



UK Health
Security
Agency

Safer Radiotherapy

Triannual RTE analysis and learning report

Issue 41 – Full radiotherapy error data analysis April to July 2023

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Full radiotherapy error data analysis

The fundamental role of reporting and learning systems is to enhance patient safety by learning from failures of the healthcare system (1). It is imperative errors and near misses are learned from, and effective preventative measures are implemented (2).

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 radiotherapy errors and near misses (RTE), reported voluntarily by UK radiotherapy (RT) providers. Anonymised reports were submitted through multiple routes, from England via the [National Reporting and Learning System \(NRLS\)](#) and the [Learn from Patient Safety Events Service \(LFPSE\)](#) at NHS England, from Wales via the [Once for Wales Concerns Management System \(OfW\)](#), or directly to UKHSA from providers in Northern Ireland, Scotland and the independent sector. In England, the NRLS will be replaced by the LFPSE by autumn 2023. RTE data submitted through both routes will be included within this analysis.

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.

There is a requirement for RT providers to notify the Ionising Radiation (Medical Exposure) Regulations (IR(ME)R) (3 to 5) inspectorates of significant accidental or unintended exposures (SAUE) (or 'reportable radiation incidents' (level 1) as defined in [Towards Safer Radiotherapy \(TSRT\)](#)). The UK inspectorates for IR(ME)R: Care Quality Commission, Healthcare Inspectorate Wales, Healthcare Improvement Scotland and the Regulation and Quality Improvement Authority, shared anonymised closed synopses of reported SAUE for analysis. It should be noted there may be a significant time lag between notification of an event to the inspectorates, it being closed and then shared with UKHSA for inclusion in the analysis. Please note the notification criteria for SAUE were updated in April 2023 (6). This data analysis has used both the 2020 and 2023 SAUE notification criteria. Future analysis will utilise only the 2023 update.

The classification level from [TSRT](#), the pathway coding, failed safety barriers (SB), methods of detection (MD) and causative factor taxonomies from the [Development of Learning \(DoL\) from Radiotherapy Errors](#) were employed for the analysis. FSB and MD are discussed further in the May 2021 issue of the [Safer Radiotherapy E-bulletin](#). A series of [presentations](#) have been developed as free educational tools to support the RT community in engaging with this work.

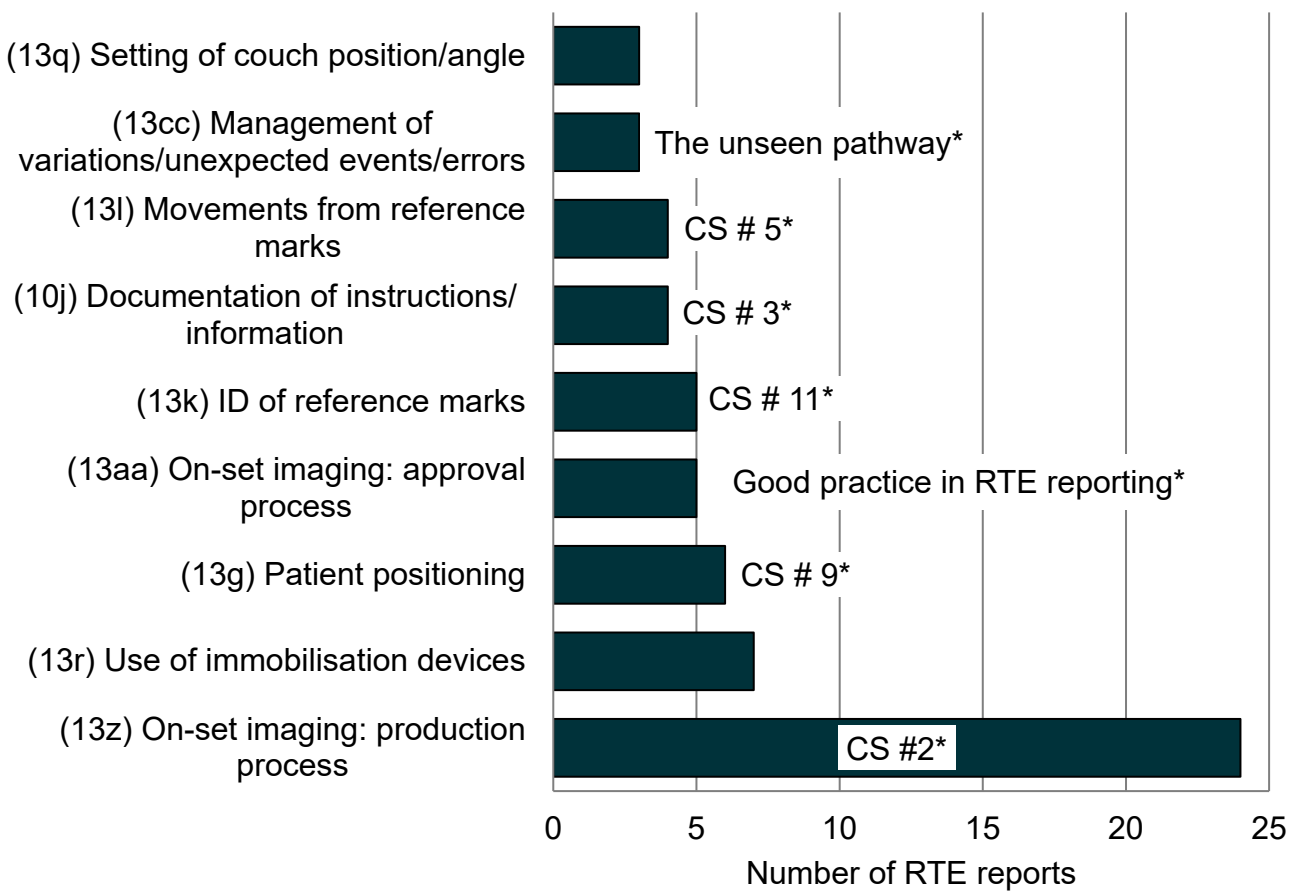
The analysis has been reviewed by the PSRT. If individual providers would like to comment on the analysis, share experience of learning from RTE or application of the coding please email the RT team at radiotherapy@ukhsa.gov.uk

Inspectorate data

A breakdown of the inspectorate data for this reporting period can be seen in Figure 1. The inspectorates shared 94 anonymised closed synopses of reported SAUE for analysis. The most frequently reported notifications were associated with ‘on-set imaging: production process’ (25.5%, n = 24). This is similar to the [previous analysis](#) (issue 40) when 81 reports were shared.

A number of case studies have been included in Safer Radiotherapy publications such as the [triannual analysis](#), the [unseen pathway](#) and [good practice guidance](#). These are based on the process sub-codes most frequently associated with the inspectorate data. Case studies already published are shown with an asterisk (*) in Figure 1.

Figure 1. Breakdown of most frequently reported inspectorate process subcodes from closed notifications (n = 61/94 subset of data) (CS = case study)



Case study 11. Identification of reference marks

Treatment unit process sub-code (13k) 'identification of reference marks' is one of the most frequently reported inspectorate subcodes. This includes the misidentification of a reference mark, either on masks, immobilisation devices, Tegaderm or tattoos.

Misidentification of a tattoo can lead to another tattoo being used as the basis of locating a treatment or a skin mark being used in place of a tattoo as the reference mark. These are usually detected during on-set verification imaging which leads to additional exposure for the patient. This type of RTE is often linked to pretreatment subcodes (10j) 'documentation of instructions' and (10k) 'marking of patient'.

Synopsis

Treatment Site: Anal Canal. IMRT Treatment: 53.2Gy in 28#, daily using 1.9Gy per #

Patient attended for fraction 8 of radiotherapy. Patient was set up in the treatment position and a verification image was acquired. When the image match with the reference image was completed, the patient position was found to be out by 4.0cm in the lateral direction. Due to the magnitude of the displacement, it was believed that the patient moved after set up. The patient was re-set up and a new verification image was acquired. The image match was still 3.5cm out in the lateral direction. During the third attempt at set up the ink marks outlining the tattoos were reassessed. It was realised that a skin mark had been identified as the reference mark rather than the tattoo.

With the identification of the tattoo the patient was re-set up, a verification image acquired which indicated the patient was in the correct position for treatment and the treatment was completed as planned for this fraction. On this occasion the patient received 3 kV- kV verification images, with an estimated dose of 0.001Gy per exposure.

Following review by an MPE, it was determined that due to the set up error this patient had 2 additional imaging exposures, leading to a total of 3 imaging exposures in a single fraction meeting the threshold to notify the inspectorate. It is important to note the additional imaging facilitated the correct delivery of the patient's treatment.

Locally a pause and check procedure was in place. This included ensuring the reference marks and moves from reference marks were correct and the patient position was correct for treatment. During review it was highlighted that the identification of the tattoos was not independently checked by both operators and pen marks from previous treatments had not been removed. A review of the verification images for previous treatments indicated treatment was correct for the preceding #s.

Coding: Level 1/ 13k/ 13g/ 13hh/ MD13aa/ CF1c/ CF2c

Contributory factors

The contributory factors (CF) for this synopsis was 'slips and lapses' (CF1c) as the initial marking of the reference marks was incorrect. During the review it was highlighted that the independent check of the reference marks was not completed, this was part of the local pause and check procedure to ensure correct patient positioning. (CF2c 'adherence to procedures/ protocols').

Failed safety barriers

The pause and check procedure included the requirement to independently verify the correct reference marks had been used for set up. This should have been part of the 'end of process check' (13hh) before leaving the treatment room. It was noted within the review that this was not completed.

Method of detection

The verification image ((13aa) 'on-set imaging: approval process) identified that the first set up was incorrect by 4.0cm and the second set up by 3.5cm. This then led to a third evaluation of the set up and identification of reference marks.

Corrective actions

Corrective actions include:

- ensure patient is positioned appropriately on the treatment bed before set up
- utilise additional lighting or torches when required to identify reference marks
- include independent checks of reference marks as part of pause and check procedures
- pen marks from previous treatments should be removed before identification of reference marks
- any set up photos provided should be used as an additional visual check of treatment marks
- consider emerging techniques and technologies for patient positioning

Learning from excellence and published guidance

Learning from excellence includes:

- ensure reference mark position is indicated from surface landmarks (7)
- reference tattoos and immobilisation should be reassessed for suitability throughout the duration of treatment (8)
- reference marks for localisation should be sited according to the site treated (8)

Consideration of patient tattoo and reference marks are discussed further in the September 2023 edition of [Safer Radiotherapy E-bulletin](#).

Further guidance and national tools to aid investigations are available (9, 10). Following a simple risk matrix (11) a study of risk was produced for this case study and process sub-codes (13k) identification of reference marks and (10k) marking of patient.

Table 1. Study of risk matrix

In this table, an A in brackets indicates amber risk, a G in brackets indicates green risk.

