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Clinical Radiology

The Royal College of Radiologists

Radiology reporting networks

Understanding the technical options

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Contents

Introduction

The radiology workforce crisis, emerging clinical networks (stroke, trauma and so on), increasing subspecialisation and the steady shift of acute imaging beyond normal working hours are all reasons to connect radiology departments together, electronically. These pressures have seen most departments outsource (or insource) their work. Some use private providers and others pool resources across neighbouring, like-minded trusts, especially when junior doctors provide the first point of contact for evening and night-time cover.

Unfortunately, the hoped-for countrywide, seamless image and report sharing envisaged by the National Programme in the mid-2000s did not come to pass. Private companies have provided infrastructure for outsourced reporting from home, and NHS providers are increasingly investing in image-sharing networks. However, different network architectures, no consistent patient identifier (in England at least) and aging hospital patient administration systems (PAS) continue to make seamless access across networks difficult.

Today, the Image Exchange Portal remains the means by which most trusts exchange images, usually not including reports. It requires picture archive and communication system (PACS) teams and radiographers to manually perform the transfer and for radiologists to know of a remote examination's existence prior to pulling. The system is inefficient and inadequate for the volume of traffic, often delaying emergency patient management and multidisciplinary team (MDT) discussions.

Private teleradiology providers have successfully implemented reporting networks across NHS organisational boundaries. This is really frustrating for NHS radiologists who are not able to see or report images for their neighbouring trust, but a private teleradiology provider can do so with ease. That said, access to other hospital systems and prior imaging is often not available to teleradiologists, limiting the clinical relevance of their reports.

This document specifies what imaging departments could link to a radiology (image and report sharing) network. It has been written by NHS radiologists with the help of industry experts; the detail is beyond what most radiologists will require but hopefully it will be of use to clinical PACS leads, PACS and IT teams when they begin to procure standards-based, vendor-neutral, seamlessly interoperable network radiology platforms (NRPs).

It is important to look at the needs of referring clinicians when designing these networks. Clinicians will benefit from having access to a networked radiology platform, although they will have a marginally different set of requirements and objectives for accessing the platform than radiologists.. The real winners from this approach will be patients, who will hopefully access timely high-quality imaging reviews by radiologists and clinicians who have access to all of the relevant information.

The Royal College of Radiologists (RCR) and the College of Radiographers (CoR) have developed the Quality Standard for Imaging (QSI) (published October 2021), providing a baseline of expectations and encouraging networks to enhance mutual support and learning.[1]

Note: making the wider, strategic case for radiology networks is not the purpose of this document. Readers wishing to learn more are directed to Transforming imaging services in England: a national strategy for imaging networks from NHS England and Improvement.[2] This document also gives guidance on future operational, governance and human resource implications.

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1 Understanding the technology

Picture archive and communication system (PACS)

PACS is an IT system used to transfer, display and manipulate radiology images using a standardised digital imaging and communication in medicine (DICOM) format. In this document, hospital-level PACS systems are referred to as *enterprise PACS*.

Radiology information systems (RIS)

RIS is an IT system used to generate radiology reports, linked to PACS images. (It is also used to manage and schedule radiology examination appointments.) Transmission of reports and other information occurs via health level 7 (HL7) observation result (ORU) messaging.

Network radiology platform (NRP)

An NRP is an IT system used to connect multiple RIS and PACS systems across a clinical network. It is essentially a miniRIS and miniPACS system.

- MiniRIS offers reporting functions only: that is, no scheduling or vetting.
- MiniPACS is a short-term DICOM database with a DICOM viewer capable of remote image display over slower networks.

Demographics validation

- An NRP does not perform patient demographic validation. This information should already have been checked in the enterprise RIS and PACS before being sent to the NRP for reporting.

NRP technology connections

- Each enterprise PACS connects with the NRP using standards-based, DICOM C-FIND, DICOM C-MOVE and DICOM query retrieve (QR) messaging.
- Each RIS connects with the NRP via standards-based HL7 order messaging (ORM) and ORU messaging.

Data retention within the NRP

- The NRP is a short-term archive of images for the purpose of reporting only. The long-term archives of images and reports are the enterprise RIS/PACS systems. This needs to be clearly understood by trusts when they embark on collaborative reporting via an NRP.

Data governance within the NRP

- Vendors participating in network-sharing solutions will need to ensure that data security and confidentiality meet NHS information governance standards.
- Consistent use of NHS terminology, identifiers and coding in HL7 and DICOM messaging is key to ‘plug and play’ interoperability between RIS, PACS and NRPs (see Appendix A).

2 Why invest in a network radiology platform?

NRPs can support night-time emergency reporting, backlog reporting and specialist reporting (see next section). However, it is important to understand the limitations of this approach.

The need for on-site, local departmental radiologists (doctors trained in image interpretation) will remain. The provision of formal imaging reports is one of many radiologist roles. They regularly interact with other local clinicians, radiographers and patients, giving advice on a range of clinical issues. They also provide strategic leadership to imaging departments. However, network solutions may help mitigate the current and projected shortage of NHS radiologists by redistributing some of the work that can be undertaken remotely.

For an NRP to be usable for reporting it needs to be at least as good as the enterprise RIS/PACS solution for radiology report creation. Asking a limited workforce to report less efficiently is unlikely to support our overstretched profession.

An NRP also needs to provide all clinical staff with easy access to the full regional relevant clinical and imaging history for a patient, thus increasing patient safety and reducing duplicate requests for imaging.

3 Network radiology platform functions

Radiologists and departmental managers should consider what they wish to achieve with an NRP. The following are examples.

Out-of-hours reporting

- Networked out-of-hours reporting reduces the number of radiologists disturbed at night. (See Appendices A and B1. If it is planned to use junior radiologists for first on-call reporting, see Appendix B4.)

Share expertise across the network

- Special interest radiologists participate in regular MDT meetings and are experts in their subspecialties, whether in teaching or district general hospitals. Some specialties (such as paediatric radiology) may be reliant on a single radiologist. Networked reporting allows for support of such individuals and cross-cover during periods of leave (see Appendices A and B1). However, it is crucial to support continued pursuit of subspecialist interests in smaller centres to allow continued recruitment of radiologists to these.

Networked MDT meetings

- Cancer and other MDT meetings may rely on discussion of cases with regional specialist centres. Radiologists in these institutions need easy access to external images and reports and to be able to record second opinions and other addenda against them (see Appendices A and B2). All radiologists need access to the outcomes of such MDTs.

