UK Health Security Agency

# User guidance and application of the national taxonomy for incident learning in clinical imaging, magnetic resonance imaging and nuclear medicine

BIR The British Institute of Radiology

BNMS BRITISH NUCLEAR MEDICINE SOCIETY

IPEM Institute of Physics and Engineering in Medicine

The Royal College of Radiologists

SoR THE SOCIETY OF RADIOGRAPHERS

# Contents

# Introduction

Every day in the NHS and independent sector, tens of thousands of patients are investigated and treated safely by dedicated healthcare professionals who are motivated to provide high quality and safe clinical care. A proportion of the investigations and treatment provided will involve the use of radiation (ionising and non-ionising) to inform clinical care.
In the delivery of large numbers of medical exposures, inevitably in some cases things can and do go wrong, no matter how dedicated and professional the staff. It is imperative that incidents and near misses in clinical imaging, magnetic resonance imaging (MRI) and nuclear medicine are monitored, analysed and learning shared to help mitigate and reduce the frequency and magnitude of these events.

The value of incident and near miss reporting and the associated learning is well appreciated in the UK radiotherapy community. However, to date there is no national reporting and learning system specifically intended to analyse and learn from clinical imaging, MRI or nuclear medicine incidents in the UK.

The Clinical Imaging Board (CIB) recognised the need for a system to mirror the national radiotherapy reporting analysis and learning system. The CIB commissioned a working party to develop a classification and pathway coding system intended to enable organisations to locally code, analyse and learn from incidents. A working party report 'Learning from ionising radiation dose errors, adverse events and near misses in UK clinical imaging departments' [1] was published in June 2019. The report provided a number of recommendations including the establishment of a multidisciplinary steering group to take this initial work forward and develop it into a national system for learning from incidents.

The Medical Exposures Group (MEG) in UK Health Security Agency (UKHSA) established a multidisciplinary working party to develop a process for coding incidents, collecting data and analysing incident reports at a national level. The incident coding system first developed for the CIB was reviewed to mirror the patient pathway from referral to clinical evaluation, rather than focussing on the Ionising Radiation (Medical Exposure) Regulations (IR(ME)R) duty holders of referrer, practitioner and operator. The coding taxonomy was expanded to include the modalities of MRI and molecular radiotherapy and the associated guidance further developed to explain how to classify incidents and near miss events.

In order to minimise the burden on clinical departments, MEG plan to extract relevant incident data from existing systems such as Learning from Patient Safety Events (LFPSE) NHS England and Once for Wales Concerns Management System NHS Wales Shared Services Partnership. Individual departments in Northern Ireland, Scotland and the independent sector will also have the opportunity to submit data directly to UKHSA. Departments will need to add the trigger code (PRIA24) and the appropriate coding to incident reports within their local incident management system, for example Datix, prior to submission to UKHSA.

The anonymised incident data will be analysed by MEG. Results and learning will be published in regular reports. This will provide opportunities for clinical departments to learn from a larger data set with a view to supporting a reduction in the magnitude and probability of incidents locally. As the system becomes established and more departments contribute data, this will allow departments to compare local incidents with the national picture.

# Background

The objective of this voluntary learning system is to support services reviewing their own practice and provide a framework that can be used to share data and learning nationally. This system is not intended to replace the existing mandatory responsibility to report to the appropriate authority under regulations such as the Ionising Radiation (Medical Exposure) Regulations (IR(ME)R), and the Ionising Radiation Regulations (IRR).

Many departments are using the CIB 'Error Reporting and Learning Coding Taxonomy' at a local level. This taxonomy has been refined and expanded, based on user learning. The updated taxonomy is now available to clinical departments for adoption locally and to facilitate meaningful analysis and learning at a national level.

Local reporting, investigation and learning from incidents are requirements of IR(ME)R, however other clinical imaging services, such as MRI, may be vulnerable to the same or similar issues. Use of national coding taxonomies allows for the collation and analyses of these events nationally so that effective mitigations may be identified. Sharing learning from clinical imaging incident data at a local, national and international level is essential to maximise opportunities to improve patient safety.

The clinical imaging incident classification system defines terms to avoid ambiguity and provides a pathway coding system to identify the point along the patient pathway where an incident occurred, in a consistent way. This approach introduces additional taxonomies to classify these events by modality and contributory factors.

The objective of this document is to present the taxonomies and provide guidance on their application in real life scenarios.

It will:

- support and promote a positive safety culture with a robust incident reporting framework
- implement a classification and pathway coding framework intended to enable organisations to code, analyse and learn from local incidents
- improve communication between stakeholders to disseminate national learning from incidents to influence local practice and ultimately support patient safety

**All data must be anonymised by the clinical department prior to submission to the UKHSA. This includes any information which may identify any individuals (including patients, comforters, carers, healthy volunteers or staff).**

# Scope

The incident coding taxonomy includes the following modalities:

- general radiography
- computed tomography
- nuclear medicine diagnostics
- nuclear medicine therapies
- fluoroscopy
- mammography
- magnetic resonance imaging

# Definition of an incident

An unintended departure from the planned procedure or an unexpected event which may, or may not, be intercepted and prevented and could or does result in unnecessary harm to the patient involved.

For the purposes of this work:

- the definition of a patient includes a healthy volunteer participating in a research trial
- the coding can also be applied to incidents involving exposures to carers and comforters (defined below)

## Carers and comforters

Carers and comforters include those who are knowingly and willingly exposed while supporting an individual undergoing an exposure. Carers and comforters can be involved in any exposure type, for example medical exposures, non-medical imaging, MRI and research exposures. This definition does not apply and should not be used for incidents involving staff or members of the public.

# How to code an incident

When coding an incident it is important to identify the first point or task on the pathway that failed – the 'what' rather than the 'why'. This will be the primary point on the pathway taxonomy chosen when coding an incident.

It is usual for more than one task on the pathway to fail in the lead up to an incident. Secondary points will be those that followed from this primary point; further factors which occurred in the pathway stemming from this point.

In addition to the severity, exposure type and modality, at least one pathway code and contributory factor code must be applied to an incident to support analysis. In some incidents multiple pathway or contributory factor codes may be applied to illustrate the detail of the incident.

The staff involved in coding incidents or near misses must have a clear understanding of clinical imaging, interventional radiology, nuclear medicine or MRI processes and service delivery. Using the coding taxonomy table and guidance, clinical departments will include the following codes to the first open text field of their local reporting and learning system; this includes a trigger code, classification and pathway coding and contributory factor codes for each individual incident.

The following describes the coding abbreviations used and the example scenario demonstrates how the coding is derived:

- trigger code – **PRIA24**
- level of severity - **L**
- exposure type - **E**
- intended modality - **M**
- performed modality - **P**
- patient pathway code and sub coding
- contributory factors – **CF**

See the full coding taxonomy

# Scenario

See an example of how the coding might be applied to a typical scenario in the general radiography setting.

Following planned maintenance and software upgrade on a DR chest unit (3.5d), a patient had a postero-anterior (PA) chest X-ray examination performed. The radiographer checked the images and noticed prior to sending to the picture archiving and communication system (PACS) the image had flipped PA to anteroposterior (AP) (3.6c). The unit was taken out of use, the engineer recalled and support was requested from the medical physics department (CF3a)(CF3b). A fault was discovered, rectified and the physics team performed additional quality assurance (QA) checks before the unit was handed back to the hospital. Additional imaging was not required in this incident as image was corrected prior to transfer and upon further investigation it was noted no previous patients had been affected.