Area of risk	Initial risk: consequence	Initial risk: likelihood	Initial risk: risk score	Risk following mitigations*: consequence	Risk following mitigations*: likelihood	Risk following mitigations*: risk score
Required tattoo missing	2	2	4 (G)	2	1	2 (G)
Unable to identify tattoo due to small size	2	2	4 (G)	2	1	2 (G)
Previous treatment tattoo not noted during CT planning scan	2	2	4 (G)	2	1	2 (G)
Two tattoos in same area when only one required	2	2	4 (G)	2	1	2 (G)
Tattoo in inappropriate area for treatment	2	2	4 (G)	2	1	2 (G)
Wrong reference tattoo used	3	2	6 (G)	3	1	3 (G)
Mistook skin mark for tattoo	3	2	6 (G)	3	1	3 (G)

* Corrective action examples shown above.

April to July 2023 data analysis

Number of RTE reports

A monthly average of 864 reports were received between April and July 2023. This was a decrease from 876 (1.4%), when compared to the [previous analysis](#) (issue 40) and a decrease from 1,032, (16.3%) when compared to the same reporting period published in [2022](#) (issue 38). Of note a backlog of RTE reports was received in the same time period in 2022, thus inflating the number of reports.

There is some disparity in frequency of reporting across providers. A wide variation is seen when comparing the incident date with the date reported to the national voluntary reporting scheme. This time lag ranges from 0 days to 3,017 days, with a mean of 56 days and a mode of 0 days, reflecting that 154 were reported nationally on the same day as the incident. There were 30 outliers with a lag time greater than 365 days which were reported from 7 providers. There was no reason annotated to explain this delay in reporting. Of these, 7 had a lag of 1.5 to 8 years. If the outliers are removed the mean average for the lag time is 47 days and mode of 0. This variation in timeliness of reporting is also reflected in the overall patient safety incident reports received by the [NRLS](#) who encourage organisations to report incidents monthly.

To ensure timely learning from RTE nationally, providers are asked to make RTE submissions at the earliest opportunity. [Issue 26 of Safer Radiotherapy](#) provides further information on reporting frequency.

Monitoring of RTE coding by radiotherapy providers

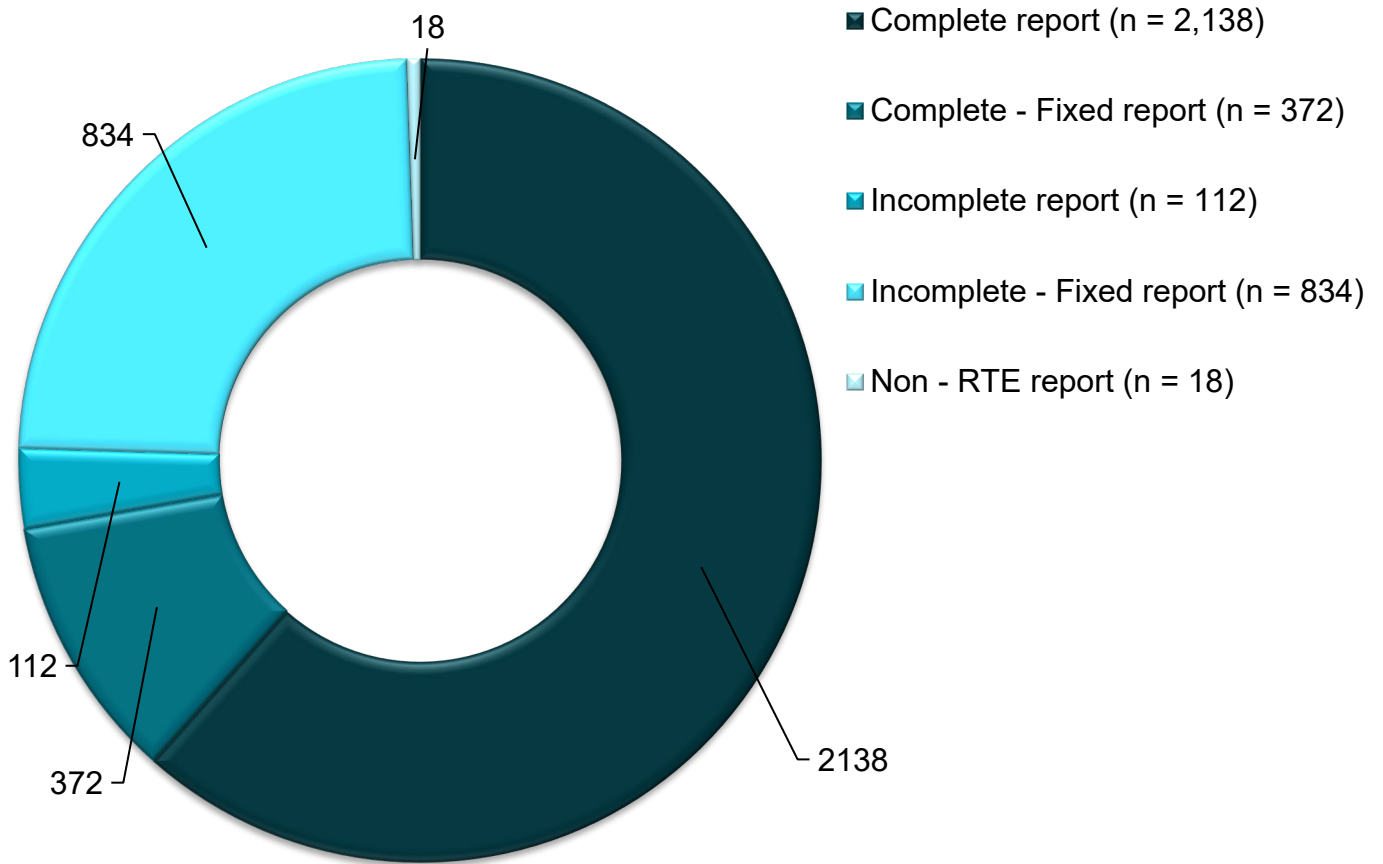
All providers are asked to apply a trigger code, classification level, pathway coding (including failed safety barriers (FSB)), method of detection (MD) and contributory factors (CF) to their RTE reports to facilitate both local and national analysis.

The format of coding for submission is TSRT9/ Level 4/ 13c/ 13l/ MD13hh/ CF1c/ CF2c. This should be included in the opening section of the first open text field of the local incident learning system where possible.

Consistency checking was undertaken by UKHSA staff on the application of the RTE coding by RT providers. The coding was reviewed for all RTE classified as reportable through to near miss (levels 1 to 4) and 10% of non-conformances (level 5) RTE were audited. A complete report includes the trigger code, classification, pathway code, including FSB, MD, and CF taxonomies. From the 2,510 RTE reports classified and coded locally with all the taxonomies, 1,691 were classified as levels 1 to 4. A total of 255 of these were amended (complete fixed in Figure 2 includes level 5 data (n = 372)). Thus, an 84.9% level of consistency was achieved for levels 1

to 4 RTE. This is a slight increase since the [previous analysis](#) (issue 40) when an 83.3% level of consistency was achieved.

Figure 2. Breakdown of report completeness (n = 3,474)



A total of 946 RTE reported did not contain one of the required taxonomies, including MD. A total of 834 were classified or coded by UKHSA staff using the supporting text supplied by the local providers (incomplete fixed in [Figure 2](#)), 394 of these only required the MD to be included.

Some amendments were made to reports to ensure consistent allocation of the taxonomies. Table 2 indicates the amendments to the complete RTE reports.

It is recommended entire pathway sub coding should be considered when allocating primary pathway subcodes. Further information on the consistent allocation of pathway codes can be seen in [E-bulletin edition 3](#).

Table 2. Amendments to complete RTE

Taxonomy amended (n = 372)	Initial coding	Most frequently amended to
Classification (17.7%, n = 66)	Level 5 'other non-conformances' (56.1%, n = 37)	Level 4 'near miss' (56.8%, n = 21)
Primary pathway subcode (58.1%, n = 216)	13i 'use of on-set imaging' (19.9%, n = 43) 13jj 'other' (19.9%, n = 43)	13z 'on-set imaging: production process' (37.2%, n = 16) 6a 'bookings made according to protocol' (30.2%, n = 13)
MD (55.6%, n = 207)	13jj 'other' (41.5%, n = 86)	13hh 'end of process checks' (17.4%, n = 15)
CF (7.8%, n = 29)	CF7a 'other' (51.7%, n = 15)	CF2c 'Adherence to procedures/ protocol' (46.7%, n = 7)

Non-RTE reports submitted formed 0.5% (n = 18) of all the reports for this reporting period. Data and accompanying text indicate that these were patient safety incidents (PSI) but not RTE. This is consistent with the [previous analysis](#) (issue 40). 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' ([12](#)). Further information on PSI can be found in [issue 5 of Safer Radiotherapy](#). Non-RTE reports were excluded from the detailed analysis.

In total, 3,456 RTE for the reporting period from April to July 2023 were included for analysis. The analysis is presented here.

Number of reports per provider

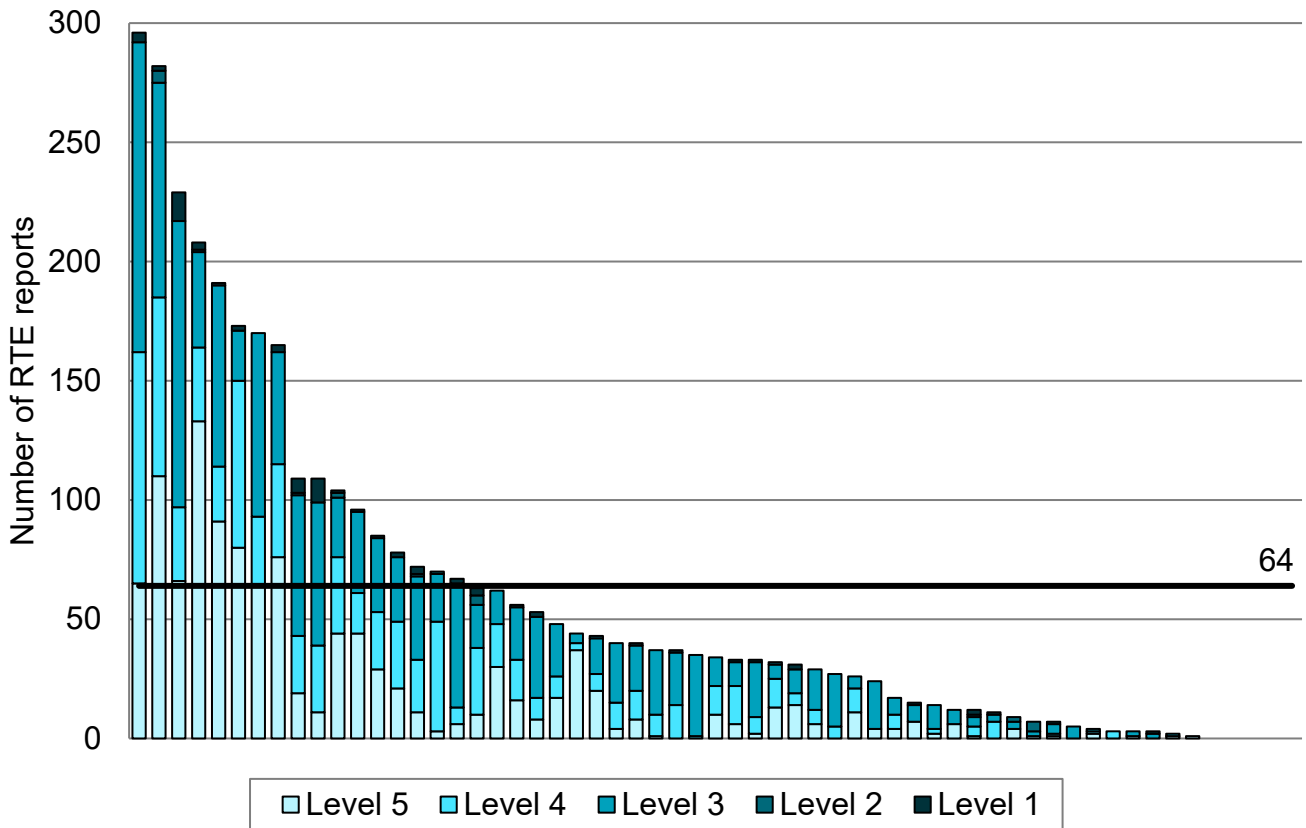
Data was received from NHS providers and from the independent sector. For this reporting period 54 RT providers across both the independent and NHS providers have reported. This is a decrease since the [previous analysis](#) (issue 40) (n=58).

