Original Article

Enhancing trauma care in remote regions: A trauma training course for physicians in Northern Canada

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Abstract

Introduction: This study reports the implementation of the Nunavik Trauma Course (NTC), a simulation-based curriculum developed in collaboration with rural physicians in Nunavik.

Methods: A needs-assessment pilot questionnaire was distributed to rural physicians in Nunavik through snowball sampling. In response to the questionnaire, an 8-h trauma course was developed, incorporating hands-on and scenario-based training sessions. The curriculum prioritised the unique challenges and training requirements identified by the participants of the pilot survey. A simulation centre hosted the course to replicate realistic, high-stakes scenarios, providing participants an opportunity to enhance their procedural skills and decision-making abilities in a supportive atmosphere. In-training surveys assessed participants' knowledge, confidence and skills pre/post-course.

Results: Of the 13 participants, 11 completed the pre-course survey (85% response rate). Most were employed full-time (n = 8; 73%) and had >5 years of experience (n = 6; 55%). Among them, 36% managed critically injured people once per week (n = 4), whereas 64% were involved once every 1–3 months (n = 7). Following the course, physicians endorsed significantly greater comfort with bougie-assisted endotracheal intubation (P = 0.014), cricothyroidotomy (P = 0.003), pleural pigtail insertion (P = 0.003), pelvic binder application (P = 0.003), tourniquet placement (P < 0.001) and increased intracranial pressure management (P = 0.007).

Conclusion: The NTC represents a targeted educational initiative addressing the needs of physicians in remote resource-limited settings. By prioritising contextual relevance and procedural proficiency, the NTC is a model for adaptable, physician-informed rural trauma training.

Keywords: Emergency, Nunavik, rural, simulation, training course, trauma

Résumé

Améliorer les soins en traumatologie dans les régions éloignées: Une formation en traumatologie destinée aux médecins du Nord canadien

Introduction: Cette étude présente la mise en œuvre du Nunavik Trauma Course (NTC), un programme de formation par simulation élaboré en collaboration avec des médecins ruraux du Nunavik.

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Méthodes: Un questionnaire pilote d'évaluation des besoins a été distribué à des médecins ruraux du Nunavik au moyen d'un échantillonnage boule de neige. À la suite des réponses obtenues, une formation de huit heures en traumatologie a été conçue, combinant des ateliers pratiques et des mises en situation. Le contenu de la formation a été établi en fonction des défis particuliers et des besoins de formation soulevés par les participants au sondage pilote. La formation s'est déroulée dans un centre de simulation afin de recréer des scénarios réalistes à haut niveau d'enjeu, permettant aux participants de renforcer leurs habiletés techniques et leur prise de décision dans un environnement encadrant. Des questionnaires administrés pendant la formation ont permis d'évaluer les connaissances, la confiance et les compétences des participants avant et après le cours.
Résultats: Parmi les 13 participants, 11 ont rempli le questionnaire préalable à la formation, pour un taux de réponse de 85%. La majorité travaillait à temps plein (n = 8; 73%) et comptait plus de cinq ans d'expérience (n = 6; 55%). Parmi eux, 36% prenaient en charge des personnes gravement blessées une fois par semaine (n = 4), tandis que 64% y étaient exposés une fois tous les un à trois mois (n = 7). Après la formation, les médecins ont rapporté un niveau de confort significativement plus élevé pour l'intubation endotrachéale assistée par bougie (P = 0,014), la cricothyroïdotomie (P = 0,003), l'insertion d'un drain pleural de type pigtail (P = 0,003), l'application d'une ceinture pelvienne (P = 0,003), la pose d'un garrot (P < 0,001) et la prise en charge d'une hypertension intracrânienne (P = 0,007).
Conclusion: Le NTC constitue une initiative de formation ciblée qui répond aux besoins des médecins pratiquant en régions éloignées et à ressources limitées. En misant sur la pertinence du contexte et la maîtrise des gestes techniques, le NTC offre un modèle adaptable de formation en traumatologie rurale, conçu à partir de l'expérience et des besoins des médecins sur le terrain.