Networked support for regional specialties such as acute stroke care and neurosurgery

- Clinical management decisions on thrombolysis, head injury and intracranial haemorrhage are often taken at tertiary referral centres. Access to images and reports across the network is essential (see Appendices A and B3).

Networked reporting of unreported studies

- The RCR surveys in 2015 and 2016 revealed a large, number of unreported imaging examinations nationwide.[3–6] Networked reporting may allow NHS departments to reduce their reliance on outsourcing companies by maximising out-of-hours NHS resources, whether individual local radiologists or more widely across a region (see Appendices A and B1).

4 Challenges and opportunities for network reporting

The reporting experience using an NRP should mirror that of enterprise RIS/PACS reporting as much as possible.

- **Full local patient imaging history list** must be available as a minimum (see Appendix B for details).
- **Network-wide imaging history list** should be available (see Appendix C for further details).
- **Other relevant information** such as blood, histopathology results and electronic patient record (EPR) information should also be available efficiently to radiologists (using URL-based context linking between NRP and enterprise EPR).
- **Improving dialogue:** potential effects of reduced dialogue between referrer and radiologist associated with off-site reporting or unfamiliarity should be mitigated by use of telephone calls, email, messaging and videoconferencing. This requires efficient order communications (Ordercomms) systems that record and transmit the referring clinician and their contact details so that they are visible to the reporting radiologist.
- **RIS procedure codes**: each radiology examination is given a unique identifier (exam code), derived from the National Interim Clinical Imaging Procedure (NICIP) code set. Harmonising codes within the network is critical to success.
- **Protocols**: alignment of computed tomography (CT) and magnetic resonance imaging (MRI) acquisition protocols across a network is important to avoid duplication.
- **Failsafe alert protocols**: network-wide agreement of failsafe protocols must be in place prior to NRP reporting.
- **Leadership**: clinical and managerial leadership is essential.
- **Artificial intelligence (AI)** will be used in the future for worklist reprioritisation and image pre-analysis in RIS/PACS and also NRPs.
- **Information governance:** all NRP transactions must meet NHS information governance standards. However, over-zealous interpretation of these at the expense of good patient care should be avoided.
- **Co-operation with clinicians:** all systems should respect the need for trusted partnerships between clinicians and radiologists to be nurtured, so as to avoid all images being second reviewed locally.
- **Network-wide agreements and understanding** around reporting allocation among radiologists is needed to avoid future conflicts.

5 Billing, invoicing and cross-charging

NHS trusts are increasingly focused on the cost of reviewing and reporting images not generated in local departments. The concept of cross-charging is important to ensure individual NHS departments remain financially viable and are able to recruit appropriate numbers of radiologists. Billing software should be seen as highly desirable when procuring an NRP solution to enable cross-charging. Simple fee-per-item tariffs may not suffice; tariffs must be based on national exam codes, and out-of-hours uplifts may need to be incorporated (see Appendix D for examples of billing information required). Gaming via use of multiple codes for the same exam should be monitored.

An NRP may also automatically issue technology handling fees to cover the costs of upload, transfer and temporary storage of files at central and remote locations.

6 Vendor mechanisms employed to share imaging histories across a network

Patient journeys are increasingly reliant on cancer, stroke and trauma networks. Images and reports may be acquired in multiple hospitals across a region. A unified and comprehensive patient imaging history with real-time access to all images and reports within the network is essential and has been highlighted as a requirement in the RCR survey.[7] Access to all images and reports improves report quality, reduces unnecessary additional imaging and so improves clinical management. Options for how this sharing can be achieved are detailed in Appendix C (and are the subject of ongoing debate).

When specifying a local RIS/PACS solution and/or an NRP, purchasers should ask vendors for details of how they propose to provide unified patient imaging histories across the network.

7 Glossary of terms

Health level 7 or **HL7** is the international standard for transfer of clinical and administrative data between software applications used by various healthcare providers, including RIS.

HL7 ORM is a general order message that is used to transmit information about an order (electronic request). An order can be defined as a 'request for service' that is sent between healthcare IT applications.

HL7 ORU is an observation result message (ORU) that provides clinical observations. Clinical observations can include clinical laboratory results, reports of imaging studies (text), electrocardiogram (ECG) results, pulmonary function studies and so on.

Digital imaging and communications in medicine (DICOM) is a standard for handling, storing, printing and transmitting information in medical imaging. It includes a file format definition and a network communications protocol. It applies predominantly to imaging data.

DICOM C-FIND is a service that enables one PACS client to query a PACS server for matches against a template of key DICOM tag values.

DICOM C-MOVE is a service that allows one PACS to instruct ('command') another PACS to transfer stored DICOM studies to another PACS using the **DICOM C-STORE** operation.

Web access to DICOM object (WADO) is a standard that specifies a web-based service for accessing and presenting DICOM objects, such as images and medical imaging reports. WADO is intended for the distribution of results and images to healthcare professionals.

Open database connectivity (ODBC) is a standard application programming interface (API) for accessing database management systems (DBMS). This could be used to query data items within a database using criteria for the query.

References

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6. The Royal College of Radiologists. *CQC radiology review: where are we now? Exploring the reality of image reporting turnaround times in England*. London: The Royal College of Radiologists, 2019.
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Appendix A
NHS clinical terms with their associated HL7 and DICOM tag mapping

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
Creating and updating electronic radiology requests	Event trigger: ORM^O01 New order – NW Edit order – XO Cancel order – CA Hold order – HD Status changed – SC Accession not assigned by RIS – send order/service number – SN	
Creating and updating radiology report – primary report or addendum	Event trigger: ORU^R01 – unsolicited transmission of observation message	
Patient name	PID field 5	0010,0010 – PatientName *(updated by admit, discharge and transfer [ADT]-A08 and A40 messages from enterprise patient administration system [PAS])*
Patient date of birth	PID field 7	0010,0030 – PatientBirthDate *(updated by ADT-A08 and A40 messages from enterprise PAS)*
Patient gender	PID field 8	0010,0040 – PatientSex *(updated by ADT-A08 and A40 messages from enterprise PAS)*
Patient address	PID field 11	