[Figure 3](#) shows the number of RTE reports submitted by provider. This ranged from one to 296 reports, with a mean of 64. Of the 54 providers who reported, 63.0% (n = 34) reported less than the national mean. [Figure 3](#) also indicates the classification of reports received per provider. The providers that submitted higher numbers of RTE reports included all classification levels of reports. Seven providers did not report any level 5 RTE.

There may be several reasons for this disparity in reporting. Reporting culture varies across providers. Incident learning systems are not always easily accessible. Additional resource may be required to support a full incident learning system. Finally, a local requirement to use more than one system may disincentivise reporting. Findings of the most recent survey of UK RT providers on reporting culture is published in the January 2022 issue of [Safer Radiotherapy E-](#)

[bulletin](#). This survey demonstrated that those providers required to use more than one system were less likely to submit all classification of RTE. Furthermore, only 64.3% stated their local incident learning system was linked for data transfer to the wider hospital/trust risk management incident learning system.

Figure 3. Number of RTE reported by provider (n = 3,456)

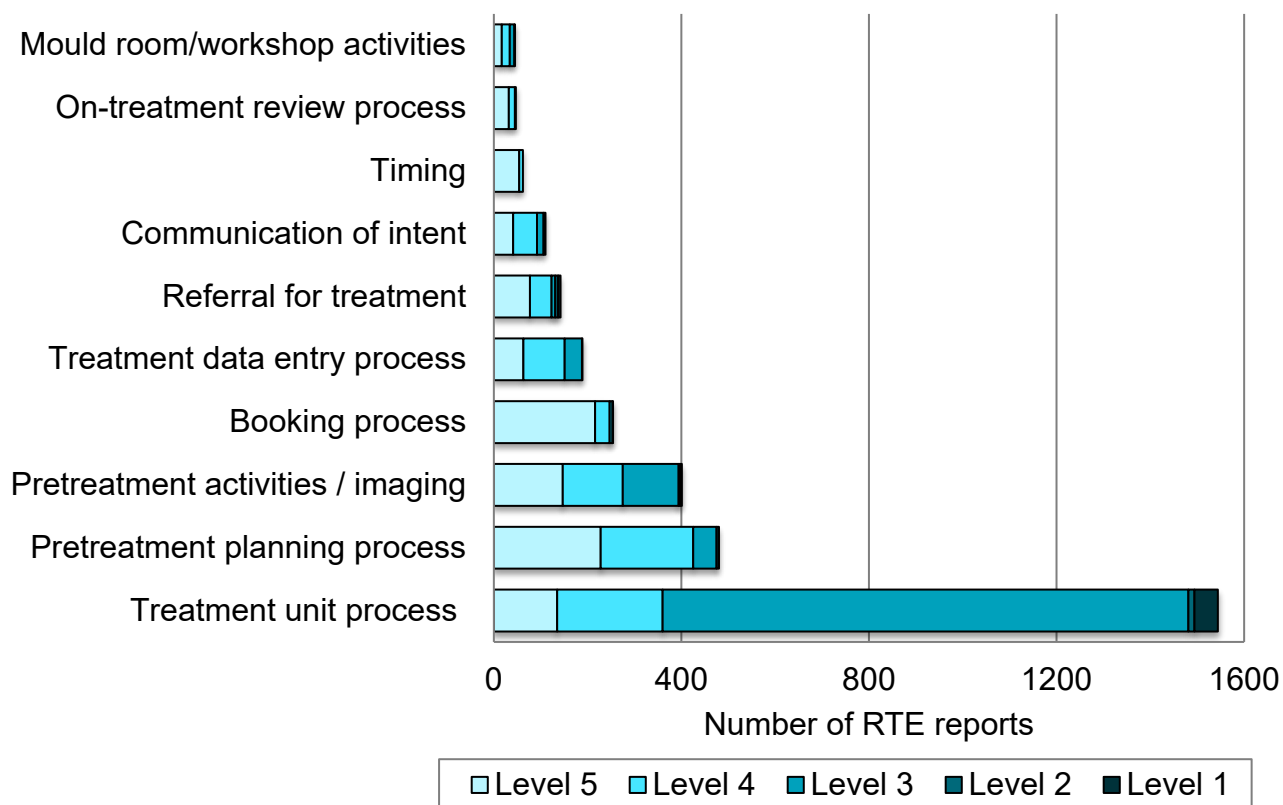


The number of reports per provider has not been normalised to account for the variation in provider capacity or service specification. It should be noted that those providers reporting higher numbers of RTE represent providers with mature reporting cultures and should be encouraged to continue reporting.

Breakdown of process codes

The 3,456 RTE reports were categorised by process code and classification level so the main themes could be derived. [Figure 4](#) shows 44.7% (n = 1,544) of the RTE were reported to have occurred during treatment unit processes. The treatment process represents the last opportunity to identify errors. Accurate treatment relies on the correct interpretation of the treatment plan and set up details which need to be replicated at each fraction of treatment. This might explain prevalence of RTE within treatment unit processes. All but one of the most frequently reported process codes are the same as the [previous analysis](#) (issue 40).

Figure 4. Breakdown of RTE process code by level (n = 3,274/3,456 subset of RTE)



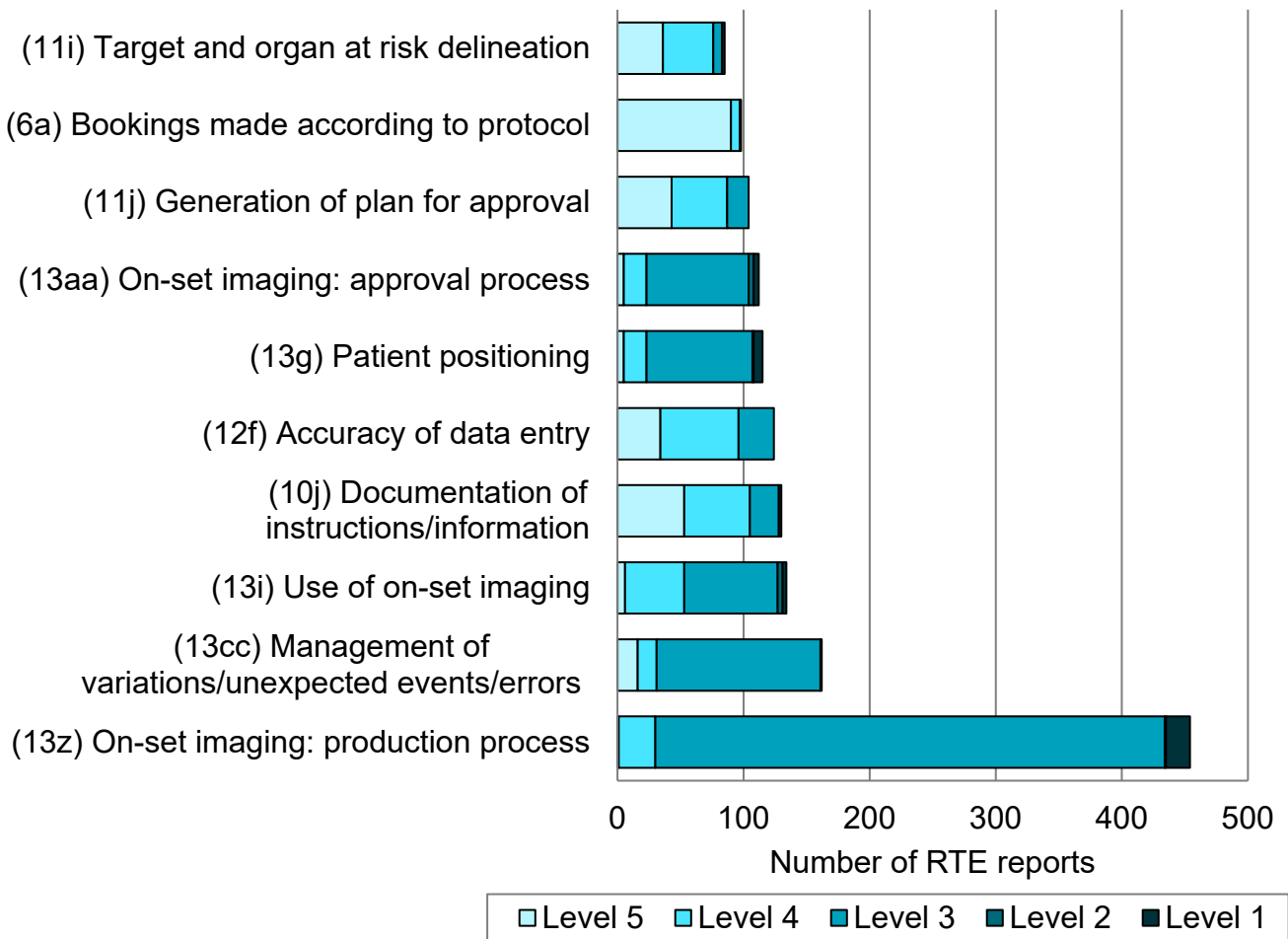
Breakdown of process subcodes

The most frequently reported process subcodes in the RT pathway are presented in [Figure 5](#). This subset of data was also broken down by level.

The most frequently reported RTE reported was ‘on-set imaging: production process’ at 13.1% (n = 454) of all the reports an increase in percentage when compared to the [previous analysis](#), issue 40 (11.6%, n = 407). Of this subset, 95.6% (n = 434) of the reports were minor radiation, near miss or other non-conformities with little or no impact on patient care. The second most frequently reported RTE was ‘management of variations/ unexpected events/ errors’ at 4.7% (n = 162). All of the most frequently reported process subcodes were seen in the [previous analysis](#) (issue 40).

