



Audit Report

National Audit of Paediatric Radiology Services
in Hospitals



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Introduction

Getting the diagnosis right in sick children is vital but can be difficult. They may be too young to explain their symptoms or to co-operate with a physical examination. X-rays and scans are often needed to aid diagnosis but the performance and interpretation of paediatric imaging requires different expertise to that employed for adult patients for several reasons. For instance, a young patient may not be able to lie still for the time necessary to perform the test; children are more sensitive to ionising radiation than older patients and every effort must be made to ensure that radiation dose is kept to the minimum while still producing adequate images. Children have different anatomy and there are also many conditions which are restricted to, or manifest themselves differently in, childhood. Non-accidental injury (NAI) is, unfortunately, common¹ and the signs of physical abuse can be subtle and are easy for a non-specialist to miss but the consequences of missing them can be disastrous.

While some paediatric imaging takes place in specialist units, it is estimated that 75% does not.² If missed or mistaken diagnoses are to be avoided, it is essential that general units have the support of specialist centres when they need it. Even the larger units cannot always provide

comprehensive 24/7 services and may require support from other hospitals. The identification of serious problems with the interventional radiology service at Birmingham Children's Hospital³ and the death of Peter Connelly (Baby P),⁴ together with concern that procedures were not standardised and that the standard of care was inadequate in some areas, led to the publication of the document *Delivering Quality Imaging Services for Children*⁵ in 2010 by the former National Imaging Board of the Department of Health. This recommended the development of formal networks in which staff carrying out procedures at smaller units could be supported by the larger specialist hospitals. By 2012, however, there was anecdotal concern that the recommendations in the report were not being implemented.

The purpose of this audit was to compare the situation in UK hospitals two years after the publication of *Delivering Quality Imaging Services for Children*⁵ with the standards laid out for paediatric imaging in this document and The Royal College of Radiologists' publications relating to paediatric interventional radiology services⁶ and imaging for non-accidental injury.¹

Standards

Each of the audit standards in Table 1 comprises a recommendation which specifies the structure, process or outcome against which the quality of performance is to be judged; an indicator which is a single variable that measures whether a recommendation is conformed with and a target

which is the level of conformity aimed at or required. Recommendations may be derived from standards documents such as *Standards for radiological investigations of suspected non-accidental injury*,¹ research or guidelines.

Table 1. Audit standards

Recommendation	Indicator
1. Children's imaging should be performed by staff with appropriate training ⁵	% of exams performed by radiographers who had received specific training in imaging children
2. Children's imaging should be reported by staff with appropriate training ⁵	% of exams reported by paediatric radiologists/radiographers appropriately educated and trained in image interpretation
3. Radiologists with an interest in paediatric radiology/neuroradiology/interventional radiology should have access to continuing professional development (CPD) ^{1,6}	% of paediatric radiologists who have attended paediatric CPD in 2012
4. All radiographers imaging children should have access to CPD ⁵	% of radiographers who regularly image children who have attended paediatric CPD [†] events in 2012
5. Arrangements should be in place to access a specialist paediatric radiology/neuroradiology opinion 24/7 ^{5,6}	% of institutions having 24/7, year-round access to paediatric radiology opinion
6. These arrangements should be supported by facilities for image transfer ^{5,6}	% of institutions with facilities for image transfer to another institution for second opinions
7. Funding arrangements should be in place to support access to second opinions ^{5,6}	% of institutions with facilities for image transfer in which there is a funding agreement in place
8. Formal pathways should be in place for transfer of patients if appropriate ⁶	% of those institutions that transfer patients to another institution for paediatric radiology opinion/treatment that have formal arrangements in place
9. Skeletal surveys should be reviewed by a consultant radiologist or an experienced senior radiographer prior to the child leaving the department ¹	% of surveys reviewed by consultant/specialist paediatric radiographer before child left department
10. Departments that image children for suspected non-accidental injury (NAI) must be able to provide an initial report ¹	% of surveys with initial written report
11. Skeletal surveys should be double reviewed ¹	% of surveys double reviewed
12. It is recommended practice that follow-up imaging should be performed after a skeletal survey for NAI ¹	% of surveys for which there was follow-up imaging

All targets are 100%. For the purpose of the audit, a paediatric radiologist was defined as a radiologist with six months or more training in a specialist paediatric centre.