Mots-clés: urgence, traumatologie, simulation, milieu rural, formation, Nunavik

INTRODUCTION

Traumatic injuries remain the third-leading cause of death in Canada,[1] with rural populations disproportionately affected due to distance-related barriers to timely healthcare access. Although an estimated one in five Canadians lives in rural regions,[2] Canada ranks among the lowest of developed nations for rural healthcare accessibility.[3] Compared to urban populations, rural Canadians experience elevated morbidity and mortality[4-6] because of widespread disparities in primary care,[7,8] acute care[9,10] and surgical services.[11] This imbalance is particularly concerning given that over 23% of the population lives more than an hour away from a trauma centre.[9] In rural Quebec, for instance, 40% of emergency departments are over 300 km from the nearest Level I-II trauma centre,[12] contributing to higher mortality during pre-hospital transport compared to urban regions.[13] Compounding these challenges, remote healthcare facilities face significant resource constraints, including underdeveloped infrastructure, insufficient funding and challenges in recruiting and retaining medical professionals.[7,8,14,15]

Given these limitations, remote populations depend heavily on small, local primary care facilities as their initial point of contact for a wide range of healthcare needs. These services are often overburdened by the demand of the region and operating beyond their original capacities.[14-16] For instance, although rural Canada has seen the fastest population growth among developed countries from 2016 to 2021,[2] the proportion of family physicians in rural areas has remained below 20% since 2000.[17] Rural physicians must therefore function as comprehensive medical lifelines, singularly responsible for managing complex medical emergencies, performing critical interventions and providing subspeciality care across multiple disciplines, often without the support of trauma centres or specialists.[8-10,14,15] This growing mismatch between population need and healthcare availability contributes to fragmented service delivery and disproportionately high trauma-related mortality in rural communities.[5,6,13]

The College of Family Physicians of Canada and the Society of Rural Physicians of Canada have discussed these inequities in the provision of trauma care through The Rural Road Map for Action. In their report, they outline priorities which could further improve the current system, such as infrastructure investment, targeted funding and enhanced training for rural physicians.[16] Despite these initiatives, critical gaps in emergency care access persist and training for rural general physicians remains limited.[15,16] In particular,

61% of rural physicians report good working knowledge of provincial emergency guidelines; however, 6% received formal emergency medicine training during residency.[12] Many rural physicians express interest in pursuing further critical care training, particularly through simulation-based and practice-specific approaches that address their unique context.[18,19] Research consistently demonstrates a direct correlation between implementing trauma training programmes and enhanced patient outcomes, including reduced mortality and enhanced clinical care capacity.[20-25] While established programmes such as Advanced Trauma Life Support (ATLS) and the Rural Trauma Team Development Course (RTTDC) provide foundational knowledge, they are not tailored to the realities of resource-limited rural practice and do not emphasize the hands-on skill development crucial for rural practitioners facing critical cases in isolation.[16,18,19,26] This disconnect highlights the urgent need for trauma education that is both contextually relevant and practically feasible for rural healthcare providers working within significant resource constraints.

Recognising these distinct educational needs, the Nunavik Trauma Course (NTC) was developed; it is a simulation-based course designed to directly address feedback solicited from physicians serving rural communities in Nunavik, Quebec, a region which experiences a fourfold higher risk of trauma compared to the provincial average.[6] The course aimed to align with real-world challenges faced by physicians, improve provider preparedness and strengthen collaboration between urban trauma centres and remote healthcare teams. This initiative serves as an important step toward developing sustainable, scalable training models that bridge research, education and clinical practice.

METHODS

Study design

Rural physicians, including full- and part-time practitioners working in Nunavik communities, were invited to complete a needs assessment pilot questionnaire. Physicians practising in the region on a temporary basis, such as visiting specialists, or those without a license to practise in the region, were excluded from the study. The NTC was implemented in a remote northern region of Quebec characterised by multiple small fly-in communities, limited local resources and considerable distances from tertiary trauma centres. Although the course was developed in partnership with regional leaders in Nunavik, individual community names and facility identifiers have been omitted to protect participant confidentiality. Physicians in this region routinely manage high-acuity cases with limited on-site support, making targeted skills training operationally necessary.