On-set imaging associated RTE include ‘on-set imaging: production process’, ‘use of on-set imaging’, ‘on-set imaging: recording process’ and ‘on-set imaging: approval process’, 3 of these were reported as the most frequently reported RTE process subcodes shown in [Figure 5](#). On-set imaging associated RTE combined made up 22.5% (n = 776) of all RTE reported for this period. Further guidance on mitigating and reporting these types of RTE can be seen in the Safer Radiotherapy [good practice guidance series](#).

Figure 5. Breakdown of most frequently reported RTE process subcodes by level (n = 1,518/3,456 subset of RTE)



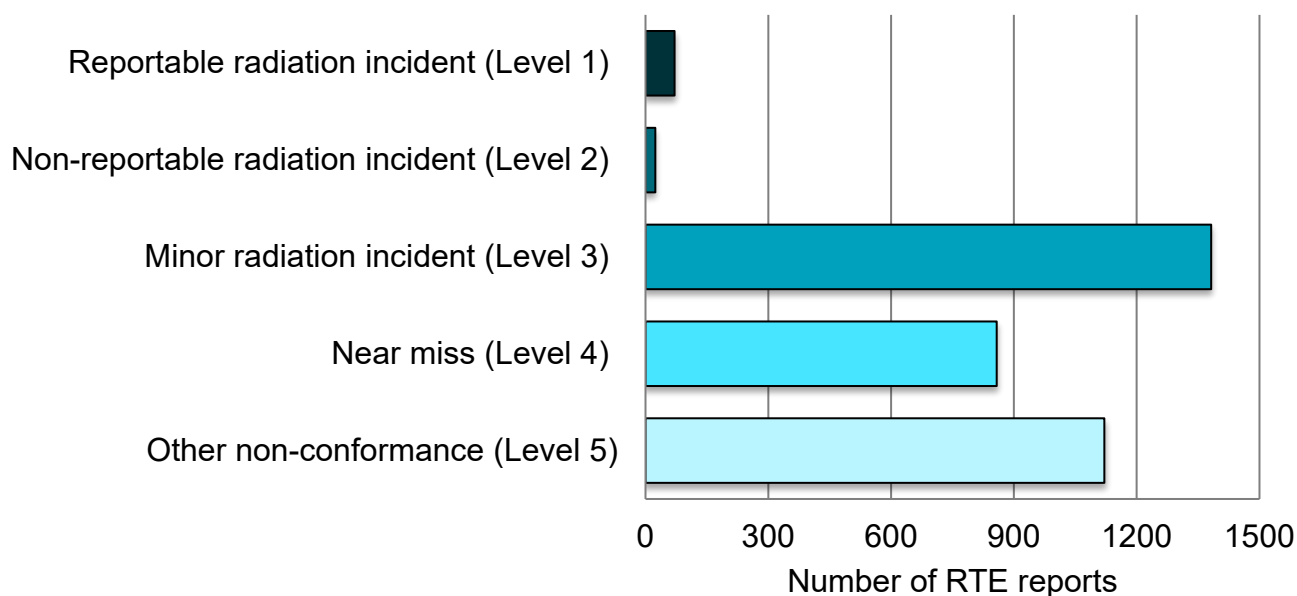
Classification (level) of RTE

Each of the 3,456 RTE reports was classified as ‘other non-conformance (level 5)’, ‘near miss (level 4)’, ‘minor radiation incident (level 3)’, ‘non-reportable radiation incident (level 2)’ or ‘reportable radiation incident (level 1)’ ([Figure 6](#)).

Of the RTE reports, 97.2% (n = 3,361) were minor radiation incident, near miss or other non-conformities (levels 3 to 5) with little or no impact on patient outcome. Of the remaining 2.8% (n = 95) of reports, only 2.1% (n = 71) were reportable under IR(ME)R to the appropriate authority.

The national survey on reporting culture published in the January 2022 issue of [Safer Radiotherapy E-bulletin](#) indicates that providers are less likely to submit all levels of RTE reports to the national voluntary reporting system. It was found that RTE reports of classification level 4 to 5 are less likely to be shared due to resource constraints and use of multiple reporting systems. This trend is also reflected in [Figure 3](#) which shows providers who report a higher number of RTE, report all levels of RTE.

Figure 6. Classification (level) of RTE reports (n = 3,456)



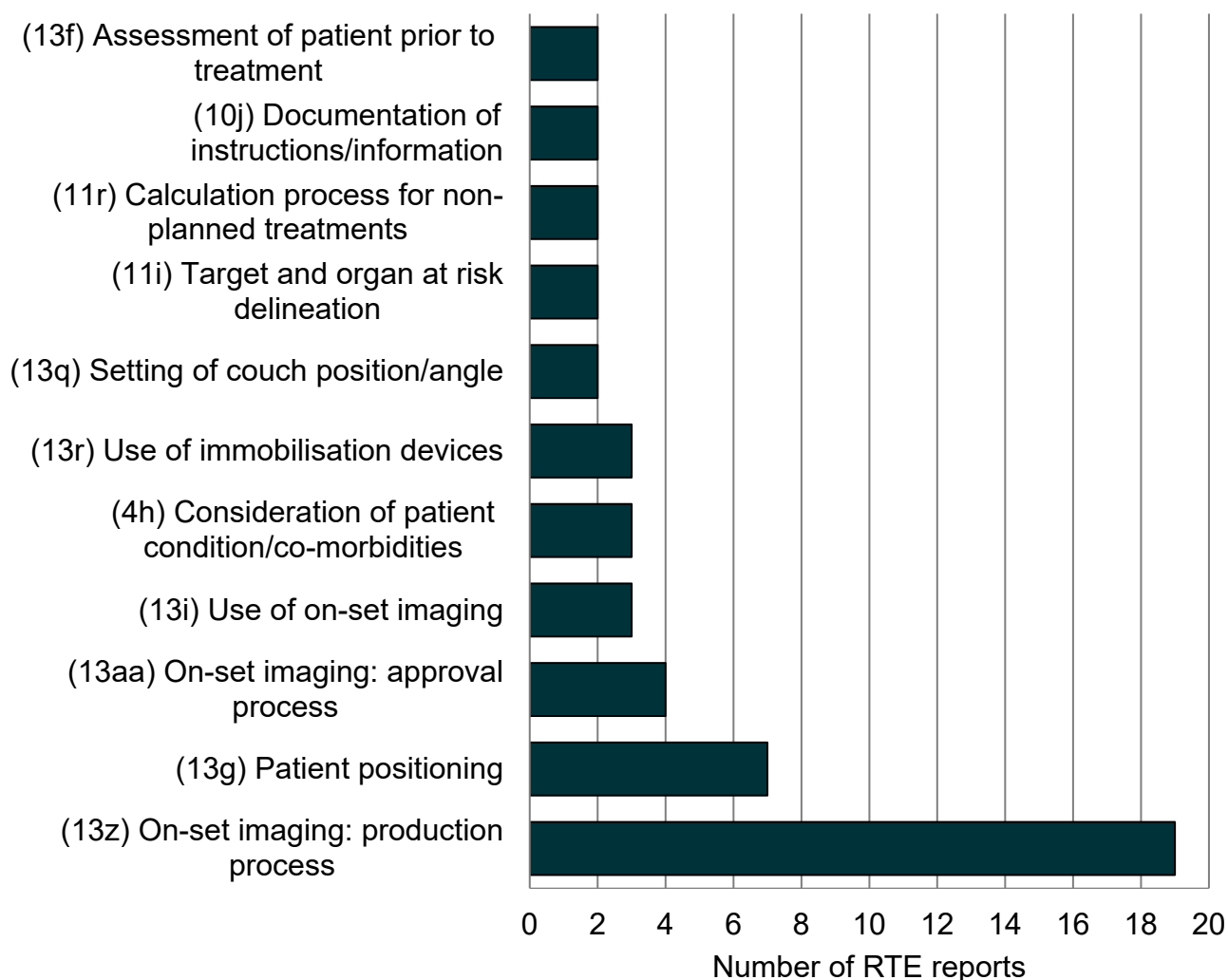
Reportable radiation incident (level 1) RTE

Reportable radiation incidents (level 1), as defined in [TSRT](#) fall into the category of reportable under [IR\(ME\)R \(3 to 5\)](#). These incidents will generally be significant, although they may be correctable within the course of treatment. The majority of these incident reports related to a single exposure. This meant that corrective action could be applied to the remaining treatment fractions, so the incident did not have a significant impact on the patient or the outcome of their treatment.

There were 71 level 1 incidents submitted by 27 providers to the voluntary system for this reporting period ([Figure 6](#)), comprising 2.1% of the RTE reviewed. This proportion is slightly higher than the [previous analysis](#), issue 40 (1.8%, n = 64) (p = 0.36). Further analysis of the reports indicates the points in the pathway at which the reportable incidents occurred ([Figure 7](#)).

'On-set imaging: production process' comprised 26.8% (n = 19) and was the most frequently reported event within the reportable radiation incidents. This was also the most frequently reported event within the [previous analysis](#) (issue 40), comprising 20.3% (n = 13) of all level 1 incidents. An example of an 'on-set imaging: production process' reportable RTE is when repeat verification image is taken multiple times due to either machine malfunction and or setting the incorrect position for the image panel. Taking 3 or more images in one fraction due to machine malfunction met the 2020 reportable threshold of the inspectorates. New guidance and notification criteria on reporting significant and accidental exposures has now been published (6). Further guidance on reducing this type of event can be seen in case study 2 in [issue 32](#), the [good practice guidance series](#) and the [biennial report](#).

Figure 7. Breakdown of most frequently reported level 1 RTE by process subcode (n = 49/71 subset of RTE)



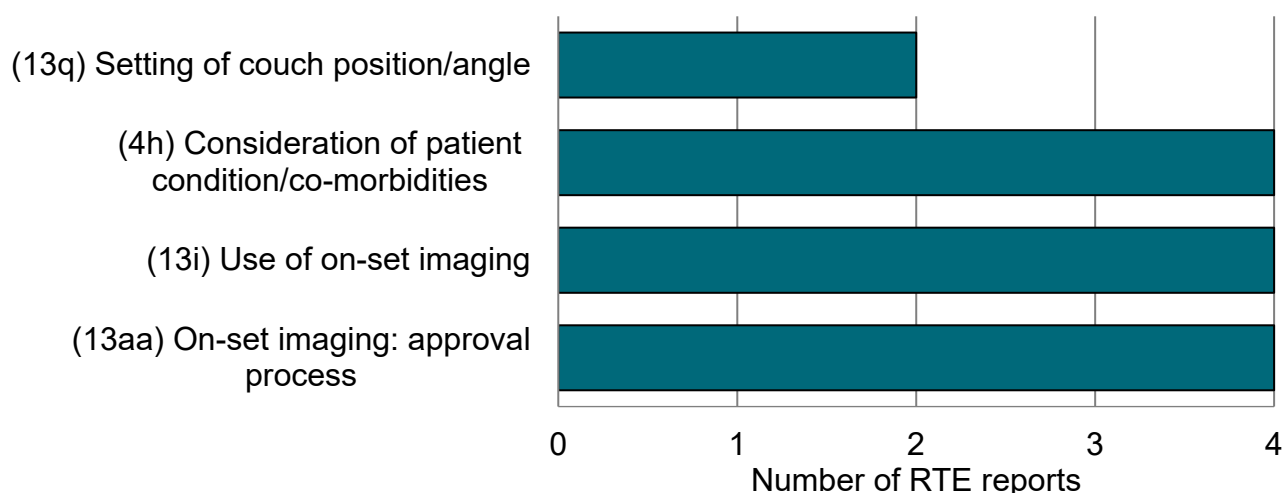
'Patient positioning' was the second most frequently reported level 1 RTE comprising of 9.9% (n = 7) of the reportable radiation incidents. An example of this type of RTE is when the patient is positioned incorrectly, including limb positioning, which leads to a geographical miss. Further guidance on reducing these types of events can be seen in the [previous analysis](#) (issue 40).