[†] Examples given of paediatric CPD events for radiographers included Non-accidental Injury Study Day, Association of Paediatric Radiographers events and UK Radiological Congress (UKRC) paediatric-focused sessions.

Material and methods

All clinical radiology audit leads at institutions across the UK (hospitals/trusts or equivalent) imaging children aged 16 years or younger between 1 January and 31 December 2012 were invited to participate. Information about the audit was also circulated to lead paediatric radiographers via the Society and College of Radiographers and also to paediatric radiologists via the British Society of Paediatric Radiology. Reminders were sent to non-participating institutions. Data were submitted on a web-based SurveyMonkey data collection tool on or before 19 January 2014. A period of one year was chosen to ensure coverage of variation in the provision of paediatric imaging over time resulting from equipment and staffing issues. After the cessation of data collection,

size of institution based on number of paediatric emergency admissions was compared with data from the Royal College of Paediatric and Child Health (RCPCH). Using data from the current audit, institutional performance was compared across the participating organisations and the results circulated to clinical radiology audit leads, providing them with an opportunity to check their data. Two hospitals queried their results – one of which submitted amended data, which were fed into the current analysis.

Data were analysed using Microsoft Office Excel 2010. Don't know responses were excluded from the analysis except for Standard 2.

Results

Characteristics of participating institutions

Eighty-seven of 198 (44%) eligible institutions submitted data. Response rates for three of the four home nations were comparable, ranging from 43% to 52%; however, Northern Ireland appeared to be less well represented at 25%. The median number of examinations per institution performed on children aged less than one year was 2,000

(IQR 995–3,386). The median number of examinations performed on children aged between one and four years was 2,884 (interquartile range [IQR] 1,464–4,587). The median number of examinations performed on children aged between five and 16 years was 10,696 (IQR 6,047–14,500). Table 2 shows that while the vast majority (92%) of institutions have a neonatal unit, little more than a half (57%) perform paediatric surgery.

Table 2. Institution demographics

	n	%
Nation		
England	66	76
Scotland	12	14
Wales	5	6
Northern Ireland	2	2
Others (Guernsey, Isle of Man)	2	2
Size of institution (RCPCH category)		
Very small	5	6
Small	18	21
Medium	35	40
Large	27	31
Unknown	2	2
Institutions with neonatal unit	79	92
Institutions performing paediatric surgery	50	57

RCPCH categories based on Hospital Episode Statistics (HES) data for number of paediatric emergency admissions in 2011–12: very small <1,500; small 1,501 to 2,500; medium 2,501 to 5,000; large >5,000.

Compliance with audit standards

Table 3 shows that only one standard: 'Arrangements to access a specialist paediatric radiology/neuroradiology opinion 24/7 should be supported by facilities for image transfer' was met (100%). Review of skeletal surveys by a consultant radiologist or an experienced senior radiographer prior to the child leaving the department (99%), double reviewing of skeletal surveys (97%) and access to CPD for radiologists with an interest in

paediatric radiology/neuroradiology/interventional radiology (95%) came close to being met. Institutions failed to meet the remaining standards by a considerable margin, with compliance between 34% for access to CPD for all radiographers imaging children to 74% for departments that image children for suspected non-accidental injury (NAI) being able to provide an initial report.

Table 3. Compliance with standards

Standard	Indicator	Compliance n/N (%)
1.	% of exams performed by radiographers who had received specific training in imaging children	532,499/821,661 (65)
2.	% of exams reported by paediatric radiologists/radiographers appropriately educated and trained in image interpretation	(60) [†]
3.	% of paediatric radiologists who have attended paediatric CPD in 2012	162/170 (95)
4.	% of radiographers who regularly image children who have attended paediatric CPD events in 2012	789/2,342 (34)
5.	% of institutions having 24/7, year-round access to paediatric radiology opinion	30/78 (38)
6.	% of institutions with facilities for image transfer to another institution for second opinions	78/78 (100)
7.	% of institutions with facilities for image transfer in which there is a funding agreement in place	34/61 (56)
8.	% of those institutions that transfer patients to another institution for paediatric radiology opinion/treatment that have formal arrangements in place	40/64 (63)
9.	% of surveys reviewed by consultant/ specialist paediatric radiographer before child left department	2,412/2,441 (99)
10.	% of surveys with initial written report	1,884/2,538 (74)
11.	% of surveys double reviewed	2,441/2,525 (97)
12.	% of surveys for which there was follow-up imaging	1,300/2,152 (60)

