidents, good catches or other non-conformities with little or no impact on patient care. Almost two-thirds of reports within this category were associated with contributory factor ‘equipment or IT network failure’ (61.8%, n=501).

Figure 3. Breakdown of most frequently reported RTE primary pathway subcodes by level (n=2,613 out of 5,424)



The second most frequently reported primary pathway subcode was ‘management of variations, unexpected events’ at 9.1% (n=494). As with ‘on-set imaging: production process’, this pathway subcode is frequently associated with contributory factor ‘equipment or IT network failure’ (83.6%, n=413). The majority of reports within this category (94.3%, n=466) were classified as minor radiation or MRI incident, good catch or other non-conformities with little or no impact on patient care.

An analysis of the most frequently occurring primary pathway subcodes was conducted. Between April 2025 and July 2026 there were no statistically significant changes.

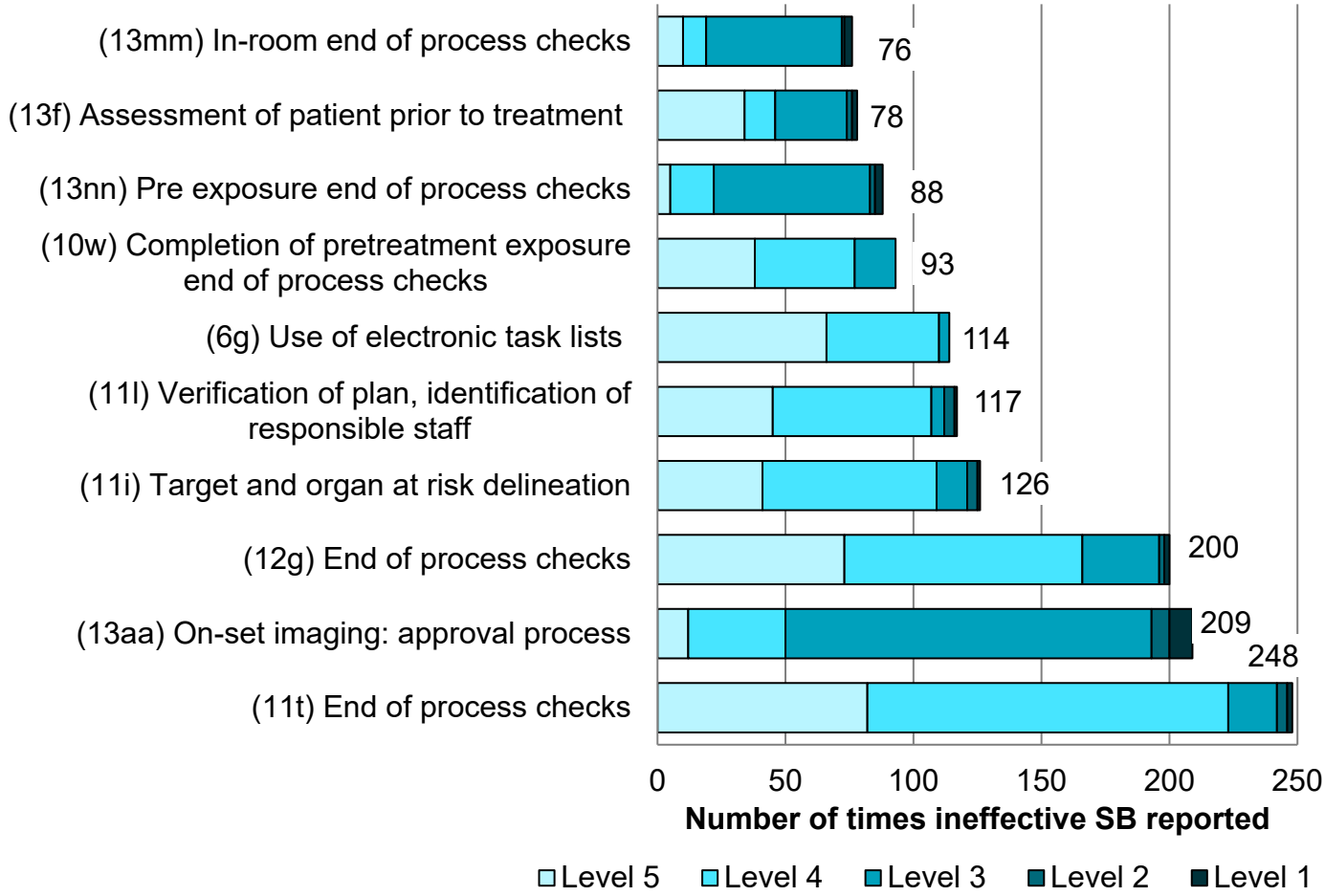
Ineffective safety barriers

Within the 9th biennial radiotherapy event data analysis and learning report an ineffective safety barrier (SB) is defined as ‘a defence or function that did not perform its intended safety role when required, to prevent, mitigate, or contain an incident’.