Only 6 of the process subcodes within the most frequently reported level 1 incidents were also featured in the most frequently reported level 1 RTE within the [previous analysis](#) (issue 40). The level 1 RTE were spread across 33 different process subcodes. Of these, 11 did not occur during a patient attendance. A review of checking processes to ensure they contain a minimum criteria for checking is recommended, this may mitigate RTE propagating through the pathway to the patient treatment process.

Non-reportable radiation incident (level 2) RTE

A non-reportable radiation incident (level 2) is defined as a radiation incident which is not reportable, but of potential clinical significance (7). Non-reportable radiation incidents comprised 0.7% (n = 24) of the RTE reported for this time period (Figure 6). This is a slight decrease since the [previous analysis](#), issue 40 (0.9% (n = 32) (p = 0.35). Further analysis indicates the points in the pathway at which non-reportable radiation incidents occurred (Figure 8).

Figure 8. Breakdown of most frequently reported level 2 RTE by process subcode (n = 14/24 subset of RTE)



The reports were spread across just 14 different subcodes, 10 of which were singular and not shown within Figure 8. 'On-set imaging: approval process', 'use of on-set imaging' and 'consideration of patient condition/ co-morbidities' each comprised of 16.7% (n = 4) of all the non-reportable radiation incident reports. An example of 'on-set imaging: approval process' is the incorrect approval of an on-set verification image which leads to a partial geographical miss which is non reportable. An example of 'use of on-set imaging' is when a patient receives more verification images than planned. An example of 'consideration of patient condition/ co-morbidities' is when the condition of a patient changes after the planning CT which then leads to a delay in radiotherapy treatment and the need for an additional planning CT.

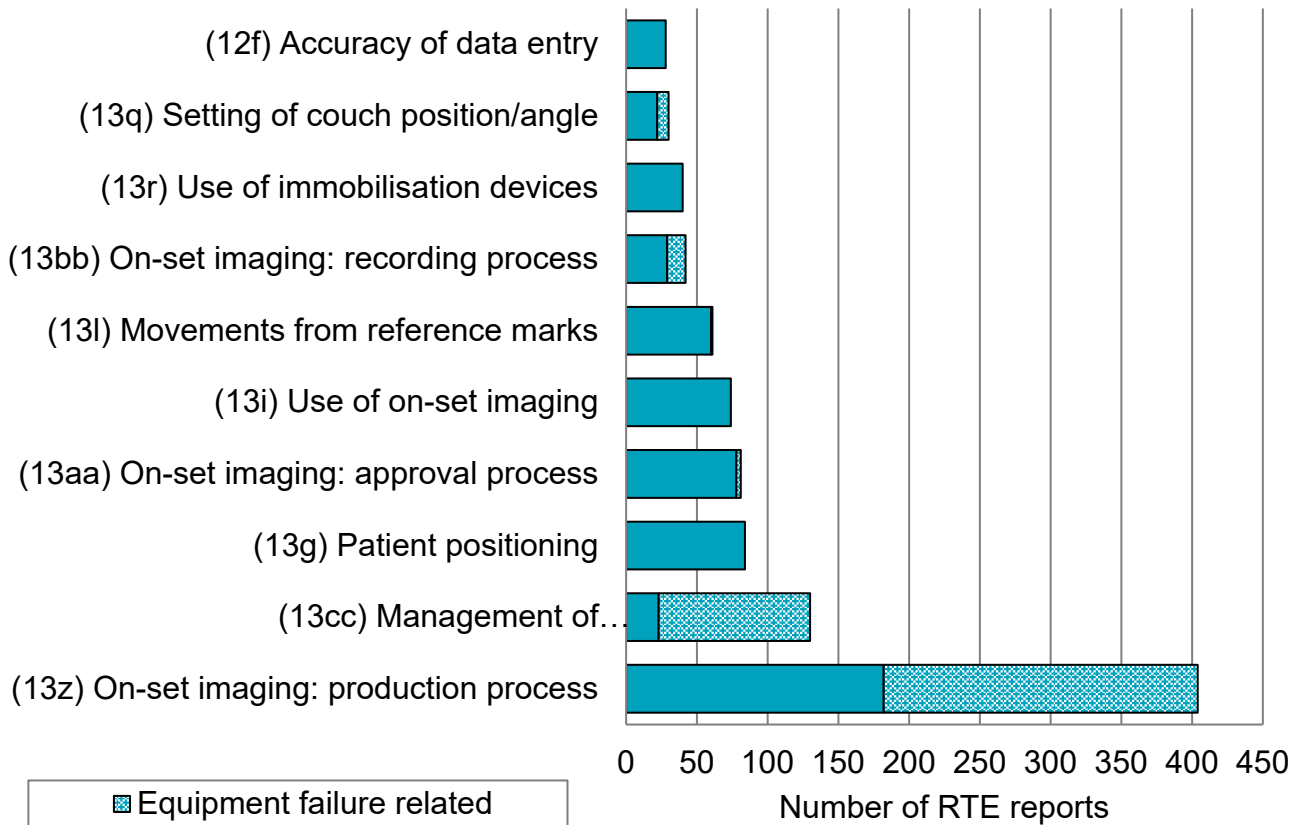
Minor radiation incident (level 3) RTE

A minor radiation incident (level 3) is defined as a radiation incident in the technical sense, but of no potential or actual clinical significance (7). Minor radiation incidents comprised 40.0% (n = 1,382) of the RTE reported for this reporting period (Figure 6). This is a statistically significant (p = 0.001) increase in proportion since the [previous analysis](#), issue 40 (35.8%, n = 1,254), this increase in proportion is directly linked to the decrease in level 4 and 5 RTE (Figure 6). A breakdown of level 3 RTE by process subcode can be seen in Figure 9.

'On-set imaging: production process' was the most frequently reported event (29.2%, n = 404) within this subset. This is a similar to the [previous analysis](#), issue 40 (29.4%, n = 369).

Examples of this type of minor radiation incident can include setting the jaws incorrectly for a single image, leading to an additional image. A total of 55.0% (n = 222) level 3 RTE with the primary process subcode 'on-set imaging: production process' were attributed to equipment failure, this is shown in [Figure 9](#). Examples of this type of RTE include CBCT faults during acquisition. Equipment failure and on-set imaging: production process is discussed further in [issue 18 of Safer Radiotherapy](#).

Figure 9. Breakdown of most frequently reported level 3 RTE by process subcode (n = 974/1,382 subset of RTE) includes equipment failure related



'Management of variations, unexpected events or errors' made up 9.4% (n = 130) of all minor radiation incidents, of these 82.3% (n = 107) were due to equipment malfunction, examples of this type of event includes when treatment equipment malfunction leading to a patient requiring movement to a matched treatment machine, this re-set of the patient positioning then requires additional verification imaging. Further information on this type of event can be seen in Safer Radiotherapy the [unseen pathway](#).

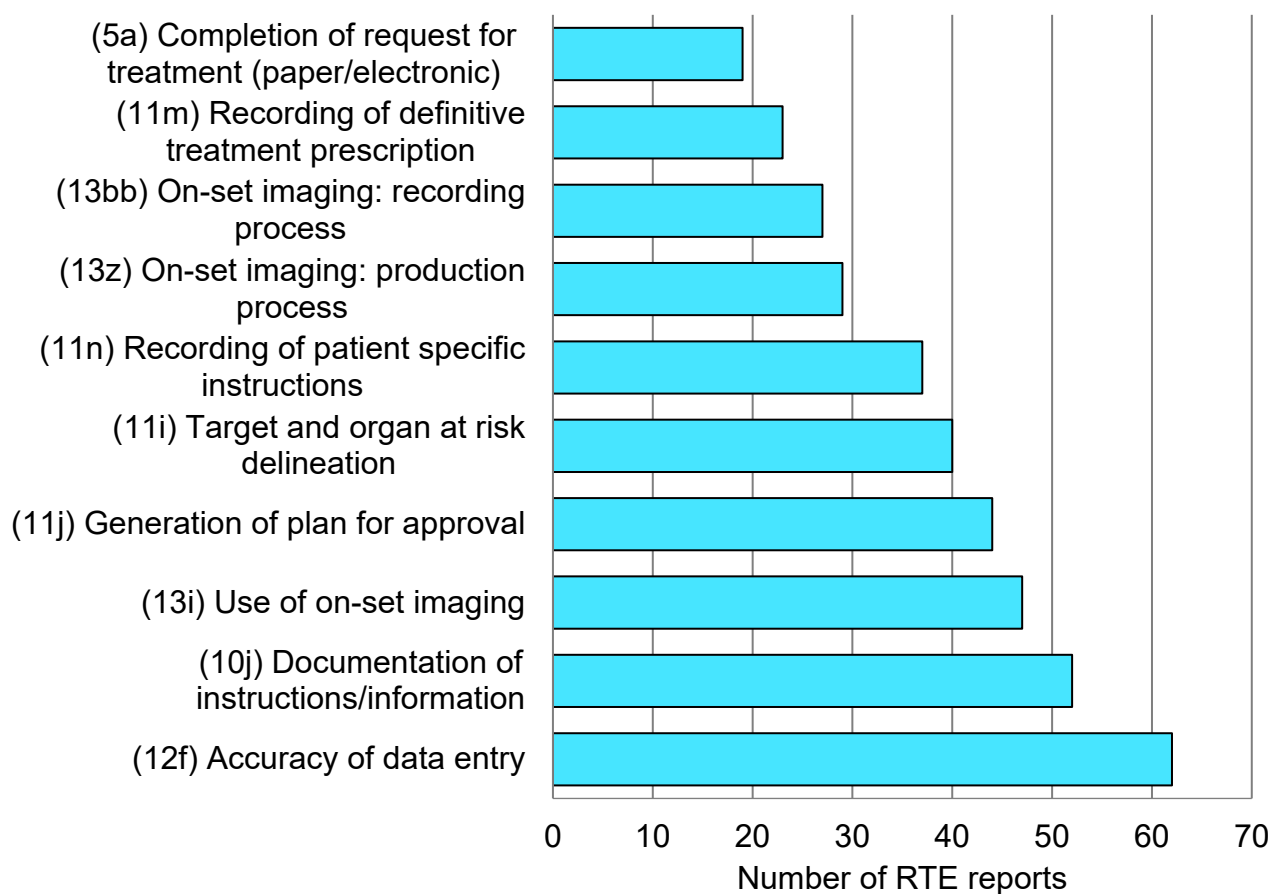
All but 1 of the most frequently reported process subcodes within the minor radiation incidents (level 3) RTE also featured in the most frequently reported minor radiation incident RTE within the [previous analysis](#) (issue 40).