Using a Modified Delphi approach, the pilot questionnaire included 4 sections: demographics, training background, clinical content and course format preferences. Clinical preparedness was assessed across 6 domains: prehospital care (10 skills), resuscitation (15), stabilisation (15), patient transfer (3), collaboration/communication (10 scenarios) and common emergencies (4). Comfort levels were rated on a 6-point scale ('not applicable' to 'extremely comfortable'). Preferences for training delivery (e.g., in-person simulation, remote didactics and online modules), course duration and location were also rated using 5-point scales.

Subsequently, a course was designed directly integrating physician-identified training gaps. The training course was held at a Simulation Centre in Montreal, chosen to facilitate attendance by rural physicians who routinely travel to the city. The high-fidelity simulation environment replicated realistic trauma scenarios, allowing participants to practise both procedural and decision-making skills in a controlled setting. The 8-h course included 45-min modules on: advanced airway management (difficult intubation, cricothyroidotomy and laryngeal mask airway); thoracic trauma interventions (pigtail insertion, chest tube placement, needle decompression and thoracotomy); circulatory support procedures (central line placement, massive transfusion protocols, intraosseous access, pelvic binding and tourniquet application) and patient stabilisation techniques (management of increased intracranial pressure, sedation and ventilator troubleshooting). Resuscitative endovascular balloon occlusion of the aorta (REBOA) was included as a benchmark advanced skill presumed to be outside participants' comfort levels. The course concluded with a 2.5-h hands-on simulation

incorporating case-based scenarios and targeted feedback.

During the simulation section, participants rotated through procedural stations led by trauma surgeons, using task trainers and high-fidelity manikins to replicate realistic injury patterns. Each module followed a structured approach: (1) brief demonstration, (2) participant hands-on practice and (3) scenario-based integration. Simulations included case vignettes mirroring rural challenges such as delayed transport, limited blood products and equipment improvisation. Faculty provided immediate feedback and guided post-scenario debriefings emphasising communication, teamwork and transfer decision-making. The course was also intentionally structured as a team-building exercise, fostering collaboration among physicians. By integrating procedural skill development with interprofessional communication and shared problem-solving, the course reinforced both technical and relational aspects of rural trauma care.

Selection and Description of Participants

The sample size was determined by the number of practising physicians in Nunavik at the time of data collection. Given that the total physician workforce in the region is small and highly distributed across remote communities, all available physicians were invited to participate. This approach maximised inclusivity and minimised selection bias, but it also meant that the final sample size was constrained by the size of the physician population rather than by statistical power analysis. Finally, participants completed the initial pilot questionnaire to inform course design and subsequently participated in the course, completing pre- and post-course surveys.

Outcome measures

The pre-course survey was used to collect demographic data (training, years of practice, employment status, frequency of critical care exposure and certifications across 11 emergency courses) and assessed comfort with 17 trauma-related skills on a 5-point Likert scale ('not at all' to 'extremely comfortable'). Skills spanned airway, thoracic, circulatory and critical care procedures.

The post-course survey repeated the skills assessment and added 6 domains of course satisfaction: clinical relevance, improvement in comfort, format appropriateness, content clarity, interest in future courses and likelihood of recommendation. Each was rated on a 5-point Likert scale. Open-ended questions solicited qualitative feedback and suggestions for future training topics. Data collection and course delivery occurred in October 2024.

Data analysis

Anonymous survey administration resulted in unpaired pre-course and post-course responses. Consequently, comparisons were performed at the group level using permutation tests to estimate the null distribution of mean differences between pre- and post-course scores. No imputation was undertaken because the primary aim was descriptive and feasibility-focused, the sample was small and any single-imputation strategy would risk model-dependent bias under these conditions. Permutation testing was selected because it provides valid inference with small samples and does not rely on parametric distributional assumptions; however, it cannot replace the precision that true paired data would have provided and may yield wider uncertainty around estimates. Permutation tests were used to estimate mean differences between pre- and post-course scores, accounting for unequal sample sizes. Pre-course scores were subtracted from resampled post-course scores over 1000 replicates to estimate treatment effects. Paired pre- and post-course labels were randomly assigned to twice the number of available pre-course scores (20 or 22) over 100,000 permutations. Mean differences were calculated for each permutation, and P values were derived as the proportion of scores more extreme than the observed mean effect. Statistical significance was set at $P < 0.05$.