The application of the following taxonomy coding abbreviations for the example scenario demonstrates how the coding is to be used:

| | |
|---|---|
| **PRIA24** | Trigger code |
| **L3** | Level 3 incident: Near miss |
| **E1** | Exposure type: Medical exposure |
| **MA** | Intended modality: General radiography |
| **P1** | Performed modality: General radiography |
| **3.5d** | Equipment: Servicing or planned maintenance |
| **3.6c** | Image acquisition and management: Image annotation |
| **CF3a** | Procedural: Equipment or IT network failure |
| **CF3b** | Procedural: Commissioning, calibration, maintenance and handover |

**Applied code: PRIA24/L3/E1/MA/P1/3.5d/3.6c/CF3a/CF3b**

# Taxonomies

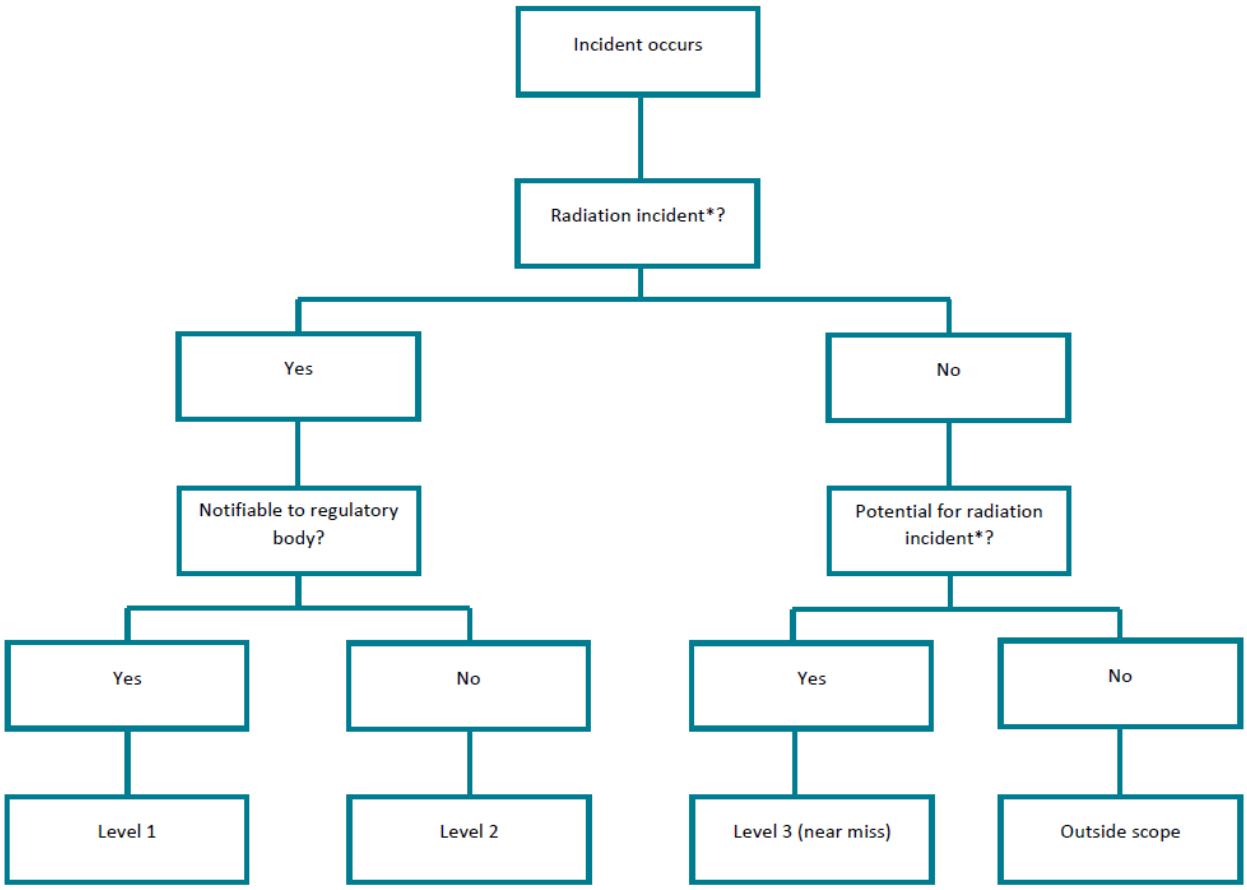
## Severity

The taxonomy provides 3 levels of incidents related to the severity of the event. Examples have been provided for MRI. This is not an exhaustive list.

| Severity level | Description |
|---|---|
| **Level 1** | Incidents that require notification to the relevant regulatory authorities. These are incidents that mee the published criteria from the IR(ME)R regulators Care Quality Commission (CQC), Regulation and Quality Improvement Authority (RQIA), Healthcare Inspectorate Wales (HIW), Healthcare Improvement Scotland (HIS) for ionising radiation exposures and other bodies such as Medicines and Healthcare products Regulatory Agency (MHRA) for MRI incidents.<br>MRI incident examples include:<br>• patient burn<br>• projectile incident resulting in patient injury<br>• ferromagnetic item brought into the MRI environment resulting in patient injury<br>• scanning of undeclared MRI unsafe implants |
| **Level 2** | Incidents that are not notifiable to the relevant regulatory authority but are locally reported, investigated, analysed and the outcome documented.<br>Accidental exposures (defined below) that do not meet the criteria for notification but are locally reported, investigated, analysed and the outcome documented.<br>MRI incident examples include:<br>• patients scanned incorrectly and an additional examination required at a later date |
| **Level 3** | Potential radiation incidents that were detected and prevented before an exposure took place and did not result in harm.<br>MRI incident examples include:<br>• hazard was identified before the patient entered the MRI environment<br>• images corrected before clinical evaluation for example laterality or patient orientation |

Note: Accidental exposures - In England only, there are adult and child dose thresholds for notification of accidental ionising radiation exposures. Employers should apply the criteria applicable to them.

**Figure 1. Level of severity flowchart**




Radiation incident* includes both ionising and non-ionising radiation

The flowchart demonstrates how an incident can be assessed to determine the appropriate severity code.

# Exposure type

The exposure type describes the type of exposure where the incident occurred. One of the following exposure types must be selected when applying the taxonomy coding.

## E1. Medical exposure

Exposure to patients as part of their medical diagnosis or treatment.

## E2. Non-medical imaging

Exposures performed for employment, insurance or immigration purposes.

## E3. Research

Exposures to patients or persons voluntarily taking part in medical, biomedical diagnostic or therapeutic research programmes involving ionising and non-ionising radiation.

## E4. Health screening programmes

Exposures to a healthy group or population who may be at increased risk of developing a disease, for example, NHS Breast Screening Programme (including MRI for individuals with a high-risk of breast cancer).

## E5. Individual health assessment

Exposures used as preventative health checks or to exclude disease in individuals with no symptoms (for example, nuclear medicine Glomerular Filtration Rate (GFR) test for potential kidney donors).

# Intended modality

The intended modality is the imaging modality which was either requested or intended. This may not have been the imaging modality performed. One of the following intended modalities must be selected when applying the taxonomy coding.