Near miss (level 4) RTE

A near miss (level 4) is defined as a potential radiation incident that was detected and prevented before treatment delivery (7).

Near misses comprised 24.8% (n = 858) of the RTE reported ([Figure 6](#)). This is a slight decrease since the [previous analysis](#), issue 40 (27.1%, n = 948) (p = 0.03). [Figure 10](#) shows the most frequently reported process subcodes for level 4 RTE.

Figure 10. Breakdown of most frequently reported level 4 RTE by process subcode (n = 380/858 subset of RTE)



'Accuracy of data entry' comprised 7.2% (n = 62) of level 4 RTE. An example of this type of RTE would be a transcription error or the omission of information during a data entry task.

All but one of the most frequently reported process subcodes within the near misses (level 4) RTE also featured in the most frequently reported near miss RTE within the [previous analysis](#) (issue 40). Similar to the minor radiation incidents (level 3), the most frequently reported level 4 RTE shown in [Figure 10](#), includes the pathway subcodes associated with on-set imaging (12.0%, n = 103). Examples of 'on-set imaging: production process' associated RTE include using a kV image for verification when a CBCT should have been acquired, the kV image is used for treatment verification and no additional exposure is given. An example of 'use of on-set imaging' includes when a verification image is required but omitted for a single fraction of

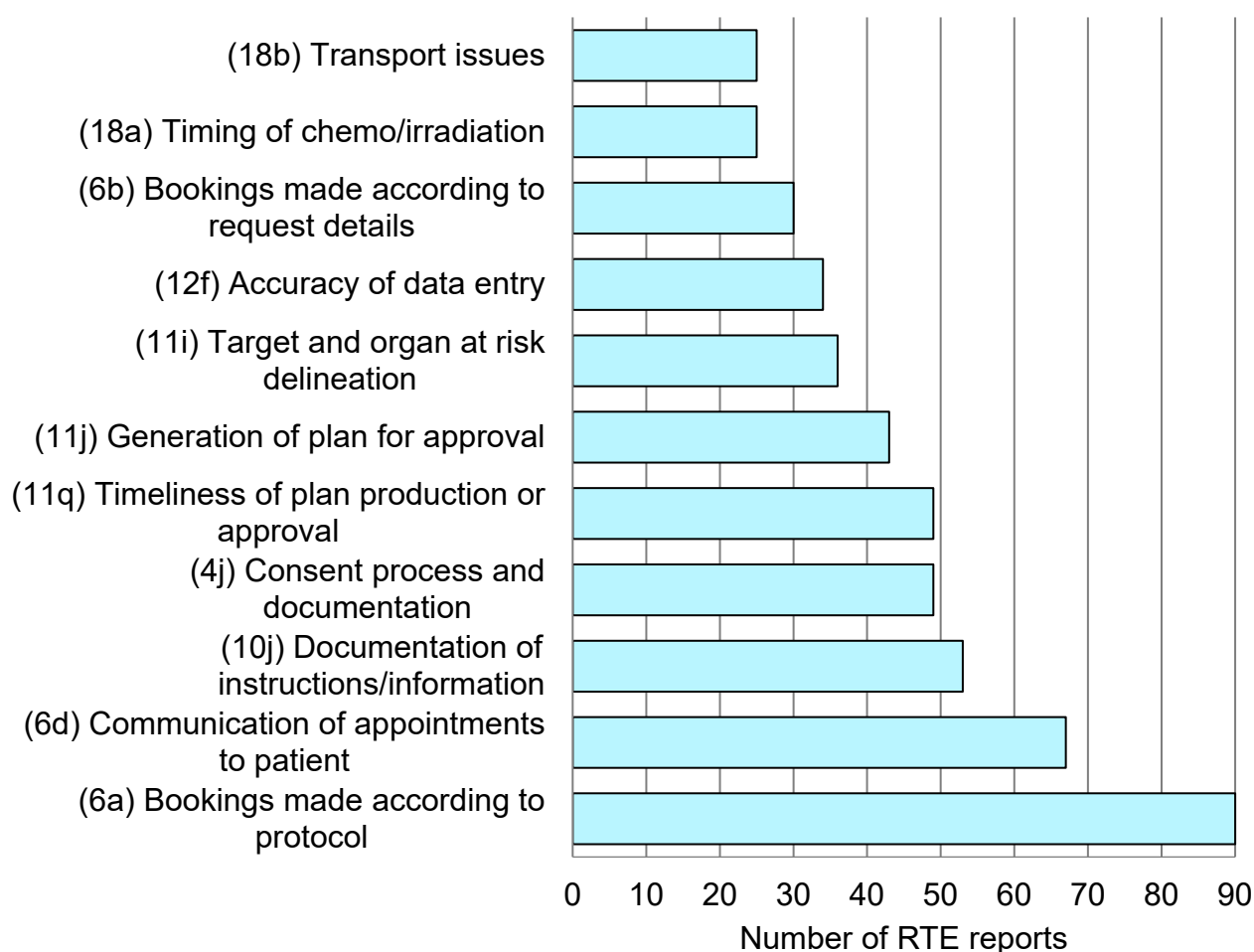
treatments. An example of ‘on-set imaging: recording process’ RTE includes the actions following image review not being undertaken, where this does not lead to incorrect or additional exposure.

Other non-conformance (level 5) RTE

Other non-conformance (level 5) is defined as a non-compliance with some other aspect of a documented procedure, but not directly affecting RT delivery (7).

Level 5 RTE comprised 32.4% (n = 1,121) of all RTE reported for this period ([Figure 6](#)). This is a slight decrease since the [previous analysis](#), issue 40 (34.4%, n = 1,205), (p = 0.08).

Figure 11. Breakdown of most frequently reported level 5 RTE by process subcode (n = 501/1,121 subset of RTE)



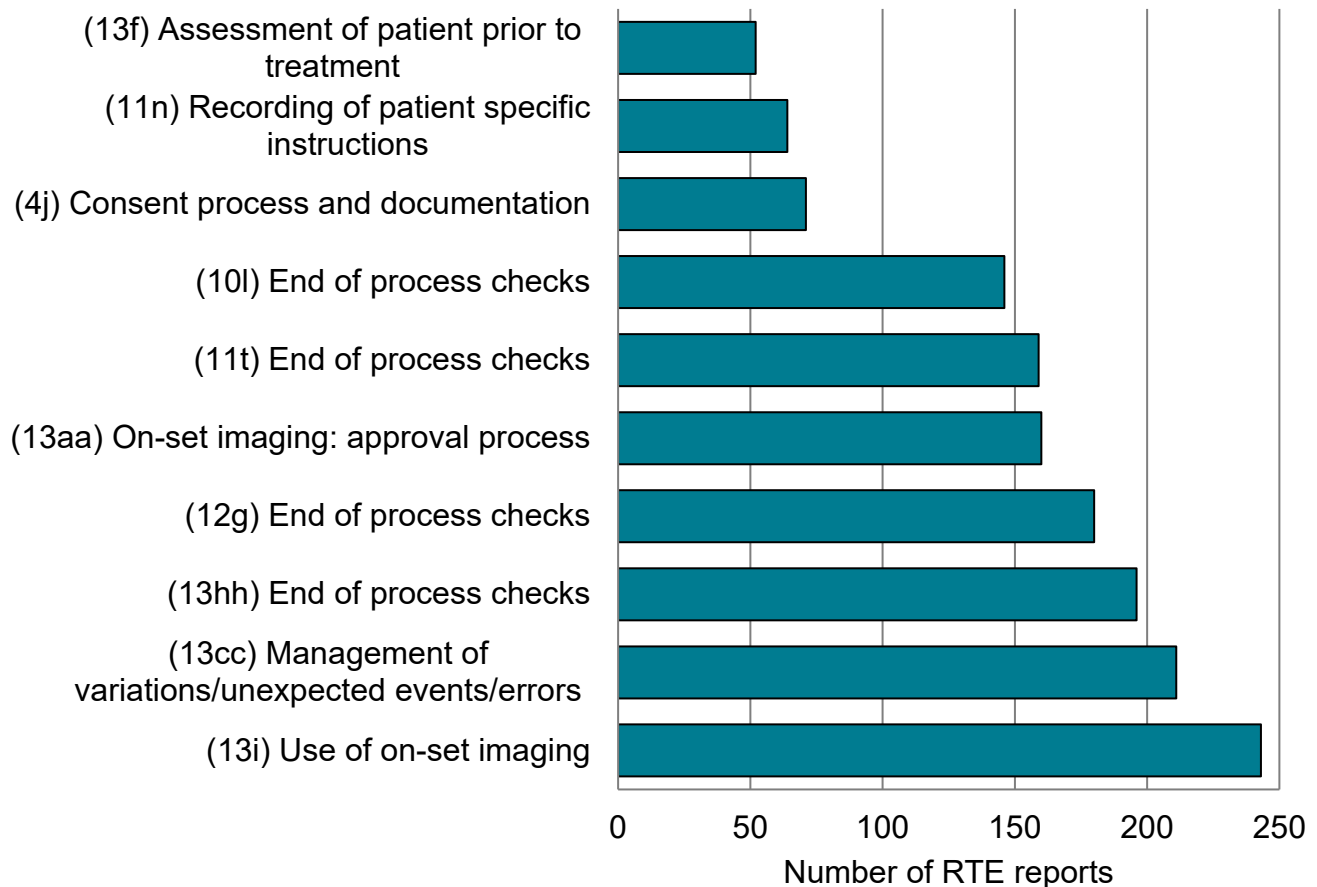
The most frequently reported level 5 process subcodes were ‘bookings made according to protocol’ comprising of 8.0% (n = 90) of all level 5 RTE ([Figure 11](#)). An example of this type of RTE is the incorrect booking of patient appointments, this includes booking appointments on the incorrect day and/or treatment machine. These are detected during an end of process check before affecting patient treatment. The booking process includes 6 different process subcodes, which were reported in 19.3% (n = 216) of level 5 RTE.

No treatment process subcodes were included in the most frequently reported level 5 RTE (Figure 11). Eight of the most frequently reported process subcodes were also seen in the previous analysis (issue 40).

Failed safety barriers

A safety barrier (SB) is a critical control point, defence in depth, or any process step whose primary function is to prevent errors occurring or propagating through the RT workflow (13). SB embedded in the pathway coding (14) can be allocated to each RTE report to identify all points in the pathway where the error was not detected (failed SB). Multiple FSB codes can be attributed to each individual RTE. A total of 2,196 failed safety barriers (FSB) were identified from the RTE reported (Figure 12).