Ethics

The project was deemed exempt from review from the McGill University Health Centre Ethics Board, as it was classified as a quality improvement initiative. Surveys were clearly explained as voluntary, with no consequences for non-completion. All participant information remained anonymous, in accordance with confidentiality standards. The course relied

on simulations of real-world scenarios, and participants were not exposed to experiences beyond those already encountered in their professional practice. All procedures were conducted in accordance with the ethical standards of the institutional review board and with the principles outlined in the Declaration of Helsinki (1975, as revised in 2000). Consent to participate was obtained from all participants, with the understanding that survey responses and feedback during the course would be included in a potential de-identified manner in published work to allow for candid reporting.

RESULTS

Part I: Evaluating the needs of physicians in Northern Quebec

The pilot questionnaire was completed by 17 family physicians, 76% (n = 13) of whom work full-time in Nunavik. Many physicians held certifications in various trauma-related courses, including ATLS (n = 16; 94%), ultrasound-guided resuscitation (n = 12; 71%) and fundamentals of critical care support (FCCS; n = 3; 18%). While 94% (n = 16) agreed these courses adequately prepared them, all were interested in additional training to enhance their clinical skills [Figure 1]. The identified topics of priority included advanced airway management, thoracic trauma interventions, circulatory support procedures and patient stabilisation techniques. Although many physicians had prior experience with these interventions, their comfort with specific skills varied. For example, physicians reported being 'moderately' comfortable with initiating

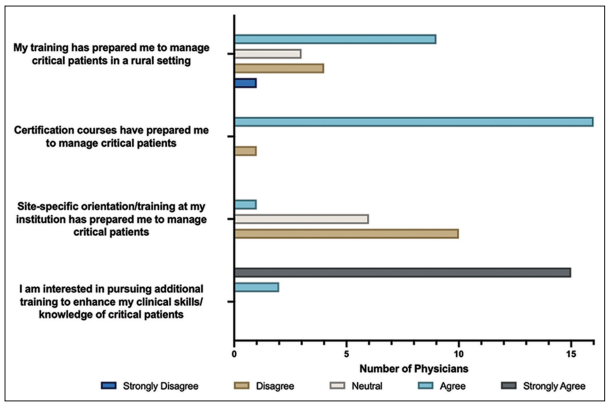

Figure 1: Previous formal training in managing critical patients.

and titrating vasopressors (n = 12; 71%), central venous access (n = 11; 65%), traumatic brain injury and increased intracranial pressure (n = 11; 65%), post-intubation sedation and analgesia (n = 10; 59%), massive transfusion protocol (n = 9; 53%), pelvic binder application (n = 8; 47%) and tourniquet application (n = 8; 47%). Physicians stated they were 'not at all' to 'slightly' comfortable with cricothyroidotomy (n = 8; 47%).

To address these needs, the NTC was structured around the highest-priority gaps while also incorporating additional skills related to emergency trauma care. The advanced airway management topics included difficult airway assessment, bougie-assisted endotracheal intubation, LMA insertion and cricothyroidotomy. Thoracic trauma interventions included chest tube insertion, pleural pigtail insertion and pleural needle decompression. Circulatory support procedures were addressed through central line placement, pelvic binder application, tourniquet placement, intraosseous insertion, massive transfusion protocols and vasopressor use. The course also incorporated training on patient stabilisation techniques, including post-intubation sedation, mechanical ventilation, management of increased intracranial pressure and polytrauma management. While not all identified skills from the pilot questionnaire could be covered, the curriculum was structured to align with the most pressing needs. In addition, some topics, such as LMA insertion and mechanical ventilation, were included despite not being explicitly highlighted in the pilot questionnaire to complement the broader training in advanced airway management, an area where many physicians expressed interest.

Regarding the course format, the majority of respondents favoured a full-day or 2–3 day format, with most respondents believing that in-person training would be ideal. Following additional discussions with participants, simulation centre-based training was ultimately selected to enable the greatest possible physician participation.