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
PAS/enterprise unique ID	PID: 3.1 – PAS number PID: 3.4 – assigning authority (NHS) ODS (organisation data service) code PID: 3.5 – MR (identifier type code for PAS number)	0010,0020 – PatientID *(updated in enterprise PAC by ADT-A08 and A40 messages from enterprise PAS)*
NHS number/national unique ID	PID: 3.1 – the unique NHS number PID: 3.4 – NHS (assigning authority) PID: 3.5 – NH (identifier type code for NHS number)	OtherPatientIDsSequence (0010,1002) DICOM tag has two important components: a. HL7 ADT PID: 3.1 for NHS number must be mapped to DICOM tag (0010,1010) of OtherPatientIDsSequence b. HL7 ADT PID: 3.4 'assigning authority' must be mapped to (0010,0021) IssuerOfPatientID, which is part of the sequence too. In England/Wales this would be 'NHS'. *(updated by ADT-A08 and A40 messages from enterprise PAS)*
Patient category a. NHS b. Private c. Category 2	PV1: 18 (patient type)	
Unique order number Assigned by Ordercomms for electronic requests and RIS for paper requests	ORC: 2 – placer order number and/or OBR: 2 – placer order number	0040,2016 – PlacerOrderNumberImaging ServiceRequest
Group order number Exams requested together in Ordercomms	ORC: 4 – placer group number	

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
Accession number Unique number generated by RIS/scheduling system for each exam	ORC: 3 – filler order number and/or OBR: 3 – filler order number	0008,0050 – AccessionNumber 0008,0051 – assigning authority that issued the accession number
Visit number Generated by RIS/scheduling system for exams grouped together for a single visit	PVI: 19	
Study instance UID Unique identifier of the study in DICOM		0020,000D – StudyInstanceUID generated by the equipment/modality
Order status a. Requested b. In-vetting c. Held d. Scheduled e. Patient arrived in department f. Exam started/in progress (patient in room) g. Completed h. Cancelled	ORC: 5 – order status Requested/new – NW Held – HD Scheduled – SC Patient arrived (in progress, in department) – IP Exam completed – CM Cancelled – CA	0040,0020 – ScheduledProcedureStatusID
Priority U – urgent R – routine 2WW – 2-week wait	ORC: 7.6 or OBR: 27.6 quantity/timing	0040,1003 – RequestedProcedurePriority

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
Requester – junior doctor, nurse specialist etc a. ID – GMC number/HCPC number/NMC number[1–3] b. Name c. Job role (NHS data dictionary)[4] d. Main specialty (NHS data dictionary)[5] e. Institution of the referring clinicians – as per ODS code for trust/general practitioner (GP) surgery[6]	ORC field 10 – entered by ORC: 10.1 – national ID (GMC number/HCPC number/NMC number etc)[1–3] ORC: 10.2 and 10.3 – surname and name ORC: 10.5 – job role ORC: 10.7 – main specialty ORC: 10.9 – institution	0040,2008 – OrderEnteredBy
Referring consultant / GP / clinician a. ID – GMC number / HCPC number / NMC number[1–3] b. Name c. Job role (NHS data dictionary)[4] d. Main specialty (NHS data dictionary)[5] e. Institution of the referring clinicians – as per ODS code in NHS data dictionary for trust / GP surgery[6]	ORC field 12 – ordering provider a. ORC: 12.1 for GMC number b. ORC: 12.2 and 12.3 – surname and forename c. ORC: 12.5 – job role d. ORC: 12.7 – main specialty e. ORC: 12.9 – institution code	0080,0096 – ReferringPhysician IdentificationSequence (GMC number) 0008,0090 – ReferringPhysician Name (name) (mapped to ORC 12.2) >0008,0082 – InstitutionCode Sequence (Institution) (mapped to ORC 12.9) 0032,1034 – RequestingService Code Sequence (mapped to ORC 12.7 NHS main specialty code) ReferringPhysicianIdentification Sequence (GMC number) 0008,0090 – ReferringPhysician Name (name) (mapped to ORC 12.2) >0008,0082 – InstitutionCode Sequence (Institution) (mapped to ORC 12.9) 0032,1034 – RequestingService Code Sequence (mapped to ORC 12.7 NHS main specialty code) ReferringPhysicianIdentification Sequence (GMC number) 0008,0090 – ReferringPhysician Name (name) (mapped to ORC 12.2) >0008,0082 – InstitutionCode Sequence (Institution) (mapped to ORC 12.9)

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
		0032, 1034 – RequestingService Code Sequence (mapped to ORC 12.7 NHS main specialty code) ReferringPhysicianIdentification Sequence (GMC number) 0008,0090 – ReferringPhysician Name (name) (mapped to ORC: 12.2) >0008,0082 – InstitutionCode Sequence (Institution) (mapped to ORC: 12.9) 0032,1034 – RequestingService Code Sequence (mapped to ORC: 12.7 NHS main specialty code)
Phone number of referring consultant/GP	ORC: 14 – callback telephone number	0008,0094 –ReferringPhysician'sPhoneNo
Location type at time of request (NHS diagnostic imaging dataset [DID] data dictionary[7] – patient source setting type with code) a. Admitted patient care – inpatient (this healthcare provider)-01 b. Admitted patient care – day case (this healthcare provider)-02 c. Outpatient (this healthcare provider)-03 d. GP direct access-04 e. Accident and emergency department (this healthcare provider)-05 f. Other healthcare provider-06 g. Other-07	ORC: 13.6 a. Inpatient b. Day case c. Outpatient d. GP e. A&E f. Other hospital g. Other	None

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
Patient location at request Description at time of request (full name of ward, clinic, GP surgery, accident and emergency department etc)	ORC: 13.9 – enterer's location description ORC: 13.1 – location code (national or local codes) ORC: 13.7 – hospital site or GP surgery ORC: 13.6 – location type (DID data dictionary)[8] ORC:13.4 – location organisation (NHS trust or GP practice – NHS data dictionary codes and description)	0040,2009 – OrderEntererLocation
Reason for cancellation Free text field reason for cancellation	ORC: 16 – order control code reason – text up to 250 characters	0074,1238 – ReasonForCancellation and also part of DICOM structured report for cancellation reason
Person cancelling the exam a. ID – for example GMC number/HCPC number/ NMC number[1–3] b. Name c. Job role (NHS data dictionary)[4] d. Main specialty (NHS data dictionary)[5] e. Institution of the person – as per ODS code in NHS data dictionary for trust/GP surgery[6]	ORC: 19 – actioned by ORC: 19.1 – GMC/HCPC number 1–3 ORC: 19.2 and 19.3 – surname and name	

