ORIGINAL ARTICLE

Can implementation of *in situ* simulation support rural emergency provider self-confidence and improve patient safety? A mixed-methods study

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Abstract

Introduction: Rural emergency departments across Canada face challenges such as limited access to continuing medical education and resource constraints. Our study evaluates *in situ* Simulation (ISS) as an educational tool in a small rural emergency department, focusing on participant satisfaction, clinician confidence and the identification of latent safety threats (LSTs).

Methods: Five monthly ISS sessions were conducted during active clinical hours, involving physicians, nurses and nurse practitioners selected through convenience sampling. After each session, participants anonymously completed the validated student satisfaction and self-confidence in learning survey and short-answer questions to identify LSTs.

Results: Participants reported high satisfaction with ISS, and high confidence in clinical skills post-simulation. Thematic analysis of short-answer responses identified several LSTs in clinical care systems, which were brought for review by department leadership to improve patient and provider safety.

Conclusion: ISS is a feasible and valuable educational strategy for rural healthcare providers, promoting participant satisfaction and enhancing confidence in managing acute situations. In addition, it effectively identifies safety issues, contributing to improved patient care. This model can inform similar initiatives in other rural settings facing educational and resource challenges.

Keywords: *In situ simulation,* rural emergency departments, rural simulation

Résumé

Introduction: Les services d'urgence en milieu rural à travers le Canada font face à des défis tels que l'accès limité à la formation médicale continue et les contraintes de ressources. Notre étude évalue la simulation *in situ* (SIS) comme outil pédagogique dans un petit service d'urgence rural, en mettant l'accent sur la satisfaction des participants, la confiance des cliniciens et l'identification des menaces latentes à la

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sécurité.
Méthodes: Cinq séances mensuelles de SIS ont été réalisées pendant les heures cliniques actives, réunissant des médecins, des infirmières et des infirmières praticiennes sélectionnés par échantillonnage de convenance. Après chaque séance, les participants ont rempli de façon anonyme le questionnaire validé *Student Satisfaction and Self-Confidence in Learning Survey* (SCLS), ainsi que des questions à réponses courtes visant à identifier les menaces latentes à la sécurité.
Résultats: Les participants ont rapporté un haut niveau de satisfaction à l'égard de la SIS et une grande confiance dans leurs compétences cliniques après les simulations. L'analyse thématique des réponses courtes a permis d'identifier plusieurs menaces latentes à la sécurité dans les systèmes de soins cliniques, lesquelles ont été soumises à l'examen de la direction du service afin d'améliorer la sécurité des patients et des prestataires.
Conclusion: La SIS constitue une stratégie pédagogique réalisable et précieuse pour les professionnels de la santé en milieu rural, favorisant la satisfaction des participants et renforçant leur confiance dans la gestion des situations aiguës. De plus, elle permet de cerner efficacement des enjeux de sécurité, contribuant ainsi à l'amélioration des soins aux patients. Ce modèle peut inspirer des initiatives similaires dans d'autres contextes ruraux confrontés à des défis éducatifs et de ressources.

Mots-clés: Simulation *in situ*, Simulation en milieu rural, Services d'urgence ruraux

INTRODUCTION

Rural emergency departments across Canada treat approximately four million patients annually, accounting for 30% of all emergency visits in the country, despite only 20% of Canadians living in rural areas.[1] When comparing rural populations to their urban counterparts, rural residents tend to be older, have poorer health indicators and are at greater risk for traumatic injuries.[1,2]

Physician retention in rural areas is also challenging, often leaving patients without access to family physicians or with limited healthcare options.[1,3] As a result, emergency departments in rural areas have been described as an 'important safety net' for these populations. Despite the recognised importance of rural emergency departments, few studies have explored the specific challenges they face or strategies to improve them compared to their urban counterparts.[4]

Northern Ontario is a vast region spanning over 800,000 square km, comprising 90% of Ontario's land area, but home to a relatively small population of about 840,000. Notably, around 60% of this population (roughly 504,000 people) live in rural and remote communities.[3] Studies indicate that residents of Northern Ontario experience a higher prevalence of chronic disease, as well as elevated morbidity and mortality rates compared to urban populations.[3]

Although rural emergency departments are less frequently studied than their urban counterparts, there is evidence suggesting that rural emergency physicians and nurses are requesting additional training.[5] One potential solution for providing this training to rural emergency department physicians and interdisciplinary team members is *in situ* Simulation (ISS or *In Situ* Sim).[1,6] ISS involves conducting simulation training in the actual clinical environment where providers typically see patients,[6] removing the need for dedicated simulation labs or expensive simulation equipment. Training can occur while clinicians are on duty or afterwards, allowing physicians and interdisciplinary team members to practise their roles before encountering real patients with acute needs.[7]

While ISSs in rural emergency departments have been studied,[7] to the best of our knowledge, few studies have used validated questionnaires to assess physicians' and nurses' experiences post-ISS in the context of rural emergency departments. We sought to answer the following questions:

1. Can *in situ* sim be implemented in a way that participants are satisfied with the training experience?
2. Can *in situ* sim support rural clinician self-confidence in managing acute and critical medical presentations?
3. Can *in situ* sim identify latent safety threats (LSTs) in the clinical care systems and physical equipment of a rural emergency department?