Part II: Evaluating the designed course

Thirteen physicians participated in the course and provided feedback, with the majority (n = 11; 85%) also completing the pre-course survey, which included demographic information. The participants included 10 family physicians

and 1 emergency physician, most of whom were employed full-time (n = 8; 73%) and had more than 5 years of experience (n = 6; 55%). Of those surveyed, 36% were involved in the management of a critically ill or injured person approximately once per week (n = 4), whereas most were involved once every one to 3 months (n = 7; 64%). Courses and certifications previously completed included ACLS (n = 11; 100%), ATLS (n = 11; 100%), ultrasound-guided resuscitation (n = 7; 64%), FCCS (n = 2; 18%) and wilderness first responder (n = 2; 18%).

Following the course, physicians demonstrated notable self-reported improvements in their comfort levels with several critical procedures, including bougie-assisted endotracheal intubation (P = 0.014), cricothyroidotomy (P = 0.003), pleural pigtail insertion (P = 0.003), pelvic binder application (P = 0.003), tourniquet placement (P < 0.001) and increased intracranial pressure (P 0.007). Although there was a general trend towards increased comfort, no statistically significant changes were observed for difficult airway assessment, Laryngeal Mask Airway (LMA) insertion, chest tube insertion, pleural needle decompression, central line placement, intraosseous insertion, massive transfusion protocols, post-intubation sedation, vasopressors, mechanical ventilation or the management of polytrauma patients [Table 1].

The post-course survey revealed unanimous positive feedback from participants. All attendees considered the course relevant to their clinical practice and reported increased comfort with the presented material. They agreed that the course effectively met their learning needs and objectives and was delivered with clarity. Furthermore, participants expressed strong interest in similar future educational opportunities and would recommend the course to colleagues.

DISCUSSION

The aim of our study was to design, evaluate and implement a training course in response to the identified needs of physicians serving rural communities in Northern Quebec. The NTC curriculum incorporated the feedback of 17 rural physicians to provide additional, specialised training in skill areas identified as less comfortable that are not typically offered in traditional trauma education programmes. Following participation in a targeted, 1-day simulation-based training, the results demonstrated the overall effectiveness of the course in enhancing emergency preparedness, with rural physicians reporting a significant increase in their overall comfort relative to their pre-course comfort levels across various critical care competencies. Notably, physicians who completed the course provided overwhelmingly

Table 1: Participant self-rated comfort in performing trauma-related skills pre- and post-course

Outcome	Pre-course, mean (SD)	Post-course, mean (SD)	Difference between means	Mean of differences	*P*
Difficult airway assessment	2.00 (0.45)	2.38 (0.51)	0.385	0.381	0.053
Bougie-assisted endotracheal intubation	1.91 (0.54)	2.46 (0.52)	0.552	0.550	0.014
LMA insertion	2.50 (0.71)	2.77 (0.73)	0.269	0.259	0.442
Cricothyroidotomy	1.20 (0.63)	2.23 (0.73)	1.031	1.022	0.003
Chest tube insertion	2.55 (0.82)	2.77 (0.60)	0.224	0.220	0.468
Pleural pigtail insertion	1.09 (1.14)	2.38 (0.51)	1.294	1.290	0.003
Pleural needle decompression	1.82 (0.87)	2.15 (0.80)	0.336	0.330	0.375
Central line placement	1.82 (1.08)	2.15 (0.90)	0.336	0.329	0.456
Intraosseous insertion	2.64 (0.50)	2.62 (0.97)	–0.021	–0.024	0.872
Massive transfusion protocols	1.64 (0.92)	2.31 (0.73)	0.671	0.667	0.071
Pelvic binder application	1.75 (0.75)	2.77 (0.83)	1.019	1.021	0.003
Tourniquet placement	1.45 (0.69)	2.69 (0.63)	1.238	1.233	<001
Increased intracranial pressure	1.45 (0.69)	2.31 (0.63)	0.853	0.849	0.007
Post-intubation sedation	2.36 (0.81)	2.38 (0.51)	0.021	0.018	0.872
Vasopressors	2.27 (0.65)	2.46 (0.66)	0.189	0.187	0.413
Mechanical ventilation	2.27 (0.47)	2.31 (0.48)	0.035	0.033	0.830
Management of polytrauma patients	2.09 (0.70)	2.38 (0.51)	0.294	0.290	0.227

Based on a 5-point Likert Scale survey – 0: Not at all, 1: Slightly, 2: Moderately, 3: Very, and 4: Extremely comfortable. *P*-values were estimated using permutation tests on artificially paired data with 100,000 replicates. SD: Standard deviation, LMA: Laryngeal mask airway

positive feedback of the course and requested continuation of future iterations.