## MA. General radiography

Includes direct digital radiography (DR), computed radiography (CR), mobile units used for general radiography, dental imaging including cone beam CT and dual energy x-ray absorptiometry (DEXA).

## MB. Computed tomography

Includes interventional CT (biopsies ablations etc), CT fluoroscopy, angiography, spectral imaging, perfusion studies. This category is to be used for CT examinations only. This category

should not be used for hybrid nuclear medicine (NM) imaging or for radiotherapy planning exposures.

### MC. Nuclear medicine diagnostic

Includes planar, dynamic, whole body, SPECT, SPECT-CT and gated NM imaging, nuclear cardiology, PET-CT, PET-MRI, and non-imaging NM examinations.

### MD. Nuclear medicine therapies

Includes the treatment of benign and malignant conditions using unsealed radioactive sources.

### ME. Fluoroscopy

Any procedure performed under fluoroscopic control including interventional radiology and cardiology imaging performed outside of the radiology department using mobile c-arms (for example theatres, endoscopy units, pacing labs).

### MF. Mammography

Includes asymptomatic and symptomatic breast imaging and intervention, for example biopsy procedures.

### MG. Magnetic resonance imaging

Includes all imaging, interventional and functional MRI scanning.

### MH. Ultrasound

Included only in the intended modality section to capture the detail of incidents where the wrong modality was performed. For example, the requested (intended) modality may have been an ultrasound of the abdomen but an incident occurred in the referral pathway and a CT scan of the abdomen was performed.

### MX. No exposure intended

## Performed modality

The performed imaging modality is the area where the incident or near miss occurred. This may not have been the imaging modality requested or intended. One of the following performed modalities must be selected when applying the taxonomy coding:

### P1. General radiography

### P2. Computed tomography

### P3. Nuclear medicine diagnostic

### P4. Nuclear medicine therapies

### P5. Fluoroscopy

### P6. Mammography

### P7. Magnetic resonance imaging

### PX. No exposure performed

PX includes incidents where a referral was made but the examination was not performed.

# Patient pathway

The pathway coding is divided into 3 main areas which pinpoint where in the pathway the incident first occurred:

1. Referral process
2. Justification and authorisation process
3. Practical aspects

The patient pathway codes are broken down into sub-codes. At least one pathway sub-code must be applied. Multiple pathway sub-codes can be applied to further illustrate the detail of the incident.

Within the following sections, there are multiple references to “imaging” which in this guidance includes any nuclear-medicine non imaging tests.

# 1. Referral Process

These codes should be used for incidents that have occurred in the referral process. The referral process is divided into 3 categories:

- 1.1 Referral information
- 1.2 Appointment process
- 1.3 Patient preparation

## 1.1 Referral Information

Where there was an incident in the referral information. There are 3 sub-codes to describe the detail of what went wrong:

### 1.1a Referral information – insufficient or inaccurate demographic information or duplicate referral

The following examples for insufficient or inaccurate demographic information include:

- failure to provide sufficient information in the referral to identify the patient
- wrong patient has been referred
- duplicate referral submitted

### 1.1b Referral information – insufficient or inaccurate clinical information or working outside scope

The following examples apply when the correct patient is referred but there is insufficient or inaccurate information which leads to:

- wrong laterality, site or region
- wrong timing of a requested examination, for example imaging required in 3 months' time but requested within 3 weeks
- referrer working outside scope
- failure to include information on pertinent blood or pathology results
- failure to include details of known allergies, co-morbidities or additional special needs
- failure to include information about contraindicated medication, for example, for nuclear medicine exposures
- research trial information not indicated on the referral

### 1.1c Referral information - MRI insufficient or inaccurate safety information

The following examples for insufficient or inaccurate safety information include:

- failure to provide sufficient or accurate information on passive or active implants and foreign bodies
- failure to provide sufficient or accurate information on previous surgery involving implants or recent surgery; that is, within 6 weeks

## 1.2. Appointment process

Where there was an incident in the appointment booking process, there is one sub-code to describe the detail of what went wrong.

### 1.2a Appointment process - appointment booking

The following examples include:

- referral is appropriate but the appointment created does not match details on the referral, for example:
  - wrong examination booked
  - wrong area to be examined (for example laterality)
  - wrong patient booked
  - duplicate appointment booked
- timing incident where a specific time was specified in the referral but the appointment was made too early or too late
- failure to cancel a referral (by referrer or others)
- booking incident when adding patient information to the system
- missing alarm flags for MRI implants/contraindicated foreign bodies
- booking on incorrect scanner for implant conditions, for example, 3T instead of 1.5T

## 1.3. Patient preparation

Where there was an incident in patient preparation or where there are patient factors that directly contribute to an incident. There are 2 sub-codes to describe the detail of what went wrong.

### 1.3a Patient preparation - psychological preparation

This task can be carried out here and at other points.

The following examples include:

- information regarding psychological preparation for procedure not shared with patient, for example, the need to stay alone within an uptake room prior to PET-CT scan
- failure in patient preparation for an examination including consent, benefit and risk dialogue
- failure to complete MRI safety checking procedures

### 1.3b Patient preparation – physical preparation

The following examples include:

- information regarding physical preparation for the procedure not shared with patient for example:
  - oral preparation
  - fasting/restricted diet regime
  - cannulation or access
  - medicines advice
- insufficient time given for patient to understand and follow instructions

# 2. Justification and Authorisation Process

This primary code should be used for incidents that have occurred in the justification and authorisation process. The justification and authorisation process has one category.

## 2.1 Safety checks

Where there was an incident in the safety checks that inform the justification or authorisation process. There are 6 sub-codes to describe the detail of what went wrong.

### 2.1a Safety checks - patient identification and pregnancy/breastfeeding status

Includes failure to follow justification and authorisation procedure to:

- correctly identify the patient
- establish pregnancy and breast-feeding status

### 2.1b Safety checks - imaging history check

Includes failure to read clinical information or to check the radiology information system (RIS) system for relevant previous imaging.

This task can be carried out here and at other points in the patient pathway.

### 2.1c Safety checks - contraindication or allergy checks

Includes when justification and authorisation has not considered information regarding:

- allergies
- contraindications to medicines or contrast
- blood/pathology results
- BMI
- claustrophobia

### 2.1d Safety checks – MRI implanted medical device check

Includes when justification and authorisation has not considered information regarding:

- implanted medical devices
- contraindicated metallic foreign bodies

### 2.1e Safety checks - record of authorisation

The following examples include:

- lack of record of justification or authorisation of the exposure
- inappropriate authorisation (outside scope of the authorisation guidelines)
- wrong protocol
- wrong modality indicated
- prioritised inappropriately

### 2.1f Safety checks – no appropriate employer or practitioner licence in place (NM only)

The following examples include:

- where the referral is authorised, but the procedure is not included in the relevant employer or practitioner licence (or both)
- where a research exposure is authorised, but the procedure is not held on the employer or practitioner licence for the purpose of research

# 3. Practical aspects

This primary code should be used for incidents that have occurred in the practical aspects of the exposure. The practical aspects are divided into 7 categories:

- 3.1 Patient safety checks
- 3.2 Exposure safety checks
- 3.3 Radiopharmaceutical preparation
- 3.4 Contrast/pharmaceutical administration
- 3.5 Equipment
- 3.6 Image acquisition and management
- 3.7 Clinical evaluation

## 3.1. Patient safety checks

Where there was an incident in the patient safety checks, there are 6 sub-codes to describe the detail of what went wrong.

