

Why an IPE Team Matters... Improvement in Identification of Hospital Hazards: A Room of Horrors Pilot Study

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Purpose: To evaluate student performance in a simulation-based interprofessional learning activity that focused on identifying patient safety hazards in a simulated patient's hospital room.

Participants and Methods: Students from nursing, occupational therapy, physiotherapy, radiography, social education, social work, biomedical laboratory science, dental hygiene, and medicine participated in this two-phased study. In the first phase, students worked alone to identify safety hazards. In the second phase, students worked in interprofessional teams. Following each phase, students completed a structured questionnaire to report their findings. In addition, following the first phase, each student wrote down the hazards they identified in an unstructured essay format.

Results: Out of 48 intended hazards, individual students identified 10.7% on the open essay and 42.6% on the questionnaire, and interprofessional teams identified 90.1%.

Conclusion: The number of hospital hazards identified increased considerably when working in interprofessional teams. A room of horrors exercise expands participants' observational skills. With some modifications, this pilot study can be implemented on a wider scale with the goal of increasing interprofessional students' awareness of hospital hazards.

Keywords: hospital hazards, interprofessional learning, simulation-based learning, team based learning, questionnaire

Introduction

Estimates indicate that 16.8 million adverse events occur globally each year.¹ Adverse events (AE) are defined as “unintended physical injuries resulting from medical care that require additional monitoring, treatment or hospitalization, or that result in death”, including hospital infections, malpractice, failure of medical devices, medical errors, falls, and development of pressure ulcers.² These events are costly, may prolong the patient's rehabilitation, and can ultimately lead to death.³ In developed countries, healthcare errors have been cited as the third leading cause of death,⁴ and represent a major source of morbidity and mortality globally.

The responsibility to prevent AE belongs to the hospitalized patient's interprofessional care team, who must not only manage the existing health problem but also prevent the myriad of potential AE that could occur during the patient's hospitalization.³ The rising incidence of AE reveals a crucial need for training and education to help these teams to identify and mitigate patient safety hazards.⁵ Despite the team-based nature of hospital care, patient safety training to reduce hazards of hospitalization has rarely been team based or interprofessional.³

Active learning strategies that focus on patient safety can be beneficial for skill retention and transfer upon graduation from a health professions program.⁶ In particular, simulation-based education has emerged as an essential pedagogical approach for identifying and managing patient safety concerns.^{7,8} In addition, it enables students to learn from mistakes without compromising the care of real patients.^{6,9} The purpose of this pilot study was to evaluate student performance in a simulation-based

interprofessional learning activity that focused on identifying patient safety hazards in a simulated patient's hospital room. The aims were to: (a) describe the ability of health professions students to identify pre-staged safety hazards and (b) compare the ability of individual students and interprofessional student teams to identify pre-staged safety hazards.

Background

The Room of Horrors (ROH) simulation exercise was developed using elements of team-based learning (TBL), interprofessional education (IPE), and simulation-based learning (SBL). Team-based learning activities provide opportunities to apply conceptual knowledge as part of a team.¹⁰ Central to the idea of TBL is a sequence of three distinct phases: (1) Individual preparation, (2) Individual and team readiness assurance testing with an instructor-led discussion, and (3) Team application. This final step is the most important component of TBL as it positions students to solve significant problems within the discipline while making decisions as a team. In contrast to traditional group projects, TBL activities emphasize the importance of individual preparation so that contributions to the group do not fall on the shoulders of one or two high-performers; the student's final grade for a TBL activity is a function of their individual performance and the team performance.¹¹

The TBL approach was originally developed in undergraduate business programs but has been successfully implemented in a variety of graduate and undergraduate health professions programs, including nursing, dentistry, medicine, and veterinary sciences.¹² Although TBL has traditionally been described as an intraprofessional activity, the increasing emphasis on interprofessional teamwork has created an opportunity for health professions educators to develop TBL activities that include interprofessional student teams.¹³

IPE occurs, "when learners from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes".¹⁴ Health professions educators have acknowledged the foundational importance of IPE to the development of practice-ready clinicians, who must work within interprofessional teams for optimal patient care. However, best practices in IPE continue to evolve in response to a dynamic, complex, and often unpredictable health education landscape.