Our results demonstrate a substantial improvement in the overall comfort levels of physicians across a range of critical clinical skills, particularly in cricothyroidotomy, pleural pigtail insertion, pelvic binder application and tourniquet placement. These skills are essential for managing high-acuity, low-occurrence (HALO) events in remote settings, where maintaining competency can be challenging due to limited exposure. Significant improvement in comfort levels was also observed in bougie-assisted intubation and in increased intracranial pressure management, reinforcing the value of structured training in ameliorating technical proficiency. Of broader relevance, these techniques are integral aspects of patient stabilisation and transfer. Studies have shown that rural physicians primarily identify transfer management as a critical challenge, particularly when stabilising trauma patients for long-distance transport or when transfers are delayed.[18,26] Furthermore, the literature indicates that one-third of trauma patients in Nunavik require transfer to a tertiary care centre,[6] increasing the importance and relevance of this training course in helping to improve patient survival rates during transfers. By demonstrating measurable gains in physician confidence across key trauma skills, our study highlights the effectiveness of physician-informed, simulation-based training in addressing these gaps and strengthening rural emergency preparedness. Moreover, the data suggest that, despite many participants holding prior certification such as ATLS, the demand for additional skill development remained evident.

In contrast with traditional trauma education programmes such as the ATLS and RTTDC, which provide a foundational understanding of trauma care and emphasize initial patient management and multidisciplinary teamwork, the NTC's curriculum addresses gaps in individual skill development for rural trauma care. Findings regarding transfer times suggest that an emphasis on stabilisation during delays could have a significant impact across rural trauma systems, with improvements in training and protocols shown to decrease time to transfer for trauma patients.[27,28] While ATLS equips practitioners with a strong foundation in trauma assessment and initial care, it does not delve deeply into managing complex trauma cases in rural environments experiencing such logistical and resource challenges. Similarly, while the RTTDC focuses on team dynamics in rural trauma resuscitation, it provides limited training in individual technical skills. Early initiatives such as the *Rural Advanced Life Support Update Course* highlighted these same challenges more than three decades ago, underscoring the enduring need for rural-specific emergency and trauma education programmes designed to maintain procedural competence and confidence among rural physicians.[29] However, that programme primarily described course structure and implementation, without assessing its impact on participants' confidence.[29] The NTC builds on these foundational efforts by incorporating a systematic needs assessment and formal evaluation of participant outcomes, representing an evolution in rural trauma education methodology. The curriculum offers hands-on training for managing complex emergency scenarios, including advanced airway management, thoracic trauma interventions and circulatory support techniques, tailored to rural-specific scenarios. These skills are vital in rural settings but are often overlooked in typical trauma courses. Our course integrates a simulation environment that reinforces technical skills and offers targeted feedback on performance in complex, time-sensitive cases, fostering individual expertise in high-stakes emergency care.

Beyond clinical skills, such training programmes reduce professional isolation and improve job satisfaction, contributing to better retention of physicians in rural areas, thereby increasing access to trauma care.[30] These outcomes underscore the external validity of the NTC curriculum, as the challenges addressed in Northern Quebec (e.g., geographic remoteness, limited resources and transfer delays) mirror those faced by rural health systems worldwide. The enduring necessity for rural acute care underscores the critical importance of tailored, rural-specific training programmes, a perspective echoed in foundational work by Rourke and reinforced by contemporary simulation-based education research across varied disciplines and settings.[29,31] By grounding the curriculum in physician-driven needs assessment and simulation scenarios tailored to local contexts, the NTC model can be readily adapted globally to other

rural communities that encounter similar barriers to trauma care. This adaptability suggests a scalable framework for improving emergency preparedness in diverse global settings.