### 3.1a Patient safety – confirmation of patient identification and information

Includes failure to:

- correctly identify a patient
- confirm with the patient and primary source data what type of examination they are having and why (Pause and Check)
- confirmation of age (for example wrong paediatric protocol selected based on incorrect age)

### 3.1b Patient safety - confirmation of pregnancy or breastfeeding status

Includes failure to check the following:

- confirmation of age (impacts whether pregnancy checking is required)
- pregnancy status where appropriate for all modalities
- failure to check breast feeding status (NM and MRI)
- failure to follow pregnancy procedure
- failure to follow breast feeding procedures
- failure to record pregnancy or breast feeding checks
- no procedure in place or inadequate procedures

### 3.1c Patient safety - duplicate referral or imaging history check

Includes failure to perform imaging history check or failure to identify duplicate referrals submitted.
This task can be carried out here and at other points in the patient pathway.

### 3.1d Patient safety - contraindications, preparation and medication check

Includes failure to identify the following:

- previous contrast reactions
- significant GFR values
- medication that could be a contraindication to having the procedure, for example, carbimazole not stopped prior to Iodine-131 administration in molecular radiotherapy (MRT) or hyoscine butylbromide (for example Buscopan) in MRI

### 3.1e Patient safety – MRI implanted medical devices or contraindications check

Includes failure to set, agree or follow MRI implant conditional requirements. MRI conditions may include requirements for:

- reduced specific absorption rate (SAR) limits patient or implant positioning
- exclusion zones in patient
- additional monitoring of patient required
- implant or device preparation

### 3.1f Patient safety - check patient information provided and patient consent

This task can be carried out here and at other points.

Examples include:

- failure to provide benefit and risk explanation or information letter for the examination
- failure to obtain implied, verbal and written valid informed consent

## 3.2. Exposure safety checks

Where there was an incident in the exposure safety checks, there are 3 sub-codes to describe the detail of what went wrong.

### 3.2a Exposure safety checks – patient selection on equipment

Includes patient selection on equipment, for example, incorrect patient folder and examination area uploaded.

### 3.2b Exposure safety checks – patient set-up

Includes incidents involving the physical set-up of the patient in the exposure room:

- incorrect laterality or body part
- additional view acquired that was not justified
- incorrect/poor positioning technique
- MRI coil incorrectly positioned, for example, with implants that require isocentre at a particular reference point on the body
- incorrect MRI coil used for example MRI conditional implants that require transmit-receive head coil but a body coil used

### 3.2c Exposure safety checks – equipment set-up and protocol selection

Includes incidents involving equipment set-up and/or exposure selection:

- wrong protocol selected
- wrong exposure factors selected
- wrong Automatic Exposure Control (AEC) or detector selected or inappropriately used
- wrong radionuclide selected on dose calibration
- incorrect gating /triggering CT/MRI
- inappropriate selection of normal or first level SAR levels (MRI)

Note contrast is covered in a section 3.4.

## 3.3. Radiopharmaceutical preparation

Where there was an incident in the radiopharmaceutical preparation, there are 4 sub-codes to describe the of detail what went wrong.

### 3.3a Radiopharmaceutical preparation – physical labelling issue

Examples include:

- incidents regarding physical labels such as stickers attached to vials, syringes, or other delivery equipment
- inaccurate activity, radiopharmaceutical, reference dates or expiry times

### 3.3b Radiopharmaceutical preparation – pharmaceutical

Examples include:

- unsuccessful radiolabelling or outside tolerance limits
- imaging demonstrating presence of free pertechnetate
- incorrect gas connected to an aerosol generator
- pharmaceutical was not prepared correctly

### 3.3c Radiopharmaceutical preparation – concentration or volume

Examples include:

- situations where the prepared concentration or volume of the radiopharmaceutical is outside tolerance limits
- where insufficient volume is available to inject for sentinel lymph node biopsy

### 3.3d Radiopharmaceutical preparation – radioactivity measurement

Examples include:

- incorrect measurement of radioactivity during preparation or drawing up
- wrong calibrator factor used or copper filter not used when required
- incorrect preparation of standards or other reference sources used as part of non-imaging tests

## 3.4. Contrast or pharmaceutical administration

Where there was an incident during the contrast or pharmaceutical administration. There are 3 sub-codes to describe the detail of what went wrong.

### 3.4a Contrast or pharmaceutical administration – wrong timing

Includes situations when the contrast or pharmaceutical is administered at the wrong time for the examination protocol, resulting in an additional exposure. Includes all routes of contrast or pharmaceutical administration.

CT and MRI scanning – includes situations where contrast has not been administered or taken as required for an examination.

For example:

- insufficient bowel preparation for CT or MRI colonography
- inadequate air insufflation
- oral contrast not administered or administered at incorrect time
- Hyoscine butylbromide (for example Buscopan) not administered or administered at incorrect time

Nuclear medicine – includes situations where medication has not been taken or stopped prior to the appointment.

For example:

- thyroid blocking medication not administered prior to 123I-ioflupane injection
- carbimazole not stopped prior to 131I iodide administration
- blood thinning medication not taken prior to sentinel lymph node biopsy surgery

Also includes timing problems with dynamic imaging where administration timing issues affect the images acquired.

### 3.4b Contrast or pharmaceutical administration – radiopharmaceutical

Examples include:

- administration of the incorrect radiopharmaceutical
- administration of radioactivity outside locally specified tolerance levels, for example +/-10% of local diagnostic reference level (DRL)
- administration of radioactivity different to the patient-specific variation that has been authorised, for example a practitioner authorised lower activity for pregnant lung patient but the usual DRL was used

### 3.4c Contrast or pharmaceutical administration – physical administration

Examples include:

- extravasation of contrast, pharmaceutical or radiopharmaceutical rendering the images undiagnostic leading to additional exposure
- extravasation of therapeutic radiopharmaceutical not requiring additional exposures
- incorrect set-up of pressure injector, for example, air in connectors, poor or leaking connection requiring an additional exposure
- incorrect contrast or pharmaceutical administered, for example, hyoscine butylbromide (for example Buscopan) instead of glucagon
- incorrect dose or route of contrast or pharmaceutical

For incorrect radiopharmaceutical please use code 3.4b.

Nuclear medicine examples include:

- high residual activity or issues with the delivery equipment used to administer the radiopharmaceutical such as incorrect set-up, different tubing sets, leaking connections or air bubbles in the line
- where a patient attempts but is unable to swallow a capsule for 75Se-SeHCAT or radioiodine procedures should be reported under this code

CT/MRI scanning example includes:

- patient unable to tolerate scan following contrast administration

## 3.5. Equipment

Where there was an incident in the patient pathway relating to an equipment failure or fault. There are 6 sub-codes to describe the detail of what went wrong.