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
NHS national exam code and description for radiology studies as per NHS data dictionary[8]	OBR: 4 – universal service ID	0008,1032 –ProcedureCodeSequence 0008,1030 – StudyDescription >Code value (0008,0100) >Code meaning (0008,0104) >Coding scheme designator (0008,0102) – National Interim Procedure Codes (NICIP) >Coding scheme version (0008,01030)
Modality DICOM codes for modalities	OBR: 24 – diagnostic serv set ID	0008,0060 – Modality
Date and time of request Exam status – requested	ORC: 9 – Date/time of transaction	0040,2004 –IssueDateOfImaging ServiceRequest and/or 0040,2005 – IssueTimeofImaging ServiceRequest
Appointment scheduled date/ time Same as arrival date and time for walk-in patients Exam status – scheduled	ORC: 7.3 – observation start date and time or OBR: 27.3 – observation start date and time	0008,0020 – StudyDate and 0008,0030 – StudyTime (Note: Study date and time is populated from appointment start date and time – OBR: 27.4, until this is replaced with acquisition date and time from modalities once the images arrive) 0008,0022 – AcquisitionDate comes directly from modalities and NOT from HL7
Exam completion date and time by radiographer Exam status – exam completed	ORC: 7.4 – observation end date and time or OBR: 27.4 – observation end date and time	

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
Date and time of exam cancellation Exam status – cancelled	ORC: 7.4 – observation end date and time or OBR: 27.4 – observation end date and time	
Scanner/machine that created the images Machine/scanner ID exam room code Exam room description Hospital site[8] Institution – NHS data dictionary terms for organisation[6]	PV1: 3.1 – exam room code (local table) PV1: 3.9 – exam room description PV1: 3.4 – facility (organisation: hospital trust – NHS data dictionary code and description)[8] PV1: 3.7 – hospital site	0008,1049 – PhysicianOfRecord IdentificationSequence >0008,0082 – InstitutionCode Sequence (Institution) (mapped from PV1: 3.4)
Operator Radiographer/radiologist etc a. ID – for example GMC HCPC/NMC number[1–3] b. Name c. Job role (NHS data dictionary)[4] d. Main specialty (NHS data dictionary)[5] e. Employing institution – as per ODS code in NHS data dictionary for trust/GP surgery[6]	OBR field 34 – technician a. ORC: 34.1 for GMC number b. ORC: 34.2 and 12.3 – surname and forename c. ORC: 34.5 – job role d. ORC 34.7 – main specialty e. ORC 34.9 – institution	0008,1049 – PhysicianOfRecord IdentificationSequence 0008,1048 – PhysicianOf RecordName (name) >0008,0082 – InstitutionCode Sequence (Institution) and/or 0008,1070 – OperatorsName
Radiographer comments Communication between enterprise RIS and NRP	NTE field 3 of ORM message – observation value (text – length up to 65,536 characters)	

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
Result status a. Registered (R) – report exists but content not available b. Preliminary (P) –preliminary, interim or unverified report c. Final (F) – verified or finalised report d. Corrected/amended report (C) – report modified after being verified/finalised (for grammatical or spelling errors) e. Appended report (B) – after a final status, additional report content is added but existing content is unchanged f. Deleted/withdrawn (D) – the report is deleted or withdrawn after a finalised version	OBR field 25 – result status a. Registered (R) b. Preliminary (P) – preliminary, interim or unverified report c. Final (F) – verified or finalised report d. Corrected/amended report (C) – report modified e. Appended report (B) – additional report content is added but existing content is unchanged f. Deleted/withdrawn – report is deleted or withdrawn after a finalised version	
Finalised report issued date/ time	OBR: 22 – results date/time or OBX: 14	DICOM structured reporting (SR) object content
Intended recipients of report This will include referring consultant but may include others	OBR: 28 – results copies to	0040,1010 – NamesOfIntended RecipientsOfResults

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
Primary reporter a. ID – GMC /HCPC/NMC number[1–3] b. Name c. Job role (NHS data dictionary)[4] d. Main specialty (NHS data dictionary)[5] e. Employing institution – predefined by ODS code for trust/GP surgery[6]	OBR field 32 – principal result interpreter a. ORC: 32.1 for GMC number b. ORC: 32.2 and 12.3 – surname and forename c. ORC: 32.5 – job role d. ORC: 32.7 – main specialty e. ORC: 32.9 – institution	0008,1062 – PhysiciansReadingStudy IdentificationSequence 0008,1060 – NameOfPhysicians ReadingStudy >0008,0082 – InstitutionCode Sequence (Institution) (mapped from ORC 33.9)
Second reporter a. ID – GMC /HCPC/NMC number[1–3] b. Name c. Job role (NHS data dictionary)[4] d. Main specialty (NHS data dictionary)[5] e. Employing institution – predefined by ODS code for trust/GP surgery[6]	OBR field 33 – assistant results interpreter a. ORC: 33.1 – GMC number b. ORC: 33.2 and 12.3 – surname and forename c. ORC: 33.5 – job role d. ORC: 33.7 – main specialty e. ORC: 33.9 – institution	0008,1062 – PhysiciansReadingStudy IdentificationSequence 0008,1060 – NameOfPhysicians ReadingStudy >0008,0082 – InstitutionCode Sequence (Institution) (mapped from ORC 33.9)
Transcriptionist name with job role according to NHS data dictionary[4] a. Name b. Job role (NHS data dictionary)[4]	OBR field 35 – transcriptionist	

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
Narrative clinical history on radiology requests	OBX field 5 or NTE field 3 of ORM message – observation value (text – length up to 65,536 characters)	
Final radiology report narrative content	OBX field 5 of ORU message – observation value (text – length up to 65,536 characters)	DICOM SR object
Provisional report The report content should be preceded by a sentence that states, 'This is a provisional report only. It will be superseded by the final report.'	OBX field 5 of ORU message – Observation value (Text – length up to 65,536 characters)	
Corrected reports narrative (Reports that have been corrected after a final report was issued.) The narrative content should also include who corrected the report and when it was corrected, in addition to the clinical narrative content of the report.	OBX field 5 of ORU message – observation value (text – length up to 65,536 characters)	DICOM SR object