METHODS

Espanola, Ontario, a community with just over 5000 residents, is served by the Espanola Regional Hospital and Health Centre's Emergency Department (ERHHC ED), which caters to a catchment area of approximately 15,000 people.[8] This includes many seasonal visitors who use the ED during peak times on Lake Huron's North Shore. Surrounding Espanola are the First Nations communities of Sagamok Anishnawbek and White Fish River First Nations, with Indigenous, Métis and Inuit people comprising about 30% of the population within the ERHHC service area.

Espanola qualifies as a rural community according to provincial definitions, with a population under 30,000 and a location more than 30 min away from a larger urban centre.[9] For urgent or emergency medical care, residents of Espanola and the surrounding areas rely exclusively on the ERHHC ED. The facility includes an 11-bed emergency department and a total of 79 beds on its health campus, which provides both inpatient and long-term care services.[10] In 2023, the ERHHC ED averaged 35 patient visits per day, with staffing consisting of one physician and two nurses during the day and one physician and one nurse overnight.

The convenience sampling was used to assess physicians and nurses who provide care in the emergency department at the ERHHC. In addition, any learners present in the department at the time were also invited to join the simulation. Participation was optional. Informed consent was obtained through signed consent forms from every participant.

To address common barriers to simulation training – such as participant anxiety, fear of making mistakes, fear of reprisal or negative prior experiences – a scripted pre-briefing was implemented to reinforce a culture of safe learning. Participants were informed of the general simulation topic 1 week in advance, allowing them to prepare in their preferred way if desired. In addition, instructors underwent dedicated training in simulation and debriefing through the Health Sciences North Simulation Laboratory, completing two courses, each lasting 3 h. Instructors sent a 'Simulation Recap' E-mail to all nursing and physician staff after each session, summarising key educational topics, relevant evidence and guidelines.

A total of 5 ISSs ran from January 2024 to June 2024 [Table 1]. The simulations lasted a minimum of 10-min and a maximum of 15-min and ended if objectives of the simulation were met.

The timing of the scenarios was strategically planned to coincide with typically lower patient volumes and maximum department staffing, specifically mid-morning. Backup staffing was arranged in case a true medical emergency arose during the simulation, with a nurse available from the inpatient unit if necessary. Management was supportive of the initiative and actively participated in the delivery of ISS. To minimise the impact on ED operations, the combined duration of each scenario and debrief was planned to be 30 min. The method of delivery required at least two instructors, and in some scenarios, a standardised patient or actor. If the simulation interfered with ED operations it was postponed or rescheduled. This occurred once.

Following the simulations, a debriefing session was held in a confidential area of the hospital. Participants were able to describe and discuss the simulation in a structured debriefing facilitated by the instructors, and relevant up-to-date care guidelines on the case were also shared and discussed with participants as educational resources. At the end of the debriefing participants filled out the validated Student Satisfaction and Self-Confidence in Learning Survey (SCLS) questionnaire.[12] The SCLS questionnaire consists of 13 items that are grouped into two dimensions: (1) satisfaction with current learning and (2) self-confidence in learning during simulation. The SCLS is validated and used in multiple different regions, countries, languages

Table 1: Simulation case and the respective Canadian Triage and Acuity Scale[11]

Simulation case	CTAS
Unstable Bradycardia requiring transcutaneous pacing	1
Ventricular Tachycardia requiring defibrillation and intubation	1
COPD exacerbation requiring intubation	2
Pediatric asthma exacerbation	2
Septic shock	1

CTAS: Canadian Triage and Acuity Scale, COPD: Chronic obstructive pulmonary disease

and settings.[13-16] This is a Likert scale from 1 to 5, with 1 being 'Strongly Disagree', 3 being 'Neutral', to 5 being 'Strongly Agree'. Participants were asked three questions about safety, feedback and suggestions that were later used to complete a thematic analysis. Furthermore, specific LSTs were identified and documented for institutional review and quality improvement (QI).

