UK Health Security Agency

Safer Radiotherapy

Triannual RTE analysis and learning report

Issue 49: full radiotherapy event data analysis, December 2025 to March 2026

Contents

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 subcoding, 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.

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. 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.

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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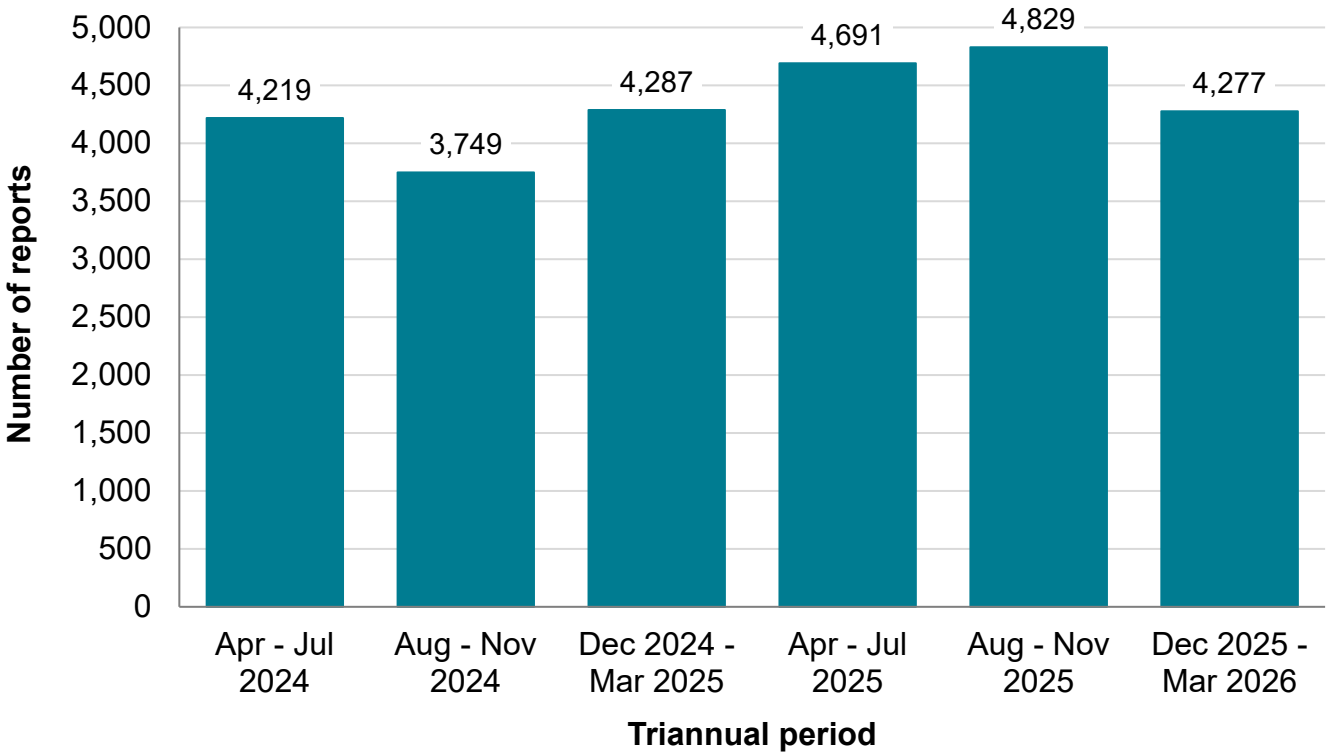
December 2025 to March 2026 national radiotherapy event (RTE) data analysis

Number of RTE reports

A total of 4,277 classified RTE reports were received between December 2025 and March 2026, a decrease of 11.4% (n=4,829) when compared to the previous analysis (August to November 2025) and a decrease of 0.2% (n=4,287) when compared to the same reporting period between December 2024 and March 2025 (issue 45). During the current review period there were 80 reported events which involved multiple patients, ranging from 2 to 19 patients, resulting in 238 RTE, whilst 37 RTE reports were received without any coding and did not contain sufficient detail to assign any classification or coding. The volumes of classified reports received over the past 6 triannual analysis periods are shown in Figure 1.

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



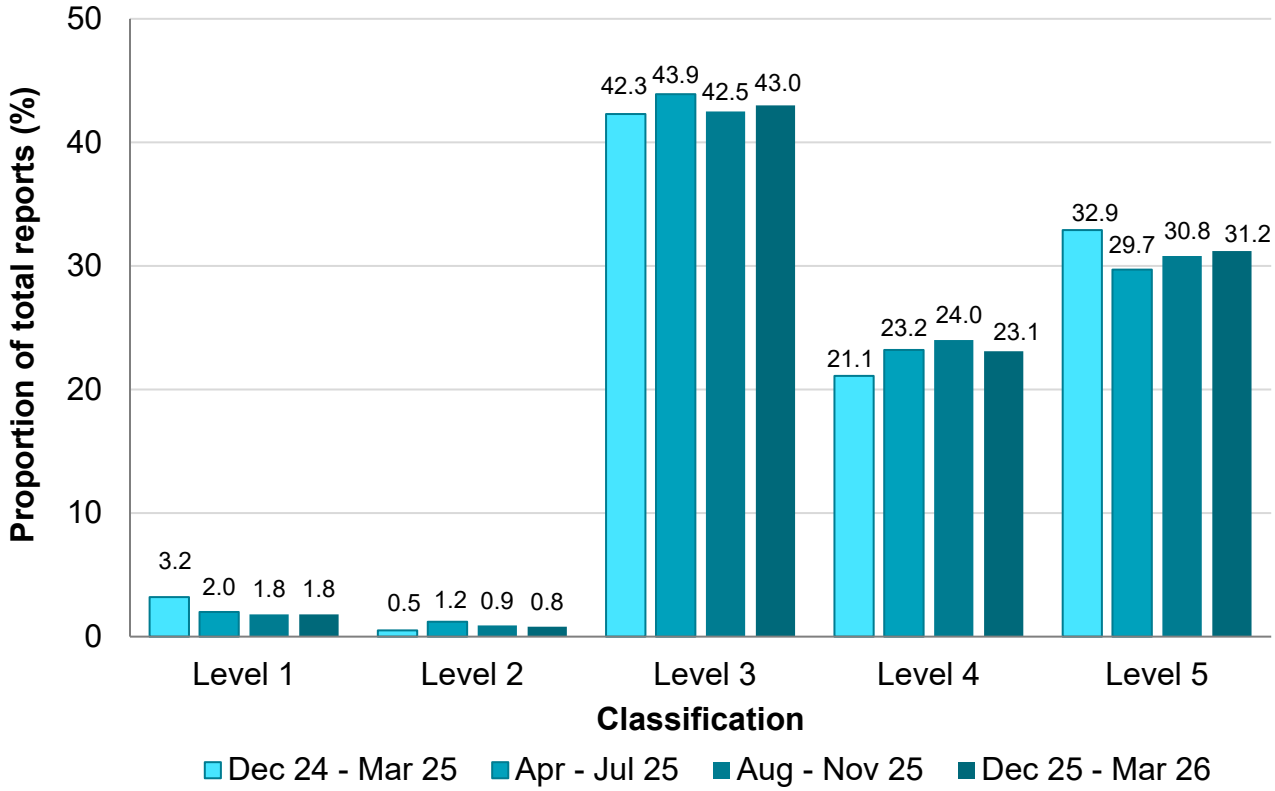
For this reporting period, data was received from 56 providers, including the NHS and independent sector. An average of 75 reports per provider were received, reflecting a decrease of 12.8% (n=86 reports) from the previous reporting period. It should be noted that this decrease does not mean every individual provider experienced a decrease 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’ (31.2%, n=1,336), Level 4 ‘good catch’ (23.1%, n=986), Level 3 ‘non-reportable (minor) radiation or MRI incident’ (43.0%, n=1,840), Level 2 ‘non-reportable (moderate) radiation or MRI incident’ (0.8%, n=36), or Level 1 ‘reportable radiation incident or other notifiable event’ (1.8%, n=79).