Simulation has emerged as a key pedagogical approach to both TBL and IPE. SBL can take a variety of forms, but a key feature is an active-learning scenario that requires learners to apply both conceptual (eg, discipline-specific content, team dynamics) and contextual (eg, situational awareness) knowledge to solve a real-world problem in a simulated clinical environment.^{7,8} This allows learners to identify and correct mistakes without compromising the care of real patients.⁶ Moreover, SBL can be used to promote intra- and interprofessional problem solving, critical thinking, and affective change. Non-technical skills, including communication, collaboration, leadership, and management, can also be developed through SBL.^{8,15,16}

The simulated environment, storyline, and consequences are carefully prepared according to a set of learning objectives.¹⁷ The scenario can involve a full-body manikin, task trainer, standardized patient, avatar, or combination of these, along with realistic props, furniture, medical equipment (eg, telemetry monitors), and other audiovisual cues to replicate the look and feel of a particular health care setting. As learners progress through the scenario, their decisions and actions lead to natural consequences for the simulated patient. For example, if a learner inserts a chest tube into a manikin who has a simulated pneumothorax (eg, unilateral absent lung sounds, tachycardia, tachypnea, hypoxemia), the manikin can be programmed to respond with clear lung sounds bilaterally and improved vital signs.

Additional key features of SBL are the prebriefing and debriefing phases. During the prebriefing phase, learners are oriented to the learning objectives, scenario, and simulated environment and equipment. The facilitator may also provide a brief review of content that is relevant to the scenario. Following the prebriefing phase, learners complete the simulation scenario. Most of the learning in SBL occurs during the debriefing phase.¹⁸ During debriefing, a facilitator guides the learners to reflect on their performance during the scenario. The focus of this phase is primarily on the learning objectives, but it inevitably includes a review of "what went well" and "what didn't go well". Learners generally complete an evaluation of their experience in the simulation following the debriefing phase.

These three pedagogies – TBL, IPE, and SBL – are not mutually exclusive. Both TBL and SBL have been used, alone or in combination, as frameworks for IPE activities. However, research about this approach is limited. Recommendations

and standards have been developed for faculty interested in creating TBL, SBL, and IPE activities;¹¹ however, a standardized approach for integrating these three pedagogies has not been fully described.

Given the heavy content load, clinical requirements, and logistical challenges facing many health professions programs, identifying a “one-size-fits-all” approach to integrating TBL, SBL, and IPE is probably unlikely. Burgess and McGregor¹³ have identified a variety of challenges in integrating IPE and TBL, with or without SBL, which include an unequal distribution of students within teams, varied levels of student experience with TBL, a lack of resources to support large student groups, time constraints, design of patient cases that suit multiple disciplines, and others. Until these barriers to integration can be overcome, health professions faculty must tailor the pedagogical underpinnings of these three approaches to suit the resources, needs, and priorities of their specific academic settings. This philosophy was used to guide the development, implementation, and pilot evaluation of our ROH simulation activity.

Materials and Methods

Design

This pilot study used a mixed methods descriptive design, collecting data from self-report questionnaires and open-ended essay responses.

Participants and Setting

This pilot study randomly, by number generation, recruited thirty-six 3rd-year health professions students participating in a one-week interprofessional course arranged by two universities in Western Norway. The students came from nine different health professions (nursing, occupational therapy, physiotherapy, radiography, social education, social work, biomedical laboratory science, dental hygiene, and medicine students in their 5th year), with four students from each profession. One medical student had to drop out of the project leaving us with 35 participants. The small number of students was recruited due to time and space restrictions and limited faculty availability. Students in the interprofessional course who did not enroll in this pilot study participated in other group learning activities. Participants from the nine professions did not know one another prior to this ROH activity.

The study team determined that both biomedical laboratory science students and dental hygiene students were appropriate for the study due to their important roles within the interprofessional care team in Norway. Biomedical laboratory science students obtain blood samples and analyze biological material, and dental hygienist prevent diseases of the oral cavity and promote dental health. Both of these members of the health care team are involved in ensuring patient safety.

The setting for this learning activity was a high-fidelity simulation room equipped with a mannequin in a hospital bed and walking aid props for rehabilitation. The simulation scenario was designed by a team of nurse researchers and patient safety experts, and it involved the acute care of a patient who is recovering after a cerebrovascular accident (CVA). Students were provided with an overview of the scenario prior to the experience (Table 1).