Six months after completing the initial simulation case series, a digital version of the SCLS, along with supplemental questions, was sent to all ED nursing and physician staff via their hospital E-mail. This survey aimed to gather additional anonymous feedback on self-confidence and satisfaction with simulation long after the intervention.

All anonymous SCLS questionnaires were scanned, and the data were digitised and entered into spreadsheets for the subsequent analysis. Descriptive statistics were calculated to summarise the findings. The debriefing responses to the three questions underwent thematic content analysis, which was independently conducted by two authors (AW and SD). After completing their independent reviews, the two authors discussed any discrepancies in identified themes, reaching consensus through deliberation.

RESULTS

A total of 5 physicians, 9 nurses, 1 nurse practitioner and 1 medical student participated. All prospective participants agreed to participate in the simulation training sessions. All 16 participants completed the SCLS questionnaires as well as the three debriefing questions, resulting in a 100% completion rate.

Self-confidence in learning survey questionnaire results

For all five questions pertaining to satisfaction in the SCLS satisfaction section the score was 5, meaning that participants strongly agree with questions as they pertain to satisfaction with the simulation intervention.

The eight self-confidence-related questions of the SCLS had an average score of 4.78, meaning that participants were somewhere in between agreeing (score of 4) and strongly agreeing (score of 5) when it came to self-confidence in learning with respect to the clinical subject matter presented in the simulation.

Short-answer survey response analysis

The survey short-answer responses were analysed and a total of three themes were established [Table 2].

Theme 1: Provider safety

Participants highlighted several issues related to personal protective equipment (PPE), including challenges with donning and doffing techniques, the location of PPE carts and the placement of disposal receptacles.

Another safety concern involved the physical layout of the resuscitation room, particularly the placement of equipment. For example, the location of the power cords and outlets for the video laryngoscope impeded the ability to move the bed away from the wall during intubation.

Theme 2: Available equipment, setup and use

Participants suggested improvements in equipment knowledge and setup. In addition, the absence of certain resuscitation equipment in the department was identified. Short-answer responses raised the question of whether arterial line blood pressure monitoring should be available for critically ill patients at ERHHC.

Another LST involved the availability of specific supplies for non-invasive positive pressure

Table 2: Themes identified from short answer responses, number of respondents that mentioned the theme in their feedback and representative quotes

Theme (number responding)	Representative quotes
Provider safety (3)	'PPE cart not in a good location'
	'Glidescope power cords can be cumbersome'
Available equipment, setup and use (4)	'lack of PPV masks for peds'
	'arterial line would help for sick patients'
Suggestions for improvement (4)	'we would benefit from ACLS and PALS courses'
	'more frequent equipment training for use and setup would be helpful'

PPE: personal protective equipment, PPV: Positive pressure ventilation, ACLS: Advanced cardiovascular life support, PALS: paediatric advanced life support

ventilation (NIPPV), which was also addressed with department leadership.

Finally, concerns were raised regarding self-reported staff comfort with ventilator operation. In two separate simulations, participants indicated that they did not feel fully comfortable setting up and operating the ventilator after patient intubation.

Theme 3: Suggestions for improvement and additional training

Participants specifically highlighted the need for additional training in areas where they felt their knowledge was lacking, such as paediatrics and advanced cardiac rususcitation, which became apparent after the fourth simulation case involving paediatric asthma. Two participants made specific recommendations for additional training courses, such as ACLS (Advanced Cardiac Life Support) and PALS (Paediatric Advanced Life Support).

Topics raised during verbal debriefing

During the verbal debriefing, participants provided positive feedback about their experience, highlighting several key aspects. They appreciated the high yield of the training, noting its effectiveness in fostering team building, improving teamwork and ultimately enhancing patient care. In addition, the calm and comfortable learning environment was well-received. The simulations were praised for their high quality and for providing valuable opportunities for professional development, particularly in practising crisis resource management (CRM). Specific CRM topics raised by participants included effective leadership, followership and closed-loop communication.

The follow-up survey sent 6 months after the initial case series had only three responses, which precluded any meaningful analysis of attitudes towards satisfaction and self-confidence.

DISCUSSION

For all 5 questions pertaining to satisfaction in the SCLS satisfaction section, the score was 5. This is in keeping with simulation research that has shown that participants typically enjoy the simulation experience and overall feel satisfied.[16] However, it is unclear if satisfaction with ISSs has previously been measured in a rural emergency department context.

Self-confidence with ISS was high with a SCLS average score of 4.78. It has previously been established in the literature that participants typically feel more confident following simulations[17] and our results support those findings.

The use of simulation to identify LSTs has been previously investigated.[18,19] These studies assessed various form of LSTs, involving equipment, personnel and resources.

