Radiography xxx (2014) 1–5

Contents lists available at ScienceDirect

Radiography

journal homepage: www.elsevier.com/locate/radi

# Reducing image interpretation errors – Do communication strategies undermine this?

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ARTICLE INFO

*Article history:*
Received 23 January 2014
Received in revised form
11 March 2014
Accepted 14 March 2014
Available online xxx

*Keywords:*
X-ray
Radiographer
Interpretation
Error
Red dot
Emergency department

ABSTRACT

*Introduction:* Errors in the interpretation of diagnostic images in the emergency department are a persistent problem internationally. To address this issue, a number of risk reduction strategies have been suggested but only radiographer abnormality detection schemes (RADS) have been widely implemented in the UK. This study considers the variation in RADS operation and communication in light of technological advances and changes in service operation.

*Methods:* A postal survey of all NHS hospitals operating either an Emergency Department or Minor Injury Unit and a diagnostic imaging (radiology) department ($n = 510$) was undertaken between July and August 2011. The questionnaire was designed to elicit information on emergency service provision and details of RADS.

*Results:* 325 questionnaires were returned ($n = 325/510$; 63.7%). The majority of sites ($n = 288/325$; 88.6%) operated a RADS with the majority ($n = 227/288$; 78.8%) employing a visual 'flagging' system as the only method of communication although symbols used were inconsistent and contradictory across sites. 61 sites communicated radiographer findings through a written proforma (paper or electronic) but this was run in conjunction with a flagging system at 50 sites. The majority of sites did not have guidance on the scope or operation of the 'flagging' or written communication system in use.

*Conclusions:* RADS is an established clinical intervention to reduce errors in diagnostic image interpretation within the emergency setting. The lack of standardisation in communication processes and practices alongside the rapid adoption of technology has increased the potential for error and miscommunication.



## Introduction

Errors in the interpretation of diagnostic images in the emergency department (ED) are a persistent problem internationally.[1–4] Where injuries remain undiagnosed, or a delay to injury diagnosis is experienced as a consequence of interpretive error, patients may be predisposed to long term morbidity[4,5] and organisations to the potential of litigation.[6] Similarly, the unnecessary treatment of 'normal' conditions, whilst not resulting in preventable morbidity, may impact on the lifestyle and psychological experience of the patient. Importantly, with increasing financial constraints being applied to healthcare, the overtreatment of patients also results in unnecessary resource utilisation although few authors have considered this directly.[7–9] To address these issues, a number of strategies to reduce the risk of diagnostic error in the ED have been suggested including senior medical review of images,[4] immediate radiology reporting[5,6] and initial evaluation of images by the examining radiographer.[7–9] With increasing ED attendances and staff shortages placing unprecedented pressures on ED services,[10] the opportunity for senior medical scrutiny of diagnostic images may be limited.[11] Likewise, whilst immediate radiology reporting has been shown to be clinically and cost effective,[9,12] widespread implementation has not been achieved, presumably due to the overall rise in radiology activity and competing pressures. As a result, the only widely implemented intervention to date in the UK has been review of diagnostic images by the examining radiographer and immediate communication of these findings to the ED clinician to assist clinical diagnosis.[13] Often described as a radiographer abnormality detection scheme (RADS), this system offers a second pair of eyes in the image review process but does not replace the review and interpretation of images by the treating

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http://dx.doi.org/10.1016/j.radi.2014.03.006
1078-8174/

clinician and ultimate definitive radiology report. Initially developed in the UK, RADS have now been implemented in approximately 85%–90% of UK hospitals and acute care centres[13,14] and are increasingly being adopted internationally.[15,16] 2 common methods of radiographer communication through RADS have been reported. The first is the use of a visual flag (symbol) on the diagnostic image or electronic system (the colloquial 'red dot system'[17]) to highlight abnormal findings, and the second is communication via an electronic or paper comment proforma[13,18] requiring the radiographer to write a description of their image observations.

A number of studies have evaluated the success of RADS in reducing ED interpretive errors.[18] Yet despite initial implementation in the 1980s and subsequent multidisciplinary acceptance and widespread adoption, the absence of RADS guidance or standards resulted in UK hospitals developing local systems in response to patient pathways and clinician preferences.[13] Prior to the introduction of digital imaging technologies, these locally driven approaches were a relatively effective and safe method of communication. However, advances in technology over the last decade have revolutionised imaging services and the filmless environment now provides greater opportunities for image sharing both within and across organisations. This rapid introduction of digital imaging technologies did not overtly consider operational needs beyond image acquisition and radiology reporting. Consequently, opportunities to standardise RADS were overlooked and individual organisations were once again left to implement RADS communication in an ad hoc way.[19] Due to the differences in working practices associated with digital imaging advancements (e.g. remote image review, telemedicine, electronic image transfer to specialist hospitals), these inconsistencies in RADS communication may now pose a threat to patient safety and service quality although the potential size of any risk remains uncertain as no study detailing the variety of approaches to RADS communication has been published.