Figure 12. Breakdown of failed safety barriers (n = 1,482/2,196 subset of RTE data)



Treatment unit processes were attributed to 43.9% (n = 964) of all FSB. The most frequently reported FSB are represented in Figure 12. Treatment unit processes ‘use of on-set imaging’ was the most frequently reported FSB (11.1%, n = 243). An example of an RTE with this FSB includes when a verification image is not taken when required. Each of the FSB were also seen in the previous analysis (issue 40).

'End of process checks' occur at the end of each discrete part of the pathway and include 6 different pathway subcodes. These comprised of 31.5% (n = 691) of all FSB. The PSRT provided further information on the use of end of process checks in the January (#6) and September (#7) 2022 issues of [Safer Radiotherapy E-bulletin](#).

Method of detection

A method of detection (MD) is the process that identified the error and can be coded using the entire pathway taxonomy.

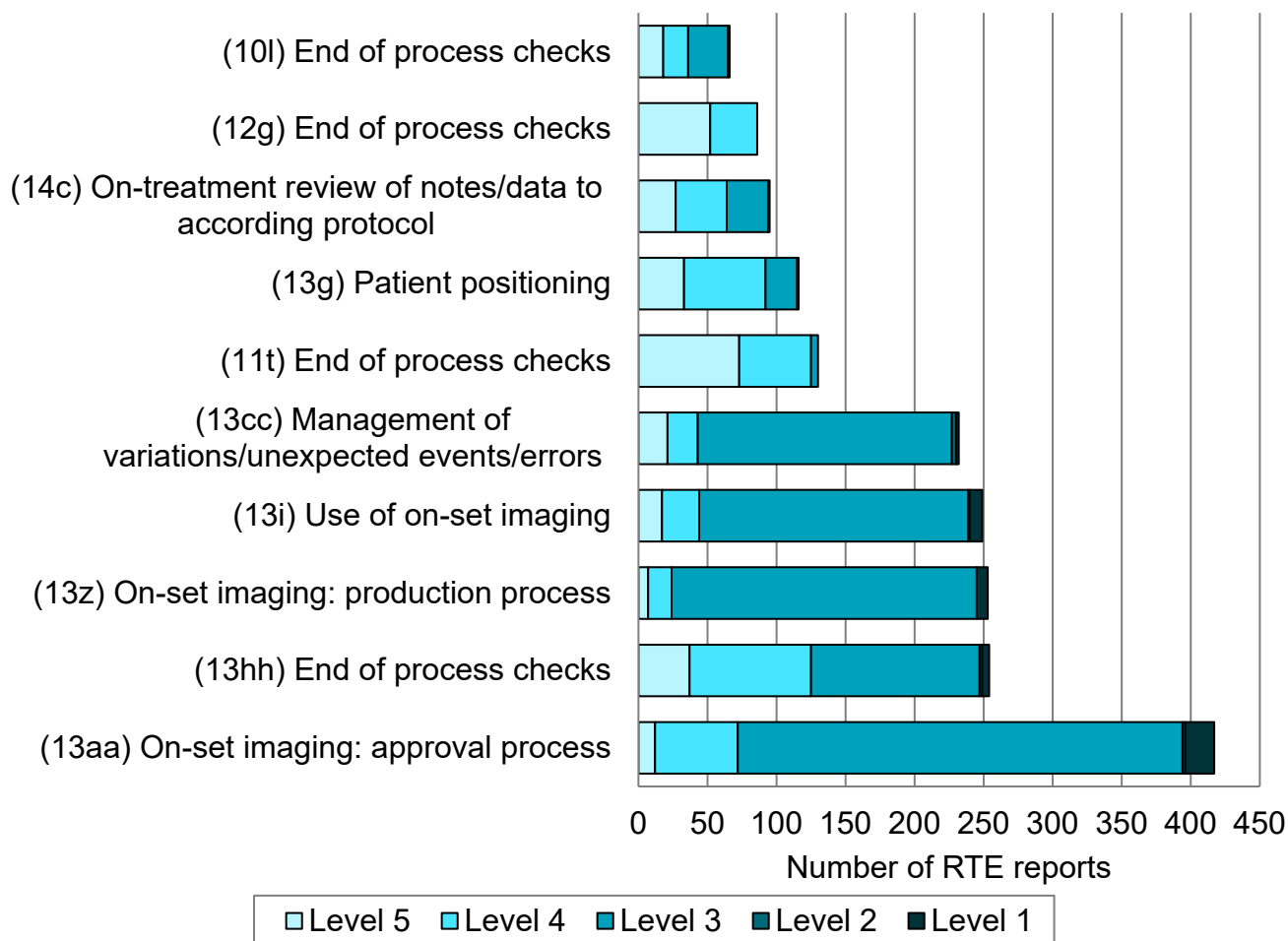
For this reporting period 42 providers indicated MD in 71.6% (n = 2,476) of reports. This is an increase in numbers since the [previous analysis](#) (issue 40), where 45 providers indicated MD in 64.0% (n = 2,243) of reports. Following consistency checking, UKHSA coded a further 868 reports with MD taxonomy, resulting in 3,344 reports for analysis. The most frequently reported MD can be seen in [Figure 13](#).

The most frequently reported MD was 'on-set imaging: approval process' (12.5%, n = 417). This MD was most frequently reported with a primary process code 'on-set imaging: production process' (22.5%, n = 94). Six of the most frequently reported MD occurred at the treatment unit process.

'End of process checks' occur at the end of each discrete part of the pathway and include 6 different pathway subcodes. These comprised of 16.3% (n = 544) of all MD, of which 69.9% (n = 380) were classified as either near miss or other non-conformances, stopping the RTE from propagating across the pathway.

For each part of the pathway there are 'other' pathway subcodes. Before consistency checking 10.6% (n = 262/2,476) of MD were assigned 'other' pathway subcode. After consistency checking this was reduced to 4.2% (n = 104). It is recommended the entire pathway coding should be considered when assigning a MD as described in the January 2022 issue of [Safer Radiotherapy E-bulletin](#).

Figure 13. Breakdown of method of detection by level (n = 1,898/3,344 subset of RTE data)



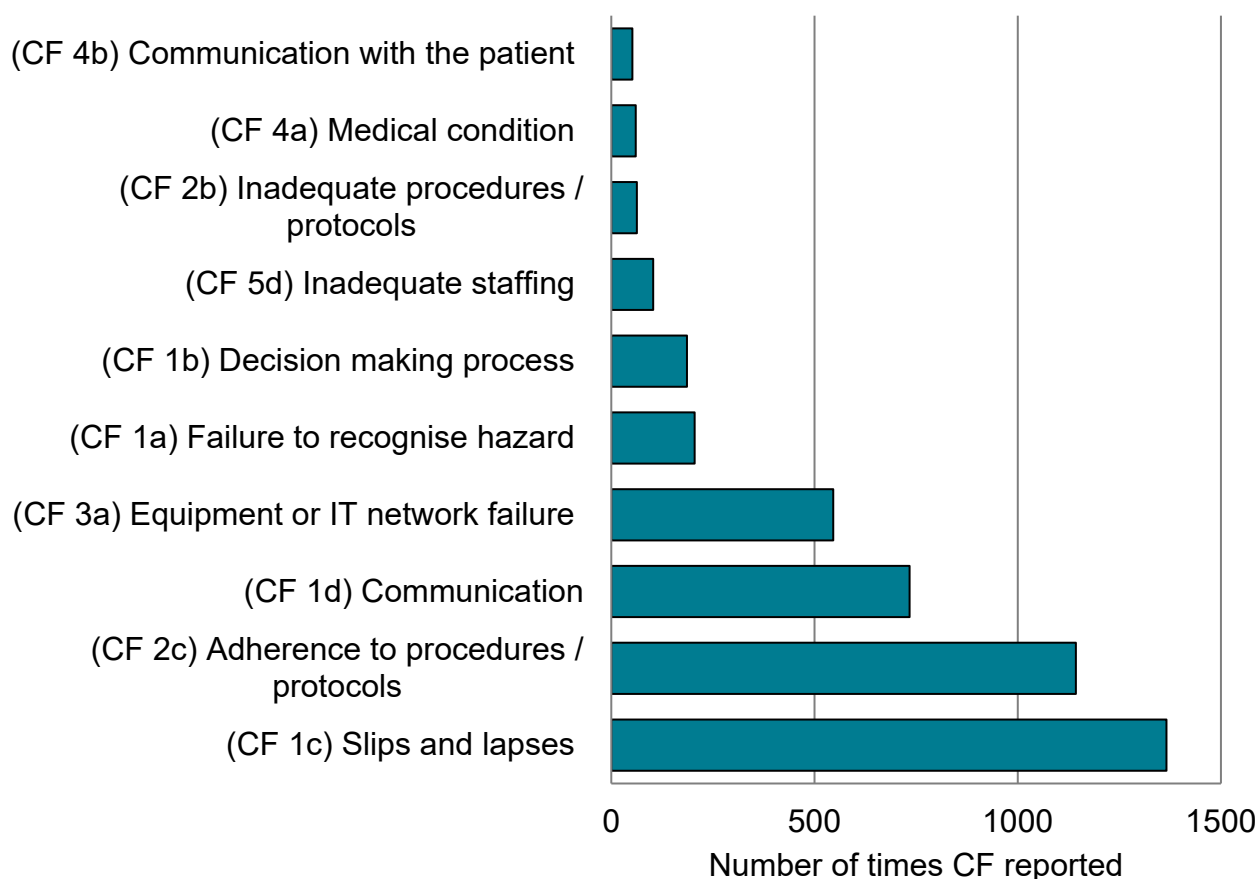
Contributory factors

The use of a causative factor (CF) taxonomy enables identification of system problems or contributory factors that could precipitate a range of different incidents (15).

From the 3,456 RTE reported, 89.4% (n = 3,088) included CF coding. These were reported from 48 providers. This is a slight increase since the [previous analysis](#) (issue 40), when 54 providers reported and 87.3% (n = 3,059) of RTE included CF. UKHSA were able to assign primary CF to all of the remaining RTE reports.

Multiple CF can be assigned to a single RTE, across the 3,456 RTE, 1,038 contained multiple CF totalling 4,709 CF codes. [Figure 14](#) shows the most frequently reported CF codes. The most frequently reported CF was ‘slips and lapses’ making up 29.0% (n = 1,366) of all CF reported ([Figure 14](#)). [Issue 22 of Safer Radiotherapy](#) includes guidance on minimising the occurrence of RTE caused by a slip or lapse of an individual. All but 2 of the most frequently reported CF were also seen in the [previous analysis](#) (issue 40), these were patient related CF.

