

Review Article

Errors in Medical Imaging and Radiography Practice: A Systematic Review

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ABSTRACT

Background: Errors in health care can harm patients and undermine public trust, yet many are preventable. In medical imaging and radiography, errors can cause increased radiation dose, misdiagnosis, and clinical mismanagement.

Aim: The purpose of this review was to identify the type and prevalence of errors directly associated with radiography practice and the imaging cycle, with a view to developing recommendations to reduce common errors.

Method: A systematic review was undertaken of current literature obtained through the Ovid Medline and PubMed databases. A total of 41 useable articles were analysed into a priori categories of the medical imaging cycle: preprocedural, procedural, and postprocedural.

Findings: This review found that errors may occur during any phase of the cycle and that communication breakdown, especially during handover periods, was the main contributing factor to errors. Although the importance of incident reporting is well recognised, feedback to users is often limited.

Conclusions: A systematic approach to radiographic practice may assist in reducing communication-related errors. Future research is required to determine how extending radiographers' roles or using electronic ordering systems could also help to reduce errors.

Keywords: Radiography; medical errors; diagnostic errors

RÉSUMÉ

Contexte : Les erreurs dans les soins de santé peuvent nuire aux patients et miner la confiance du public, et pourtant plusieurs d'entre elles peuvent être prévenues. En imagerie médicale et en radiographie, les erreurs peuvent causer une augmentation de la dose de radiation, un mauvais diagnostic et une mauvaise gestion clinique.

But : Le but de cette étude était de recenser le type et la prévalence des erreurs directement associées à la pratique radiographique et au cycle d'imagerie, dans le but de développer des recommandations visant à réduire les erreurs les plus fréquentes.

Méthodologie : Les auteurs ont entrepris un examen systématique de la documentation scientifique recensée dans les bases de données Ovid Medline et PubMed. Au total, 41 articles utilisables ont été recensés et analysés dans les catégories à priori du cycle de l'imagerie médicale: préprocédure, procédure et post-procédure.

Constats : L'examen a constaté que des erreurs peuvent se produire à toutes les étapes du cycle et que les ruptures de communication, particulièrement pendant les périodes de transfert, sont le principal facteur d'erreur. Bien que l'importance du signalement des incidents soit largement reconnue, la rétroaction aux utilisateurs est souvent limitée.

Conclusion : Une approche systématique de la pratique radiographique pourrait contribuer à diminuer les erreurs associées à la communication. D'autres recherches seront nécessaires pour déterminer de quelle façon l'extension du rôle des radiographes ou l'utilisation de systèmes électroniques de commande pourraient aussi contribuer à diminuer le nombre d'erreurs.

Introduction

Errors in health care settings have drawn considerable attention from researchers, health administrators, health professionals, and the general public. Errors that harm patients are known

The author(s) has no financial disclosures or conflicts of interest to declare.

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as adverse events. These adverse events are often preventable [1, 2]. In 2000, the publication of a report by the Institute of Medicine (IoM), “To Err is Human,” provided an extensive investigation into medical errors and became a milestone for subsequent research [3–5]. According to the IoM report, between 44,000 and 98,000 people die every year in the United States from medical errors [1]. After the IoM report was published, studies on the prevalence of adverse events were conducted in several countries, including the United Kingdom, New Zealand, and Canada [6–8]. A recent review combining these studies found the average adverse incident rate to be around 9.2% [9]. Errors have significant impact on patient outcomes, health care workers’ wellbeing, and the public’s trust in the health care system [1]. Studying errors in health care helps to reduce future errors and improve patient care and safety [5, 10]. The main focus of research on errors in health care is on medication and surgical errors [2, 9]. Although errors in medical imaging departments have a high potential for harm [11], they are less frequently discussed in the literature [5]. Errors can occur at any stage of the imaging cycle, potentially leading to incorrect radiation doses to patients, misdiagnosis, or disrupted treatments [12, 13].

This article reports the findings of a systematic review that identifies the types of errors directly associated with radiography practice and the imaging cycle. The purpose of conducting this review was to identify common or preventable errors in radiography practice so that a process may be developed to reduce the prevalence of those errors. This article will conclude with recommendations of which errors might be most easily reduced, and thus implemented by educators, industry, or practitioners undertaking professional development.

Background

The IoM report served as a “wake-up call” [1] to health care practitioners and prompted research into error analysis and measures to increase patient safety [5, 9, 14]. Retrospective medical record reviews of hospital admissions and adverse events were conducted in several developed countries, including the United Kingdom, New Zealand, and Canada [7, 8, 15]. The findings of these studies indicated adverse event rates of 10.8% (110 of 1,014), 12.9% (850 of 6,579), and 7.5% (289 of 3,745), respectively. In addition, all these studies found relatively high percentages of adverse events that could be easily prevented (approximately 40%).

Errors in health care may also directly affect the wellbeing of the practitioner(s) involved in the error [10, 13]. Health care professionals who made errors have experienced feelings of guilt, diminished levels of self-confidence, and fear of being ostracised or losing the respect of colleagues [16, 17]. A survey-based prospective longitudinal study conducted by West et al [18] found that medical errors often led to increased burnout ($P = .002$) and an associated decrease in quality of life for those responsible ($P = .02$).

Errors in radiography practice are harder to quantify [19]. In Australia, the number of incidents in diagnostic radiography reported to the Australian Radiation Incident Register, a national database of radiation incident reports, showed an upward trend in the past few years [20]. The cause of the upward trend is unknown. It may relate to the use of digital imaging equipment and/or an increased compliance with incident reporting, although not enough information is available to suggest either of these factors as contributing to the increase [20].

Within this context, a research question becomes apparent for radiography and medical imaging: what errors occur during the imaging cycle in radiography practice? Once this is answered, a second question emerges: how can errors be reduced? This article will address the first research question through a systematic review. The second question requires further research; however, some themes for research are identified in this article.

Methodology

A systematic review is an academically rigorous literature review that follows established steps to address a research problem. The systematic review allows conclusions to be drawn from examination of the literature by relevance, quality, and methodology [21]. Systematic reviews are suited to problems for which there is an existing body of research but limited consolidation of findings; or where research methodology has been inconsistently applied causing uncertainty in results. The systematic review allows the research question to be rigorously framed, with results presented by themes so further or additional research is targeted and valid. There are a number of recognised approaches to conducting systematic reviews [22–24]. In this case, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for conducting systematic reviews [25] were adopted.

Searches were conducted using Ovid Medline and PubMed databases to obtain publications discussing errors in medical imaging practice. Key words included: error* OR mistake* OR malpractice AND radiography OR radiographer* OR medical imaging OR medical imaging technologist OR radiology. As per the PRISMA guidelines, the articles were assessed for eligibility and relevance for the review. Criteria for inclusion were that the article needed to specifically consider radiography practice and errors. Furthermore, the article needed to be research based, academically rigorous, and peer reviewed. The search was restricted to English language articles published since 1985. Papers were rejected from the review if they related to equipment malfunction. It was also beyond the scope of this article to evaluate specialized areas such as magnetic resonance imaging, ultrasound, nuclear medicine, and radiation therapy. Additional articles were identified by reviewing the reference lists of relevant articles obtained through the search. After eligibility criteria were applied, a total of 41 articles were reviewed.

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