A number of LSTs identified in our study related to provider safety, especially power cords and outlet locations related to equipment such as video laryngoscopy. Previous simulation studies[18] in emergency departments have identified equipment-related challenges, although not specifically related to laryngoscopy. Consistent with existing simulation literature, a safety threat identified in our ISS was the improper use of PPE and the failure to place the PPE cart in a prominent location in front of the trauma bay.[18]

Previous studies in larger centres[18,19] have also used ISSs to assess overall preparedness and to identify the significant equipment gaps. Similar to our results, these studies reported missing or improperly functioning equipment.[18,19]

Prior to the project's commencement, some participants expressed anxiety about their performance during simulation training, stemming from both inexperience and previous negative experiences. This phenomenon has been noted in earlier studies involving simulations in larger emergency departments.[19] As with those previous findings, participants' tensions eased once they were informed during the pre-brief that the goal was to practise and improve by simulating challenging cases, leading to greater buy-in.[19] Anecdotally, within our institution, participants became less anxious as each simulation session progressed, with a culture of educational safety being established over time.

Specific departmental outcomes

The QI component of this study led to several changes aimed at enhancing patient care and

safety. Paediatric-sized masks for NIPPV were purchased to improve airway management for paediatric patients. The placement of PPE was reviewed and reorganised to ensure better accessibility and efficiency. In addition, the arrangement of stretchers and video laryngoscopes in the resuscitation room was optimised to facilitate safer movement around the patient during critical interventions.

As part of monthly ISS days, dedicated equipment review sessions are now scheduled during shifts. These sessions provide staff with hands-on opportunities to review and practise using critical care equipment, such as NIPPV, ventilators and defibrillators. Our results have allowed authors to secure dedicated educational funding to bring in instructors and facilitators to provide task-and topic-specific training in areas identified as needing improvement.

While not directly a result of this study, the results support the decision to implement ACLS and PALS training for all emergency departments' nursing staff since the project's completion.

Anecdotal evidence highlights the direct impact of ISS on patient care. For example, after an ISS case focused on managing unstable bradycardia requiring transcutaneous pacing, a real patient with the same condition presented within the same week. Several members of the care team who had participated in the simulation felt well-prepared to manage the case, attributing their confidence to the ISS training. While this phenomenon was not captured in the study's surveys or quantitative results, it underscores the practical benefits of ISS in enhancing clinical readiness and response.

Limitations

Our study may be affected by response and researcher bias, as participants had prior relationships with the instructors, potentially influencing their responses. Despite anonymity of surveys, this relationship could lead to skewed feedback.

Surveys and questionnaires were administered only post-intervention, which limits our ability to directly attribute changes in satisfaction and self-confidence to the ISS experience. This decision was made for practical reasons, to avoid overburdening participants, many of whom were already managing busy clinical shifts and to minimise the risk of discouraging participation. This approach highlights a broader structural challenge in researching the impact of ISS, particularly in the setting of rural emergency departments.

The results of our study may not be generalisable to rural emergency departments with a higher average daily patient volume. The feasibility of implementing ISS would need to be adapted to the specific care systems and operational factors of each department.

The sample size of 16 is small and reflects staffing limitations in rural emergency departments. While this represents a significant percentage of our hospital's total staff complement, the sample size is overall quite low and may impact the generalisability of the findings. This highlights a challenge across all small, rural hospital-based research. In addition, participants' behaviour might differ in the real-life situations versus simulation, known as the 'simulation effect'. Larger studies in rural settings are necessary to validate these findings.

Further research may focus on whether high acuity – low occurrence procedure-specific training can be successfully implemented in a rural hospital emergency department via ISS, as well as examining the downstream impacts of *in situ* Sim on patient safety and health outcomes.

CONCLUSION

ISSs are increasingly used to support training for rural emergency department physicians and interdisciplinary teams. However, research specific to rural settings remains limited. This study assessed participant satisfaction, self-confidence and key themes from debriefings.

Participants reported high satisfaction and strong self-confidence. Debriefings highlighted the value of CRM practice and revealed LSTs, including equipment challenges, PPE placement and training gaps.

These results suggest ISS is a feasible and low-cost strategy for ongoing education and clinical QI in rural emergency care.

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Conflicts of interest: While the authors do not believe this constitutes a conflict of interest, we felt it pertinent to disclose that Dr. Wharton serves as Chief of Staff and ED Medical Director at ERHHC – duties include supporting staff training and education.