### 3.5a Equipment - installation, acceptance testing and commissioning

Includes incidents resulting from activities undertaken or decisions made during:

- installation
- acceptance testing
- commissioning of equipment
- room design for example emergency off button positioning

### 3.5b Equipment – set-up and changes to embedded protocols

Examples include:

- unauthorised changes to embedded protocol adversely affecting the dose or image quality
- failure to optimise embedded examination protocols
- inconsistent examination protocols and delivered doses for example, identical equipment not matched, leading to one unit delivering a different dose or image quality to another

### 3.5c Equipment – Quality Control (QC) and calibration

Examples include:

- failure in the escalation process when QC tests are out of tolerance
- equipment that is deemed as not fit for purpose and where replacement has been advised

### 3.5d Equipment - servicing or planned maintenance

Examples include:

- failure to communicate maintenance or corrective work carried out by an engineer which impacts on dose delivered or image quality
- failure to communicate when manufacturer's applications specialists change a protocol which impacts the exposure or image quality
- failure to follow appropriate equipment handover procedure
- maintenance of adjoining facilities that impact use of the equipment, for example, drainage system leading to flood in camera room

### 3.5e Equipment – equipment malfunction

Includes any equipment or software malfunction that affects the ability of the equipment to acquire images and data, for example:

- auto collimator/detector fault
- image loss or image artefact
- gamma camera detector contamination which can't be removed
- sample counter conveyor belt malfunctions

MRI includes:

- radiofrequency (RF) power failure
- auto coil-detector issues
- coil or connection faults leading to additional imaging
- RF interference from ancillary equipment

Includes ancillary equipment malfunction that affects the ability of the equipment to acquire images and data, for example:

- faulty ECG lead adversely affecting gated cardiac studies requiring additional exposures
- faulty pressure injector (not including set-up or loading issues) leading to incidents and additional exposure
- failure in ancillary equipment, for example, ventilator failure under anaesthesia resulting in scan aborted
- failure in the triggering or display equipment
- software malfunction

### 3.5f Equipment – MRI projectile hazards

Examples include:

- extraneous ferromagnetic objects, for example infusion pumps, pulse oximeters, tools, scissors, pens and so on

## 3.6. Image acquisition and management

Where there was an incident in the patient pathway relating to image and data transfer, image annotation or post processing acquired data. There are 4 sub-codes to describe the detail of what went wrong.

### 3.6a Image acquisition and management – incomplete or inadequate image or data acquisition

Includes scenarios where image or data acquisition cannot be completed due to:

- patient motion, claustrophobia, distress or not being able to comply or tolerate instructions
- nuclear medicine - where a patient returns too late for their scan which results in undiagnostic images or does not come back for the scan to be completed or relevant blood samples for GFR exam
- where the start of the procedure is delayed or interrupted

### 3.6b Image acquisition and management - image storage or transfer of data

Examples include:

- failure to save an image or clinical data
- failure in image reconstruction
- images/data in wrong patient folder
- patient data is lost
- image transfer failure

### 3.6c Image acquisition and management - image annotation

Examples include:

- incorrect date or time stamp recorded
- incorrect laterality markers recorded
- incorrect orientation recorded

### 3.6d Image acquisition and management - post processing data

Examples include:

- incorrect software selection for post processing
- failure to post process

## 3.7. Clinical evaluation

Where there was an incident relating to clinical evaluation. There are 4 sub-codes to describe the detail of what went wrong.

### 3.7a Clinical evaluation – failure to undertake clinical evaluation

Examples include:

- failure to undertake or record a clinical evaluation
- delays on clinical evaluation leading to additional exposure

### 3.7b Clinical evaluation - inaccurate or discrepancy in a clinical evaluation leading to additional exposure

Examples include:

- peer review identifies inaccuracies leading to additional exposure
- peer review identifies discrepancy leading to additional exposure

### 3.7c Clinical evaluation - failure to escalate or act on results or unexpected findings

Examples include:

- failure to escalate clinical findings
- failure to act on clinical findings
- failure to highlight or act on unexpected findings
- failure to refer for additional imaging or treatment

### 3.7d Clinical evaluation – unexpected event or reaction

Includes situations where all procedures were followed but an unexpected event or reaction occurred, for example:

- RF Burns in MRI
- toxicity
- deterministic skin reddening or hair loss
- notification of pregnancy after the procedure has been completed

# Contributory factors

There is often a complex chain of events and influences that lead to an incident and although a particular action or omission may be the immediate cause of an incident, closer analysis can reveal a series of events and departures from safe practice. These are contributory factors; they describe related events that have contributed to the incident. The contributory factor coding taxonomy has been designed to capture these events.

Contributory factor (CF) codes have been developed for each of the pathway coding. The benefit of using CF taxonomy is that it supports the identification of system problems and root causes that could trigger a whole range of different incidents. If the contributory factors are addressed, overall system safety can be improved.

A minimum of one contributory factor code must be applied. More than one contributory factor code may be applied to an incident to describe additional events which may have contributed to an incident.

## CF1 Individual

The field of human factors concerns the interaction between humans and the system in which they work. Human error occurs when the actions and decisions of individuals result in failures that can immediately or directly impact patient safety. Human or individual factors may be sub-divided into 5 categories.

### CF1a Failure to recognise the hazard

Examples include:

- where the person did not know or understand the process
- the individuals involved did not know enough to recognise that the wrong thing was done
- knowledge based incidents, for example, not recognising or understanding a pathology - this could be during patient preparation, imaging or clinical evaluation

### CF1b Decision making process

Examples include:

- where the decided course of action is inappropriate/flawed or where poor judgement was used
- individual encounters a relatively familiar problem, but applies the wrong solution
- rule-based incidents

### CF1c Slips and lapses

Examples include:

- involuntary automaticity for example actions that are well learned and practised, proceeding without much conscious involvement
- tasks of a repetitive nature or preoccupation or distraction
- physical stress
- fatigue
- skill-based incidents occurring in a pressurised work environment

### CF1d Communication

Examples include:

- human interaction failures within the team
- poor or absent verbal, written communication
- poor listening skills leading to ineffective or inaccurate transfer of essential information
- incomplete/inadequate handovers
- illegible handwriting
- signature cannot be read
- unclear/incorrect instructions

### CF1e Violation

Examples include:

- deliberate actions by an individual
- knowingly acting outside scope of practice
- deliberately ignoring procedures or protocols

## CF2 Procedural

Procedural factors are associated with the failure of a procedure or process designed to prevent an incident. Procedural factors are sub-divided into 4 categories.

### CF2a No procedures, protocols or guidelines

Examples include:

- appropriate documentation is not in place or is unavailable for existing or new processes, techniques and/or technologies.
- no written examination protocol in place

### CF2b Inadequate procedures, protocols, guidelines or contracts

Examples include supporting documentation is not sufficient or is out of date for existing or new processes, techniques and/or technologies. For example:

- practitioner licence does not include a specific procedure code
- contract or agreement with a third-party provider is out of date
- handwritten amendments to a protocol making the process unclear
- Failure of QA programme to adequately review documentation

### CF2c Failure to follow procedures, protocols or guidelines

Examples include:

- where there was a departure from the procedure, protocol or guideline

### CF2d Process design fault

Examples include:

- impractical or inefficient processes that cannot be performed
- insufficient time allocated or allowed to carry out the process

## CF3 Technical

Technical factors relating to the equipment used which directly contribute to the incident. Technical factors are sub-divided into 3 categories.