A total of 48 patient safety hazards were intentionally placed throughout the room and in the simulated patient's hospital record. These specific hazards were chosen based on a review of the literature that focused on common patient safety hazards in the hospital setting.^{3,19–21} Validity of these hazards was established by a panel of experts, including educators within the nine different professions and clinicians from a hospital ward treating patients suffering from a stroke. Hazards were categorized according to seven distinct domains: infection control, prevention of hospital-acquired infections, safe care, medication safety, vital signs, blood tests, and safe discharge. The safe discharge domain was tailored to the needs of a patient being discharged from the hospital after a CVA.²² For the purpose of this learning experience, the setting was referred to as the “Room of Horrors”.

Data Collection

A questionnaire that lists the 48 patient safety hazards was developed in two nearly identical versions. One version (IROH) was to be completed by each individual student, and the second version (TROH) was to be completed by the interprofessional teams. In addition to the IROH questionnaire, each student submitted an open-ended essay in which

Table 1 Scenario

<p>Day 1</p> <p>Klara Kronstad, 58, admitted to hospital at 08.00 with apoplexia cerebri. She has decreased strength on the left side of the body, dysphagia and neglect. She reports being hospitalized in Spain a month ago for dizziness and severe headache, and high blood pressure was identified. Other diagnosis: Type 1 diabetes. Operated mastectomy and axillary lymph node dissection on the left side 10 years ago. Allergic to penicillin. CT did not show signs of intracranial hemorrhage. ECG shows atrial fibrillation frequency 125. BP 160/90 mm/Hg. SpO2: 93%. Temperature: 38.1 Celsius degrees tympanic.</p> <p>Height 1.75 m and weight 60 kg. Foley catheter inserted. Peripheral venous catheter placed in the left arm for fluid treatment. Thrombolysis treatment starts at 08.50. Oxygen therapy is ordered. Blood glucose 11.3 mmol/L (203 mg/dL). Other blood test are normal. Klara is an educated preschool teacher and works in a 100% position. She is married and has a son and daughter in the 30s. The daughter lives in another town and her son lives at home because of challenges associated with social anxiety. The patient wears glasses for myopia.</p>
<p>Day 2</p> <p>Klara Kronstad has together with the physiotherapist been sitting on the bedside and tested balance. She has problems with daily activities. Also, still dysphagia and problems with the intake of food and drinks. She complains about soreness of the oral cavity and a dental hygienist is contacted. She receives a central line catheter and total parenteral nutrition. At 17:00 the temperature is measured to 39.5 Celsius degrees tympanic. Urinstix gives positive results. Blood samples are taken from the left arm, as well as blood culture from the central line. Selexid 400 mg x 3 iv is ordered for urinary tract infection. In the evening she becomes confused and wondering where she is. CRP 260 mg/L, blood glucose 10.0 mmol/L(180mg/dL), HbA1c 7.0%.</p>
<p>Day 3</p> <p>She now feels better. The morning temperature is now 37.4 Celsius degrees tympanic. Her swallowing difficulties are diminishing. She expresses a strong desire to start drinking and eating herself. She would like to read in a magazine but cannot find her glasses. After lunch, the occupational therapist and physiotherapist will look at her needs for home aids. She is wondering about sick leave and her rights towards the employer and an appointment with a social worker is arranged. She is thinking a lot about how to support her son in the future and a social worker will come and talk to her. Discharge is planned at day 6 with home rehabilitation.</p>

they were asked to list the safety hazards they identified. This essay was completed on a computer outside of the ROH using Microsoft Word after they toured the room individually, but before they saw the IROH questionnaire. The timeline for data collection is described in [Figure 1](#).

Intervention

The intervention for this study consisted of a self-guided tour through a simulated patient’s hospital room and medical record. This simulation included a prebriefing phase, the ROH event, and a debriefing phase. The timeline for the intervention is summarized in [Figure 1](#). The prebriefing phase began 14 days before the ROH event. During this phase, students were given a description of the ROH concept, reading materials, and the expected educational outcomes of this activity.

