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# Rating and Classification of Incident Reporting in Radiology in a Large Academic Medical Center☆

Mohammad Mansouri, MD, MPH, Shima Aran, MD, Khalid W. Shaqdan, MD, Hani H. Abujudeh, MD, MBA*

*Department of Radiology, Massachusetts General Hospital, Harvard Medical School, Boston, MA*

The purpose of this article is to provide a rate of safety incident report of adverse events in a large academic radiology department and to share the various types that may occur. This is a Health Insurance Portability and Accountability Act compliant, institutional review board–approved study. Consent requirement was waived. All incident reports from April 2006-September 2012 were retrieved. Events were further classified as follows: diagnostic test orders, identity document or documentation or consent, safety or security or conduct, service coordination, surgery or procedure, line or tube, fall, medication or intravenous safety, employee general incident, environment or equipment, adverse drug reaction (ADR), skin or tissue, and diagnosis or treatment. Overall rates and subclassification rates were calculated. There were 10,224 incident reports and 4,324,208 radiology examinations (rate = 0.23%). The highest rates of the incident reports were due to diagnostic test orders (34.3%; 3509/10,224), followed by service coordination (12.2%; 1248/10,224) and ADR (10.3%; 1052/4,324,208). The rate of incident reporting was highest in inpatient (0.30%; 2949/970,622), followed by emergency radiology (0.22%; 1500/672,958) and outpatient (0.18%; 4957/2,680,628). Approximately 48.5% (4947/10,202) of incidents had no patient harm and did not affect the patient, followed by no patient harm, but did affect the patient (35.2%, 3589/10,202), temporary or minor patient harm (15.5%, 1584/10,202), permanent or major patient harm (0.6%, 62/10,202), and patient death (0.2%, 20/10,202). Within an academic radiology department, the rate of incident reports was only 0.23%, usually did not harm the patient, and occurred at higher rates in inpatients. The most common incident type was in the category of diagnostic test orders, followed by service coordination, and ADRs.



## Introduction

High-reliability organizations teach us that obsession with errors lead to better safety.[1] Incident reports in medicine and particularly radiology are a window to the possible faults within a hospital or a radiology department.[2] Identification of the magnitude and type of these possible faults may lead to improvement in health care and imaging delivery.[1]

The Aviation Safety Reporting System, which is considered a high-reliability organization, is used to identify both systems and human errors through a well-developed reporting system.[3,4] This system has led to reduction in risks in the aviation industry by collecting, analyzing, reporting, and making necessary changes in the system.[3] They were able to decrease the risk of fatal accidents by 73% in 10 years by implementing systematic investigations of airline crashes and near misses.[5]

An example of early adoption of an incident reporting system in medicine was seen in anesthesia. In 1985, the Anesthesia Patient Safety Foundation was created in the United States as a national incident reporting system to address the causes of high rates of adverse events in the field.[6] Mortality and catastrophic morbidity for healthy patients undergoing routine anesthetics were reduced from 10-20-fold, mainly because of the incident reporting systems.[6] This incident reporting system led to the identification of where the errors occurred and allowed them to be properly addressed.[6] Similar incident reporting systems in Australia, Switzerland, and Germany have also led to improved safety in anesthesia.[7–9] The successful experiences in aviation and anesthesia have led to adaptation of similar national incident reporting systems in other medical fields such as intensive care, transfusion medicine, emergency medical services, pathology, occupational and industrial medicine, pharmacy, and infection control surveillance.[6] Unfortunately, no national radiology safety incident reporting system exists in the United States of America.

The National Reporting and Learning System was established in the United Kingdom (UK) in 2003 by the National Patient Safety Agency as a central database of patient safety incident reports.[10] The National Reporting and Learning System now includes over 9 million incident reports. The 2012 report suggested that “patient accidents-slips, trips, and falls” was the most common incident (26%), followed by “medication incidents” (11%), and “incidents relating to treatment or procedures” (11%).[11] This analysis showed that 68% of reports resulted in no harm, 25% resulted in low harm, 6% in moderate harm, and 1% in death or severe harm.[11]

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* Reprint requests: Hani H. Abujudeh, Department of Radiology, Massachusetts General Hospital, Harvard Medical School, 55 Fruit St, Founders Building, Room 210, Boston, MA 02114.

*E-mail address:* Habujudeh@partners.org (H.H. Abujudeh).

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The Pennsylvania Patient Safety Authority is an independent statewide agency that initiated safety incident reporting in 2004.[12] It is charged with collection of data, identification of problems, and recommendation of solutions to promote patient safety.[12] The 2014 report indicated "errors related to procedure or treatment or test" as the most common event type (23% of total reports) followed by "medication error," and "complication of procedures or treatment or test" (18% and 15% of total reports, respectively).[12] The departments of "critical care" and "general medical or surgical units" had the most frequent safety incident reports (19% and 18% of reports, respectively).[12] In total, 4% of reports were related to the department of radiology.[12] The Pennsylvania Patient Safety Authority 2011 report identified factors within the radiology department that may harm patient safety, including patient misidentification, inaccuracies in procedure verification processes, and order and scheduling inaccuracies.[13] Wrong-procedure or wrong test was the most common safety incident type (50%), followed by wrong patient (30%), wrong side (15%), and wrong site (5%).[13] The most common modality was conventional radiography (45%), followed by computed tomography (CT) (18%), and mammography (15%).[13]