It is reassuring to note that 97.3% (n=4,162) of RTE reports were Level 3 to 5 events with little or no impact on patient outcome. Of the remaining 2.7% (n=115) of reports, 1.8% (n=79) were reportable under IR(ME)R to the appropriate enforcing authority (Level 1). This represents a similar proportion of all RTE reports as the previous reporting period. The proportion of reports for each classification level across the 4 most recent triannual periods (December 2024 to March 2026) is shown in Figure 2.

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

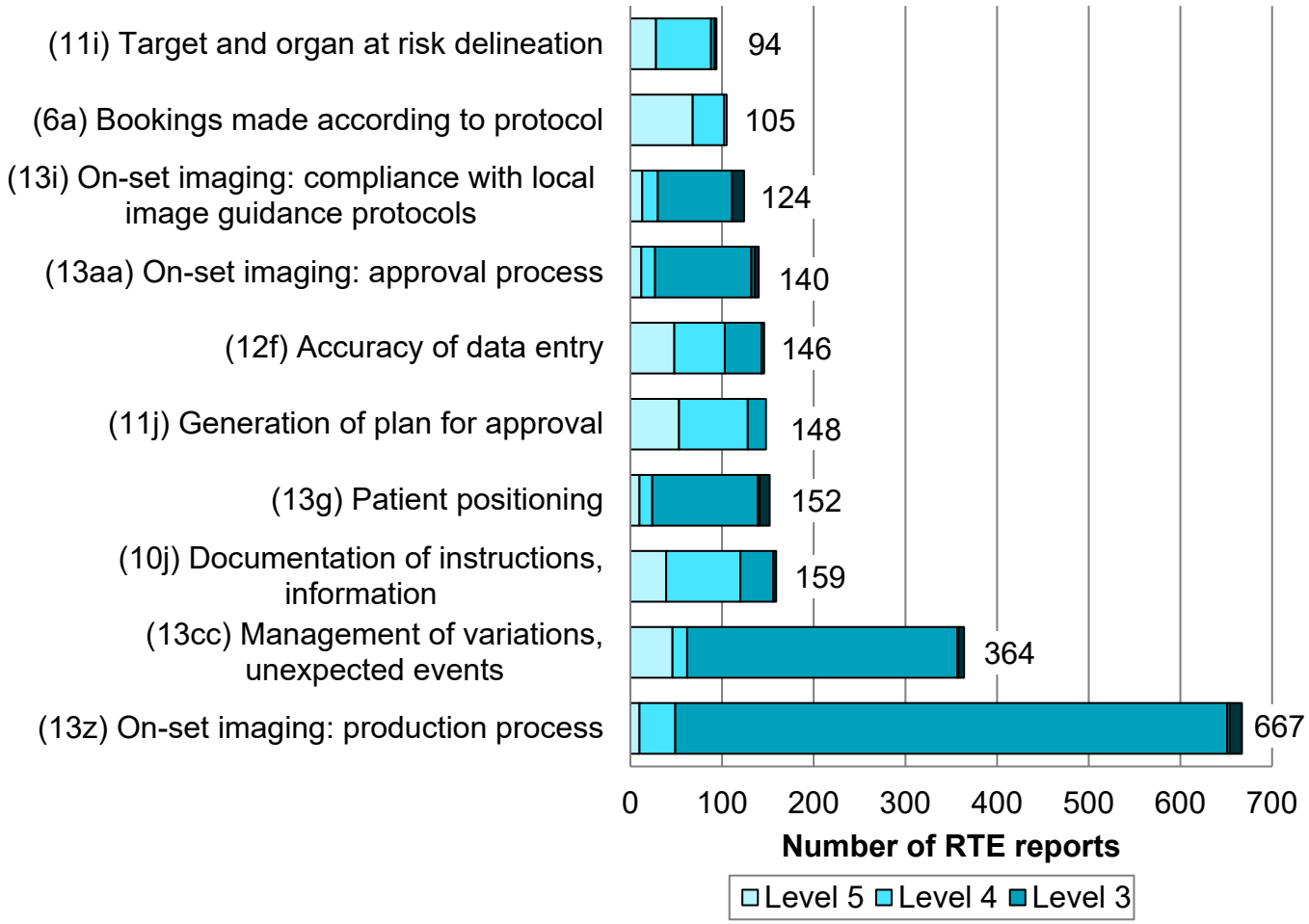


Breakdown of primary pathway subcodes

The most frequently reported primary pathway subcodes are presented in Figure 3. This subset of data was also broken down by classification level so the main themes could be derived. The most frequently reported RTE was ‘on-set imaging: production process’ at 15.6% (n=667) of all reports. This is an increase from the previous analysis, at 14.7% (n=711). Of this subset, 97.6% (n=651) of the reports were minor radiation or MRI incident, good catch or other non-conformities with little or no impact on patient care. A large proportion of this pathway subcode

reports were associated with contributory factor ‘equipment or IT network failure’ (63.0%, n=420).

