Original research article

Application of an incident taxonomy for radiation therapy: Analysis of five years of data from three integrated cancer centres

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ABSTRACT

Aim: To develop and apply a clinical incident taxonomy for radiation therapy.

Background: Capturing clinical incident information that focuses on near-miss events is critical for achieving higher levels of safety and reliability.

Methods and materials: A clinical incident taxonomy for radiation therapy was established; coding categories were prescription, consent, simulation, voluming, dosimetry, treatment, bolus, shielding, imaging, quality assurance and coordination of care. The taxonomy was applied to all clinical incidents occurring at three integrated cancer centres for the years 2011–2015. Incidents were managed locally, audited and feedback disseminated to all centres.

Results: Across the five years the total incident rate (per 100 courses) was 8.54; the radiotherapy-specific coded rate was 6.71. The rate of true adverse events (unintended treatment and potential patient harm) was 1.06. Adverse events, where no harm was identified, occurred at a rate of 2.76 per 100 courses. Despite workload increases, overall and actual rates both exhibited downward trends over the 5-year period. The taxonomy captured previously unidentified quality assurance failures; centre-specific issues that contributed to variations in incident trends were also identified.

Conclusions: The application of a taxonomy developed for radiation therapy enhances incident investigation and facilitates strategic interventions. The practice appears to be effective in our institution and contributes to the safety culture. The ratio of near miss to actual incidents could serve as a possible measure of incident reporting culture and could be incorporated into large scale incident reporting systems.

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1.   Background

While radiation therapy has made impressive gains as a treatment modality for cancer, radiation therapy is not without risk and effective quality management remains essential. Incident reporting systems are invaluable for improving quality and safety; however, developing a suitable system for radiation therapy has been challenging.[1,2] The International Atomic Energy Agency (IAEA) developed a safety reporting and learning tool — Safety in Radiation Oncology (SAFRON) — that supports the voluntary reporting of radiotherapy incidents and near misses.[3] In Europe, the Radiation Oncology Safety Information System (ROSIS) was established in 2001 as a voluntary, web-based reporting tool.[4] A voluntary, web-based reporting tool that uses a comprehensive incident taxonomy has been developed in Canada.[5] In the United States, recommendations for the content and structure of incident learning databases in radiation oncology have been made with the support of professional societies.[2] A national Radiation Oncology Incident Learning System (RO-ILS) was launched in 2014 by the American Society for Radiation Oncology (ASTRO) and the American Association of Physicists in Medicine (AAPM).[6,7] In Australia, the importance of a national incident monitoring system as a risk management and quality improvement tool has been recognised in the Australian Tripartite Radiation Oncology Practice Standards (ROPS)[8] and the National Strategic Plan for Radiation Oncology 2012–2022.[9] However, there is no uniform system for classification of clinical incidents although a number of paper-based and electronic incident reporting systems are in use.[10,11] Our efforts to meet the national standards at our regional centres have been reported previously.[12]

In New South Wales (Australia), incidents in cancer treatment centres are reported and managed using the Advanced Incident Management System (AIMS). Incident definitions in AIMS are necessarily broad as they apply to *all* patient services; the system lacks the native ability to capture radiation therapy-centric incident information such as dose level variation. Moreover, the four-step Severity Assessment Code (SAC), used for grading severity of outcomes from incidents, is incapable of adequately assessing the potential for future changes in toxicity arising from radiation incidents.

2.   Aim

In the light of the above, we set out to develop a clinical incident taxonomy for radiation oncology (incident classification system) based in part, on the work of Arnold et al.[13] and modified to align with the Australian radiation oncology practice

standards. As in the US, it was felt that a database structure more closely reflective of local (Australian) practices would be desirable.[2] The aim was to develop a system, which could provide information about clinical incident trends in radiation therapy, that might support quality improvement.[3,5,14] In particular, near-miss incidents form a valuable source of quality improvement information[1,3,7,15–18] and this aspect was incorporated into the system outputs/learning tools.[19] Here, we report on the application of the taxonomy and analysis of five years of incident data from three integrated cancer centres.

3.   Methods and materials

3.1.   Department characteristics

Our radiation oncology service comprises three centres, which opened between 2007 and 2010, in regional Australia. All staff can lodge incident reports electronically; near-miss reports are encouraged to aid learning and quality improvement. The majority of errors are detected, reported and investigated by experienced Radiation Therapists. Quality and safety initiatives have included revisions to planning quality assurance (QA) checks and audits against national radiation oncology practice standards.[6] Staff have been encouraged to report imaging-related variations as near-miss incidents.

The present study covers the period from January 2011 to December 2015, during which 8432 courses of treatment were provided. The same period saw rapid development and expansion with additional linear accelerator (linac) capacity and staff, along with a range of new technology and practices. This included changes in intensity modulated radiotherapy (IMRT) delivery from step and shoot to dynamic and volumetric modulated arc therapy (VMAT)-based approaches, along with the implementation of a stereotactic body radiation therapy (SBRT) protocol.

3.2.   Data collection and definitions

All incidents — including complaints, staff-related occupational health and safety, trips and falls as well as those from clinical causes — were recorded in the AIMS database in compliance with local and state health policy directives. Definitions of incidents and near misses also met this policy. True adverse events were defined as incidents that resulted in unintended treatment and, potentially, patient harm. A 'near miss' was defined as an actual incident that could have had adverse consequences but did not; this includes an arrested or interrupted sequence, where the incident was intercepted before causing harm.