The Radiology Events Register (RaER) was established by the Royal Australian and New Zealand College of Radiologists in 2006 to analyze adverse incidents in radiology.[14] It was designed to collect, classify, and analyze imaging-related incidents to improve quality.[14] RaER has increased the knowledge of the errors that occur in medical imaging care, and made changes possible.[14] The initial report suggested "clinical management" as the most common incident (72%) with "documentation" being the next most common (7%).[15] CT scan was the highest reported modality (30%), followed by x-ray (29%), and ultrasound (16%).[15]

How many incident reports should I expect today in my radiology department based on published data? What are the different incidents that may occur in a radiology department in the United States? Currently, there is no national radiology safety incident reporting system in the United States. RaER provides a great platform; an example that we can follow.[16] Sharing this information among radiology groups may lead to benchmarking and learning from best practices.[16] The aim of our article is an attempt to answer the earlier questions based on our experience in incident reporting in a single large academic institute.

## Material and methods

An institutional review board for human subject research approved our study. Our study was Health Insurance Portability and Accountability Act compliant. Informed consent requirement was waived for this study. Electronic incident reporting system of our institute was searched for the variables. Our institute's electronic incident reporting system was searched for all reports from April 2006-September 2012 including the following variables: diagnostic test orders, identity document or documentation or consent, safety or security or conduct, service coordination, surgery or procedure, line or tube, fall, medication or intravenous (IV) safety, employee general incident, environment or equipment, adverse drug reaction (ADR), skin or tissue, or diagnosis or treatment. Definitions and examples of each category are listed in Table 1.

### *Statistical analysis*

The data were entered into a spreadsheet (Excel 2010, Microsoft) and descriptive analysis was used to calculate rates of safety incident categories, severity levels, and location of incidents (inpatient, outpatient, or emergency).

## Results

There were 10,224 incident reports among 4,324,208 radiology examinations during the study period. The incident report rate was 0.23% (10,224/4,324,208) of examinations. The ratio was 1 incident report for every 423 radiology examinations. Reports were categorized into 14 different categories.

The highest rate of incident reports during the length of the study was due to diagnostic test orders (0.081%; 3509/4,324,208), which represented 34.3% (3509/10,224) of our incident reports. Service coordination was the second most common (0.029%; 1248/4,324,208) which accounted for 12.2% (1248/10,224) of reports. ADR was the third most common incident (1052/4,324,208) which comprised 10.3% (1052/10,224) of our reports. Table 2 describes our results in detail.

The rate of incident reporting was highest in inpatient radiology examinations (0.30%; 2949/970,622), followed by emergency radiology (0.22%; 1500/672,958), and outpatient (0.18%; 4957/2,680,628) (Table 3). Incident reports were mostly in outpatient (52.7%; 4957/9406), followed by inpatient (31.4%; 2949/9406), and emergency radiology (15.9%; 1500/9406) (Fig). The emergency portion was discussed in more detail in a previous publication.[17]

Approximately 1 in 6 incident reports in radiology were associated with patient harm. In all, 48.5% (4947/10,202) were level 0 (no harm—did not affect patient), 35.2% (3589/10,202) were level 1 (no harm—did affect patient), 15.5% (1584/10,202) were level 2 (temporary or minor harm), 0.6% (62/10,202) were level 3 (permanent or major harm), and 0.2% (20/10,202) were level 4 (death) (Table 4). Our data indicated that patient harm occurred at a ratio of approximately 1 in 2600 radiology examinations. Permanent or major harm occurred at a ratio of approximately 1 out of every 70,000 examinations, and death occurred in approximately 1 out f every 216,000 examinations.

## Discussion

One of the resources available to us to benchmark is the Joint Commission. The Joint Commission adopted a sentinel event policy to help hospitals that experience serious adverse events, improve safety, and learn from them.[22] A sentinel event is an event that reaches a patient and results in death, permanent harm, or severe temporary harm.[22] Organizations are strongly encouraged to report sentinel events to The Joint Commission.[22]

The Joint Commission reported on 1102 sentinel events because of wrong patient, wrong site, and wrong procedure from 2004-2014.[23] Their analysis showed leadership, human factors, and communication as the most common root causes.[23] Knowing how often these errors occur and what is the most probable root cause can help prevent future errors. Collecting these types of data helps when comparing the results before and after implementing improvement plans.[23]

A rate of 0.075% for misfiled radiographs in general radiography and 0.429% for radiography in the emergency department have already been reported.[24] In the United States, a radiology-specific incident reporting system addressed 313 patient misidentification incidents in 1617 total incident reports (19% of reports). The rate of misidentification incidents was reported to be 0.017% of all imaging examinations.[25] Wrong patient accounted for 1.3% of our safety incidents. In our institution, we adopted the universal protocol and the 2 identification check system.[13]

Patient transportation requires coordination between services and exposes the patients to increased risk of complications.[26] Communication problems are considered to be the most common safety incidents related to patient transport.[27] The rate of service