Figure 3. Breakdown of most frequently reported RTE primary pathway subcodes by level (n=2,099 out of 4,277)



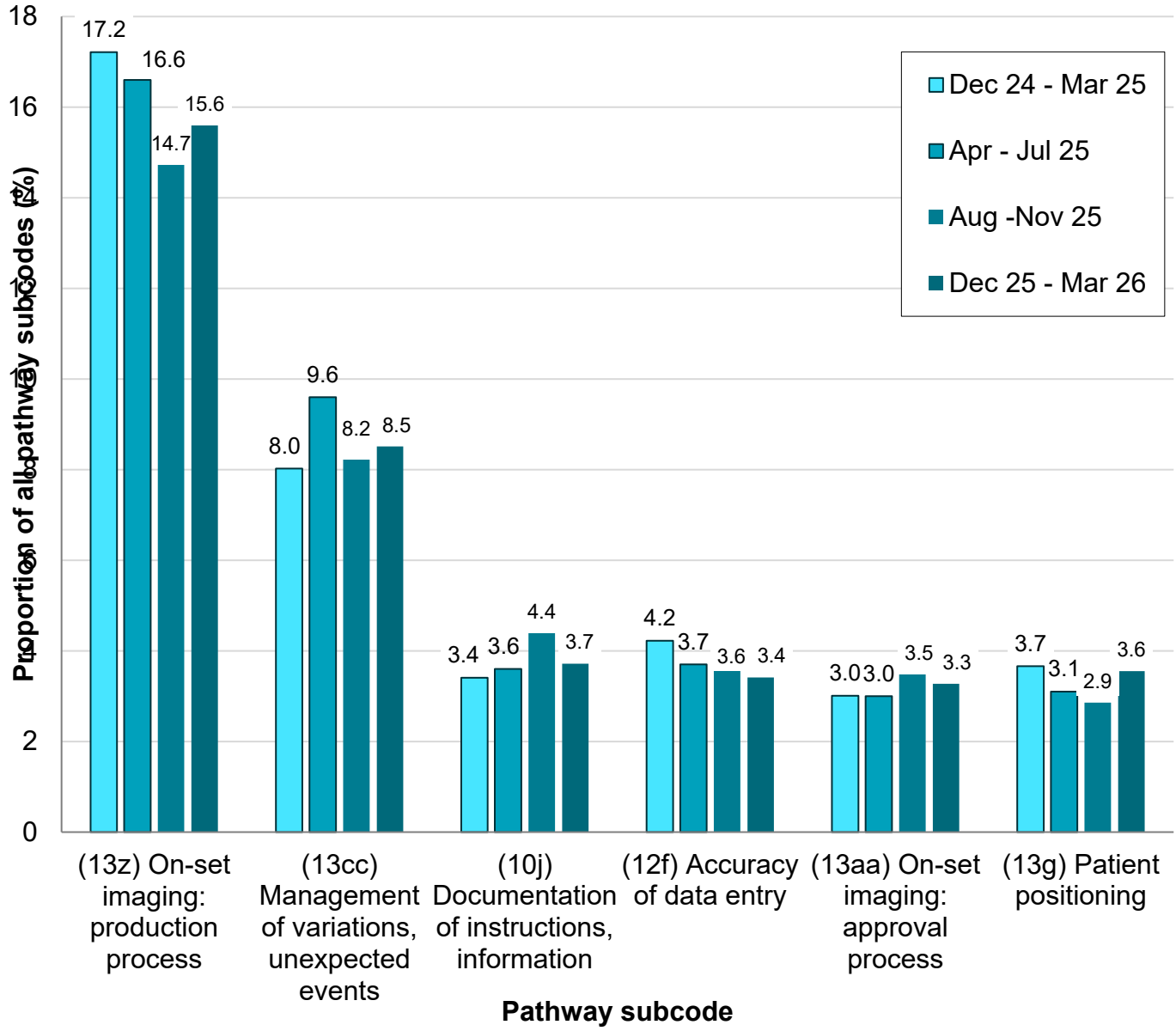
The second most frequently reported RTE was ‘management of variations, unexpected events’ at 8.5% (n=364). Similarly, this pathway subcode is often associated with contributory factor ‘equipment or IT network failure’ (82.7%, n=301) and with a large proportion comprising of minor radiation or MRI incident, good catch or other non-conformities with little or no impact on patient care (98.1%, n=357).

Figure 4 demonstrates a frequency trend analysis over time for the 5 most frequently occurring primary pathway subcodes for the current triannual period.

After recent decreases, both primary pathway subcodes ‘on-set imaging: production process’ and ‘management of variations, unexpected events’ have increased their proportions since the previous analysis.

Primary pathway subcode ‘accuracy of data entry’ has demonstrated a decrease over the past 4 triannual periods, however this is not considered statistically significant (p=0.06).

Figure 4. Breakdown of most frequently reported RTE primary pathway subcodes over time



Failed safety barriers

Safety barriers (SB) are additional tasks undertaken across the radiotherapy pathway with the primary purpose of identifying and mitigating an event. These process steps are over and beyond core tasks undertaken as part of the planning and delivery of radiotherapy treatment (1). Identifying those safety barriers that fail (FSB) most frequently is important in learning where vulnerabilities in radiotherapy safety systems reside.

Based on feedback from the radiotherapy community, the recent National patient safety radiotherapy event taxonomy guidance has refined many pathway subcodes, including the expansion of end of process check (EOPC) subcodes, for increased granularity. EOPC are a subset of the pathway taxonomy that are often allocated as a failed safety barrier. Due to these