NHS clinical data items in RIS database	HL7 segments and fields Transmission by RIS, Ordercomms and NRP	DICOM header data items in the DICOM database PACS or vendor-neutral archive (VNA) or NRP
Appended reports Report has been modified subsequent to being finalised and new content has been added, but existing content has not changed. The narrative content should include who added this content and when new content was added.	OBX field 5 of ORU message – observation value (text – length up to 65,536 characters)	DICOM SR object
Failsafe alert within a report	OBX: 8 A – abnormal flag (either null or A when there is an alert)	0010,2000 – MedicalAlert
Intended reporter This may be a radiologist or a group of radiologists to whom the exam has been allocated for reporting	OBR: 32.2 in HL7 ORM message (Note: OBR: 32 in HL7 ORU will contain the actual reporter of the study)	

Coding of the HL7 data items should use the NHS data dictionary:

1. GMC number: www.gmc-uk.org/doctors/register/LRMP.asp
2. HCPC number: www.hpc-uk.org/check
3. NMC number: www.nmc.org.uk/registration/search-the-register
4. Job role of staff: www.datadictionary.nhs.uk/attributes/job_role_code.html?hl=job%2Crole%2Cstaff
5. Main specialty of referrer/reporter: www.datadictionary.nhs.uk/attributes/main_specialty_code.html?hl=main%2Cspecialty
6. Employing institution of referrer/reporter (NHS trust or GP practice) ODS code: www.datadictionary.nhs.uk/attributes/organisation_code.html?hl=organisation%2Ccode
7. Hospital site where image acquisition took place: www.datadictionary.nhs.uk/data_elements/site_code__of_imaging_.html?hl=site%2Ccode
8. National exam codes and descriptions: www.datadictionary.nhs.uk/data_elements/imaging_code__nicip_.html
9. NHS diagnostic imaging dataset patient source setting type: www.datadictionary.nhs.uk/attributes/patient_source_setting_type_for_diagnostic_imaging.html?hl=diagnostic%2Cimaging%2Cdata

Appendix B
Network radiology platform workflows

1. Shared reporting workflow

If cross-site reporting is required, whether for out of hours, on call or sharing of expertise (see *Network radiology platform functions*), the workflow is as follows.

a. It is assumed that all hospitals in the network have an Ordercomms system and are capable of sending electronic requests by HL7 ORM message (scanned paper request workarounds are not discussed here).

b. If a decision is taken to send a particular exam to the NRP for reporting, the RIS data item – 'intended reporter or assigned radiologist' – is changed by the radiographer to, for example, 'network radiologist (NR)–Dr Smith' on the enterprise RIS.

c. The 'assigned radiologist' maybe an individual, a specialist group or a general group. Prefixing the assigned radiologist (intended reporter) with 'network radiologist' (for example, network radiologist–Dr Smith, network radiologist–Chest) will trigger the outbound HL7 ORM from the RIS to the NRP.

d. The intended reporter is assigned by the radiographer in the RIS. It is transmitted in OBR: 32 of the HL7 ORM message.

e. When an exam is sent to the NRP for reporting, it is essential that it is removed from the enterprise RIS reporting worklist (to avoid double reporting on both enterprise RIS and NRP).

f. It is important that radiologists working on the NRP are aware what will be coming for reporting. Hence, 'intended reporter' allocation and transmission via HL7 ORM should happen from very early in the workflow by RIS status (scheduled, arrived, started and completed). This is essential for NRP reporting success.

g. The HL7 message to the NRP should contain *all* the data items in the HL7 ORM message described in Appendix A.

h. The arrival of the HL7 ORM message should trigger a DICOM C-FIND query with a matching key attribute of 0010,0020 – PatientID to the relevant enterprise PACS, to submit DICOM data items in Appendix E as responding DICOM attributes. This is essential as it allows the network radiologist to view a comprehensive local imaging history on the DICOM viewer (PACS).

i. The HL7 ORM message should also trigger a pre-fetch with DICOM C-GET of the relevant prior 'same exam code' in the procedure code sequence (0008,1032). This will ensure that there is automatic relevant prior display on the NRP during reporting.

j. The HL7 ORM message should also trigger wide area discovery of all the imaging studies performed in the network. This is essential so that the radiologist has a unified network-wide imaging history on the DICOM viewer of the NRP (see Appendix C for wide area discovery).

k. HL7 ORM status updates of the exam will enable network radiologists to be aware of when the patient has been scheduled, when they have arrived in the department, when the exam has started and when it has been completed.

l. During reporting, image display of the current study and relevant prior studies should be instant (within three seconds). Radiologists may wish to review other imaging studies (in addition to the ones previously transferred as part of DICOM C-MOVE). An ad hoc DICOM C-MOVE or WADO display must be available to display previous studies held in the enterprise PACS. When WADO is used for display, it is important that the display

happens on the same viewer with side-by-side comparison with previous images (a separate viewer for display of priors is not acceptable).

m. All standard DICOM tools for image interrogation must be available to network radiologists (window, pan, zoom, measure, comparison, cross-link and so on).

n. Reporting worklists: radiologists must be able to filter, sort and prioritise their reporting worklists using the following data items on the NRP:
   - Urgency – (urgent, two-week wait and routine) – sent in OBR: 27.6 or ORC: 7.6
   - Referring clinician (surname) – sent in ORC: 12.2
   - Referring specialty – sent in ORC: 12.7
   - Patient location type (A&E, inpatient, outpatient and GP) – sent in ORC: 13.6
   - Date of request – sent in ORC: 9
   - Date and time of exam completion – sent in ORC: 7.4 or OBR: 27.4
   - National exam description – sent in OBR: 4
   - Modality – sent in OBR: 24
   - Intended reporter (or assigned radiologist) – sent in OBR: 32 (to allow for both pooled allocation and individual allocation for reporting by radiographer/ departmental agreements)
   - Referring institution (where exam was acquired) – sent in PV1: 3.

o. Work allocation or assignment: it will be down to network teams to decide how to allocate work for reporting. Options are:
   - Radiologist allocating to themselves or to a specialty group
   - Allocation by administrative staff
   - Automatic allocation by a computer algorithm

   Data items for filtering and sorting reporting worklists are essential to facilitate work assignment, whether automated or manual.

p. It must be possible to change the 'intended reporter' within the NRP at any time, so as to assign the work to another radiologist when required.

q. Reports created within an NRP must be transmitted back to the local institution from which the HL7 ORM message was initiated, via an HL7 ORU message (see Appendix F for report types and report content). The HL7 ORU message must contain all the data items identified in Appendix A. Usually the HL7 ORU message will be sent to the enterprise HL7 integration engine for onward distribution to all relevant IT systems (EPR, RIS, PACS, Ordercomms and so on) that receive and store radiology reports. (See Appendix F for radiology report status and data content.)