Multiple SB codes can be linked to a single RTE and may be reported against either the primary, or any additional pathway subcode. Across all RTE reports, 1,986 ineffective SB were identified, the most frequently reported are shown in Figure 4.

The most frequently reported ineffective SB was the pretreatment planning process ‘end of process checks’ (EOPC) accounting for 12.5% (n=248) of all ineffective SB. The majority of these (97.6%, n=242) were classified as minor radiation or MRI incident, good catch or other non-conformities with little or no impact on patient care. A total of 89.5% (n=222) of the EOPC were reported as additional pathway subcodes.

Figure 4. Breakdown of ineffective SB (n=1,349 out of 1,986 subset of RTE data)



Method of detection

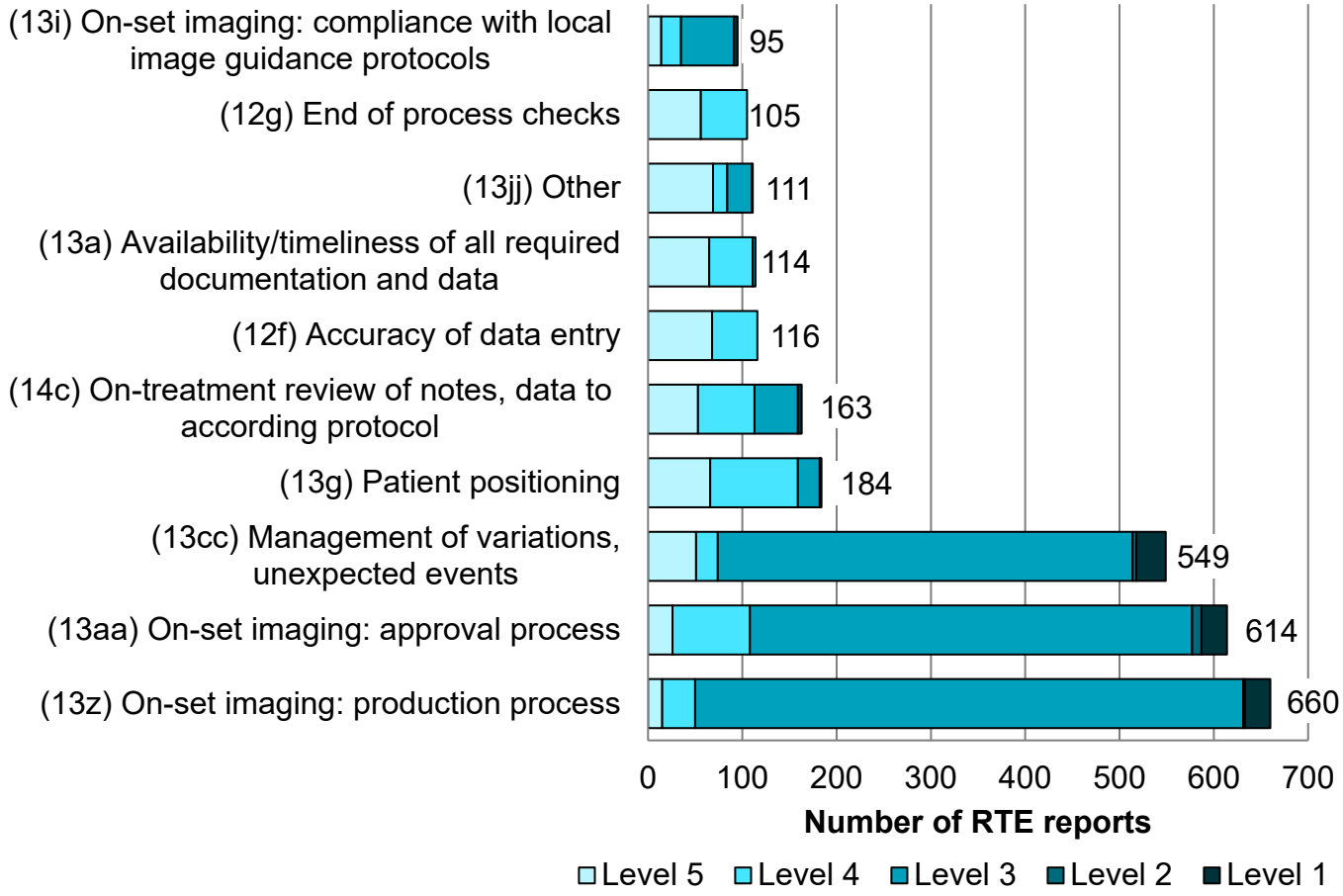
A method of detection (MD) is the process that identified the event and can be coded using the entire pathway taxonomy. The most frequently reported MD can be seen in Figure 5.