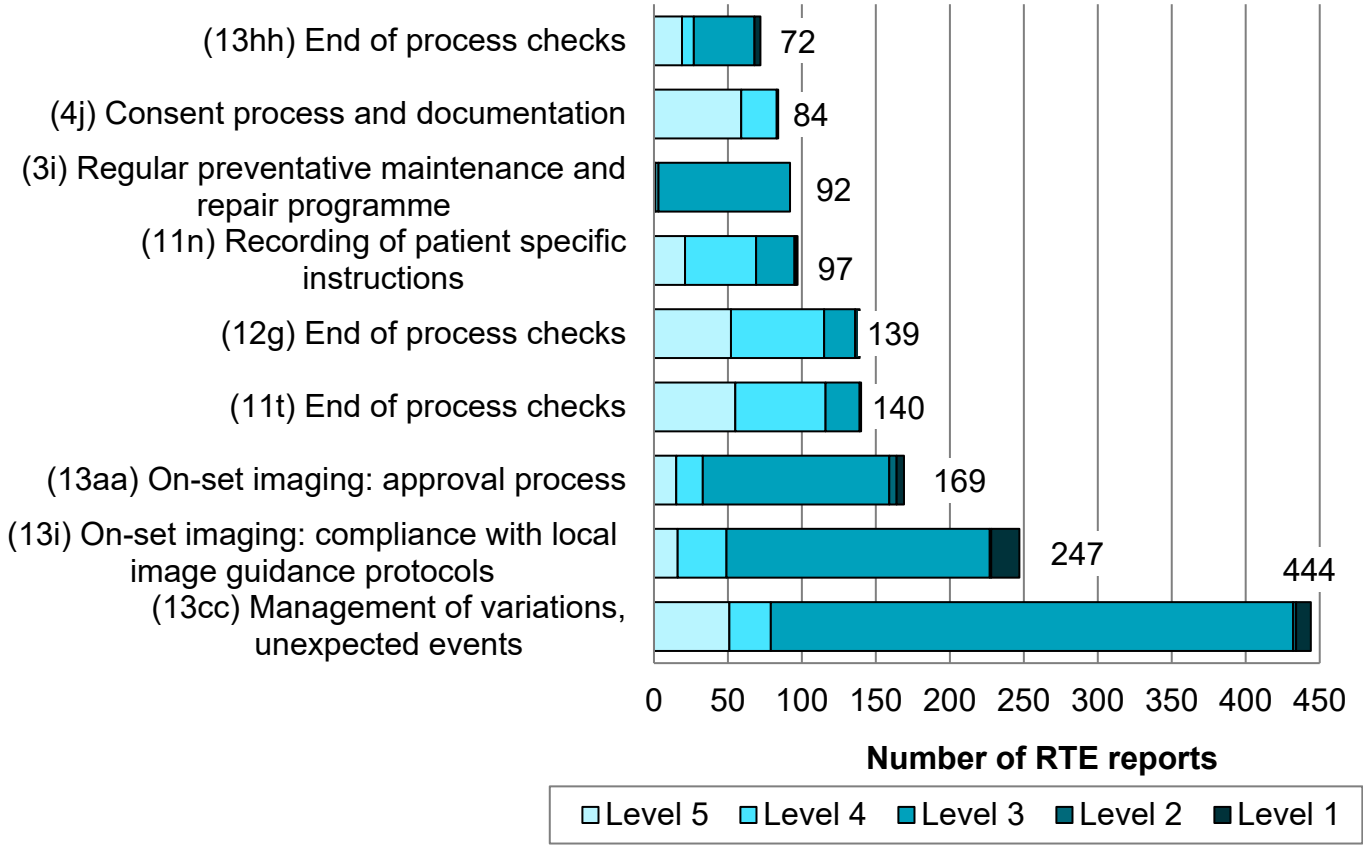
changes the PSRT are currently reviewing FSB with the aim of refining those pathway subcodes that meet the criteria of an SB. Results from this ongoing work will be shared shortly.

In the interim period, Figure 5 shows the breakdown of failed safety barriers based on the existing criteria. Multiple FSB codes can be attributed to each individual RTE. A total of 2,480 failed safety barriers (FSB) were identified from the RTE reported.

Treatment unit process 'management of variations, unexpected events' was the most frequently reported FSB (17.9%, n=444). An example of an RTE with this FSB includes when a machine failure occurs at the treatment unit, and the correct course of action is not taken in accordance with departmental protocol.

As previously stated the updated National patient safety radiotherapy event taxonomy included expansion of the EOPC pathway subcodes, and previous EOPC treatment subcode 13hh 'end of process check' has been archived. During this transition period there were 2.9% (n=72) of all FSB allocated as 13hh. The expanded pathway subcodes include 13mm 'in-room end of process checks', 13nn 'pre exposure end of process checks' and 13oo 'completion of treatment exposure end of process checks'. These combined made up 4.6% (n=115) of all FSB.

Figure 5. Breakdown of failed safety barriers (n=1,484 out of 2,480 subset of RTE data)