The implementation of simulation-based training in the NTC aligns with recent successful approaches in rural healthcare education, such as Knapp's study, which examined high-fidelity simulation training in rural Level III trauma centres. Their study demonstrated marked improvements in provider confidence and team performance, particularly in managing trauma within resource-limited environments.[32] By integrating simulation-based training with local, context-specific scenarios, the NTC ensures the immediate applicability of the training, reinforcing procedural proficiency in critical, time-sensitive interventions. Trauma patients in rural hospitals in Quebec experience higher mortality rates pre-hospital and in the emergency department compared to major urban centres.[13] Research has shown that rural regions with limited trauma care access have higher mortality rates due to delayed trauma care, underscoring the need for targeted training.[5] Furthermore, specialised trauma care training in rural settings has been demonstrated to improve patient outcomes during the critical initial hours following trauma.[33] These findings reinforce the value of simulation training for enhancing trauma care education for rural settings, where rapid, effective intervention is needed.

Delivering trauma education to rural physicians presents inherent challenges, including time constraints, geographic dispersion and variability in baseline experience.[30] The NTC addresses these barriers through its 8-h format, enabling participation without requiring extended periods away from clinical duties. In fact, at the participants' request, our course was conducted in Montreal during non-clinical time to minimise disruptions to clinical coverage. However, another iteration of the course has been developed to be given locally within the communities to minimise travel time and offer flexibility to local physicians. The use of site-specific equipment and scenarios enhances the training's relevance, an approach supported by literature emphasising the need for compact and relevant programmes tailored to the unique demands of rural practice.[26,30] Another distinguishing feature of the NTC is its physician-driven development process. By incorporating direct feedback through our Delphi survey, the curriculum prioritises actual needs rather than perceived needs, marking a departure from traditional top–down educational strategies. This approach aligns with research emphasising the importance of personalised training in improving skill acquisition and retention.[34-36] Our focus on interprofessional simulation reflects recent research demonstrating the value of team-based training in improving trauma care outcomes.[32] Partnerships with urban trauma centres, exemplified by the collaboration between the trauma programme and Nunavik physicians, further bolster the programme's efficacy. These collaborations provide access to specialised expertise while strengthening networks crucial for coordinated care during patient transfers.

Limitations

While our results demonstrate significant improvements in provider confidence across multiple competencies, several limitations must be acknowledged. The small sample size and single-region focus may restrict generalisability, and long-term skill retention and direct impact on patient outcomes remain areas for further research, concerns similarly noted in rural trauma education literature.[18,26,30] Most skills, such as massive transfusion protocols and polytrauma patient management, showed a trend toward increased comfort, but did not demonstrate significant improvement. This may be due to variations in prior experience or the limited time available for hands-on practice. Moreover, these findings reflect self-perceived rather than observed competence, and the employed methodology of single post-course measurement does not allow for conclusions about long-term skill retention. In addition, while the direction of change across several skills appears clinically meaningful, the absence of individual-level pairing and the rarity of these procedures in practice may limit inferences about generalisability and real-world impact. However, the success of the NTC underscores its potential scalability.

Future development should focus on expanding the programme's reach through hybrid delivery methods that integrate virtual and in-person components, an approach supported by recent studies on mixed-modality rural

medical education.[37-39] While many participants expressed a preference for on-site training in rural locations, others favoured the simulation centre, due to its accessibility for those frequently in the urban area. On-site training may reach fewer physicians, as rural locations often have limited staff at any given time. Future iterations could address this by offering both on-site and simulation-based options, thus maximising reach and adapting the course to the realities faced by rural physicians, while reducing their travel burden.[26,30-33]

CONCLUSION

The NTC represents a responsive and targeted educational initiative that addresses the specific needs of physicians in remote rural territories. Our study provides insights into the competencies that healthcare providers in remote Northern Quebec regions find challenging and demonstrates that a tailored trauma course can significantly improve confidence levels in these areas. The success of this accessible, short-duration programme offers a model for future rural trauma training initiatives, while informing how the trauma programme can enhance its support for remote communities. Scaling similar programmes to other underserved regions could close critical gaps in trauma care delivery and improve patient outcomes. By prioritising accessibility, contextual relevance and procedural proficiency, the NTC serves as a model for adaptable, physician-informed trauma training. It empowers rural healthcare providers, strengthens healthcare resilience and helps reduce disparities.

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