The ROH event occurred over 2 days. On the first day of the event, students received a verbal description of the ROH setting and toured the ROH within their own health professions group. Although they toured in groups, they were

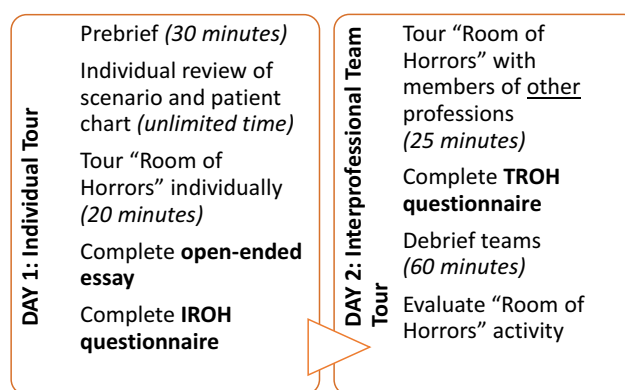


Figure 1 Room of horrors project timeline.

instructed not to verbally or nonverbally share their findings with other members of their group. A study assistant was stationed both in the ROH and in the documentation area to assure independent work. Following this self-guided tour, students recorded their findings in their open-ended essays and on the IROH questionnaire. On the second day of the event, students toured the ROH as part of their assigned 9-member interprofessional group. One student from each health profession was represented in each group, apart from one group which did not have a medical student. During this tour, students were encouraged to discuss findings along the way with the other members of their group. Following this tour, teams recorded their findings on the TROH questionnaire.

The debriefing phase occurred immediately following the TROH simulation exercise and data collection. During debriefing, each team gathered for discussion and reflection about the consequences of safety hazards that were discovered, safety hazards that were not detected, and means of preventing AE in a hospitalized patient. Debriefing was led by two experienced nurse educators with expertise in simulation-based learning. Following the debriefing session, students were asked to individually evaluate the exercise, including whether the ROH simulation exercise should be repeated for future IPE students, be repeated with modifications, or not be offered at all.

Analyses

To compare individual hazard detection to interprofessional team hazard detection, we used results from the IROH and TROH questionnaires, respectively, to calculate the proportion of students or teams who identified each type of patient safety hazard. The denominators for this analysis were either 35, representing the 35 students who completed an IROH questionnaire, or 4, representing the 4 interprofessional teams who completed a TROH questionnaire. The mean number and proportion of students who detected each hazard was also calculated.

To compare individual hazard detection across professions, we calculated the proportion of patient safety hazards that were reported based on either the individual open essays or the IROH questionnaires. The denominator for this analysis was 48, representing the total number of individual patient safety hazards in the simulation.

Finally, to compare the detection of each patient safety hazard across report type (open essay, IROH, TROH), we calculated the proportion of patient safety hazards that were reported on each of these reports. The denominators for this analysis were 35, 35, and 4, respectively, to represent 35 students who completed the open essay and IROH questionnaire, and 4 to represent the number of teams who completed a TROH questionnaire.

Ethics

The ROH simulation exercise was mandatory, but participation in the study was voluntary. The students who participated in the study gave written consent for use of the questionnaire results and course evaluation. The study was approved by the Norwegian Centre for Research Data (project number 475132).

Results

Table 2 describes detection of the 48 intended hospital hazards, both in the IROH and the TROH, showing that the number of hazards identified increased considerably when working in interprofessional teams. On average, fewer than half of the students working alone reported each safety hazard, whereas almost 90% of the interprofessional teams were able to identify each hazard (Figure 2). Detection level in the IROH questionnaire reached a level of 50% or more for 18 out of 48 intended hazards (Table 2). Among individual students, the most commonly identified hazard was dangerous bed height (71.4%), and the least commonly identified hazard was a body mass index less than 20.5 (8.6%). Nearly all of the hazards were identified by all 4 teams, and the least commonly identified hazards by teams included a lack of indication for a Foley catheter, blood glucose too high and not treated per guidelines, no pressure ulcer mattress, a body mass index less than 20.5, the wrong nutritional supplements, and a lack of several assessments upon discharge (all 50%).

The number of identified safety hazards differed by profession and by report type (Table 3). Medical students (85.4%) and nursing students (66.7%) correctly reported more safety hazards than the other seven professions.