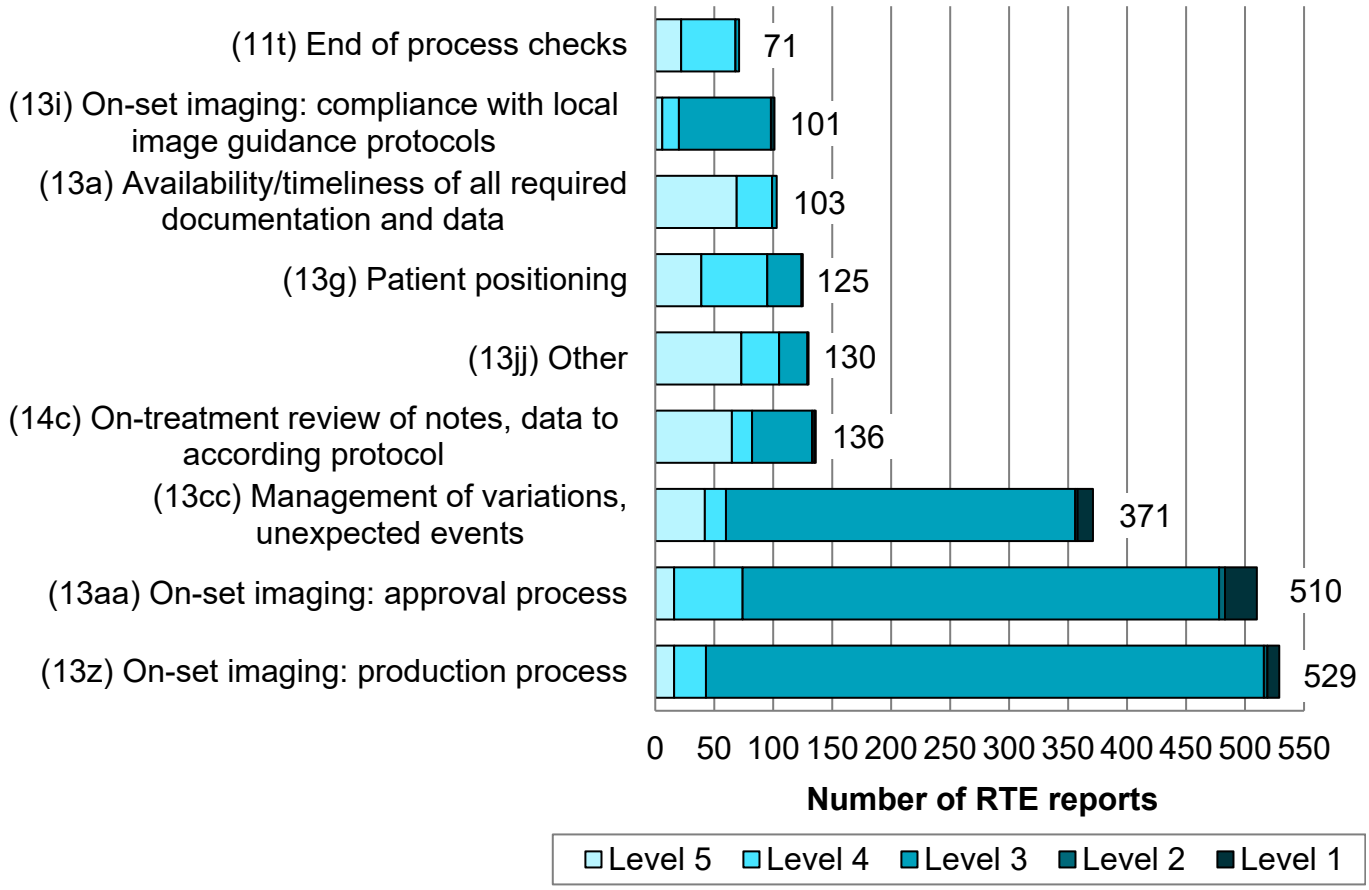


Method of detection

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 6.
The most frequently reported MD was ‘on-set imaging: production process’ (13.3%, n=529). Seven of the most frequently reported MD occurred at the treatment unit process. Treatment unit process subcode ‘other’ increased in proportion, from 1.9% in the previous analysis to 3.3%. Whilst there are likely to be occurrences where the use of ‘other’ codes is appropriate, they are non-specific and generic in nature and reporters should consider the full range of pathway subcodes available for the relevant activity in question before selecting an ‘other’ pathway subcode.

EOPC occur at the end of each discrete part of the patient pathway and include multiple different pathway subcodes. These comprised of 8.3% (n=331) of all MD of which 45.9% (n=152) were classified as Level 4: good catch, detecting and preventing a radiation or MRI incident from occurring. Only 10.3% (n=34) of the EOPC reported as MD for this triannual period were coded using the archived pathway subcode 13hh ‘end of process checks’, which is a notable reduction from 15.8% in the previous analysis. The 6 expanded EOPC pathway subcodes are described within the FSB section, these include 13mm, 13nn and 13oo. These accounted for 47.1% (n=156) of all EOPC MD, an increase from 35.1% in the previous analysis.

Figure 6. Breakdown of method of detection by level (n=2,076 out of 3,973 subset of RTE data)



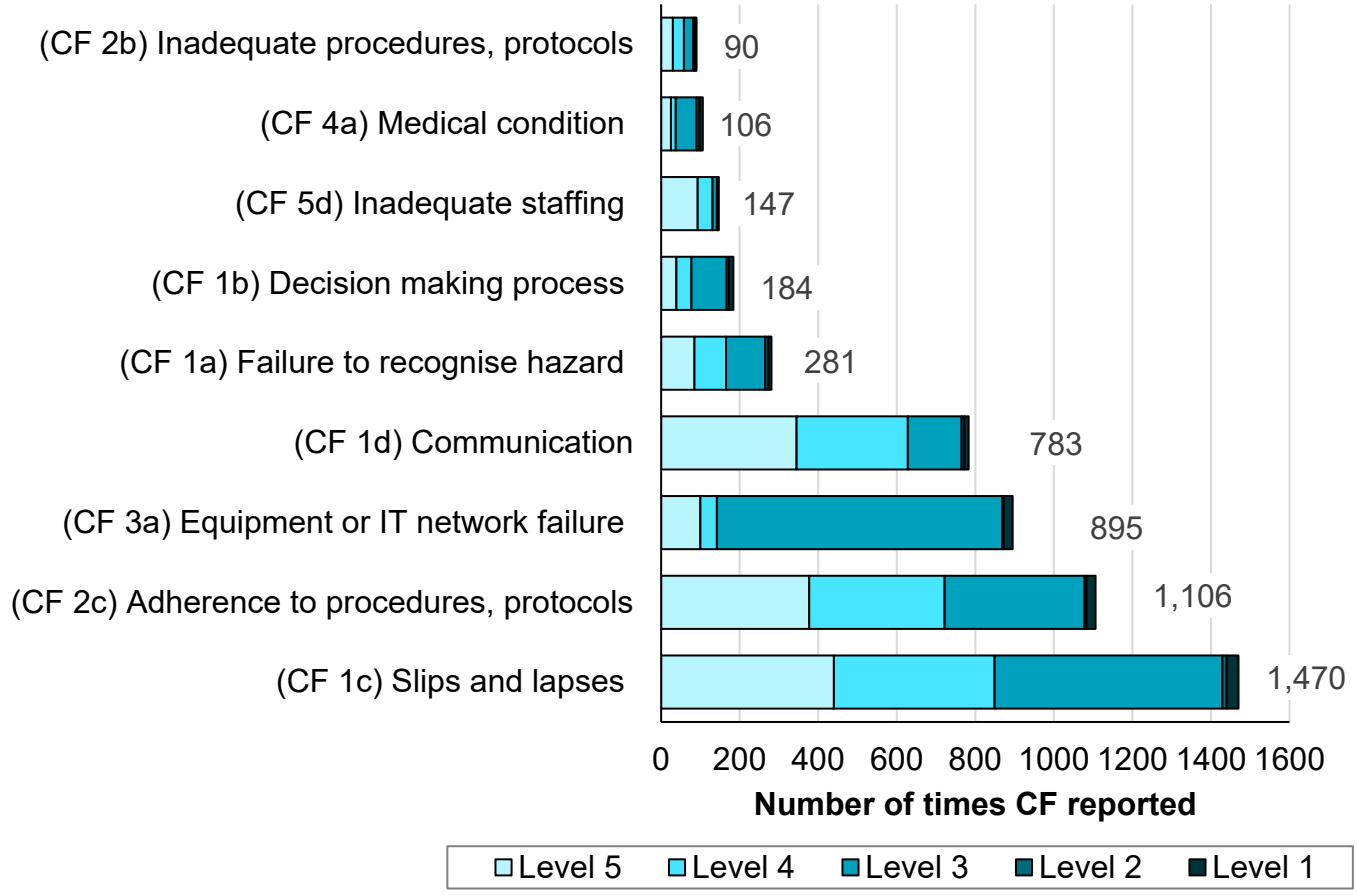
Contributory factors

Including contributory factors (CF) within a RTE taxonomy enables identification of system problems that could precipitate a range of different events (2).

A systems-based approach to RTE analysis may identify multiple CF for a single event. During the current review period, a total of 5,463 CF codes were assigned to 4,092 RTE, with 1,046 reports containing multiple CF.

The most frequently occurring CF codes are illustrated within Figure 7. The most frequently reported CF was ‘slips and lapses’ making up 26.9% of all contributory factors (n=1,470). 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.

