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Hazards and incidents: Detection and learning in radiation medicine, a comparison of 2 educational interventions

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Abstract

Purpose: Interprofessional, educational live simulations were compared with group discussion–based exercises in terms of their ability to improve radiation medicine trainees' ability to detect hazards and incidents and understand behaviors that may prevent them.

Methods and materials: Trainees and recent graduates of radiation therapy, medical physics, and radiation oncology programs were recruited and randomized to either a simulation-based or group discussion–based training intervention. Participants engaged in hazard and incident detection, analysis, and a discussion of potential preventive measures and the concept of the "highly reliable team." A video examination tool modeled on actual incidents, using 5-minute videos created by faculty, students, and volunteers, was created to test hazard and incident recognition ability before

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and after training. Hazard and incident detection sensitivity and specificity analyses were conducted, and a survey of the participants' and facilitators' perceptions was conducted.
Results: Twenty-seven participants were assigned to the simulation (n = 15) or discussion group (n = 12). Hazard and incident-detection sensitivity ranged from 0.04 to 0.56 before and 0.04 to 0.35 after training for the discussion and simulation groups, respectively. The pre- and posttraining difference in sensitivity between groups was 0.03 (P = .75) for the minimum and 0.33 (P = .034) for the maximum reaction time. Participant perceptions of the training's educational value in a variety of domains ranged from a mean score of 6.58 to 8.17 and 7 to 8.07 for the discussion and simulation groups, respectively. Differences were not statistically significant. Twenty-six of the 27 participants indicated that they would recommend this event to a colleague.
Conclusions: Participants' ability to detect hazards and incidents as portrayed in 5-minute videos in this study was low both before and after training, and simulation-based training was not superior to discussion–based training. However, levels of satisfaction and perceptions of the training's educational value were high, especially with simulation-based training.

Introduction

Despite high quality standards, incidents still occur in modern radiation medicine programs and have the potential to harm patients.[1] An "incident" may be defined as "an unwanted or unexpected change from a normal system behavior which causes or has the potential to cause an adverse effect on persons or equipment."[2] Hazards, or risks, may increase the likelihood of an incident. Reported rates of radiation therapy incidents range between 0.2% and 2% per course; fortunately, the vast majority of incidents have either no or minimal clinical impact.[3,4] However, these incident rates are higher than those in anesthesia, transfusion medicine, or the airline industry.[5-10] Published trend analyses report that common causes of radiation therapy incidents include poor communication and errors in transmission of essential information[11-13]; therefore, in addition to the technical aspects of treatment, quality assurance in radiation medicine should also address all of the interdisciplinary interactions that occur along the patient's path from initial consultation to posttreatment follow-up.[14] Team-based interactions are difficult to change and manage, however.

We provided an interprofessional educational course at our institution that aimed to improve radiation medicine trainees' ability to detect hazards and incidents and understand behaviors that can prevent them. Although simulation, compared with no intervention, has been shown to improve the knowledge, skills, and behaviors of health professionals, it remains to be determined whether simulation is superior to less resource-intensive educational interventions.[15] The primary aim of this study therefore was to compare a live simulation-based exercise with a group discussion in terms of improving trainees' hazard and incident-detection ability and their understanding of preventive behaviors. The secondary aim of the study was to compare participants' perceptions of these 2 interventions.

Materials and methods

Institutional research ethics board approval was obtained. Participants were recruited from the University of Toronto and the Michener Institute programs in radiation therapy. A 3-year degree after 1 or more years of postsecondary education; radiation oncology, a 5-year residency after a doctor of medicine; and medical physics, a 2-year residency after a graduate degree. All of the activities described in this report occurred at the Michener Institute campus building with meeting rooms with audiovisual equipment and external beam radiation therapy and imaging simulation suites that included full-size training linear accelerators and computed tomography scanners.

Simulation group and discussion group

Participants were stratified by discipline and were randomly assigned to either a simulation or discussion group. Each exercise was approximately 2.5 hours in length and was composed of 3 groups of 4 or 5 participants who rotated through 3 stations (Table 1), each taking about 45 minutes and led by a faculty member facilitator. The majority of facilitators, in addition to their education role, also had a career focus on quality control and assurance. The objectives of these training sessions were to examine and practice detecting previous actual hazards and incidents, learn about potential preventive measures, and learn about the concept and practical aspects of a highly reliable team.[16] Before these exercises, all participants attended a didactic lecture that introduced the Canadian Partnership for Quality Radiotherapy and its National System for Incident Reporting in Radiation Treatment taxonomy[17] and reviewed the frequency and types of radiation therapy incidents worldwide.

In the simulation stations, participants initially observed a team of faculty volunteers and simulated patients demonstrating, through acting, a scenario that contained at least 1 hazard or incident. Trainees were encouraged to