Figure 14. Breakdown of most frequently reported CF (n = 4,458/4,709 subset of data)



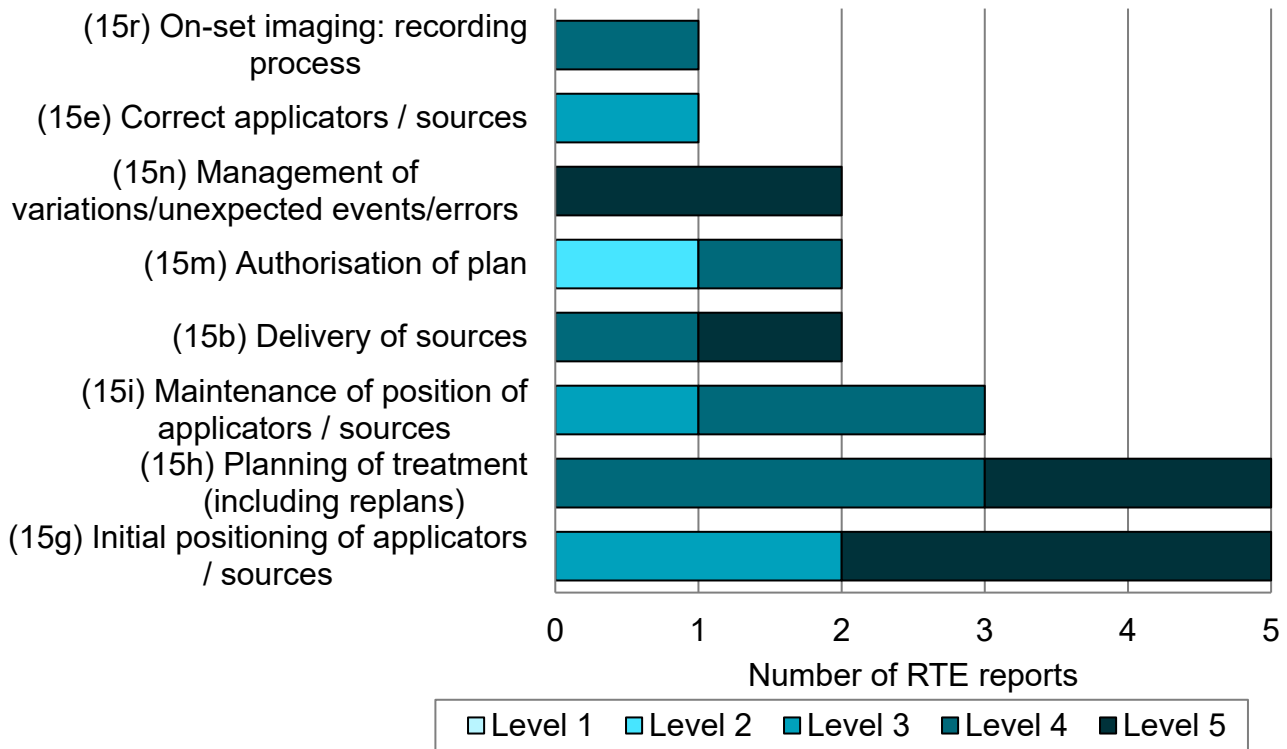
Brachytherapy RTE

Brachytherapy (BRT) is a RT sub-speciality which involves the placement of a sealed source inside or close to the treatment area (16). BRT makes up less than 3% of all RT episodes (17). Therefore, the number of BRT associated RTE would be expected to be low and should be interpreted with caution. Further learning from BRT RTE can be seen in a separate [learning resource](#).

RTE coded with BRT process subcodes as the primary code accounted for 0.6% (n = 21) of reports, a slight decrease from the [previous analysis](#), issue 40 (0.7%, n = 25). BRT RTE were submitted from just 10 providers for this reporting period. A breakdown of the brachytherapy RTE can be seen in [Figure 15](#).

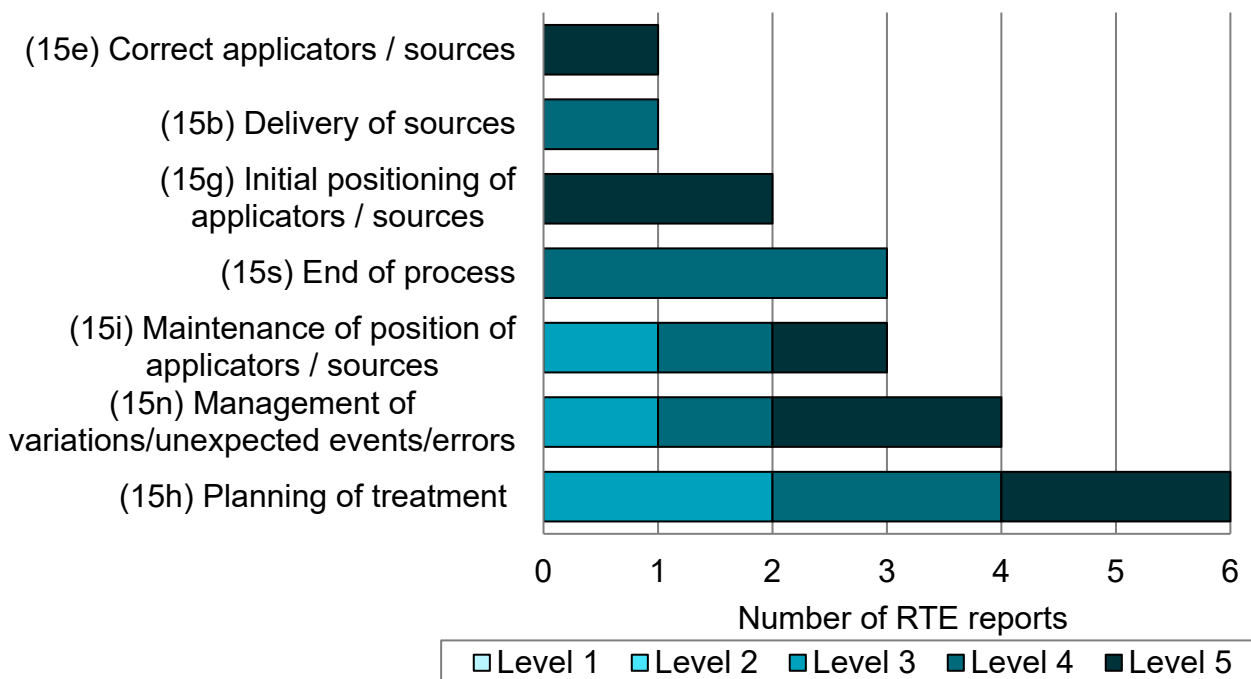
The most frequently reported BRT process subcodes was 'initial positioning of applications/ sources' and 'planning of treatment' each comprising 23.8% (n = 5) of all BRT RTE. An example of BRT RTE associated with 'initial positioning of applicator/ sources' includes when seeds are incorrectly positioned for treatment. An example of BRT RT associated with 'planning of treatments' includes when an issue with a plan is identified during first fraction checks.

Figure 15. Breakdown of most frequently reported BRT RTE coded ‘15’ by level (n = 21)



From the 21 BRT RTE, there were only 28 subcodes reported. Of these, 10 were FSB, the most frequently reported was ‘management of variations’ and ‘authorisation of plan’ each comprising 10.7% (n = 3). The FSB shown in [Figure 12](#) indicate imaging associated FSB as the most frequently reported FSB associated with external beam deliveries. This difference is due to a greater uptake of IGRT in external beam RT than in BRT

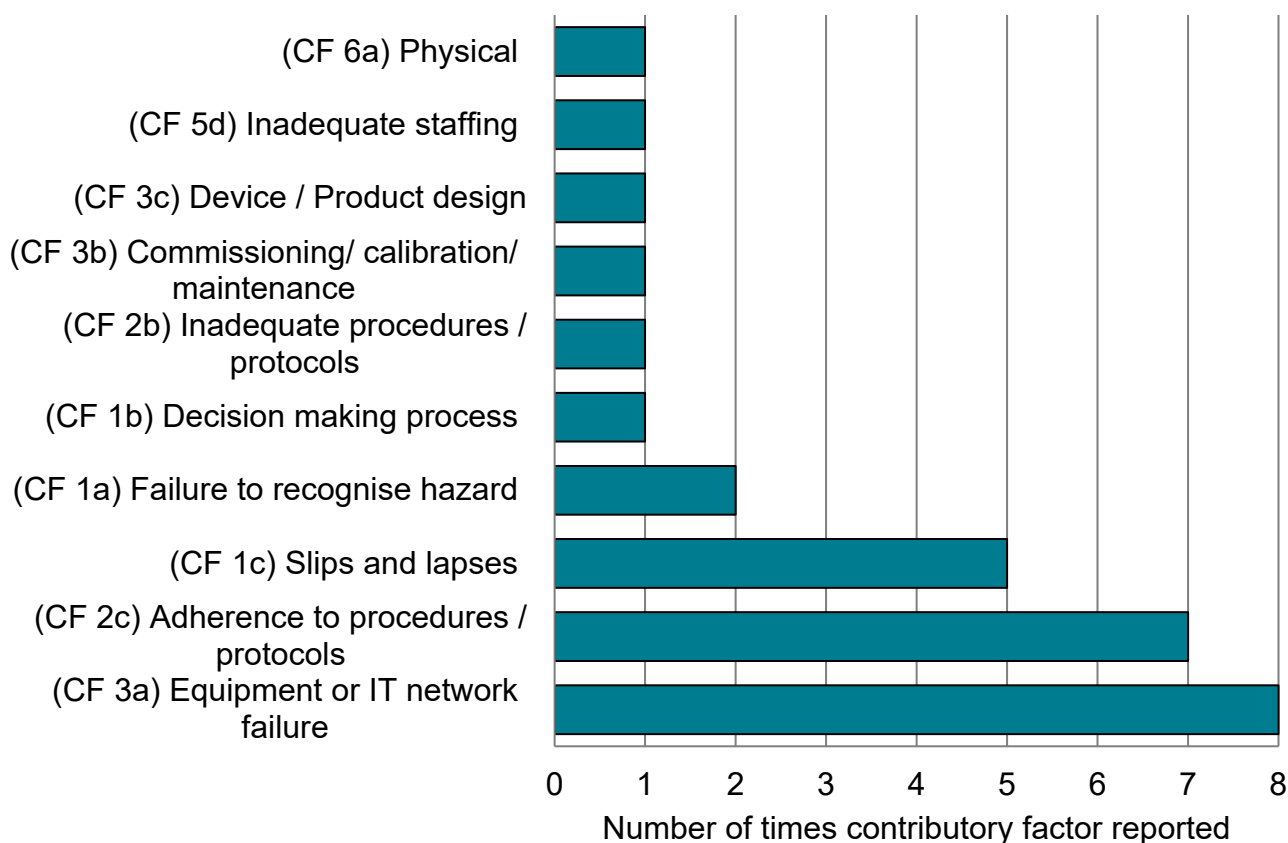
Figure 16. Breakdown of BRT method of detection by level (n = 20)



Of the 21 BRT RTE, 57.1%, (n = 12) were assigned a MD subcode. During consistency checking 8 further BRT RTE were assigned a MD using the text within the report. These are shown in [Figure 16](#), the most frequently reported MD was ‘planning of treatment (n = 6).

All CF codes were reviewed within this subset of the data and 28 CF identified ([Figure 17](#)). The most frequently reported CF associated with BRT RTE was ‘equipment or IT network failure’ comprising of 28.6% (n = 8) of all the CF for BRT RTE. The trends of these BRT CF are slightly different when compared to the entire data as in [Figure 14](#).

Figure 17. Breakdown of BRT RTE CF (n = 28)



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