Figure 7. Breakdown of most frequently reported CF (n=5,062 out of 5,463 subset of data)

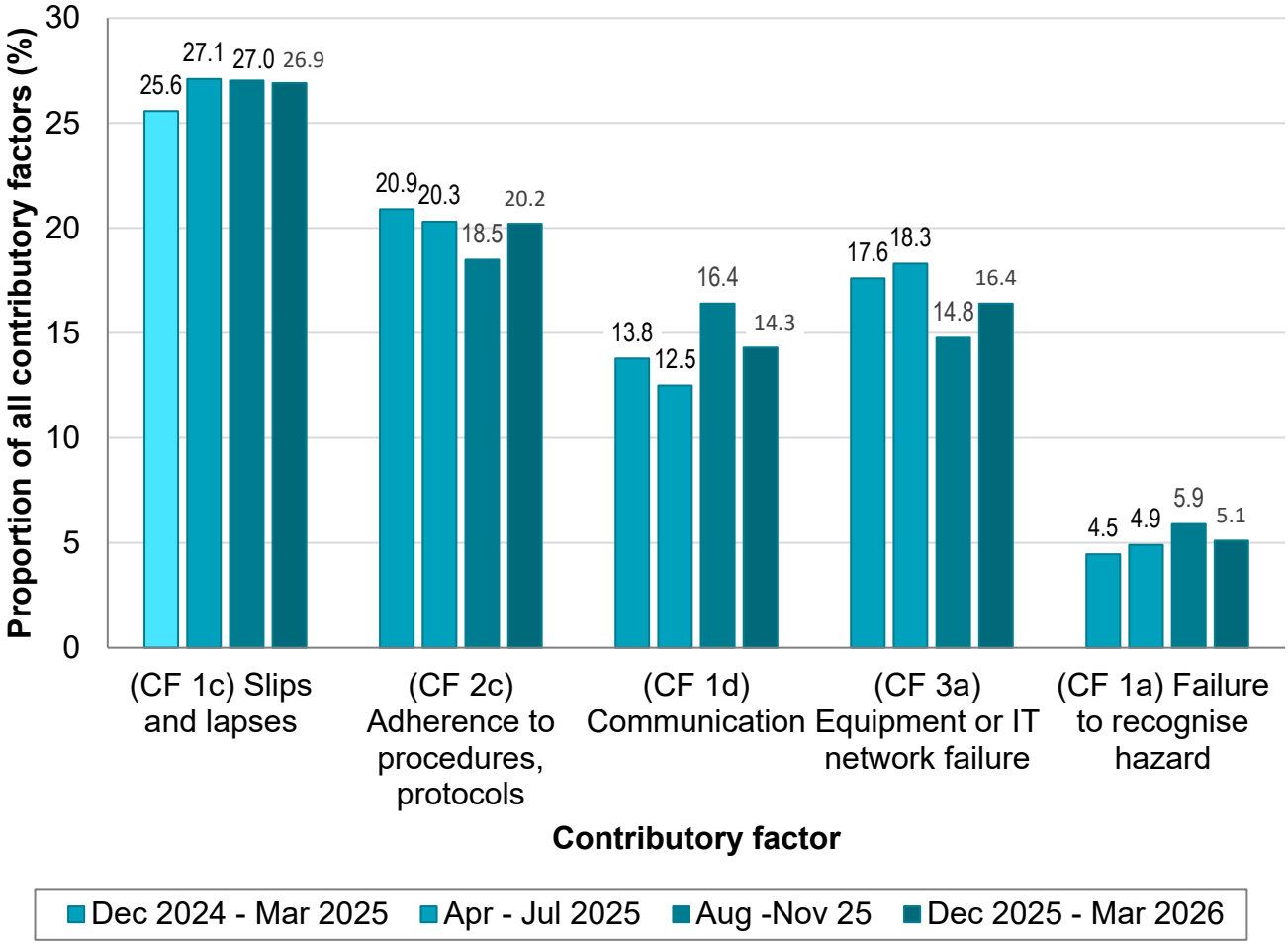


Advancing Safer Radiotherapy reflects and consolidates contemporary approaches to patient safety, including systems thinking, and recommends all CF are identified and used to inform actions required to reduce risk and potential for harm. The range of CF is broadly similar to the previous analysis.

Figure 8 illustrates the proportionality of the 5 most commonly cited CF over time. There are no statistically significant trends over these 4 triannual periods.

After showing a decrease in the previous analysis, contributory factors 'equipment or IT network failure' and 'adherence to procedures, protocols' have increased in proportion. In contrast, the increases seen in the previous analysis, contributory factors 'communication' and 'failure to recognise hazard', have decreased in proportion.

Figure 8. Breakdown of most frequently reported RTE contributory factors over time



Brachytherapy RTE

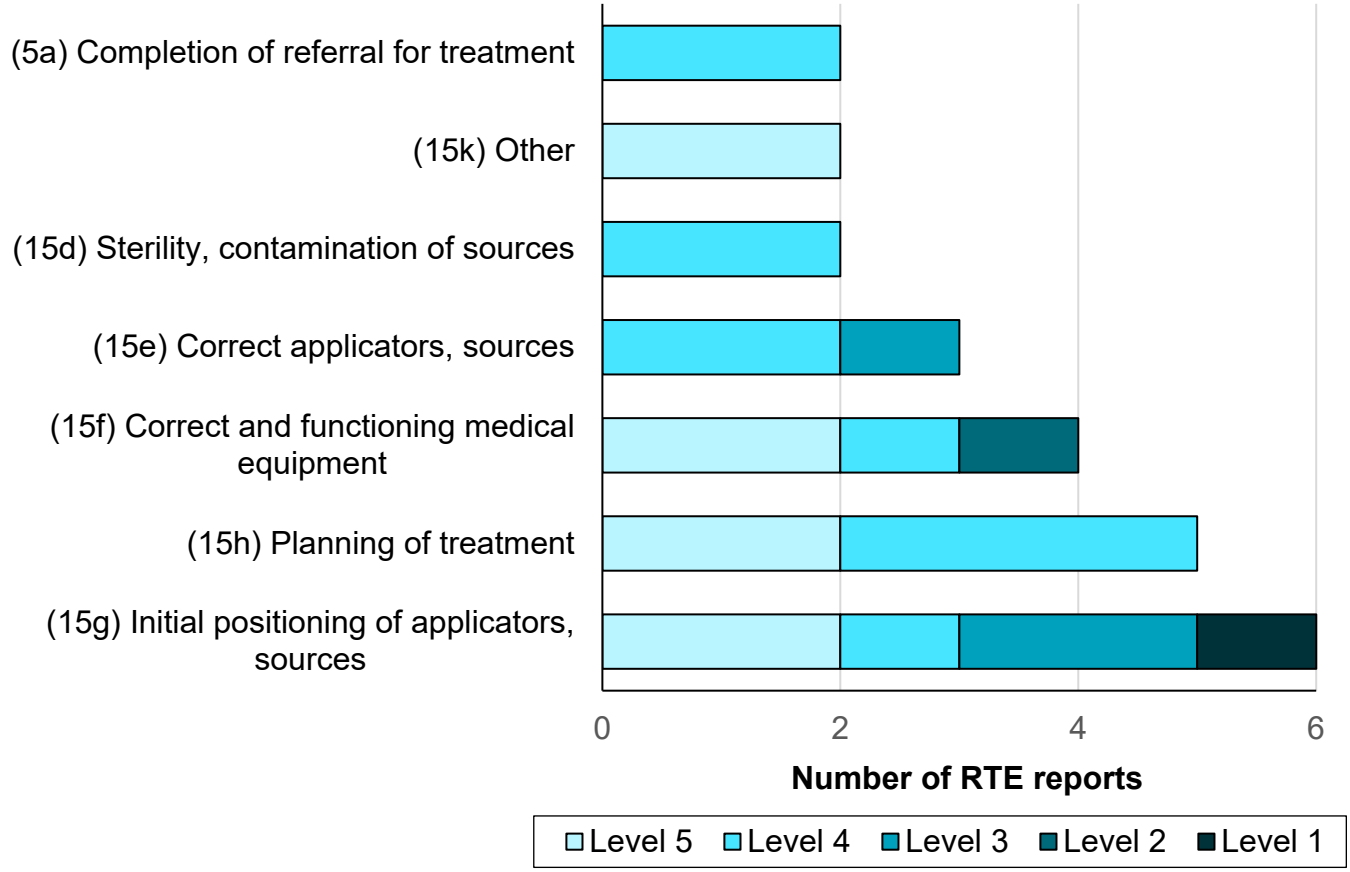
Brachytherapy (BRT) is a RT sub-speciality which involves radiotherapy treatment inside or close to the treatment area. BRT makes up less than 3% of all RT episodes (3). Therefore, the number of BRT associated RTE would be expected to be low and should be interpreted with caution.

