

Research Article

# The Influence of Image Interpretation Training on the Accuracy of Abnormality Detection and Written Comments on Musculoskeletal Radiographs by South African Radiographers

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## ABSTRACT

**Introduction:** The study was conducted in two government hospitals in Johannesburg, South Africa, investigating the extent to which image interpretation and relevant terminology training would improve the accuracy and descriptive comments provided on musculoskeletal images by South African radiographers.

**Methods:** Nine radiographers interpreted an image bank comprised of 100 skeletal radiographs (50% abnormal) both before and on completion of a tailored education program in image interpretation. Radiographer comments were compared with the reference standard diagnosis (single experienced radiologist) and deemed to be correct, partially correct, or incorrect. The radiographers were assessed for sensitivity, specificity, and accuracy on the image bank pre- and post-intervention. After testing for normality of the data, a Wilcoxon signed rank test was used for nonparametric paired data.

**Results:** Radiographer accuracy (from 71.04% to 78%), sensitivity (from 83.73% to 87.28%), and specificity (from 59.62% to 70.34%) all improved after the education program. A statistically significant improvement was noted in the accuracy (Wilcoxon value,  $z = -2.66$ ,  $P = .008$ ). Incorrect radiographer comments also decreased (from 24.1% to 17.78%, Wilcoxon value,  $z = -1.96$ ,  $P = .05$ ). Radiographer vocabulary used when describing abnormalities was more in line with the reference standard diagnosis after training.

**Conclusions:** This study has shown that training in pattern recognition and construction of a comment could enable diagnostic radiographers to improve their accuracy and the ability to provide a descriptive comment on an image. Future work should include assessing accuracy and commenting in the clinical environment and whether the improvement in commenting is maintained over time.

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## RÉSUMÉ

**Objet :** L'étude a été menée dans deux hôpitaux gouvernementaux de Johannesburg, en Afrique du Sud. Elle examine dans quelle mesure une formation en interprétation des images et en terminologie pertinente permettrait d'améliorer la précision de l'interprétation et les commentaires descriptifs sur les images musculo-squelettiques fournis par les radiographes sud-africains.

**Méthodologie :** Neuf radiographes ont interprété une banque de 100 radiographies squelettiques (dont 50 % présentaient des anomalies) avant et après avoir suivi un programme de formation spécialisé en interprétation des images. Les commentaires des radiographes ont été comparés au diagnostic de référence standard (par un même radiologue expérimenté) et jugés corrects, partiellement corrects ou incorrects. L'évaluation des radiographes a porté sur la sensibilité, la spécificité et l'exactitude sur l'intervention avant et après l'intervention. Après que la normalité des données ait été évaluée, un test de Wilcoxon (signed-rank) a été utilisé pour les données couplées non paramétriques.

**Résultats :** L'exactitude (71,04 % à 78 %), la sensibilité (83,73 % à 87,28 %) et la spécificité (59,62 % à 70,34 %) de l'interprétation de tous les radiographes ont augmenté après le programme de formation. Une amélioration statistiquement significative est notée dans l'exactitude (valeur Wilcoxon,  $z = -2,66$   $p = 0,008$ ). Le nombre de commentaires incorrects des radiographes au aussi diminué (24,1 % à 17,78 %, valeur Wilcoxon,  $z = -1,96$ ,  $p = 0,05$ ). Le vocabulaire utilisé par les radiographes pour la description des anomalies se rapproche davantage du diagnostic standard de référence après la formation.

**Conclusion :** Cette étude démontre que la formation à la reconnaissance des patrons et à la construction d'un commentaire pourrait permettre aux radiographes d'améliorer leur exactitude et leur capacité à fournir un commentaire descriptif sur une image. Les travaux futurs devraient comprendre une évaluation de l'exactitude et de la formulation des commentaires dans l'environnement clinique et de la persistance de l'amélioration des commentaires au fil du temps.

*Keywords:* image interpretation; training; accuracy; comment

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## Introduction

The development of the role of the radiographer into image interpretation has been established in the United Kingdom since the 1980s [1, 2]. However, in South Africa, research has not established if diagnostic radiographers would be able to undertake this role and, if so, what training would be required to ensure their accurate interpretation of images.

