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Comments
Medical student Daniel Frank participated in this study as part of the Senior Scholars research program at the University of Massachusetts Medical School.

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ORIGINAL RESEARCH

Upper extremity injury management by non-physician emergency practitioners in rural Uganda: A pilot study

Prise en charge des blessures des membres supérieurs par des urgentistes non médecins en zone rurale en Ouganda: Étude pilote

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Introduction: Improper management of and resultant poor outcomes from upper extremity injuries can be economically devastating to patients who rely on manual labour for survival. This is a pilot study using the Quick DASH Survey (disabilities of arm, shoulder and hand), a validated outcome measurement tool. Our objective was to assess functional outcomes of patients with acute upper extremity injuries who were cared for by non-physician clinicians as part of a task-shifting programme.
Methods: This pilot study was performed at the Karoli Lwanga Hospital Emergency Centre (EC) in Uganda. Patients were identified retrospectively by querying the EC quality assurance database. An initial list of all patients who sustained traumatic injury (road traffic accident, assault) between March 2012 and February 2013 was narrowed to patients with upper extremity trauma, those 18 years and older, and those with cellular phone access. This subset of patients was called and administered the Quick DASH. The results were subsequently analysed using the standardised DASH metrics. These outcome measures were further analysed based upon injury type (simple laceration, complex laceration, fracture and subluxation).
Results: There were a total of 25 initial candidates, of which only 17 were able to complete the survey. Using the Quick DASH Outcome Measure, our 17 patients had a mean score of 28.86 (range 5.0–56.8).
Conclusions: When compared to the standardised Quick DASH outcomes (no work limitation at 27.5 vs. work limited by injury at 52.6) the non-physician clinicians appear to be performing upper extremity repairs with good outcomes. The key variable to successful repair was the initial injury type. Although accommodations needed to be made to the standard Quick DASH protocol, the tool appears to be usable in non-traditional settings.

Introduction: La mauvaise prise en charge des blessures des membres supérieurs et les mauvais résultats enregistrés sur le plan médical peuvent avoir des conséquences désastreuses pour les patients comptant sur leurs compétences manuelles pour leur survie. Cette étude est une étude pilote utilisant le questionnaire Quick Dash (invalidité des bras, des épaules et des mains), un outil de mesure du résultat validé. Notre objectif était d'évaluer les résultats fonctionnels chez les patients souffrant de blessures graves des membres supérieurs pris en charge par du personnel soignant non médecin dans le cadre d'un programme de délégation des tâches.
Méthode: Cette étude pilote a été menée au service d'urgence de l'hôpital de Karoli Lwanga, en Ouganda. Les patients étaient identifiés de manière rétrospective en interrogeant la base de donnée d'assurance qualité du service d'urgence. Une liste initiale des patients ayant souffert de blessures traumatiques (accidents de la route, agressions) entre mars 2012 et février 2013 a été réduite aux patients souffrant de traumatismes des membres supérieurs, âgés de 18 ans et plus et disposant d'un accès aux services de téléphonie mobile. Ce sous-ensemble de patients a été contacté et le questionnaire Quick Dash leur a été soumis. Les résultats ont ensuite été analysés au moyen de la mesure Dash standardisée. Ces mesures des résultats ont encore été analysées en fonction du type de blessure (lacération simple, lacération complexe, fracture et subluxation).
Résultat: Sur un total initial de 25 candidats, 17 ont pu répondre au questionnaire. En utilisant la mesure de résultat Quick DASH, nos 17 patients obtenaient une note moyenne de 28,86 (fourchette allant de 5 à 56,8).
Conclusion: Par rapport aux résultats standardisés du questionnaire Quick DASH (pas de limitation professionnelle à 27,5 contre limitation professionnelle en raison de la blessure à 52,6), le personnel soignant non médecin traite les problèmes associés aux membres supérieurs avec de bons résultats. Bien qu'il soit nécessaire d'adapter le protocole standard du questionnaire Quick DASH, l'outil semble utilisable dans des environnements non traditionnels.

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African relevance

- EM task shifting is a growing trend in Africa and throughout the developing world.
- Modified outcome measurement metrics provide QA in developing EM markets.

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- Successful injury management in rural Africa is the ability to return to work.
- Novel utilization of an outcome measurement survey to assess post-injury return to work.

