



Are all after-hours diagnostic imaging appropriate? An Australian Emergency Department pilot study



Fergus William Gardiner*, Shaun Zhai

Calvary Health Care Australia, Calvary Hospital Canberra, Cnr Belconnen Way & Haydon Drive, Bruce, ACT, 2617, Australia

HIGHLIGHTS

- This study found that most afterhours, Emergency Department, diagnostic imaging was appropriate.
- This study found that the use of clinical guidelines may enhance patient management.
- This study broadens the limited Australian data associated with inappropriate diagnostic imaging.

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ABSTRACT

Background: This study was aimed at determining the extent to which after-hours diagnostic imaging is appropriate within the case hospital's Emergency Department. This was amid growing concerns of the inappropriateness of some medical investigations within the Australian health-care system.

Methods: After-hours referral data and patient notes were used in reviewing the clinical case. Diagnostic imaging was deemed appropriate if reflective of clinical guidelines, and if not reflective, whether the investigation changed the patient's ongoing management.

Results: Results indicated that 96.37% of after-hours diagnostic imaging adhered to clinical guidelines and was appropriately requested, with 95.85% changing the ongoing management of the patient. The most sought after diagnostic imaging procedures were Chest X-Ray (30.83%), and CT Brain (16.58%), with 99.16% and 98.44% appropriateness respectively. Chest pain (14.49%) and motor vehicle accidents (8.12%) were the leading reason for ordering after-hours imaging.

Conclusion: This study provided an Emergency Department example as it relates to after-hours diagnostic imaging appropriateness. This study found that most after-hours referrals were appropriate.

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1. Introduction

This study was formulated as a pilot study to determine the percentage of appropriate diagnostic imaging within an Australian Emergency Department (ED). Preliminarily, researchers focused on after-hours diagnostic imaging, due to a consensus that a greater percentage of night-time imaging would be more likely to be inappropriate. Results from this study, were thought to provide an indication on whether inappropriate requesting was a problem, before conducting an analysis into day-time requesting trends. The inspiration, for this pilot study was amid the growing concerns around unnecessary medical testing [1–5].

Medical imaging procedures play an important role in patient management and treatment [1]. Diagnostic imaging procedures include: computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), computed tomography (CT), radiographs (X-rays), ultrasounds (US), and nuclear medicine scans. There is interest in the appropriateness of diagnostic imaging [1], and pathology test ordering within Australia [2]. Many radiologists acknowledge that diagnostic imaging is often inappropriately requested by treating clinicians, and that up to a third of all tests are partially or completely unnecessary [3], whereas others have suggested up to 20%–50% are at least in part unnecessary [4,5]. It is recommended that these research percentages be interpreted cautiously, although they do highlight that a least some diagnostic imaging may be inappropriate.

Overutilization has been defined as 'applications of imaging procedures where circumstances indicate that they are unlikely to

* Corresponding author.

E-mail address: gus_gardiner@hotmail.com (F.W. Gardiner).

improve patient outcomes' [1]. Inappropriate medical testing has been defined as 'applications of testing procedures which are performed at the wrong time or too frequently to be of value in diagnosis, prognosis, or ongoing clinical patient management' [2]. This study defines inappropriate imaging, as procedures that do not adhere to clinical guidelines, and do not alter the ongoing management of the patient. Inappropriate diagnostic imaging exposes patients and clinicians to potential risks, associated with ionisation [5]. Medical radiation contributes to just over half of the average total radiation dose to residents within the United States of America. This figure has increased since 1980 where it contributed to less than a quarter of the average dose [1]. The reasons for ordering of diagnostic imaging that does not benefit or improve patient outcomes is often multi-factorial and can include: medico-legal malpractice fears [6], diagnostic un/certainty [7], inadequate training [8,9], requests from consulting and referring physicians, increased workloads within emergency care [10], and patient self-referral [1].