The “red dot” system is a method of abnormality detection by radiographers who highlight abnormal images to the treating clinician by placing a red dot on the film [3]. The “red dot” system proved to be ambiguous because the referring physician did not know if a lack of a “red dot” was because there was no abnormality, if the radiographer did not see the abnormality, or if the radiographer did not wish to provide an opinion on the image [4–7]. In 2006, the Society and College of Radiographers published guidelines in the United Kingdom recommending that by 2010 radiographers in the United Kingdom would provide an initial written or verbal comment on all musculoskeletal trauma images [4]. In a recent Society and College of Radiographers document, the society has stated that the “red dot” system should be replaced by a preliminary clinical evaluation, previously called a clinical comment, to overcome the ambiguity and optional participation in the “red dot” system [5]. Therefore, when considering the optimum form of role extension for South African radiographers, a commenting system would be the preferred method for radiographers rather than an ambiguous abnormality detection system [5].

As has been stated previously, a great deal of research has been performed in the United Kingdom showing the accuracy of radiographers in musculoskeletal image interpretation [1–3]. Unfortunately, this has not translated into radiographers being able to perform these tasks in other countries without further research specific to the country. South Africa and Australia have similar challenges regarding the introduction of radiographers providing image interpretation. In rural areas of Australia there is a lack of radiologists and, therefore, delays in reporting trauma images are common [8, 9]. Radiographers in rural areas of Australia are often asked for their opinion on images, and radiographers in South Africa experience a similar expectation from clinicians in rural areas. Research has shown that Australian radiographers and emergency department doctors have similar accuracy in image interpretation (88.6% vs. 89.5%). In the absence of a radiologist, it has been suggested that collaboration in image interpretation would be beneficial to the patient [9]. However, it appears the Australian government and radiologists in Australia are not supportive of role extension for radiographers into initial image reporting [8, 9].

Radiographers in Australian studies have used a radiographic opinion form to assist in the identification of the abnormality and to select a type of abnormality from a checklist. The radiographers are provided with an opportunity to add a comment once they have established there is an abnormality;

however, it was found that they did not have the vocabulary to provide an accurate comment [8, 9]. When considering the content for the training, the researcher felt that training in the descriptive vocabulary and structure of a report was required; this is supported by McConnell et al [9] in their research. The ideal radiographer comment should be clear, brief, and specific [10, 11].

Formal postgraduate qualifications in image interpretation are offered by universities in Australia; however, Smith et al [8] also suggest short courses and online learning be used in the delivery of radiographer image interpretation training. Current radiographer undergraduate education in South Africa is significantly different than that offered in Australia and the United Kingdom. In South Africa, the majority of programs provide diploma rather than degree courses. However, undergraduate training is evolving, with a 4-year degree program in development. The postgraduate training models are also different in South Africa; there are currently no image interpretation training opportunities, either formal postgraduate or short courses [11, 12].

According to a survey study with 33 higher education institutes (HEIs), 19 HEIs (out of 25 that responded) indicated that image interpretation is offered at the undergraduate level in the form of lectures and tutorials, with 12 institutions having image interpretation as a clinical learning outcome. Twelve of 18 HEIs offer postgraduate image interpretation modules [6].

“The image interpretation training offered at South African institutes has not been established, pattern recognition is within the scope of practice radiographers [personal communication] [13, 14].” Pattern recognition provides undergraduate students in South Africa with the ability to identify normal, normal variants, and abnormal patterns; however, there is no expectation that they would comment on images once qualified, as has been stated in the United Kingdom [4]. Kumar [15] found that radiographers who had postgraduate education became more confident in reporting, and the wording of the reports improved.

At present, there is a shortage of radiologists in South Africa [16], which leads to delayed reporting on images. Radiographers may be able to provide an initial comment on images to alleviate this problem. However, there have been no studies to investigate the type of training necessary to enable diagnostic radiographers to gain the skills to accurately comment on images. The current study investigated the extent to which training in pattern recognition and how to construct a comment could improve the accuracy and descriptive comments on musculoskeletal images by diagnostic radiographers in two government hospitals in Johannesburg, South Africa.

## Methods

A single group pre- and post-test study was undertaken with an educational intervention [3, 17, 18]. There was a

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