The most frequently reported MD was ‘on-set imaging: production process’13.0% (n=660) of all reports. The majority of these reports (84.1%, n=555) were associated with the same primary pathway subcode.

Seven of the most frequently reported MD occurred within the treatment unit process. Use of the treatment unit process subcode ‘other’ decreased in proportion, from 3.3% in the previous analysis to 2.2% in the current reporting period.

Whilst there are likely to be occurrences where the use of ‘other’ codes may be appropriate, reporters should consider the full range of pathway subcodes relevant to the activity being undertaken before selecting an ‘other’ pathway subcode. Increased use of specific pathway subcodes supports more detailed local and national learning.

Figure 5. Breakdown of MD by level (n=2,711 out of 5,096 subset of RTE data)



EOPC occur at the completion of each discrete stage of the patient pathway and therefore encompass multiple different pathway subcodes. EOPC accounted for 7.8% (n=400) of all MD

reported during the current triannual period. Of these, 43.0% (n=172) were classified as Level 4: good catch, where a radiation or MRI incident was detected and prevented from occurring.

The use of the archived pathway subcode 13hh ‘end of process checks’ as a MD continued to decline. Only 3.0% (n=12) of the EOPC-related MD reports were coded using the archived pathway subcode during the current reporting period, compared to 10.3% (n=34) in the previous analysis. Further information on EOPC can be found in this month’s E-Bulletin (issue 20).

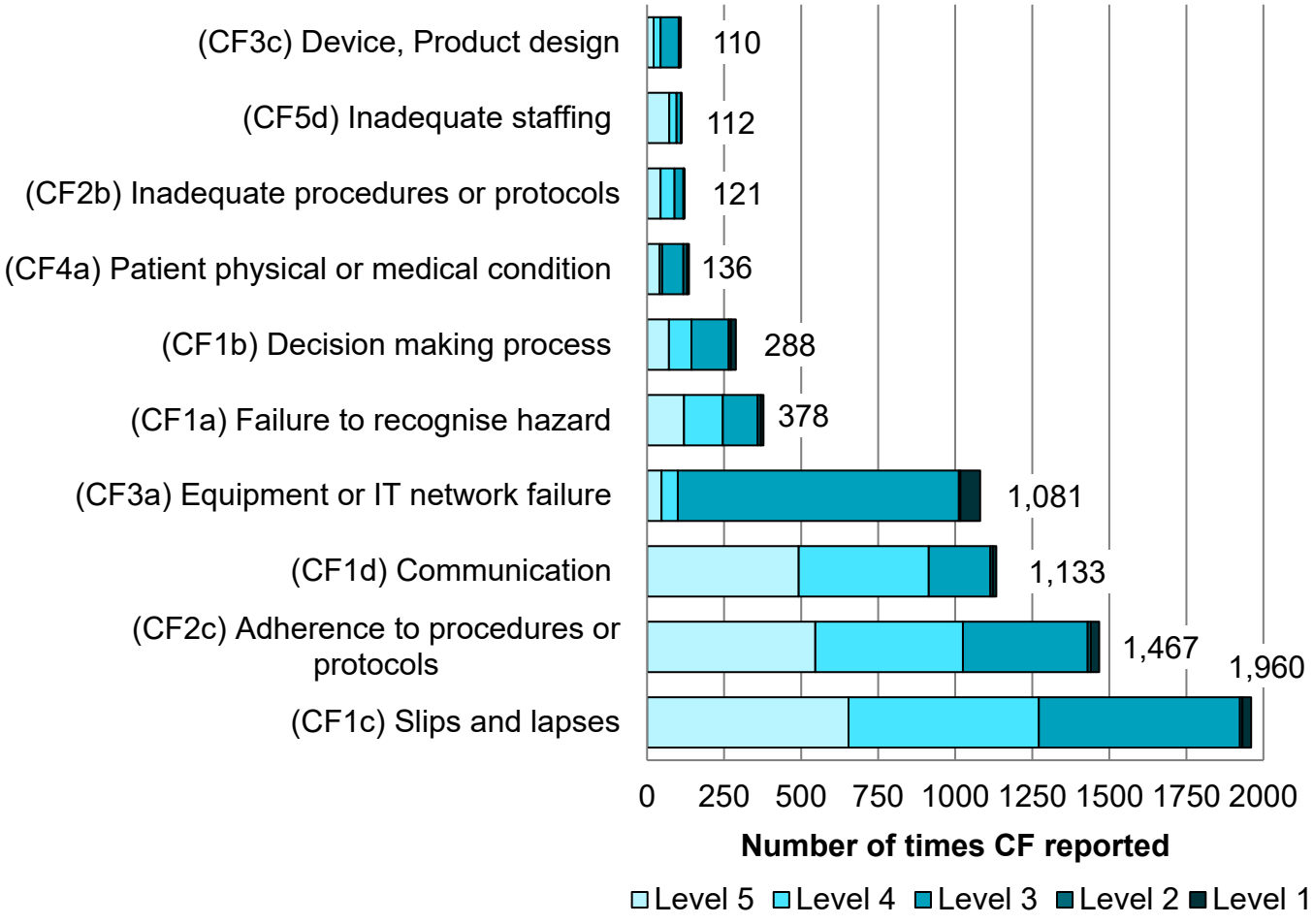
An analysis of the most frequently occurring MD pathway subcodes was conducted. Between April 2025 and July 2026 there were no statistically significant changes.