r. Once the report is complete and authorised, there should be the option to open the next exam on the reporting worklist automatically.

s. NRP technology should support speech recognition technology, digital dictation, typing and structured reports as methods of report generation.

t. NRPs must ensure that exams can be 'locked' (if they are taken up by a radiologist for reporting) to other concurrent users that are reporting. This will ensure that double reporting of the same exam does not occur within the NRP.

u. Radiographer notes and comments must be available to a reporting radiologist (sent in NTE: 3 of HL7 ORM message).

v. The clinical history must be available to the reporting radiologist on the same screen as the dictation screen.

w. Radiologists should be able to easily generate addenda on previously reported exams, for example after further clinical information becomes available. They may become aware of more clinical information following discussions with clinicians and they should be allowed to easily add an addendum to a reported study.

2. MDT meeting workflow on NRPs

A radiologist may be required to review images from multiple hospitals within a cancer network during a network-wide MDT meeting. The step-by-step workflow should be as follows.

a. MDT co-ordinators should create MDT meeting worklists, detailing patients that need to be discussed using cancer/non-cancer databases such as the Somerset Cancer Registry, Infoflex and so on.
   - MDT meeting lists should be identified by the name of the MDT meeting (for example, chest, urology and so on) and date for discussion.
   - Each patient to be discussed should be identified by the local PAS ID and National ID (for example, NHS number).
   - The unique accession number should identify each exam for MDT discussion.

b. Each hospital should be able to push images for discussion to the NRP using DICOM push from their local PACS.

c. The NRP should be able to query via API or direct database connection and download MDT meeting worklists from the MDT meeting database (list of exams to be discussed with patient ID and accession number). In the absence of ODBC query support, radiologists should be able to manually create MDT meeting lists of studies on the NRP one by one, based on images sent via DICOM push.

d. Radiologists must be able to save pre-prepared screen layouts, including layouts simultaneously displaying exams from multiple different imaging modalities and stacks of images arrested temporarily at a particular slice.

e. Radiologists should be able to create addenda on the NRP after an MDT meeting while leaving the original report unchanged.

f. Appended reports are reports containing both the original report with unchanged old content and an addendum report with new content that has been added by the MDT meeting radiologist. These should be transmitted back via the HL7 ORU message to the local institution (where the imaging study was originally generated) for onward distribution to all relevant IT systems.

g. The local RIS should have the functionality to notify a primary reporter that an addendum (an appended report) has been added to the exam that they were the primary reporter for. This is important for continuous feedback and learning (see RCR guidance on peer feedback).

h. The addendum should be displayed before the original report as the addendum may be missed if displayed after the original report.

3. Image review workflow on NRPs

Stroke physicians, neurosurgeons, neuro- and interventional radiologists and the like often cover multiple hospitals when on call and need to review images from multiple institutions on a single viewing platform. The step-by-step workflow should be as follows.

a. A local emergency department junior doctor wishes a patient's imaging study(ies) to be reviewed by the on-call regional stroke physician.
b. The junior doctor uses DICOM push to send the imaging studies (and reports, which are stored in DICOM format [DICOM SR]) from the enterprise PACS to the NRP.
c. The arrival of the imaging study should trigger a pre-fetch of the PACS database with DICOM C-FIND query for all exams for that patient within the local PACS database.
d. The arrival of the imaging study should also trigger a pre-fetch with DICOM C-GET of the relevant prior 'same exam code' in the procedure code sequence (0008,1032).
e. The stroke physician should be able to perform a DICOM C-MOVE or WADO display of any other imaging studies that they may require (for example, MRI head) that are visible to them from the C-FIND results.
f. The arrival of the imaging study should also trigger wide area discovery of all the imaging studies performed in the network. This is essential so that the stroke physician has a full and comprehensive imaging history on the DICOM viewer of the NRP (see Appendix C for wide area discovery).
g. The stroke physician should be able to review all of the images and reports for all the studies sent to them during the on-call period on a single NRP, irrespective of the hospital of origin.

4. Trainee supervision workflow on NRPs

If trainees are required to report on an NRP, it is really important that the need for proper supervision is met. The step-by-step workflow should be as follows.

a. Trainees access their reporting worklist on the NRP. Studies are allocated to the trainee as the intended reporter/assigned radiologist. The trainee creates a radiology report. This may be a registered report (R) or a provisional report (P) (see Appendix F for definitions). (Provisional reports should be created by the more experienced trainee, who can send out reports in the night for clinicians to read on their PACS/EPR.)
b. Provisional reports must start with a sentence that reads similar to '*Please note: this is a provisional report and will be replaced by the finalised version, which may differ in content*'. The precise text must be locally configurable.
c. The trainee must be able to allocate an intended supervisor (which may be a named radiologist or a group of radiologists).
d. It should be possible to change the intended supervisor if required, at any time.
e. The supervising radiologist must have access to a supervisor worklist of all exams allocated to them for supervision.
f. The supervising radiologist should be able to edit the exams using speech recognition technology or by typing. The trainee should be able to finalise the report, which is then sent out via HL7 ORU OBR: 25 with the report status of 'final'.

g. The trainee should be designated as the primary reporter in OBR: 32 and supervising radiologist in OBR: 33.

h. All changes made to the trainee's report by the supervisor should be stored within the NRP with tracked changes (in the same way as standard word-processing software).

i. A trainee review worklist should provide the trainee with all the exams they have had corrected by a supervising radiologist, displaying for the trainee the tracked changes version of the now verified report. Thus the trainee should be able to review the corrections made by the supervisor with ease. This will facilitate learning and professional development. Reports should be automatically removed from the supervisor worklist once the review is completed.

j. There should be a facility for feedback via personal messaging; for example, a supervisor may wish to send a personal feedback message to a trainee with comments. Comments should be stored only on the NRP and be visible only to the specific trainee and supervisor.

k. Workload figures for radiologists must include both the primary reporter and the secondary reporter (supervisor) and distinguish the two.

Appendix C
Wide area discovery of images and reports

A unified patient history (often referred to as a 'timeline' of radiology studies by PACS vendors) visible on an enterprise PACS or NRP requires wide area discovery of images and reports within the network.