[†] Compliance with standard 2 was calculated from estimated percentages rather than counts; therefore, the value shown (60%) is the median. Using this method, 35% of paediatric exams were reported by non-paediatric radiologists.

Discussion

These results demonstrate that the blueprint for delivering a comprehensive paediatric imaging service outlined by the Department of Health in its 2010 document *Delivering Quality Imaging Services for Children*⁵ remains a largely unmet aspiration.

A recent study has demonstrated that there is a significant error rate if paediatric examinations are reported by non-specialists.⁷ Marked variation in practice in the UK has been identified by Negus *et al* who have shown that in non-specialist paediatric trauma centres, CT scans are carried out three times more often than in specialist paediatric trauma centres indicating an excessive use of CT with its inherent radiation exposure issues.⁸ In spite of this, the current audit shows that the recommendation for developing networks to allow 24/7/365 access to a specialist opinion has only been achieved in 38% of centres. Appropriate training for staff is not available in one-third of centres and CPD of staff is not available in two-thirds of centres. Twenty-five per cent of centres carrying out radiological investigations for suspected child abuse have no radiologist capable of issuing a report on those studies and 40% are failing to carry out essential follow-up investigations.

Reasons given by respondents for non-compliance with key standards are shown in Table 4 overleaf. Lack of radiographers who had received specific training in imaging children, lack of access to paediatric radiologists/paediatric radiology cover and lack of time were the most commonly reported reason for non-compliance with these standards.

The audit was subject to a number of limitations. Specifically it was a retrospective audit reliant on the

accuracy of existing data sources and reflecting practice as it was in 2012. Furthermore, the response rate of somewhat under half, while comparing favourably to other published work with a similar design,⁹ is insufficient to rule out serious response bias. However, the data were representative when compared with the number of very small, small, medium and large units in the country¹⁰ and when compared with the geographical distribution of institutions in the target population. Moreover, there is no indication that the delivery of paediatric radiology services has altered significantly since 2012.

Taken as a whole, the results indicate that services are still some way off delivering quality imaging services for children. More recent data suggest there are still significant and important differences in imaging practice between departments that have specialist paediatric radiology support and those that do not.⁸ Further work to implement robust children's imaging networks, in which departments with specialist skills provide paediatric imaging expertise and advice to local units as needed, is urgently required.

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Table 4. Reasons for non-compliance with standards

Recommendations	Response	No. of responses	% of respondents (institutions) ^a
Children's imaging should be performed by staff with appropriate training	Specific training in imaging children not available	19	56
	Radiographers who had received specific training in imaging children not always available	25	74
	Unknown	1	3
All radiographers imaging children should have access to CPD	Respondents	34	100
	Lack of funding	28	50
	Lack of time	45	80
	No courses available	8	14
	Lack of interest	7	13
	Unknown	6	11
	Respondents	56	100
Children's imaging should be reported by staff with appropriate training	Access to paediatric radiologist not 24/7	42	60
	Paediatric radiology cover not always available	42	60
	Plain films	8	11
	Other specialist, eg, neuro/musculoskeletal radiologist	9	13
	Not deemed necessary	6	9
	Insufficient paediatric radiologists	17	24
	Respondents	70	100
All radiographers imaging children should have access to CPD	Lack of funding	28	49
	Lack of time	46	81
	No courses available	8	14
	Lack of interest	7	12
	Unknown	6	11
	Respondents	57	100

^a The percentage of relevant respondents (institutions with <100% compliance with given standard) providing each of the given responses.

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