### CF3a Equipment or IT network failure

Examples include:

- situations where equipment malfunction or information technology (IT) network failure contributes to an incident
- failure of ancillary equipment
- equipment that produces an excessive number of false alerts having potential to affect the response to a genuine hazardous situation

This code should not be used for inappropriate handling of an equipment malfunction that leads to an incident. For example, failure to communicate that faulty equipment should not be used.

### CF3b Commissioning, calibration, maintenance and handover

Examples include:

- inappropriate or incomplete commissioning, calibration, maintenance or handover of equipment (hardware and software) or ancillary equipment
- situations where incorrect data was provided
- where equipment was incorrectly calibrated
- where protocols were incorrectly adjusted

### CF3c Device or product design

Examples include:

- flaws or inadequacies inherent in the design of equipment or ancillary equipment used as part of the exposure or to inform the exposure

## CF4 Patient related

Patient factors relate to incidents where the actions or individual circumstances of a patient directly contribute to the incident. These are sub-divided into 3 categories.

### CF4a Medical condition

Examples include:

- where the patient's physical, emotional or medical condition contributes to an incident
- where the patient deteriorates suddenly
- where the patient is unable to lie flat or remain still
- claustrophobia or distress or not being able to comply or tolerate scan instructions

### CF4b Communication with the patient

Examples include:

- where there are communication failures between the team and the patient
- language barriers or comprehension difficulties
- when a patient misunderstands an instruction leading directly to an incident

### CF4c Patient choice

Examples include:

- where a patient has made a personal choice not to continue, for example, a patient attends for a radiopharmaceutical injection for a bone scan but chooses not to return at the appropriate time for the scan
- where a patient cannot continue following one phase of a multiphase scan

- where a patient following the provision of adequate information chooses not to or forgets to follow advice which directly lead to an incident, for example, withholding knowledge of a pregnancy
- where cultural, religious and/or social issues influence a patient's decision to comply

## CF5 Teamwork, Management and Organisational

Effective teamwork, management and organisational factors influence organisational structures and safety cultures. These factors go across all levels of an organisation from senior management to individual teams working at an operational level. These are sub-divided into 6 categories.

### CF5a Inadequate leadership

Examples include:

- absence of a safety culture
- where enquiring attitudes are discouraged
- outdated practice
- inadequate or inconsistent supervision
- where the emphasis might be to achieve imposed targets or waiting times without review of available resources
- where workload is not appropriately planned or managed

### CF5b Unclear responsibilities or lines of accountability

Examples include:

- undefined roles, responsibilities or lines of accountability within the organisational structure
- inconsistent approach to the management of the service and associated processes
- Service Level Agreements (SLA) or contracts are inadequate, for example, lacking in detail or generic contracts

### CF5c Inadequate capital resources

Examples include:

- insufficient funding
- IT system access or availability
- equipment no longer fit for purpose
- SLAs or contracts not sufficient to support the service

### CF5d Inadequate staffing

Examples include:

- insufficient staffing levels or skill mix to meet the demands of a service across all operational hours
- lack of availability of appropriately skilled staff
- absence of expert knowledge or appropriate advice, for example, from a Medical Physics Expert

### CF5e Inadequate training and education

Examples include:

- inadequate or lack of training and education
- lack of opportunity for continuous professional development or advanced practice

### CF5f Inadequate risk assessment or change management

Examples include:

- inadequate risk assessment
- ineffective or poorly planned change management

## CF6 Environmental

Environmental factors are associated with the design of the work area and availability of equipment. These are sub-divided into 2 categories.

### CF6a Physical

Examples include:

- workplace layout or design
- unplanned cuts to services such as water and electricity
- excessive workplace noise
- failure in the design of the examination room causing a safety device or process to fail, for example, overheating of X-ray tubes in CT or design of quench pipes in MRI scan rooms
- failure in the design of the controlled access area, for example, if controlled access is the only through-route

### CF6b Natural factors

Examples include:

- situations where a fire, flood or such like has contributed to the incident

## CF7 Other

If none of the codes above accurately describe the contributory factor for the incident, please describe the contributory factors in the free text to inform future refinement of the taxonomy.

# Examples of incident coding

The staff involved in coding incidents or near misses must have a clear understanding of clinical imaging, interventional radiology, nuclear medicine or MRI processes and service delivery. In addition to the severity, exposure type and modality, at least one pathway code and contributory factor code must be applied to an incident to support local and national analysis. In some incidents multiple pathway or contributory factor codes may be applied to illustrate the detail of the incident.

See the full coding taxonomy

The following scenarios cover a range of incidents across each of the modalities to demonstrate how the coding should be applied.

## Scenario 1

The service was busy and before exiting the room, I had just dispensed from a MIBG vial that was stored in a blue pot. On return, I saw on the bench what I thought was still the blue pot containing the MIBG vial and proceeded to dispense a subsequent required dose (CF1a) and measured this in the radionuclide calibrator under the MIBG calibration factor (3.3d). After administration - when tidying up - I realised the vial I had subsequently dispensed from was a DMSA vial (which is usually stored in a green pot). When I left the room, a DMSA had been dispensed by a colleague and the MIBG pot put to the side (CF2c). The radiopharmacy had run out of green pots (due to contamination) that morning which is why the DMSA was in the wrong-coloured pot (CF2d). I was not told that the pots had been swapped around (CF1d). The patient was administered with DMSA instead of MIBG. (3.4b)

**Code**: PRIA24/L1/E1/MC/P3/3.3d/3.4b/CF1a/CF1d/CF2c/CF2d

**L1** Level 1 incident
**E1** Exposure type – medical exposure
**MC** Intended modality – nuclear medicine diagnostic
**P3** Performed modality – nuclear medicine diagnostic
**3.3d** Radiopharmaceutical preparation – radioactivity measurement
**3.4b** Contrast or pharmaceutical administration – radiopharmaceutical
**CF1a** Individual – failure to recognise the hazard
**CF1d** Individual – communication
**CF2c** Procedural – failure to follow procedures, protocols or guidelines
**CF2d** Procedural – process design fault

## Scenario 2

A radiographer received a referral for a CT head scan from the Emergency Department. The referral was completed by a non-medical referrer. The radiographer sought a radiologist (IR(ME)R practitioner) to justify the examination. During previous imaging checks it was observed that the patient had already had a CT head examination performed that morning. The examination was not performed as this was a duplicate referral (1.1a). On further investigation it was discovered that CT head examinations were not included in the non-medical referrer's scope of practice for referring (1.1b). The non-medical referrer failed to check the patient's previous imaging prior to completing the referral and did not realise they were acting outside their scope of referral (CF1a).

**Code**: PRIA24/L3/E1/MB/P2/1.1a/1.1b/CF1a

**L3** Level 3 incident
**E1** Exposure type – medical exposure
**MB** Intended modality – computed tomography
**PX** Performed modality – no exposure performed
**1.1a** Referral information - insufficient or inaccurate demographic information or duplicate referral
**1.1b** Referral information – insufficient or inaccurate clinical information or working outside scope
**CF1a** Individual – failure to recognise the hazard

## Scenario 3

All gamma cameras daily QC tests passed early in the morning before any patients were injected. However, a fault developed later in the morning (3.5e) (CF3a) which meant that one patient who had received an administration of 99mTc tetrofosmin could not be imaged. The engineer was able to fix this fault the following morning. Therefore, the patient appointment had to be re-booked resulting in an additional exposure. No other patients were injected for the rest of the day and appointments were re-booked. All referrals were made, justified and authorised in accordance with the employer's procedures.