After-hours diagnostic imaging is essential in most large hospitals. After-hours diagnostic imaging should only occur if there is a reasonable probability of changing the patient's management [11]. The after-hours clinical findings should also result in after-hours changes in the patients' management, and not at later times or dates. Many emergency physicians, within the United States of America, agree that they should take a greater role in reducing unnecessary or inappropriate tests [12], although little is known about the extent to which after-hour's diagnostic imaging is inappropriate. In a recent study, researchers reported that 85% of emergency physicians, within the United States of America, believed their patients received too many blood tests, urine tests, and imaging tests. Furthermore, 97% acknowledged ordering at least some unnecessary imaging, including CT or MRIs. The main contributors to these figures included fear of missing a low-probability diagnosis, and medical legal fear [10]. It should be noted that Australian clinicians may not have the same pressures to image as American emergency physicians. This difference in location, to the researchers' knowledge, has not been tested within Australia.

The rate of ED presentations within Australia, per 1000 population, increased by 35% between 2003 and 2008. This increase has resulted in an increased demand and bed shortages, with occupancy rates in many hospitals greater than 85%, which has been considered the maximum level for efficiency [13]. Access block has been linked to increased ED waiting times for medical care, which has led to overcrowding [14,15]. It is unknown whether limiting imaging services to after-hours (on-call) specifically contributes to access block within EDs, although it has been documented that EDs are facing issues associated with the impact of access block associated with radiology and pathology referrals [13]. It is believed that minimising inappropriate medical testing may assist in reducing access block.

There has been limited research into the appropriateness of after-hours diagnostic imaging procedures [10,11,16,17]. A study by Wong and Siddle [11] found that most after-hours radiological procedures were justified, although the researchers did acknowledge that certain tests could be reduced after-hours [11]. While research has been completed, there has been little recent attention related to appropriateness of after-hour's diagnostic imaging in EDs. It is unknown whether ED after-hours diagnostic imaging reflects contemporary research findings into inappropriate medical test ordering. As such, the researchers aimed to determine: The extent to which after-hours diagnostic imaging is inappropriate within the case hospital's ED. The outcomes of this pilot study was designed to guide future research into day-time inpatient diagnostic imaging.

2. Methods

2.1. Study setting and participants

A retrospective chart review was performed at the Calvary Hospital Bruce from the 1st of September to the 30th of November 2015 (13 weeks). The Calvary Hospital Bruce is a 250 bed public hospital located in Canberra Australia. The hospital has many services, including an Emergency Department, an Intensive and Coronary Care Unit, Medical and Surgical Wards, a Maternity Unit, a voluntary Psychiatric Ward, and Ambulatory Care and outreach facilities and services. The hospital is a teaching hospital with associations with local universities.

Participants included, all patients requiring after-hours diagnostic imaging, referring emergency clinicians, and imaging and radiology department employees. The referring emergency clinicians included the senior registrars on the evening (15:00–23:00) and night shifts (22:30–08:30). ED employees were unaware of the study.

2.2. Design

After-hours diagnostic imaging was defined as:

- 1) Involving the imaging department's clinical staff:
 - General Radiographer
 - CT Radiographer
 - Sonographer
- 2) Occurring Monday to Sunday any time after 17:00 and before 09:00.
- 3) Involving Emergency Department patients, including Medical Emergency Team (MET) emergencies (within the Emergency Department).
- 4) Not including procedures booked in-hours although completed after-hours.
- 5) Not including staff over-time hours.
- 6) Not including private hospital patients, who were referred from the private hospital for emergency imaging.

The imaging department's clinical 'on-call' staff were required to record the date, the patient medical record number (MRN), the diagnostic imaging exam completed, the requesting doctor's clinical reasoning, and the time they received the call, followed by the time they concluded the examination(s). The requesting doctor's clinical reasoning was gained verbally, at the time of the referral, and via the imaging referral form. This information was used to guide researchers in reviewing the patient notes.

2.3. Data and statistical analysis

The after-hour's referral data was then used by the researchers in reviewing the clinical case via the patient notes, and the hospital's imaging reporting system. Diagnostic imaging exams were deemed appropriate in the following cases:

- 1) If the documented clinical reasoning met the Australasian College for Emergency Medicine clinical guidelines [18], and/or the Diagnostic Imaging Pathways [19].
- 2) If the documented clinical reasoning did not reflect clinical guidelines, it was deemed appropriate if: The procedure changed the ongoing management of the patient:
 - a. The procedure was relevant to the patients symptoms and provisional diagnosis; AND
 - b. A result (positive, or negative) was used to exclude or confirm a suspected diagnosis; AND

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