The structured questionnaires were superior to the open essay format for reporting safety hazards, with an average of 42.9% of hazards reported in the IROH questionnaire, 90.1% in the TROH questionnaire, and 10.7% in the open essays (Figure 2). However, the open essays allowed students to report safety hazards that were not reportable on the IROH or

Table 2 Detection of Hospital Hazards in IROH and TROH Questionnaire

Types of Hazards	IROH N=35		TROH 4 Teams	
	N	%	N	%
Infection Control				
Hand sanitizer empty	4	11.4%	4	100%
Hand disinfection empty	7	20.0%	4	100%
No masks for droplet precautions	20	57.1%	4	100%
No protective coat	27	77.1%	4	100%
No MRSA screening	13	37.1%	4	100%
No isolation signs on the door	22	62.9%	3	75%
Prevention of Health Associated Infections (HAIs)				
Head of bed < 30 degrees	22	62.9%	4	100%
Not prescribed cough and breathe exercises	11	31.4%	3	75%
No thickener added in the drink for a patient with dysphagia	15	42.9%	4	100%
Foley not indicated	6	17.1%	2	50%
Foley not fixated the right way	11	31.4%	3	75%
Insertion site for central line catheter not covered with semipermeable dressing	13	37.1%	4	100%
The connection was missing a plug in the central line catheter	5	14.3%	4	100%
The peripheral venous catheter had contaminated dressing	18	51.4%	4	100%
Equipment for oral care was lacking	25	71.4%	4	100%
Safe Care				
Oxygen ordered, but not connected	16	45.7%	4	100%
Paracetamol not given according to stroke guidelines	9	25.7%	4	100%
Temperature > 39 degrees not controlled with rectal measurement	9	25.7%	3	75%
Blood sugar too high and not treated according to guidelines for stroke	8	22.9%	2	50%
Crumpled bedding is a risk for pressure ulcers	9	25.7%	4	100%
No pressure ulcer mattress in bed	10	28.6%	2	50%
Not relief pads under both heels	19	54.3%	4	100%
No screening for pressure ulcer	8	22.9%	4	100%
No screening for fall risk	10	28.6%	3	75%
No order for restraints	23	65.7%	4	100%
The bed was too high	26	74.3%	4	100%
No walking aids in the vicinity	19	54.3%	4	100%
No nutrition screening	6	17.1%	3	75%
BMI < 20.5	3	8.6%	2	50%
Wrong management way for nutrition supplements	5	14.3%	2	50%

(Continued)

Table 2 (Continued).

Types of Hazards	IROH N=35		TROH 4 Teams	
Medication Safety				
Unlabelled drugs were prepared for administration laying on the nightstand	14	40.0%	4	100%
IV fluid hanging was not ordered	8	22.9%	4	100%
Penicillin allergic, but hanging	8	22.9%	3	75%
Total parenteral nutrition did not have an additive patch for vitamins and minerals	10	28.6%	4	100%
Vital Signs				
No respiration rate documented	17	48.6%	4	100%
No consciousness level documented	18	51.4%	3	75%
No pupil reaction documented	23	65.7%	3	75%
No facial expressions documented	23	65.7%	3	75%
Blood Tests				
Blood culture taken from central venous catheter	8	22.9%	4	100%
Blood tests taken from the left arm	13	37.1%	4	100%
No identification bracelet	23	65.7%	4	100%
Safe Discharge				
Lack of assessment of secondary prophylaxis, antithrombotic treatment, blood pressure treatment, lipid therapy, diabetes treatment, and lifestyle changes	7	20.0%	2	50%
Lack of assessment of complications and complication risk	15	42.9%	4	100%
Lack of assessment of rehabilitation needs and rehabilitation potential	18	51.4%	4	100%
Lack of assessment of the home situation	19	54.3%	3	75%
Lack of information about driving and driving bans	25	71.4%	4	100%
Lack of information about patient associations	17	48.6%	4	100%
Lack of clear agreements for follow-up after discharge	25	71.4%	4	100%

TROH questionnaires. Examples of these hazards included (a) that the manikin's mouth was open, which can cause dryness and other mouth complications, (b) that the bed should stand next to the wall as the patient had hemispatial neglect on the left side, (c) that the brakes on the bed were not engaged, and (d) that tests for activities of daily living, muscle strength, cranial nerves, and reflexes were missing. Also, there were concerns expressed regarding how the room was arranged and that the atmosphere of the room was "cold".

Among the 7 patient safety domains, the most commonly reported concerns on the IROH were related to vital signs (57.9%) and on the TROH were related to blood tests (100%). The least commonly reported concerns by individuals were related to medication safety (28.6%) and by teams were related to vital signs (81.3%). Interprofessional teams correctly reported nearly twice as many safety hazards as individual students.