**Code**: PRIA24/L2/E1/MC/P3/3.5e/CF3a

**L2** Level 2 incident
**E1** Exposure type – medical exposure
**MC** Intended modality – nuclear medicine diagnostic
**P3** Performed modality – nuclear medicine diagnostic
**3.5e** Equipment – equipment malfunction
**CF3a** Technical (equipment) – equipment or IT network failure

## Scenario 4

During a routine screening mammogram, the mammographer performed an exposure and then stepped backwards towards the edge of the room. The mammographer accidentally walked into the emergency off switch which was positioned on the wall behind operator panel. This then cut all power to the system and once restarted the patient's images were lost (3.6b). Additional images were taken as a result of the image loss. This room had recently been reconfigured and no guard had been placed on the emergency stop to prevent accidental activation (3.5a)(CF3c)(CF6a).

**Code**: PRIA24/L2/E4/MF/P5/3.5a/3.6b/CF3c/CF6a

**L2** Level 2 incident
**E4** Exposure type – health screening programme
**MF** Intended modality – mammography
**P5** Performed modality – mammography
**3.5a** Equipment – installation, acceptance testing and commissioning
**3.6b** Image acquisition and management – image storage or transfer of data
**CF3c** Technical (equipment) – device or product design
**CF6a** Environmental - physical

## Scenario 5

A patient was referred to the symptomatic clinic for a mammogram. The patient was correctly identified, prepared and positioned by the mammographer. When the examination was completed and the patient had left the room, the mammographer noticed the patient had undergone a mammogram 2 weeks previously. The pause and check procedure had not been followed (2.1b)(3.1c)(CF1c)(CF2c) and it transpired there had been 2 referrals made for this patient(1.1a)(1.2a). There was no alert system in place to identify duplicate referrals prior to scheduling the patient's appointment.

**Code**: PRIA24/L2/E1/MF/P6/1.1a/1.2a/2.1b/3.1c/CF1c/CF2c

**L2** Level 2 incident
**E1** Exposure type – medical exposure
**MF** Intended modality – mammography
**P6** Performed modality – mammography
**1.1a** Referral information – insufficient or inaccurate demographic information or duplicate referral
**1.2a** Appointment process – appointment booking
**2.1b** Safety checks – imaging history check
**3.1c** Patient safety checks – duplicate referral or imaging history check
**CF1c** Individual – slips and lapses
**CF2c** Procedural – failure to follow procedures, protocols or guidelines

## Scenario 6

A patient who had a sacral nerve stimulator (SNS) was referred for an MRI of the head. The referrer did not list the patient's implant at referral (1.1c) (CF1a). When going through the MRI checklist after arriving in the department, the patient reported their sacral nerve stimulator to the radiographer. The SNS was MRI conditional for MRI head, requiring use of transmit-receive head coil, however the radiographer did not note the additional MRI safety conditions of the stimulator prior to scanning (3.1e). The patient was scanned in normal mode SAR using a receive-only head coil, with the body coil used for transmit (3.2b)(CF1b)(CF2c). The patient was not injured.

**Code**: PRIA24/L2/E1/MG/P7/1.1c/3.1e/3.2b/CF1a/CF1b/CF2c

**L2** Level 2 incident
**E1** Exposure type – medical exposure
**MG** Intended modality – magnetic resonance imaging
**P7** Performed modality – magnetic resonance imaging
**1.1c** Referral information – MRI insufficient or inaccurate safety information
**3.1e** Patient safety checks – MRI implanted medical devices or contraindications check
**3.2b** Exposure safety checks – patient set-up
**CF1a** Individual – failure to recognise the hazard
**CF1b** Individual – decision making process
**CF2c** Procedural – failure to follow procedures, protocols or guidelines

## Scenario 7

The standard administered activity for 18FDG PET-CT whole body tumour imaging is 4MBq/kg. The IR(ME)R practitioner for one patient's referral, had written on the request form that 2MBq/kg should be used, this is in accordance with local procedures. The operator dispensing the activity did not notice (CF1c) the note stating 2MBq/kg should be used on the request form and set the usual 4MBq/kg dose (3.3d) leading to an administered activity 50% higher than authorised.

**Code**: PRIA24/L2/E1/MC/P3/3.3d/CF1c

**L2** Level 2 incident
**E1** Exposure type – medical exposure
**MC** Intended modality – nuclear medicine diagnostic
**P3** Performed modality – nuclear medicine diagnostic
**3.3d** Radiopharmaceutical preparation – radioactivity
**CF1c** Individual – slips and lapses

## Scenario 8

A CT patient failed to take oral preparation for a CT colonography examination in accordance with the instructions provide by the department. The patient was prepared for the CT examination and when the first scan was performed it was noted the bowel preparation had not worked (1.3b)(3.4a). A radiologist was called to review the initial set of images and advised the radiographer to abandon the examination and rebook on another day. On speaking with the patient after the scan, it was discovered the patient lived alone and due to receiving multiple appointments from the hospital had got their information confused (CF4b). They failed to tell the radiographer preparing them for the scan as they felt embarrassed (CF4c). The patient was rebooked for a later date with advice on how to correctly complete the oral preparation. After this incident the CT department agreed to review their booking process (CF2d) for examination where oral preparation is taken by the patient at home, to ensure each patient receives the correct level of instruction and communication (CF1d).

**Code**: PRIA24/L2/E1/MB/P2/1.3b/3.4a/CF1d/CF2d/CF4b/CF4c

**L2** Level 2 incident
**E1** Exposure type – medical exposure
**MB** Intended modality – computed tomography
**P2** Performed modality – computed tomography
**1.3b** Patient preparation – physical preparation
**3.4a** Contrast or pharmaceutical administration – wrong timing
**CF1d** Individual – communication
**CF2d** Procedural – process design fault
**CF4b** Patient related – communication with the patient
**CF4c** Patient related – patient choice

## Scenario 9

The delivery of an iodine-131 capsule was delayed due to circumstances outside the control of the nuclear medicine department. At the time of the patient appointment, the measured activity of the capsule was 12% less than the prescribed activity (3.4b). Two operators checked the dose but failed to notice that this was outside the locally defined tolerance of +/-10% from the prescribed activity(CF1b)(CF1c). After the treatment was administered, the staff member noticed the discrepancy when scanning the documents onto the RIS.

**Code**: PRIA24/L1/E1/MD/P4/3.4b/CF1b/CF1c

**L1** Level 1 incident
**E1** Exposure type – medical exposure
**MD** Intended modality - nuclear medicine therapies
**P4** Performed modality – nuclear medicine therapies
**3.4b** Contrast or pharmaceutical administration – radiopharmaceutical
**CF1b** Individual – decision making process
**CF1c** Individual – slips and lapses

## Scenario 10

The MRI department received a referral for an MRI brain scan to exclude a bleed on an intensive therapy unit (ITU) intubated patient. The medical staff looking after the patient completed the MRI safety questionnaire on behalf of the patient, stated no previous surgery (1.1c) (1.3a) (CF1a). Based on the information provide the patient was given an urgent in-patient appointment (2.1b) (2.1d) (CF2c). Upon receiving the safety questionnaire, the MRI radiographer reviewed the RIS system for previous imaging and noticed the patient had a CT head scan performed the previous week. The CT images showed multiple metallic clips. On investigation it was discovered the clips were from a subarachnoid haemorrhage in 1970s. Due to the time in which the clips were inserted, it was likely that the clips would be MRI unsafe. The patient was returned to ward without scan.