## Objectives

This article uses data from a UK survey of imaging departments within hospitals providing emergency care services to identify the prevalence of RADS and variation in communication methods used. While the results of this study represent UK practice, the findings have significant implication internationally as many countries have, or are planning to, implement RADS into mainstream practice.[15,16,20]

## Method

Data collection and analysis comprised a national postal survey undertaken between July and August 2011. Inclusion was restricted to NHS hospitals operating either an ED or Minor Injury Unit (MIU) and a diagnostic imaging (radiology) department ($n = 510$). The sample was compiled from the UK Government ED Statistics and National Hospital databases (Health and Social Care in Northern Ireland 2011; Health in Wales 2011; Hospital Episode Statistics 2011; The Scottish Government, 2011) and facilities were confirmed through hospital websites. Where uncertainty remained, telephone contact was made with the individual hospital to confirm eligibility for inclusion. Surveys were addressed to the lead ED/MIU radiographer.

The questionnaire (available from the authors) was designed to elicit information on the type of emergency service provided and, where in operation, details of RADS including method of communication, anatomical scope and terminology adopted. In addition, all sites using an electronic or paper comment proforma were invited to return an example with the questionnaire. The survey was piloted prior to distribution to ensure question accuracy, appropriateness and relevance. No postal reminders were employed as response rate was comparable to that of a similar study[13] and analysis of non-response bias[21] using both analysis of characteristics and methods aligned to continuum of resistance theory suggested sample representativeness. The pre-coded quantitative responses were analysed using Microsoft Excel; open-ended responses were analysed using the original questionnaire items as a framework and grouped under broad themes. The survey was considered to represent service evaluation and therefore did not require ethical approval.

## Results

We received completed questionnaires from 325 respondents ($n = 325/510$; 63.7%). Responses reflected the total sample in terms of emergency service provided with 58.8% ($n = 191/325$) being from centres with an ED. 288 sites ($n = 288/325$; 88.6%) operated a RADS with the majority ($n = 227/288$; 78.8%) employing a 'flagging' system as the only method of communication. Variation in system operation and anatomical scope was evident (Table 1).

### *Flagging systems*

Of the 277 sites that operated a 'flagging' system, 248 (89.5%) marked the image directly, most commonly by annotating the term 'red dot' ($n = 142/248$; 57.3%) although other annotations and a wide range of symbols were reported (Table 2). 29 of the responding sites indicated the annotation (flag) is placed adjacent to the site of the injury, but gave no indication of how multiple injury sites are managed. Importantly, only 53.8% ($n = 149/277$) of sites reported having RADS guidelines in place and the majority of sites ($n = 197/277$; 71.1%) considered radiographer participation to be voluntary. Inconsistency in RADS operation and application of annotations and symbols by radiographers within individual departments or organisations was highlighted in a number of textual responses.

> "Variation [exists] between radiographers, some add? some just write red dot"
>
> Respondent 58

**Table 1**
Description of RADS.

| RADS description | Responses no. (%) |
|---|---|
| *RADS system employed* | |
| Flagging system (red dot or similar) only | 227/288 (78.8%) |
| Commenting system only | 11/288 (3.8%) |
| Both flagging and commenting systems operated | 50/288 (17.4%) |
| *Flagging system employed to indicate:* | |
| Normal appearances | 8/277 (2.9%) |
| Uncertain appearances | 235/277 (84.8%) |
| Abnormal appearances | 273/277 (98.6%) |
| Not Stated | 1/277 (0.4%) |
| *Flagging system: anatomical scope* | |
| Musculoskeletal examinations only | 168/277 (60.6%) |
| Musculoskeletal and chest examinations | 35/277 (12.6%) |
| All radiographic examinations | 73/277 (26.4%) |
| Not stated | 1/277 (0.4%) |
| *Commenting proforma employed to indicate:* | |
| Normal appearances | 28/61 (45.9%) |
| Uncertain appearances | 50/61 (82.0%) |
| Abnormal appearances | 57/61 (93.4%) |
| Not stated | 2/61 (3.3%) |
| *Commenting proforma: anatomical scope* | |
| Musculoskeletal examinations only | 35/61 (57.4%) |
| Musculoskeletal and chest examinations | 11/61 (18.0%) |
| All radiographic examinations | 13/61 (21.3%) |
| Not stated | 2/61 (3.3%) |

Please cite this article in press as: Snaith B, et al., Reducing image interpretation errors – Do communication strategies undermine this?, Radiography (2014), http://dx.doi.org/10.1016/j.radi.2014.03.006