Contributory factors

Including contributory factors (CF) within a RTE taxonomy enables identification of system problems that could precipitate a range of different events (1).

A systems-based approach to RTE analysis may identify multiple CF for a single event. A total of 7,296 CF codes were assigned to 5,317 RTE, with 1,539 reports containing multiple CF.

Figure 6. Breakdown of most frequently reported CF (n=6,786 out of 7,296 subset of data)



The most frequently occurring CF codes are illustrated within Figure 6. The most frequently reported CF was ‘slips and lapses’ making up 26.9% of all contributory factors (n=1,960). Although individuals are often involved in the last interaction prior to an event, actions and behaviour are the product of influences from the whole system, requiring a holistic approach to any response.

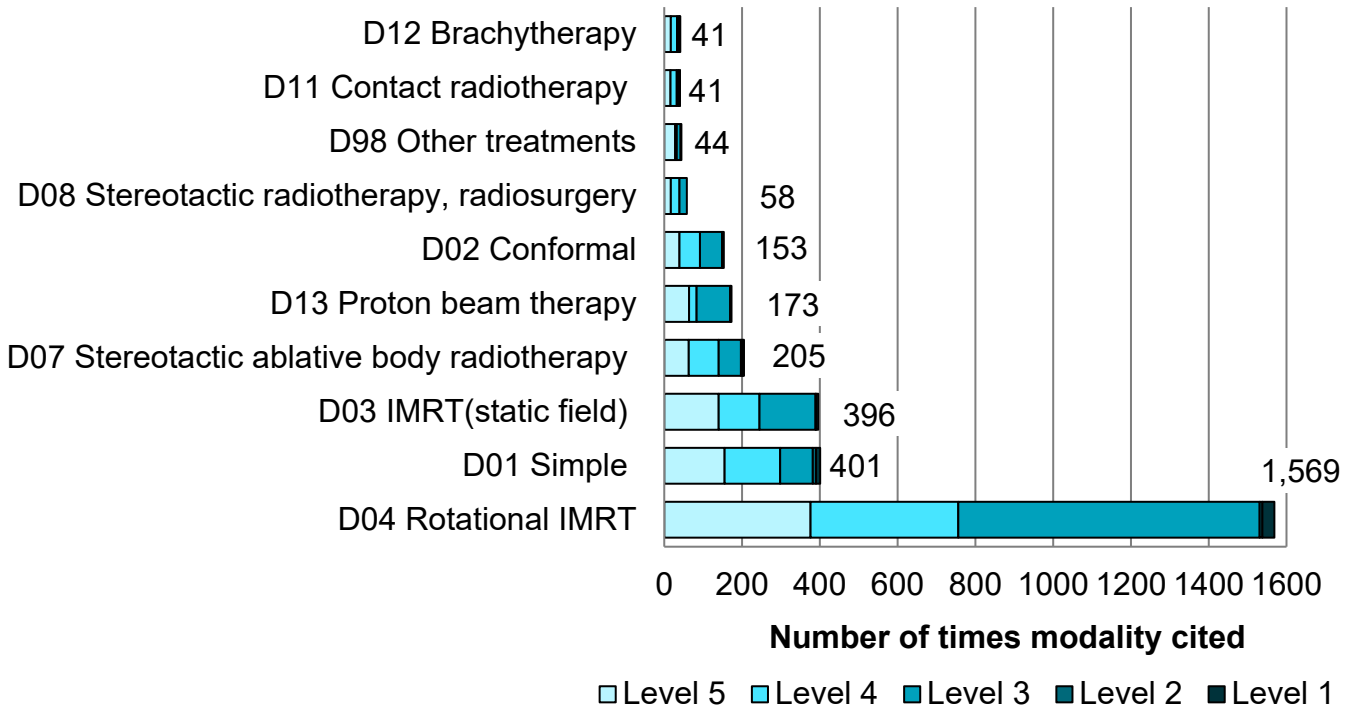
Advancing Safer Radiotherapy reflects and consolidates contemporary approaches to patient safety, including systems thinking, and recommends all CF are identified and used to inform actions required to reduce risk and potential for harm. The range of CF is broadly similar to the previous analysis.