REFERENCES

1. Fleet R, Dupuis G, Fortin JP, Gravel J, Ouimet M, Poitras J, *et al*. Rural emergency care 360°: Mobilising healthcare professionals, decision-makers, patients and citizens to improve rural emergency care in the province of Quebec, Canada: A qualitative study protocol. BMJ Open 2017;7:e016039.
2. Peek-Asa C, Zwerling C, Stallones L. Acute traumatic injuries in rural populations. Am J Public Health 2004;94:1689-93.
3. Strasser RP, Lanphear JH, McCready WG, Topps MH, Hunt DD, Matte MC. Canada's new medical school: The Northern Ontario School of Medicine: Social accountability through distributed community engaged learning. Acad Med 2009;84:1459-64.
4. Audet J, Lapointe L, Renaud M, Turgeon-Pelchat C, Mathieu B, Fleet R. P012: Québec emergency physicians propose priority solutions to improve rural emergency care. CJEM 2017;19(S1):S81-2. doi:10.1017/cem.2017.214
5. Drouin MA, Fleet R, Poitras J, Archambault P, Chauny JM, Lévesque JF, *et al*. The quebec rural emergency department project: A cross-sectional study of a potential two-pronged strategy in the knowledge transfer process. PLoS One 2015;10:e0120523.
6. Powell ES, Bond WF, Barker LT, Cooley K, Lee J, Vincent AL, *et al*. *In situ* simulation for adoption of new technology to improve sepsis care in rural emergency Departments. J Patient Saf 2022;18:302-9.
7. N Orrantia MR, Patchett-Marble RJ, Orrantia E. The occasional rural sim. Can J Rural Med 2023;28:136-40.
8. Morrison GR. Espanola. The Canadian Encyclopedia; 2015. Available from: https://www.thecanadianencyclopedia.ca/en/article/espanola. [Last accessed on 2025 Jul 20].
9. Ministry of Health and Long-Term Care. Rural and Northern Health Care Framework/Plan: Executive Summary; 2011. Available from: https://www.publications.gov.on.ca/rural-and-northern-health-care-framework-report. [Last accessed on 2025 Jul 20].
10. Espanola Regional Hospital and Health Centre. Our History. Available from: https://espanolaregionalhospital.ca/about-erhhc/our-history. [Last accessed on 2025 Jul 20].
11. Bullard MJ, Chan T, Brayman C, Warren D, Musgrave E, Unger B, *et al*. CTAS National Working Group. Revisions to the Canadian emergency department triage and acuity scale (CTAS) guidelines. CJEM 2014;16:485-9.
12. National League for Nursing. Student Satisfaction and self-Confidence in Learning. New York: National League for Nursing; 2005. Available from: https://www.nln.org/docs/default-source/uploadedfiles/default-document-library/instrument-2-satisfaction-and-self-confidence-in-learning.pdf. [Last accessed on 2025 Jul 20].
13. Jeffries PR, Rizzolo MA. Designing and implementing models for the innovative use of simulation to teach nursing care of ill adults and children: A national multi-site multi-method study. New York: National League for Nursing; 2006. p. 500-5.
14. Lee KJ. Establishing reliability of an instrument measuring nursing student satisfaction and self-confidence in learning in a service-learning clinical environment. Nurs Educ Perspect 2022;43:E112-4.
15. Farrés-Tarafa M, Bande D, Roldán-Merino J, Hurtado-Pardos B, Biurrun-Garrido A, Molina-Raya L, *et al*. Reliability and validity study of the Spanish adaptation of the "Student Satisfaction and Self-Confidence in Learning Scale" (SCLS). PLoS One 2021;16:e0255188.
16. Alberti S, Guasconi M, Bolzoni M, Donnini G, Volpi P, Rovesti S, *et al*. Assessing satisfaction in simulation among nursing students: Psychometric properties of the Satisfaction with Simulation Experience – Italian version scale. BMC Nurs 2024;23:300.
17. Alrashidi N, Pasay An E, Alrashedi MS, Alqarni AS, Gonzales F, Bassuni EM, *et al*. Effects of simulation in improving the self-confidence of student nurses in clinical practice: A systematic review. BMC Med Educ 2023;23:815.
18. Jafri FN, Yang CJ, Kumar A, Torres RE, Ahmed ST, Seneviratne N, *et al*. *In situ* simulation as a tool to longitudinally identify and track latent safety threats in a structured quality improvement initiative for SARS-CoV-2 airway management: A single-center study. Simul Healthc 2023;18:16-23.
19. Patterson MD, Geis GL, Falcone RA, LeMaster T, Wears RL. *In situ* simulation: Detection of safety threats and teamwork training in a high risk emergency department. BMJ Qual Saf 2013;22:468-77.