Students generally offered a favorable review of the ROH exercise. Slightly over half (54%) wanted to repeat the ROH exercise in the same format, while 46% wanted it repeated with some modification. Students recommended the following modifications: (a) replacing the manikin with a live actor portraying the patient in order to enable

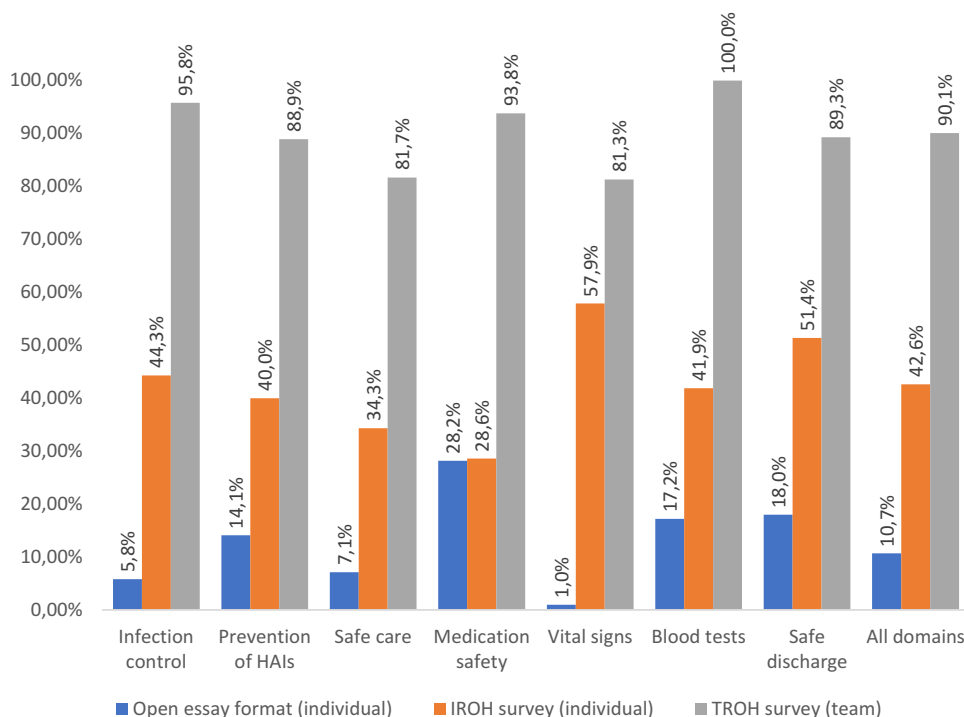


Figure 2 Mean percent detection scores for open essay format, IROH questionnaire, and TROH questionnaire for all students, based on number of hazards in each domain. **Notes:** Mean percent detection scores were calculated based on the proportion of hazards within a category that were correctly identified out of the total number of hazards that were present in that category. For the full list of hazards within each category, please refer to Table 2.

communication, (b) using a scenario more relevant to healthcare professions other than nursing and medicine, (c) allowing intraprofessional teams to speak together when they enter the IROH, (d) permitting more time to record and discuss hazards, (e) allowing participants to become better acquainted with the team on the first day, and (f) expanding the concept to allow the team to conduct patient care according to best practice and guidelines. No students recommended that the ROH exercise be discontinued in future semesters.

Table 3 Percentage of Detected Hospital Hazards for Each Profession

Professions	All Domains - 48 Hazards			
	Open Essay Format		IROH Questionnaire	
	N	%	N	%
Biomedical laboratory science students (N=4)	3	6.3%	14	29.2%
Dental hygienist students (N=4)	3	6.3%	9	18.8%
Medical students (N=3)	15	31.3%	41	85.4%
Nursing students (N=4)	8	16.7%	32	66.7%
Occupational therapist students (N=4)	2	4.2%	11	22.9%
Physiotherapist students (N=4)	4	8.3%	23	47.9%
Radiographer students (N=4)	5	10.4%	23	47.9%
Social education students (N=4)	4	8.3%	23	47.9%
Social worker students (N=4)	2	4.2%	8	16.7%

Notes: Percent detection for the open essay format and IROH are based on the total sum of correct detection of hazards within professions, as a fraction of the total sum of possible hazards.

Students also reported that their understanding of safety hazards depends on the perspectives of multiple professions, and that they had discovered the importance of working together with other professionals to identify a fuller range of threats to patient safety.