An analysis of the most frequently occurring CF was conducted. Between April 2025 and July 2026 there were no statistically significant changes.

Modality

The introduction of a modality (D) allows the identification of trends within the RTE data specific to the type of treatment (modality). For this reporting period (n=3,111) contained a modality. The most frequently reported modality can be seen in Figure 7. Rotational IMRT including volumetric modulated arc therapy (VMAT) and RapidArc were the most frequently reported making up 50.4% (n=1,569) of all modalities reported. This is to be expected as IMRT is the most frequently used modality (2).

Figure 7. Breakdown of most frequently reported modality (n=3,081 out of 3,111 subset of data)



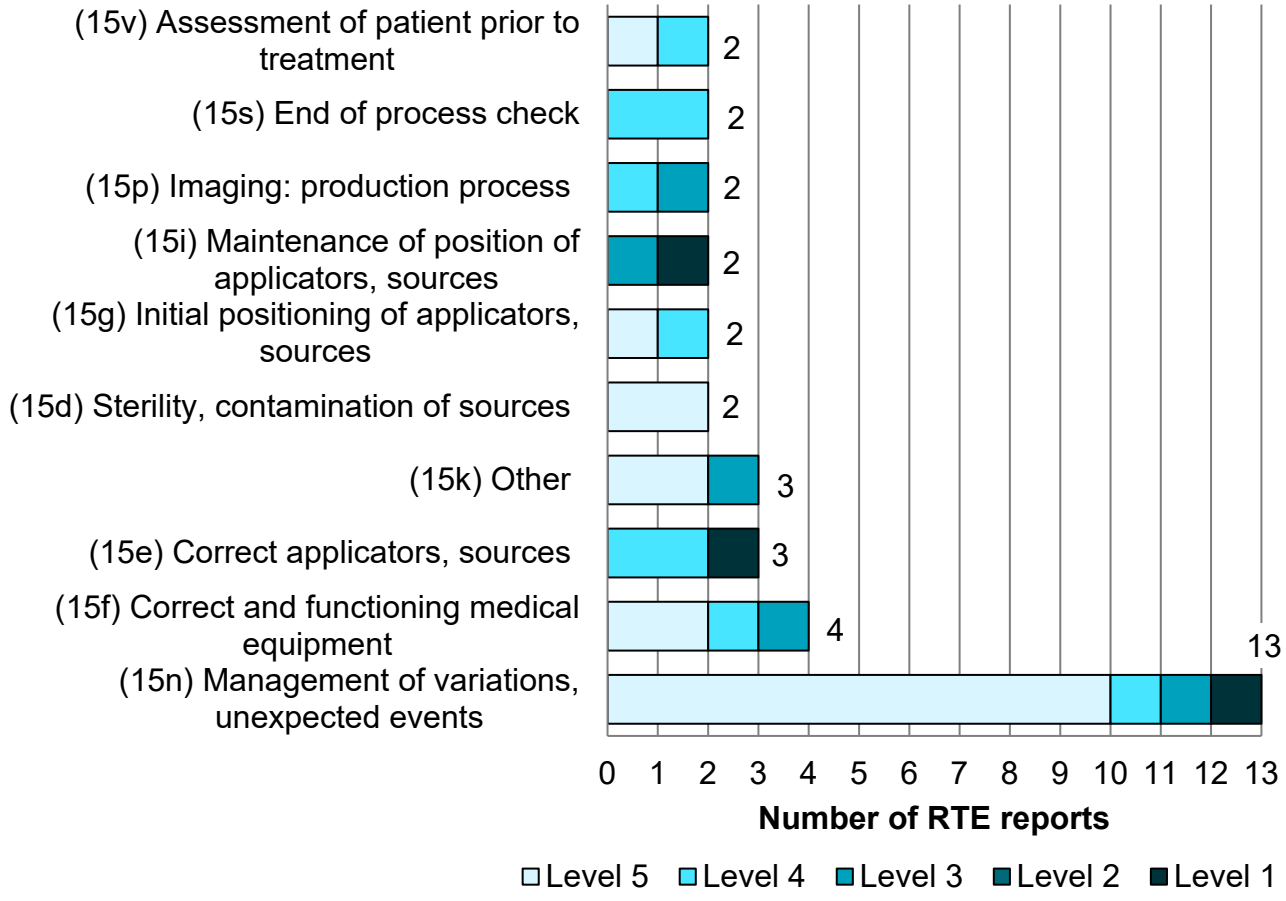
Brachytherapy RTE

Brachytherapy (BRT) is a RT sub-speciality which involves radiotherapy treatment inside or close to the treatment area. BRT makes up less than 3% of all RT episodes (2). Therefore, the number of BRT associated RTE would be expected to be low and should be interpreted with caution.

For this reporting period there were 46 reports coded with BRT process subcodes, and a further 7 reports included the modality taxonomy D12 ‘brachytherapy’. This resulted in BRT RTE accounting for 1.0% (n=53) of reports, similar in proportion to the previous analysis (1.0%, n=41). The number of providers reporting BRT RTE has decreased by 1 since the previous analysis to 16. A breakdown of the BRT RTE can be seen in Figure 8.

The most frequently reported BRT process subcode was ‘management of variations, unexpected events’ comprising 24.5% (n=13) of all BRT RTE. The majority of these were associated contributory factors ‘equipment or IT network failure’ (46.2%, n=6) and ‘natural factors’ (23.1%, n=3).

Figure 8. Breakdown of most frequently reported BRT RTE by level (n=35 out of 53)

