

Review Article

# Exploring the Benefits of Magnetic Resonance Imaging Reporting by Radiographers: A UK Perspective

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## ABSTRACT

**Background:** The United Kingdom (UK) National Health Service (NHS) Imaging and Radiodiagnostic activity 2013/14 report estimates the year-on-year increase of magnetic resonance imaging (MRI) examinations to be 12.3%, with the designated radiologist workforce disproportionate to the increase in demand.

**Objective:** To review the economics, risk, and feasibility of MRI reporting by radiographers.

**Design:** A PICO (the four major components of a clinical or research question: patient [population], intervention, comparison, and outcome) framework using example patient demand from audit data of noncomplex MRI examination attendance ( $n = 3,525$ ) over 12 months was used to review costs, potential outcome risks (diagnostic thresholds), and feasibility (workforce capacity) of both interventions.

**Conclusions:** The benefits of introducing a skills mix reporting service model to the benefit of service delivery in the UK has shown a potential £145,230–£60,524 per annum cost saving using a generic acute workload model. Research into recorded discrepancy/error audit data for potential detrimental risk to patient outcomes identified a paucity of evidence and recommends that further research is needed.

*Keywords:* Magnetic resonance imaging; reporting radiographer; role extension; advanced practice; economic evaluation

## Introduction

The National Health Service (NHS) England released the Five Year Forward View [1] in 2014 to consider possible changes that could be implemented to improve patient outcomes and

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## RESUMÉ

**Contexte :** Le Rapport sur les activités d'imagerie et de radiodiagnostic 2013-2014 du National Health Service (NHS) du Royaume-Uni estime que l'augmentation annuelle des examens d'imagerie par résonance magnétique (IRM) a été de 12,3 %, avec une disproportion entre le nombre de radiologistes désignés et l'augmentation de la demande en rapports d'imagerie.

**Objectif :** Examiner l'aspect économique, le risque et la faisabilité de faire préparer les rapports d'IRM par les radiographes.

**Conception :** Un cadre PICR (les quatre éléments d'une question clinique ou d'une recherche: patient (population), intervention, comparaison et résultat) utilisant la demande des patients tirée des données de vérification de présence à un examen d'IRM non complexe ( $n = 3\ 525$ ) sur une période de 12 mois, avec un examen des coûts, des risques potentiels pour les résultats (seuil de diagnostic) et de la faisabilité (capacité des effectifs) pour les deux interventions.

**Conclusions :** Les avantages liés à l'introduction d'un service de rapport en compétences mixtes pour la prestation des services au Royaume-Uni montrent des économies annuelles potentielles de l'ordre de £145 230 - £60 524 par année avec l'utilisation d'un modèle générique de charge de travail aiguë. Les recherches sur les données de vérifications des écarts ou erreurs enregistrées afin d'établir le risque potentiel pour les patients ont permis de constater en manque de données probantes, et il est recommandé de poursuivre les recherches sur cet aspect.

satisfaction, and decrease service delays, with an emphasis on investment for local service changes. The English Cancer Strategy 2015–20 [2] followed in 2015 and embraced the Five Year Forward View's [1] three main aims of better prevention, swifter diagnosis, and better treatment. The Royal College of Radiologists [3] (RCR) endorsed the strategy but insisted the plan to improve access to scans and reports requires a change in diagnostic capacity and an increase in radiology staffing.

The Kings Fund Better Value in the NHS 2015 [4] report called on NHS staff to engage in delivering better outcomes

by improving value rather than reducing the costs, in the wake of the Five Year Forward View [1] that proposed £22 billion of efficiency savings. The report findings emphasised the need to create an environment for change and highlighted major service areas where restructuring diagnostic pathways could deliver cost-effective service improvements, increase the speed of delivery, reduce length of stay in hospital, and fast-track treatment and management for preventable illness.