Discussion

Previous studies have called for research that tests the impact of interprofessional versus intraprofessional teams in identifying hazards of hospitalization.²³ We have piloted a ROH simulation exercise with students from nine healthcare professions and compared individual versus team identification of patient safety hazards. The aims of our study were to: (a) describe the ability of health professions students to identify pre-staged safety hazards and (b) compare the ability of individual students and interprofessional student teams to identify pre-staged safety hazards. A combination of team-based learning and simulation-based learning strategies were used to develop this learning exercise.

When working independently, individual students were less able to identify patient safety hazards. However, there was considerable variability in performance, depending on the specific patient safety hazard and hazard domain. For example, only 4 students (11.4%) identified that the hand sanitizer container in the patient's room was empty, but 27 students (77.1%) identified that a protective gown was not worn for contact precautions. No hazard was detected by all of the students while working independently.

There seemed to be marked differences in the accuracy of hazard identification, based on the student's profession. Medical students were able to identify 85.4% of hazards, whereas social work students were only able to identify 16.7%. The accuracy of hazard identification among students from the other seven health professions (nursing, physiotherapy, radiography, social education, biomedical laboratory science, occupational therapy, and dental hygiene, in descending order) was between those of medical and social work students.

Interprofessional teams were able to detect patient safety hazards more accurately than were individual students working independently. In fact, most of the hazards (64.6%) were correctly identified by all of the interprofessional teams. This finding suggests that students, and perhaps licensed health care professionals, should consider a deliberate, team-based approach to identifying, discussing, and mitigating patient safety hazards in the hospital setting. Unfortunately, the small number of teams in the study precluded us from performing a meaningful statistical comparison of these data.

Our results is consistent with findings from Clay et al,³ who compared nursing and medical students' individual identification of hazard to team identification of hazards. Students in Clay's study reported that it was much easier and faster to identify problems as a team with supporting colleagues, increasing their confidence that what they saw was actually a problem, in addition to identifying a broader range of hazards than they would have identified themselves. However, students in Clay's study felt vulnerable when the low identification rate of hazards were presented to them, since they had thought that the exercise was easy. Similarly, Zimmerman et al²⁴ reported that licensed health care professionals found it difficult to identify patient safety hazards when working independently. When these professionals were assigned to work in interprofessional groups, their ability to identify hazards increased significantly.

In a cross-sectional study of students and professionals from nursing, medicine, pharmacy, social work and psychology, Wang et al²³ found that the training and background of the different professions were associated with significant differences in the type of hazards that were identified. Moreover, Wang's study found that nursing and medical students were able to identify hazards at similar rates as licensed nurses and physicians, implying that students should feel empowered to voice concern over patient safety hazards in the clinical setting.

The method of reporting patient safety hazards affected how many hazards each individual student identified. The open-essay format, in which students listed the hazards they found on a blank piece of paper, led to only 10.7% of hazards being identified, compared to 42.6% of hazards being identified on a structured questionnaire. When working in teams, the questionnaire format led to 90.1% of hazards being correctly identified. Although the open-essay format was associated with the most unidentified hazards, students used this unstructured format to report hazards that were not intentionally placed in the scenario. Therefore, it may be reasonable to use a combined approach for hospital hazard identification that includes both a structured checklist and an unstructured open-essay section. Vincent et al²⁵ recommended an approach to hazard and error identification using multiple methods that are developed within a local, setting-

specific context. These may include checklists, unstructured “comment cards,” anonymous hazard reporting hotlines, and safety rounds. Regardless of the methods used, interprofessional team-based hazard identification is likely to be more effective than hazard identification by one individual or one profession.

Strengths and Limitations

To our knowledge, this was the first study to examine the ability of students from nine distinct health professions programs to identify common patient safety hazards using a simulation-based, team-based, and interprofessional approach. Although our findings seem to reflect the strength of this approach to teach students about patient safety, there are several important limitations of this pilot study.

A pilot study is intended to guide the planning of a large-scale investigation, but quite often the emphasis is wrongly placed on statistical significance, not on feasibility - which is the main focus of the pilot study.²⁶ Although we were able to report on the ability of both individual students and student teams to identify safety hazards, we were unable to test for a statistically significant difference between individuals and teams due to a small sample size. Furthermore, this small sample size may not truly represent the general population of health professions students. Nevertheless, these results provide preliminary evidence to support the need and feasibility of a larger study that can further explore the effect of this innovative team-based patient safety training program.