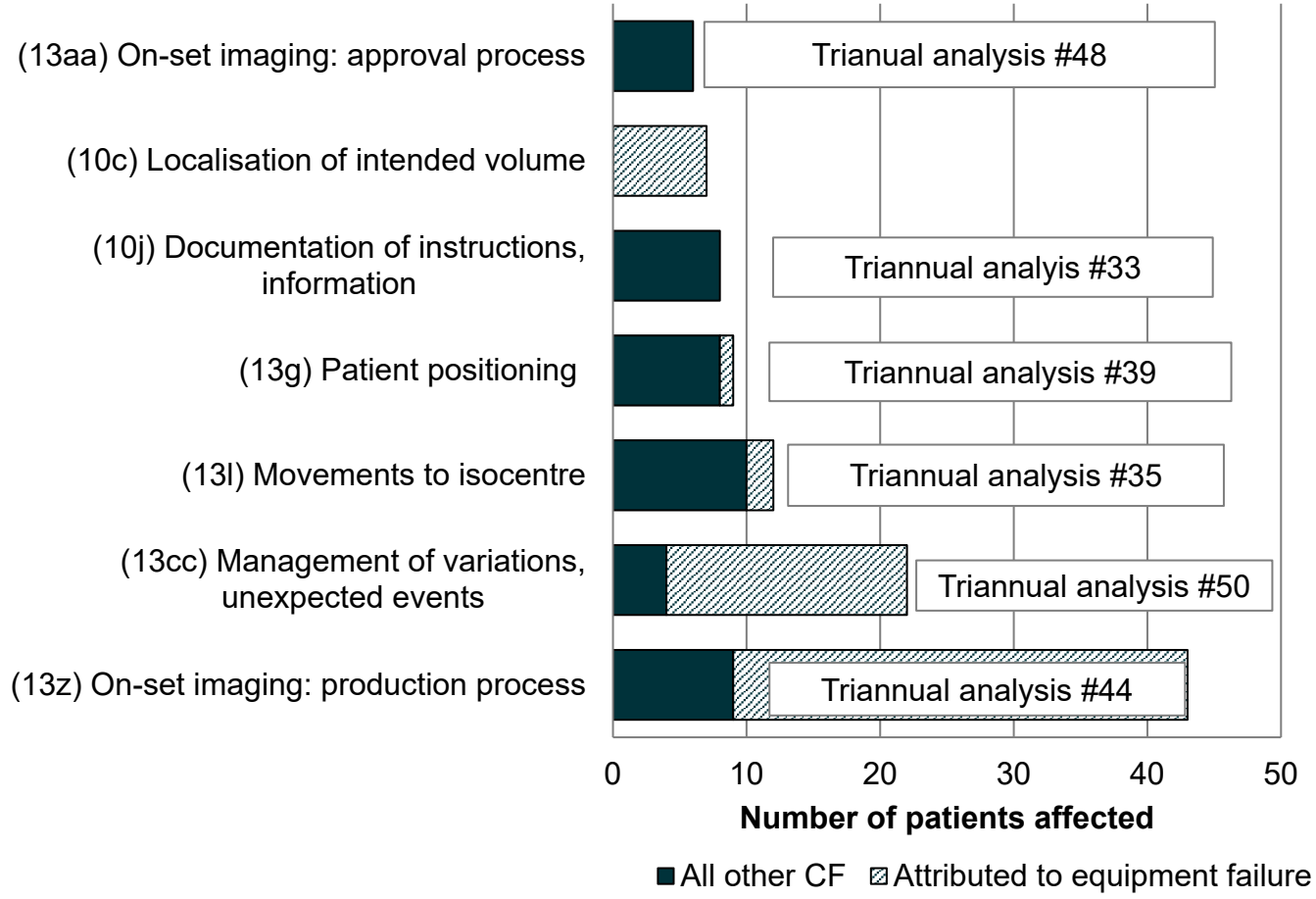


Inspectorate data

A breakdown of the inspectorate data for this reporting period can be seen in Figure 9. The inspectorates shared 115 anonymised closed synopses of reported SAUE affecting 153 patients. This is an increase since the previous analysis when 47 reports affecting 80 patients were shared. There were several reports that affected multiple patients.

Notifications were most frequently reported associated with primary pathway subcode 'On-set imaging: production process' (28.1% n=43), a large proportion of these (79.1%, n=34) were attributed to equipment failure. Further information on this type of event is featured in the case study below. Publications with relevant case studies considering each pathway subcode are indicated in Figure 9.

Figure 9. Breakdown of most frequently reported inspectorate Level 1 pathway subcodes from closed notifications (n=107 out of 153 subset of data)



Further analysis of the inspectorate data can be seen in Table 2. This shows that most notifications led to additional verification or planning imaging and did not affect the patient's treatment (79.1% n=121). Of note, those notifications that did affect treatment delivery decreased from 38.8% (n=31) in the previous analysis to 17.6% (n=27).

Table 2. Notification category

Notification category	Proportion and number of notifications
Additional pretreatment (planning) imaging	8.5%, n=13
Additional treatment verification imaging	70.6%, n=108
Affected treatment delivery	17.6%, n=27
Other	3.3%, n=5

Case study 20: Management of variations, unexpected events (13cc)