Two specific driving factors for change in radiology have been a flexible response to workforce shortages [5–10], and demand for imaging that outstrips capacity [11–13]. The NHS Imaging and Radiodiagnostic activity 2013/14 report [11] assessed the number of magnetic resonance imaging (MRI) examinations from April 2013 to March 2014 to be 2.7 million, with a 12.3% increase in examinations from the previous year [11], 71.7% over 5 years [14], and 220% growth over a 10-year period [11], which is a substantial increase in the pattern and trend of imaging demand. Both the RCR [13] and the Society and College of Radiographers [13] (SCoR) observe that demand in imaging is expected to intensify. The Centre for Workforce Intelligence (CfWI) [12] predicts the demand for imaging will escalate due to multiple factors, including growing and/or aging populations, rise in cancer diagnosis and chronic illness, screening programmes, introduction of 24/7 working hours, and future imaging techniques introduced into clinical practice. The CfWI and the RCR have estimated the total imaging workload could potentially rise from 39 million tests in 2011 to 51 million by 2025 (an increase of all imaging by 76%, with MRI alone raising 87%) [12].

The RCR [15] recommend a formal report for diagnostic examinations within 2 days, but acknowledge that due to workforce shortages, this is not occurring [14]. This causes delays in cancer and serious illness diagnosis, hospital stay, and the subsequent increased listing of radiology departments to NHS risk registers [15]. In October 2014, an RCR survey [16] highlighted a month delay in results (1,697 examinations) in the 25% of NHS trusts surveyed. The survey was repeated in February 2015 [15] with 71% of surveyed trusts having delays of more than a month, with over 3,277 unreported MRI scans (estimated for all trusts in England to be up to 4,268 [15]).

### *Methodology*

To define the perspective of the review and the key drivers of cost-effectiveness (capacity and demand, benefits, and risks) a PICO framework [17] was adopted. A PICO has four major components, in this case consisting of P for the patient sample group defined by the MRI imaging pathway; I for the intervention of radiographers reporting MRI examinations; C for the comparison to existing intervention of radiologists reporting MRI examinations; and O for the outcome comparison of current and alternative service provision through costs, savings, and risk.

This review received university research ethical and governance approval to calculate a deterministic, scenario-based evaluation of costs for the current and new intervention.

The study used data from a retrospective audit of MRI examination attendance at an acute NHS district general hospital (DGH). A defined time horizon of 12 months (August 2014–July 2015; Tables 1 and 2) was used to identify the key resource demand for MRI examinations ( $n = 12,958$ ).

Using decision tree modelling to illustrate the process mapping of the current intervention (Table 3) allowed evaluation of costs and outcomes from each intervention for internal validity. Using the audit data allowed external validation of the model as an example of expected workflow demand in a generic DGH. A decision tree was chosen over conventional Markov models because data for chronic returning patients were not available to consider all feasible transitions of patient's health states or cohorts of particular disease categorised patients.

### *Patient Group*

The sample size from the data collection identified  $n = 3,525$  noncomplex MRI scans (Table 2). The inclusion criteria included knee, lumbar, internal auditory meatus (IAMs), scaphoid, and breast. The noncomplex examination criteria limitations were due to the restricted literature evidence available on reported diagnostic thresholds of reporting radiographers and radiologists in MRI reporting.

### *The Current Intervention*

The NHS currently employs radiologists to report MRI examinations, but drivers for change include the low workforce numbers of UK registered radiologists [14]. The fifth RCR workforce report 2012 [14] recorded the number of UK registered radiologists as 2,997 (4.7 radiologists per 100,000 population); with a current deficit of 421 vacant posts [3]. To reach comparable radiologist levels with the rest of the European Union countries, the RCR estimated it would require an 82% increase of radiologists [12].

The CfWI report on Clinical Radiology [12] commissioned by the Department of Health (DoH) with multiple stakeholders, including the RCR and SCoR, reviewed the RCR 2012 [13] report for the Medical Programme Board and the Joint Working Group on Speciality Training Numbers. Recommendations included a proposed, but not implemented, increase of 60 trainee radiology registrars per year, with the use of radiographers to effectively support the future expansion of radiology.

### *Unit Costs and Discounting*

To ascertain an average hourly price for radiologists, Notten et al's Ready Reckoner for staff costs in the NHS [18] and the Personal Social Services Research Unit (PSSRU) Unit Costs of Health and Social Care 2014 [19] were adopted for the basis of the calculations. The salary was based on a full time equivalent (FTE) mean of NHS medical consultant wages [19]. An additional 33.5% was added for overtime, shift work and geographic allowances [19], National Insurance contributions (NI) [20], and employer's contribution to superannuation [21]. The costs for education and training

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