A second limitation involves the content of our simulation scenario, which focused on the hospital care of a patient recovering from a CVA. In their evaluation of the learning exercise, several students noted that the scenario, including the hospital room environment, may have been more familiar to students in medical or nursing programs. While this may have disadvantaged individual students from non-medical or non-nursing programs, the intent of interprofessional educational experiences is to promote the sharing of each professions' roles and responsibilities with each other. The markedly higher performance on team-based hazard identification validates that this likely occurred in our study.

Another important limitation was the limited amount of time students had to complete their open essays and IROH questionnaires. This may have limited the number of hazards they were physically able to recall or list from their independent self-guided tour of the simulation space. Compared to other studies that evaluated hazard identification among students,^{3,20,21,24,27} our study had a much higher number of pre-staged safety hazards. However, we neglected to increase the time limit during the data collection phase to account for this longer list of hazards.

Recall and testing biases likely affected the validity of these findings. The safety hazards in our simulated patient room did not differ between the individual exercise and the team exercise, which occurred on two consecutive days, and nor did the content change on the IROH and TROH questionnaires. Students may have remembered what they observed during their individual tour of the room or marked on their individual checklists and carried this information into the team exercise the following day. This might be one factor to explain why team performance was substantially higher than individual performance. Future studies should consider a crossover design in which students are randomly assigned to complete the individual tour or the team tour on the first day. Alternatively, or additionally, the specific hazards placed throughout each of these rooms could be different, allowing a unique experience between their individual and team tours.

Furthermore, we are aware of the possibility of an evaluator effect when asking participants to evaluate the course.²⁸ Despite this concern, students felt comfortable proposing numerous modifications to the ROH exercise for further development. These proposed modifications should be considered in future tests of the ROH learning activity.

Despite these limitations, our study was strengthened by the use of best practice guidelines for simulation-based education.¹⁷ Most notably, we incorporated a debriefing session immediately following the team-based portion of the activity, which facilitated meaningful learning from this exercise. A post-test several months after the initial exercise, using a new simulation scenario, would have been beneficial to assess the participant's knowledge retention of hospital hazards presented in the ROH course. A follow-up was unfortunately not possible in our study due to time constraints.

Implications for Interprofessional Practice and Healthcare

In this study, we found that health professions students did not correctly identify most patient safety hazards while working independently, but interprofessional teams of health professions students were able to detect almost all of the safety hazards that were present. Reliance on a single health care professional, or even a single health profession, may

lead to underdetection of patient safety hazards, avoidable AE's, and negative clinical and economic outcomes. Interprofessional team-based approaches to improving patient safety could take a variety of forms in practice, and it is unlikely that one approach will work, or even be usable, in every institution. However, simulation-based learning methods, such as the ROH simulation exercise, could serve as easily reproducible, portable, safe, and inexpensive options for training health professions students to learn about interprofessional team-based AE prevention. Activities such as the ROH simulation exercise can also be readily adopted for use during initial orientation to a facility for licensed health professionals. These exercises may have an explicit focus on patient safety, but they can also, by design, support a deeper understanding and appreciation of the roles and responsibilities, perspectives, and values of other team members. In particular, those who regularly survey the hospital environments for safety hazards, such as those who work in Quality Management, Performance Improvement, or Risk Management, can use these exercises as opportunities to engage with clinicians who may be less familiar with safety from an administrative perspective.

Future Studies

Questions remain concerning the use of IPE, such as the best time to initiate collaborative learning, which educational models work best, and how IPE may be translated from the classroom into the clinical setting. Attempts to bring all health care professional students in one university together to learn with, from, and about one another can involve a huge number of participants; however, with appropriate planning, motivation and commitment, logistical factors can be mitigated.²⁹ Studies of IPE involving professionals with clinical experience and students without it have shown no differences in their comparative ability to correctly identify hazards.^{20,23} Hence, such training could also be conducted in hospitals mixing students and professionals to strengthen situational awareness. More robust study designs are needed to test the impact of intraprofessional versus interprofessional teams in identifying hospital hazards, also incorporating demographics such as age, sex and years of experience to control for these variables.

Conclusion

The number of hospital hazards identified increased considerably when working in interprofessional teams. Despite study limitations, the students gained an appreciation for each other's roles and responsibilities, which can ultimately make an impact on delivering safe patient care. A Room of Horrors exercise expands participants' observational skills, critical thinking skills and situational awareness skills. With some modifications, this pilot study can be implemented on a wider scale with the goal of increasing interprofessional students' awareness of hospital hazards.

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Disclosure

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