The pathway subcode 13cc description is ‘Management of variations, unexpected events (including on-treatment equipment failure (not associated with on-set imaging), management of replans, migration of fiducials, transfer between treatment machines)’. The majority of RTE reported citing this as the primary pathway subcode are attributes to equipment malfunction during treatment (not associated with on-set imaging).

Between August 2025 and July 2026 there have been 14,612 RTE reported, of these 8.6% (n=1,256) were assigned ‘management of variations’ as the primary pathway subcode. 83.5% (n=1,049) of these were associated with equipment malfunction. This can include on-treatment equipment faults including those cited as multi-leaf collimator (MLC), or collimator (Col). Of the 1,256 RTE reported 85.9% (n=1,079) were reported as radiation incidents (Level 1 – 3). The majority of these incidents resulted in additional treatment verification imaging and did not affect treatment delivery.

Synopsis

A patient receiving lung SABR treatment (55Gy in 5#), required daily CBCT verification imaging. Following patient set-up, a CBCT was acquired and matched, confirming correct treatment position. Treatment was initiated; however, delivery could not commence due to an MLC fault. The fault was logged in the on-treatment fault record log and engineering support attended. The patient was removed from the treatment couch while the fault was cleared.

The patient was then repositioned and a repeat CBCT confirmed correct alignment. Treatment was restarted, but the same fault reoccurred. The fault was again logged, and engineers were contacted. The patient was removed from the couch while the issue was investigated.