Options for this have been debated with industry and standards experts; there is no single right solution. Clinical networks will need to approach vendors and ask them to define their approach. Whichever solution is chosen, it is important that any system for distribution, caching and duplication of images and other content follows a well-defined life cycle management process, so that there is always only a single permanent master source location for each study, which is clearly understood. Some of the options are discussed below.

On-the-fly DICOM-federated query and discovery

Every enterprise DICOM viewer (PACS) performs a real-time query and discovers a list of imaging studies and reports that lie in all other networked DICOM databases (PACS or VNA).

Vendor-neutral federated DICOM query requirements

- All DICOM implementations in the NHS (PACS or VNA) must be able to respond to a DICOM C-FIND SCU query with the 'matching key attribute' of NHS number in England and Wales, community health index (CHI) number in Scotland or health and care (H&C) number in Northern Ireland in the PatientID DICOM tag 0010,0020 within the OtherPatientIDSequence (0010,1002).
- All vendors must be able to initiate a DICOM C-FIND using PatientID DICOM tag 0010,0020 within the OtherPatientIDSequence (0010,1002) with a 'matching key attribute' of NHS number in England and Wales, CHI number in Scotland or H&C number in Northern Ireland.
- All vendors must respond to the DICOM C-FIND query with the responding key DICOM attributes identified in Appendix E. (These attributes are important clinical data items to form a comprehensive image history of patients on the DICOM viewer.)
- All vendors in the network should communicate radiology reports as basic DICOM SR objects as part of the DICOM query/retrieve or WADO request for the study.

Many vendors have been concerned about whether on-the-fly DICOM federated queries to multiple DICOM databases may be limited by network speeds, and could thereby compromise the performance of the enterprise PACS.

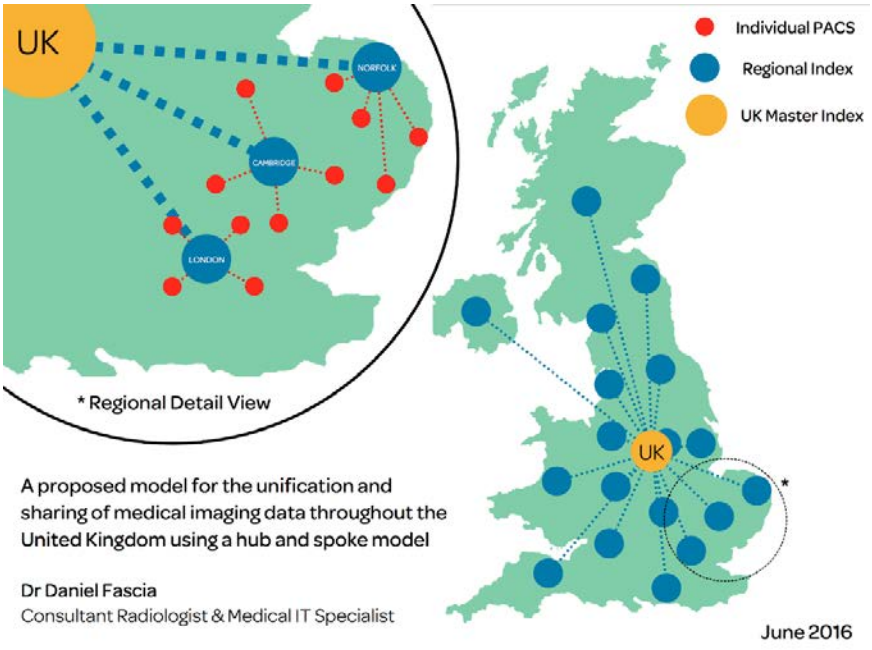
DICOM-based vendor-neutral index (VNI)

Regional DICOM index with multiple patient IDs stored and mapped within the VNI database. Any vendor's PACS could interrogate the VNI. The NRP could also interrogate the VNI. The DICOM index should contain all the DICOM header information as described in Appendix A.

- The VNI should be populated by real-time HL7 ORM and ORU messages from all the enterprise RIS within the network (and also DICOM header data from the PACS via DICOM C-STORE).
- The VNI must convert the HL7 ORU message into DICOM SR to support any DICOM C-GET or WADO query for reports.

- Historical data should be populated by a DICOM C-FIND query from all the enterprise PACS.
- Demographics should be kept up to date by all the enterprise PAS within the network by real-time ADT demographics feeds (A08 and A40 messages).
- The VNI must be able respond to a DICOM C-FIND SCU query with the 'matching key attribute' of NHS number in England and Wales, CHI number in Scotland and H&C number in Northern Ireland in the PatientID DICOM tag 0010,0020 within the OtherPatientIDSequence (0010,1002).
- The VNI must respond to the DICOM C-FIND query with the responding key DICOM attributes identified in Appendix E. (These attributes are important clinical data items necessary to form a comprehensive image history of patients.) This would allow all regional PACS and the NRP to query the VNI.
- If the user wishes to review specific imaging studies and reports, the VNI should forward the WADO (or DICOM C-GET) requests for display to the respective enterprise PACS or to the existing regional VNA. *(Some regional collaboratives have already invested in a VNA).*

Many vendors are already providing a proprietary regional index that is locked to their own DICOM viewer solution. The RCR promotes the concept of VNI solutions as part of network-sharing solutions.



Cross-enterprise document sharing (XDS) standards-based sharing

XDS is the vendor-neutral standard for sharing of images and reports along with all types of clinical images and documents. However, this requires significant investment in technology enterprise PACS. The NRP would need to have XDS consumers functionality, and every trust would need an XDS registry, XDS repository, a cross-community access (XCA) gateway, an audit trail and node authentication (ATNA), and a patient identity cross reference (PIX) manager.

Appendix D
Data items for business intelligence

Cross-charging between trusts will become increasingly essential for clinical networks to succeed as it will facilitate the appropriate channelling of resources. That is, how many radiologists each respective trust needs to staff and run their departments.

Networks should agree reporting tariffs, which could be linked to:

- National exam codes
- Day of the week/time (to enable out-of-hours uplift).

The NRP must possess business intelligence to analyse which trusts sent which exams for reporting, and who reported them.

The trust that uploaded the images for reporting may get two invoices (depending on how the NRP is funded).

a. Technology tariff: The NRP provider may send a monthly invoice to the trust that uploaded the exams: n X modality type X network-agreed rate for technology.
b. Reporting tariff: The reporting trust may also send a monthly invoice to the trust that uploaded the exams: n X modality type X network-agreed rate for reporting (based on time of day and week).