**Code**: PRIA24/L3/E1/MG/P7/1.1c/1.3a/2.1b/2.1d/CF1a/CF2c

**L3** Level 3 incident
**E1** Exposure type – medical exposure
**MG** Intended modality – magnetic resonance imaging
**PX** Performed modality – no exposure performed
**1.1c** Referral information – MRI insufficient or inaccurate safety information
**1.3a** Patient preparation – patient condition
**2.1b** Safety checks – imaging history check
**2.1d** Safety checks – MRI implanted medical device check
**CF1a** Individual – failure to recognise the hazard
**CF2c** Procedural – failure to follow procedures, protocols or guidelines

## Scenario 11

Patient attended for a standard AP pelvic X-ray examination. The radiographer failed to notice the vertical detector had been inadvertently selected when setting up the room (CF1c). This led to the exposure being taken but no image available as the incorrect detector was selected (3.2c). A repeat exposure was required.

**Code**: PRIA24/L2/E1/MA/P1/3.2c/CF1c

**L2** Level 2 incident
**E1** Exposure type – medical exposure
**MA** Intended modality – general radiography
**P1** Performed modality – general radiography
**3.2c** Exposure safety checks – equipment set-up and protocol selection
**CF1c** Individual – slips and lapses

## Scenario 12

There appeared to be a generator fault on a DR X-ray unit (3.5e) (CF3a). The operator had just taken a chest X-ray but following the generator fault these images were no longer available to review on either the X-ray unit study list or the PACS (3.6b). Despite the operator performing a full shutdown and reboot of the system the image could not be retrieved. A call was logged with IT and the PACS team were asked to provide support with locating the image. It was established that this was not an issue with PACS but an equipment fault which had erased the image permanently from the X-ray unit. The incident was explained to the patient and repeat images were acquired.

**Code**: PRIA24/L2/E1/MA/P1/3.5e/3.6b/CF3a

**L2** Level 2 incident
**E1** Exposure type – medical exposure
**MA** Intended modality – general radiography
**P1** Performed modality – general radiography
**3.5e** Equipment – equipment malfunction
**3.6b** Image acquisition and management – image storage or transfer of data
**CF3a** Technical (equipment) – equipment or IT network failure

## Scenario 13

A patient weighing 150kg was referred for an MRI of the lumbar spine in a 70cm bore MRI scanner (CF4a). The scanner could not accommodate the patient in the usual position, so the patient was positioned with their arms above their head and a sheet was placed between the patient's body and the bore (CF1b). The patient received burns to the skin on their hips due to close contact with the scanner bore (3.2b). The incident was investigated and the sheet between the patient and bore was found to be thinner than the 1-2cm padding recommended by the MHRA.

**Code**: PRIA24/L1/E1/MG/P7/3.2b/CF1b/CF4a

**L1** Level 1 incident
**E1** Exposure type – medical exposure
**MG** Intended modality – magnetic resonance imaging
**P7** Performed modality – magnetic resonance imaging
**3.2b** Exposure safety checks – patient set-up
**CF1b** Individual – decision making process
**CF4a** Patient related – medical condition

## Scenario 14

Patient attended for a barium swallow examination. During the examination, the equipment was unable to replay a fluoroscopy loop for review due to equipment malfunction (3.5e) (3.6b) (CF3a). The patient was moved into a different fluoroscopy room to complete the barium examination. The patient did not require an additional exposure. The equipment was taken out of use and an engineer was contacted to investigate the equipment issue.

**Code**: PRIA24/L2/E1/ME/P5/3.5e/3.6b/CF3a

**L2** Level 2 incident
**E1** Exposure type – medical exposure
**ME** Intended modality – fluoroscopy
**P5** Performed modality – fluoroscopy
**3.5e** Equipment – equipment malfunction
**3.6b** Image acquisition and management – image storage or transfer of data
**CF3a** Technical – equipment or IT network failure

## Scenario 15

A referral for a 99mTc bone scan was reviewed by the practitioner and a whole-body and SPECT-CT scan was authorised. This information was missed when the patient appointment was booked and only the whole-body scan was booked (1.2a). This was not noticed when the patient was injected or when images were acquired (3.2b)(CF1a)(CF2c). Only whole-body imaging was performed and no SPECT-CT images were acquired (3.6a). This was noticed at clinical evaluation. A repeat exposure was required to acquire SPECT-CT images.

**Code**: PRIA24/L2/E1/MC/P3/1.2a/3.2b/3.6a/CF1a/CF2c

**L2** Level 2 incident
**E1** Exposure type – medical exposure
**MC** Intended modality – nuclear medicine diagnostic
**P3** Performed modality – nuclear medicine diagnostic
**1.2a** Appointment process – appointment booking
**3.2b** Exposure safety checks – patient set-up
**3.6a** Image acquisition and management – incomplete or inadequate image or data acquisition
**CF1a** Individual -Failure to recognise the hazard
**CF2c** Procedural – Failure to follow procedures, protocols or guidelines

## Scenario 16

During a cardiac diagnostic catheter list, the injector pump failed to complete injection mid run (3.5e)(CF3a), resulting in an additional exposure. This occurred for multiple cases on the same list. The injector pump was taken out of action and an engineer contacted to resolve the issue. It was found that a software issue had caused the malfunction. As this incident affected multiple patients, it was deemed notifiable to the regulatory body.

**Code**: PRIA24/L1/E1/ME/P5/3.5e/CF3a

**L1** Level 1 incident
**E1** Exposure type – medical exposure
**ME** Intended modality – fluoroscopy
**P5** Performed modality – fluoroscopy
**3.5e** Equipment – Equipment malfunction
**CF3a** Technical (equipment) – Equipment or IT network failure

## Scenario 17

In a clinical trial, a patient is treated with 177Lu-PSMA and is scanned in the nuclear medicine department 1 week after the treatment administration. The patient underwent a two-bed position SPECT scan with an attenuation corrected (AC) CT from infra-orbit level to lower pelvis. After the scan, the operator realised that the CT was not required as part of the trial protocol (3.2c). The protocol information was listed on the patient referral, but this was missed by the operator who scanned the patient (CF1c) (CF2c).

**Code**: PRIA24/L2/E1/MC/P3/1.2a/3.2b/3.6a/CF1a/CF2c

**L2** Level 2 incident
**E3** Exposure type – research
**MD** Intended modality – nuclear medicine therapies
**P4** Performed modality – nuclear medicine therapies
**3.2c** Exposure safety checks – equipment set-up and protocol selection
**CF1c** Individual – slips and lapses
**CF2c** Procedural – Failure to follow procedures, protocols or guidelines

# References

1. Royal College of Radiologists. Learning from ionising radiation dose errors, adverse events and near misses in UK clinical imaging departments. Working party report to clinical imaging board. London: The Royal College of Radiologists, 2019

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# About the UK Health Security Agency

UKHSA is responsible for protecting every member of every community from the impact of infectious diseases, chemical, biological, radiological and nuclear incidents and other health threats. We provide intellectual, scientific and operational leadership at national and local level, as well as on the global stage, to make the nation health secure.

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