Arrangements were made to complete treatment on an alternative linac. Following patient re-set-up and an additional CBCT to confirm position, treatment was delivered successfully.

Subsequent investigation found that this event was reportable due to the total 3 verification exposures during a single treatment fraction.

Coding: TSRT9/ Level 1/13cc/ MD13cc/ CF3a / D07

RTE response

A robust RTE response will maximise potential learning from this event. Table 3 contains the key stages to an RTE response and further considerations for this case study.

Table 3. Key response stages to RTE described above (13cc)

RTE response stage	Considerations
Identification and local reporting of RTE	This event was detected at the same time as occurrence, therefore the same primary subcode and method of detection are identified (MD13cc). Staff subsequently reported the event on the local event learning system.
Decision to investigate	The patient received three verification exposures during a single treatment fraction due to equipment malfunction; therefore, the event meets the SAUE reporting criteria under section 4.2a 'radiotherapy treatment verification images'. In accordance with SAUE guidelines, this constitutes a reportable radiation incident (Level 1) and requires a detailed investigation in line with local procedures.
Planning and selection of investigation team	An interdisciplinary investigation team was established, comprising of the SABR lead radiographers, a clinical oncologist, a Medical Physics Expert (MPE), an engineer and a member of the radiotherapy QA team. Multiple individuals of the team were appropriately trained and competent to undertake a systems-focused patient safety event investigation.
Recording of investigation	The local investigation report template was utilised to guide the investigation and capture the relevant information. All equipment malfunctions are recorded and monitored via the local electronic fault log and associated radiotherapy events (RTE) are managed via the local event learning system. RTE involving equipment malfunctions are also shared with the national radiotherapy event learning system via LFPSE, reported to the manufacturer and to MHRA.
Information gathering	Operators and engineers involved in the event contributed to the investigation. A review of the local electronic fault log alongside an audit of RTE was undertaken to identify if any

RTE response stage	Considerations
	similar previous incidents had occurred and to ensure all faults were appropriately managed, in accordance with local procedure. It was noted that a similar notification to the regulators had been recorded, however this occurred on a different linac over six months previous.
Analysis and identification of contributory factors	Analysis was undertaken using a SEIPS (3, 4) framework. The intermittent equipment malfunction was a contributory factor, which occurred on two occasions during the patient's treatment (CF3a). The investigation identified the importance of robust equipment management and confirmed equipment testing and QA was up to date and complete as per departmental protocol.
Identification of areas for improvement and agree action plan	To address the areas for improvement identified, the following actions were agreed within a local action plan: • investigate methods for predicting equipment failure and allow for proactive maintenance to limit the impact of unscheduled repairs • continue to monitor likelihood of similar events occurring by incorporating systematic audits of equipment malfunctions and RTE analysis into planned programme of work • use intelligence from the local event learning system, fault reporting and QA programme to identify potential risks and likelihood of occurrence • perform a risk assessment for the affected equipment, identifying appropriate thresholds for when consideration is given to escalation and potential removal from clinical use, • ensure effective communication pathways are in place to facilitate escalation of reportable events and identified risk • review the contingency plan in case of equipment failure • practice and rehearse contingency plans
Dissemination of learning	The patient was informed of the event and provided with assurances regarding the routine quality assurance and safety checks performed on radiotherapy equipment. Staff across all relevant disciplines were informed of the event through dissemination of an investigation summary at departmental staff meetings. Awareness of the findings and key learning points was also reinforced via a staff email communication.

RTE response stage	Considerations
	The event was shared at the newly established local network RTE meeting.
Assessment of effectiveness	Planned audit of improvement actions to be completed 3 months after implementation. Ongoing monitoring of the electronic fault log alongside periodical audit of RTE to ensure equipment malfunctions are appropriately managed.

References

1. Clark BG, Brown RJ, Ploquin JL, Kind AL, Grimand L. ‘The management of radiation treatment error through incident learning’ Radiotherapy and Oncology 2010: volume 95, issue 3, pages 344 to 349
2. Radiotherapy dataset (RTDS)
3. NHS England. Patient safety learning response toolkit
4. NHS England. Systems Engineering Initiative for Patient Safety (SEIPS)

About the UK Health Security Agency

The UK Health Security Agency (UKHSA) prevents, prepares for and responds to infectious diseases, and environmental hazards, to keep all our communities safe, save lives and protect livelihoods. We provide scientific and operational leadership, working with local, national and international partners to protect the public's health and build the nation's health security capability.

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