Tariff agreements would allow trusts to make a decision about the cost and quality of NHS insourced network reporting against private outsourced teleradiology reporting.

1. Data items required for billing and cross-charging will include:
   - Referring institution – trust where the images were acquired (sent in PV1: 3.4)
   - Reporting institution – employing institution of reporting radiologist (sent out in OBR: 32.9)
   - Tariffs for exam reports will need to be agreed based on national exam code, exam priority (urgent, 2WW and routine) and time of day report issued (night-time reporting will cost more than daytime).
2. Radiologist workload figures on the NRP:

Radiologists must be able to extract information about their workload for a date range both as a primary reporter and supervising radiologist, including details of:

- Exam code
- Modality
- Referring specialty
- Location type – A&E, inpatient, outpatient or GP
- Report type – primary or addendum
- Reporter type – primary reporter or supervisor
- Referring institution
- Report date.

Appendix E
List of clinical data items displayed on DICOM image viewer (PACS)

In addition to the patient demographic data, the following DICOM data items are important for clinicians assessing radiology studies.

Items a–e are mandatory.

a. Study date – 0008,0020
b. Modality – 0008,0060
c. Study description (NICIP code description) – 0008,1030
d. Accession number – 0008,0050
e. Institution where images were acquired – >0008,0082 InstitutionCodeIdentificationSquence from physician of record identification sequence
f. Referring physician name (Name) – 0008,0090
g. Requesting service (NHS main specialty of referrer) – 0032,1034
h. Reason for cancellation – 0074,1238
i. Number of study-related instances (total number of images in the study) – 0020,1208
j. Name of physicians reading study – 0008,1060
k. Scheduled procedure status ID – 0040,0020

Appendix F
HL7 report status definitions

HL7 report status definitions must be understood by all vendors of network-based reporting and supervision to work appropriately. Report status is transmitted in OBR: 25 (result status).

1. **Registered (R):** Status transmitted as '(R) registered'. However, narrative report content is not transmitted by HL7 ORU message. These may be unauthorised reports (following transcription) or trainee reports (awaiting supervision). Hence, the report is not visible to the requester/other clinicians, but they are made aware that a report exists in the RIS or NRP.
2. **Provisional/interim/preliminary (P):** Provisional report content is sent out via HL7 ORU. (The report is visible to the requester/other clinicians.) This is subsequently replaced by the final report. User-level permission will decide whether a trainee can issue provisional reports or not. When a provisional report is sent out it must be prefixed with the following sentence, or similar: '*Please note, this is a provisional report and will soon be replaced by the final report, which may differ in content.*' This text must be locally configurable.
3. **Final report (F):** Final or authorised report.
4. **Corrected report (C):** Report content is corrected after a final status but no additional content is added (if a grammatical or spelling mistake is made, it allows a report to be corrected/edited with tracked changes kept in the report creator system for audit trail purposes). It should only be possible for the radiologist who created the original content of the report to edit/correct the report. When a report is corrected then it should be prefixed by the following sentence, or similar: '*Please note, this report has been edited after the initial report was issued on [date].*'
5. **Appended report (B):** Additional report content, possibly from another radiologist, is added but the original report content is left unchanged. When additional content is added the report should be prefixed with '*Please note, additional content has been by added by Dr [...] on [date]. The original report/s is/are unchanged*' or similar.
6. **Deleted report (D):** If a report has been issued in error then it should be deleted and content removed from the receiving systems. Audit trails in the report creator system must show the report that was issued and also who deleted the report and when.

HL7 fields for reporters

OBR: 32 – should contain the GMC number, name, job role, specialty and employing institution of the primary reporter or trainee radiologist.

OBR: 33 – should contain the GMC number, name, job role, specialty and employing institution of the supervising radiologist.

Radiology report content

Whether a paper printout or an electronic radiology report is communicated via the HL7 ORU method, it should contain the following data items. For the HL7 fields see Appendix A.

1. Patient demographics
    a. Name
    b. DOB
    c. Sex
    d. Address
    e. PAS number
    f. NHS number
2. Patient location at request
    a. Location description: ward name and so on
    b. Location type: A&E, inpatient, outpatient or GP
3. Requesting responsible consultant/GP
    a. ID – GMC number
    b. Name
    c. Job role (as defined by the NHS data dictionary*)
    d. Main specialty (as defined by the NHS data dictionary**)
    e. Employing institution (as defined by the NHS data dictionary***)
4. Unique numbers
    a. Accession number – unique scheduling number issued by RIS
    b. Order number – unique number issued by Ordercomms/electronic requesting system (RIS for paper requests)
5. Reporter (primary ± secondary)
    a. ID – GMC number
    b. Name
    c. Job role of reporter (as defined by the NHS data dictionary*)
    d. Main specialty (as defined by the NHS data dictionary**)
    e. Employing institution (as defined by the NHS data dictionary***)
6. Exam completed – date/time (when image acquisition was completed)
7. Exam room and institution (which owns the machine where the image acquisition took place; mobile scanners should be identified)
8. Date and time of primary report authorisation
9. Additional dates for corrections and report addenda, if issued, should also be included within the narrative text of the report
10. Priority – urgent, two-week wait, routine
11. Patient category – NHS, private, category II (medicolegal)
12. Modality – computed radiography (CR), computed tomography (CT), MRI and so on
13. Exam description – using national exam codes and description

14. Where/to whom copies of reports were sent (if reports need to be sent to someone other than referrer)
15. Report type
    a. Primary final report
    b. Appended report (additional information is added but previous information is unchanged)
    c. Corrected report (report content is changed)
16. Failsafe alert
    a. No alert
    b. Alert present
17. Narrative report text
    a. **Primary report:** this should contain the narrative clinical content of the report.
    b. **Corrected report:** when the report content is corrected then the date and time of change, and person who edited the report, should be included in the report text along with the clinical content.
    c. **Appended report:** when the report content is added to the original report then the date and time of change, and person who edited the report, should be included in the report text along with the clinical content.

*www.datadictionary.nhs.uk/attributes/job_role_code.html?hl=job%2Crole%2Cstaff

**www.datadictionary.nhs.uk/attributes/main_specialty_code.html?hl=main%2Cspecialty

***www.datadictionary.nhs.uk/attributes/organisation_code.html?hl=organisation%2Ccode

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