For this reporting period there were 35 reports coded with BRT process subcodes, and a further 6 reports included the modality taxonomy D12 'brachytherapy'. This resulted in BRT RTE accounting for 1.0% (n=41) of reports, reflecting a slight decrease from the previous analysis

(1.1%, n=51). The number of providers reporting BRT RTE remained steady at 17. A breakdown of the BRT RTE can be seen in Figure 9.

The most frequently reported BRT process subcode was ‘Initial positioning of applicators, sources’ comprising 14.6% (n=6) of all BRT RTE. This reflects an increase in proportionality from the previous analysis, where this type of event made up 9.8% (n=5) of all BRT RTE.

Figure 9. Breakdown of most frequently reported BRT RTE by level (n=24 out of 41)

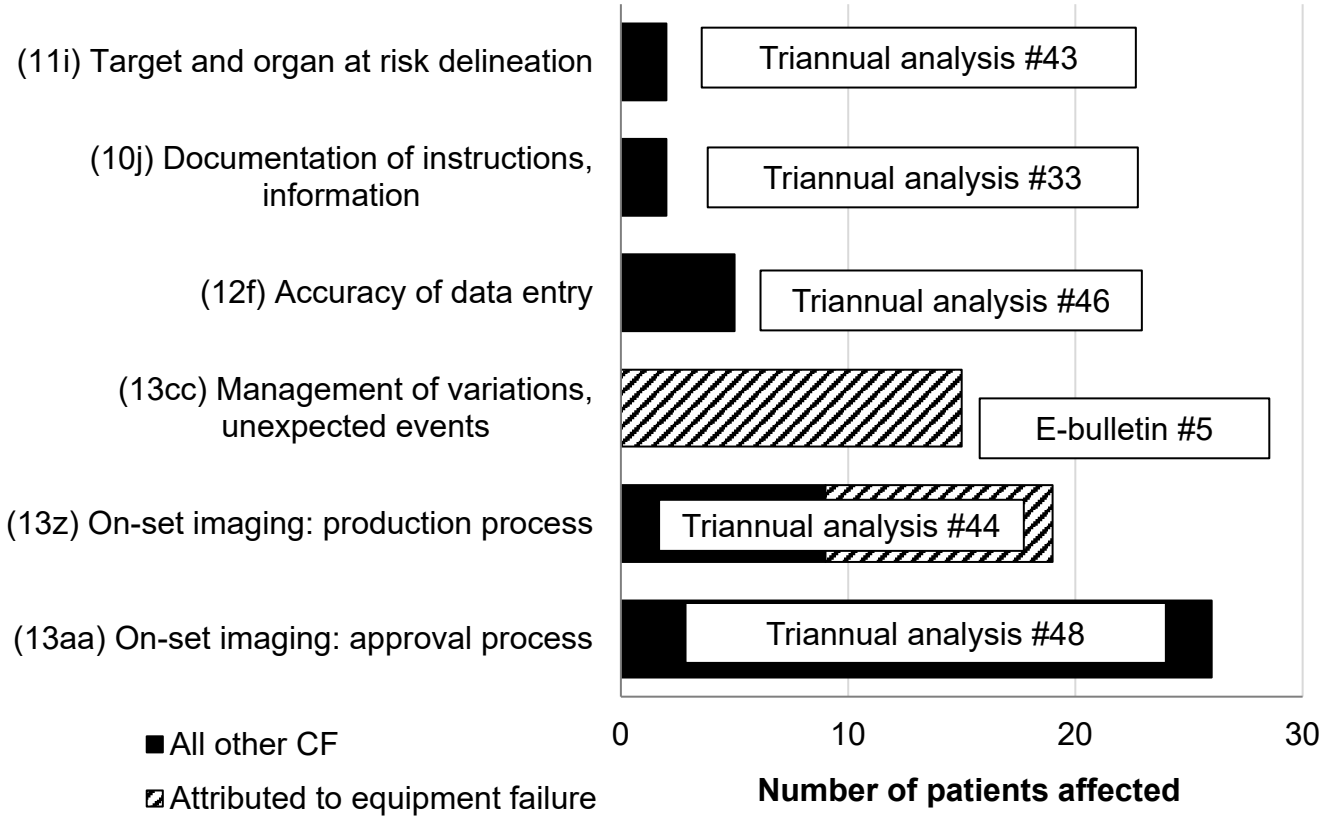


Inspectorate data

A breakdown of the inspectorate data for this reporting period can be seen in Figure 10. The inspectorates shared anonymised closed synopses of reported SAUE affecting 80 patients. This is a decrease since the previous analysis when 133 reports were shared. There were several reports that affected multiple patients.

Notifications were most frequently reported associated with primary pathway subcode ‘On-set imaging: approval process’ (32.5% n=26). The frequency of this reported pathway subcode has increased since the previous analysis (4.5%, n=6). 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 10.

Figure 10. Breakdown of most frequently reported inspectorate Level 1 pathway subcodes from closed notifications (n=69 out of 80 subset of data)



Further analysis of the inspectorate data can be seen in Table 1. This shows that most notifications led to additional verification imaging and did not affect the patient's treatment (56.2% n=45). Of note, those notifications that did affect treatment delivery increased from 18.8% (n=25) in the previous analysis to 38.8% (n=31). One notification affected multiple patients (21) and related to online treatment verification image evaluation. However, none of the reports that reached treatment delivery were reported as clinically significant.

Table 1. Notification category

Notification category	Proportion and number of notifications
Additional pretreatment (planning) imaging	5.0%, n=4
Additional treatment verification imaging	56.2%, n=45
Affected treatment delivery	38.8%, n=31

Case study 19: Documentation of instructions, information (10j)

One of the most common mistakes that happen in radiotherapy occurs during the transfer of information from one system to another (4). For example, ‘documentation of instructions, information’ has remained one of the most frequently reported primary pathway codes over several years (5). Radiotherapy events may occur where inaccurate, unclear, or insufficient instructions are recorded on pretreatment imaging immobilisation documents that are subsequently used for setting up patients during treatment. In terms of severity, these events have the potential to affect treatment delivery and are associated with numerous reportable incidents (Level 1 RTE). However, the majority of pretreatment documentation failures are detected during treatment set up and are currently reported as lower classification RTE (Level 4 and 5) (5). Nevertheless, elevated levels of RTE that relate to erroneous information transfer between pretreatment and treatment areas represents a notable area of risk within the radiotherapy workflow. This requires departments to consider how best to improve the transfer of information from one system to another.

Synopsis

The patient attended for their second fraction out of 15, forehead electron treatment. The patient reported concerns prior to set up regarding the previous day’s treatment area. When reviewing at home the marks placed on their skin to denote the treatment area at fraction one, they felt they were positioned differently to where they understood the treatment area was located.

Halting set-up, the radiographers reassured the patient that they understood their concern and would investigate prior to treatment. They escalated the issue to an advanced practitioner radiographer. Immediate investigation confirmed that the set-up sheet completed at pretreatment during clinician mark out aligned with the record of prescription and notes record – post op squamous cell carcinoma left forehead. However, treatment marks could be seen on right hand side of patient’s forehead. Guidance of the treatment area location on the patient’s skin is provided by an acetate sheet template completed by pretreatment radiographers during clinician mark out. This was found to be incorrectly orientated. Additionally, there were minimal surface landmarks and reference points to guide the position of acetate accurately. The information was reviewed by the skin specialist who agreed the acetate sheet was incorrect.

The preliminary investigation concluded that the treatment on the first fraction was considered a total geographical miss. MPE investigated the implications of this and emailed the consultant who both agreed the event met the SAUE criteria for reporting under total geographic miss for a single fraction (SAUE code 9.1). Consultant approved amended plan to ensure compensation for first fraction and carried out duty of candour.

Coding: TSRT9/ Level 1/ 10j/ 10w/ 11r/ 11t/ 12f/ 12g/ MD13d/ CF1d/ CF2b/ CF6a

RTE response

A robust RTE response will maximise potential learning from this event. Table 2 contains the key stages to an RTE response and further considerations for this case study.

Table 2. Key response stages to RTE described above (10j)

RTE response stage	Considerations
Identification and local reporting of RTE	Staff actively encourage and support patients to be engaged and vocal participants in their treatment and care in accordance with Advancing Safer Radiotherapy. This event was detected by the patient and communicated to staff prior to treatment set up (MD13d). Staff subsequently reported the event on the local event learning system.
Decision to investigate	After issue identified, examination by staff noted that marks placed on patient indicating #1 treatment were displaced away from the intended target area. The RTE meets the criteria for reporting under SAUE guidelines for 9.1 total geographical miss. In accordance with SAUE guidelines, this event is therefore a reportable radiation incident (Level 1) which requires a detailed investigation in accordance with local procedures.
Planning and selection of investigation team	An interdisciplinary team, including staff from pre-treatment, treatment, clinical oncology, an MPE, skin advanced practitioner radiographer and a member of the radiotherapy QA team, was formed to investigate the event. Members of the investigation team are trained and competent to undertake systems-focused patient safety event investigations.
Recording of investigation	The local investigation report template was utilised to guide the investigation and capture the relevant information.
Information gathering	Operators involved in the event contributed to the investigation. A review of relevant documentation and a walkthrough of the electron mark out pathway was carried out to assess 'work as done' versus 'work as imagined'. During the investigation a retrospective audit of RTE was completed to determine if this type of event was thematic. It was noted that a trend of RTE generation due to various omissions and inaccuracies within pretreatment documentation was present within the local event learning system.
Analysis and identification of contributory factors	Analysis was completed using a SEIPS (6, 7) framework. Investigation established that the event was caused by

RTE response stage	Considerations
	incorrectly orientated mark out acetate with insufficient surface landmarks outlined (CF1d). Evidence from pretreatment radiographers suggested staff were operating in a busy environment where manual documentation tasks were carried by radiographers simultaneously with other duties (CF6a). Walkthroughs noted opportunities to improve work processes, such as better pretreatment workspace design, moving away from free text during documentation completion and provision of mark out photographs (CF2b). Treatment radiographers on fraction one did not adhere to departmental procedure by omitting confirmation of the treatment laterality on the patient against relevant documentation (CF2c). Prep data entry procedures do not include requirement to check veracity of acetate sheet template (CF2b).
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: • immediate review of pretreatment mark out documentation to include revisions such as drop-down menus and selection lists, double data entry design (8) and patient photographs • interdisciplinary working group to investigate improving the complex multistep workflow between pretreatment to treatment delivery, including development of automated processes where possible. In addition, ensure independent checks are performed at critical failure stages by adequately trained and entitled operators • assess introduction, or expansion, of technology that may strengthen markup process such as CT based electron virtual simulation and SGRT • enhance pretreatment working environments to include designated quieter areas with necessary IT infrastructure to prevent multitasking and distractions and facilitate safe practice • ensure significant events such as this are reflected within the local study of risk of accidental and unintended exposures

RTE response stage	Considerations
Dissemination of learning	A summary of the investigation was shared with staff at different staff meetings and through an email alert. Positive feedback provided to treatment radiographers for effective, empathetic response to patients raised concerns. Input was sought from staff for areas for improvement ideas. Feedback provided to the patient with assurances that actions are to be implemented to prevent the same event from happening again.
Assessment of effectiveness	An audit of improvement actions to be completed 3 months after implementation. Ongoing monitoring of pretreatment documentation RTE using statistical process control methodology to ensure numbers remain within normal variation.

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