Introduction

In many middle and low-income countries there is a shortage of medical providers, especially in rural areas.[1] This shortage of skilled providers often results in delayed or absent care, which drives unnecessary morbidity and mortality. This is especially common in emergency situations. Since nurses are relatively plentiful in these settings, some countries have adopted "task-shifting" as a way to expand access to care. "Task shifting" entails training a non-physician clinician to perform tasks formerly delegated to specialist physicians.[1] This methodology is already well established in Obstetrics, Orthopaedics, Surgical Care and HIV care.[2] There are reports of advance practice nurses providing acute care in high income settings.[3–5] However, there are only isolated reports of it being applied to the acute care setting in low-income countries.[1,6,7]

In response to this need, Karoli Lwanga Hospital (a non-profit Catholic Hospital, located in the rural Rukungiri District of southwestern Uganda) in partnership with the Global Emergency Care Collaborative (GECC) opened the first rural Emergency Centre (EC) in Uganda. In July 2009, with collaboration and input from the Hospital Management Team and District Health Office, a training programme in emergency care was instituted by GECC. The goal of the programme is to train selected hospital nurses to independently assess and treat patients with emergent conditions. This training combines classroom and clinical work as well as specialised education on how to carry out procedures necessary for proper emergency care. Once trained, the providers are designated as Emergency Care Practitioners (ECPs).

Given the large trauma burden, providers in rural sub-Saharan Africa are regularly called upon to repair a broad array of upper extremity injuries. These include simple lacerations (defined as single or multiple open wounds without high intensity trauma, associated fractures or extensive soft tissue injury), complex lacerations (defined as injuries in which the tissues are torn from blunt or penetrating forces, involve deeper tissues and/or have jagged or irregular edges requiring layered closures or extensive debridement), fractures and dislocations. In rural agrarian communities, like the one in this study, upper extremity injuries can have a devastating economic impact on individuals and the larger social group if inappropriately managed.[8–10] Hence, appropriate management of upper extremity injuries represents a critical patient oriented outcome and an important indicator of successful task-shifting. This patient management is also an important economic safeguard for families who rely on farming for income and personal food production, as well as the larger community dependent on the farmers.

To our knowledge, this is the first published report that examines the ability of non-physician clinicians to repair upper extremity injuries in rural Africa. The primary aim of this study was to generate pilot data on the success of ECP management of upper extremity injuries.

Methods

The nursing curriculum in Uganda is based upon anatomy, pathophysiology and pharmacology. Neither "enrolled" nor "registered" nurses receive training in either procedural techniques or surgical skills. Hence, as part of the comprehensive emergency care training programme, the ECPs undergo training in trauma management, wound care, regional and local anaesthetic techniques, and a variety of procedural skills. The efficacy of the ECP directed procedural sedation was investigated previously.[6] An evaluation of surgical repairs was considered the next logical step.

The ECP participants in the study had between 0 and 3 years of experience, with the majority having less than 1 year. Each received an extensive written curriculum in trauma assessment and treatment as well as wound evaluation and care. These materials were furthered by didactic lectures and regularly scheduled written exams. Additionally, the Junior ECPs must log their procedures and have a sufficient number of each type of procedure before they are considered competent to perform the procedure independently.

In this study all injuries requiring repair were initially assessed by an on duty ECP. When the initial assessment was done by a member of the junior class, their findings were reported to a Senior ECP and/or a visiting GECC Emergency Physician. The injury list included simple lacerations, complex lacerations, dislocations, and fractures. Following the assessment, the actual surgical repairs were performed solely by the responsible ECP with regularly scheduled follow-up for wound assessment and suture removal. All patients were given a tetanus booster and placed on antibiotics and/or anti-rabies prevention when appropriate.

This was a retrospective case series involving patients with upper extremity injuries evaluated and managed in the Karoli Lwanga Emergency Centre by ECPs. All trauma patients included in the study were seen at the Karoli Lwanga EC between March of 2012 and February of 2013. The start date was selected as it coincided with the completed conversion from the old quality assurance database (QAD), (Microsoft Excel®), to the newly designed Microsoft Access Database. The end date was used as a way of drawing in participants that had at least 30 days of recovery from the initial presentation and treatment.

The initial patient list was generated using the QAD and narrowed as in Fig. 1. This QAD was designed to monitor the care provided by ECPs to ensure that it met appropriate standards. This was deemed necessary prior to the inception of the ECP training programme because task-shifting in emergency care remains understudied and hence of unclear benefit. Review of the database was approved via the Institutional Review Board at Mbarara University of Science and Technology, the University of Massachusetts and the Uganda National Council of Science and Technology.

The Quick DASH (disabilities of arm, shoulder and hand) is comprised of 11 questions, each with a bounded Likert Scale (1–5). The validity of the Quick DASH is well established.[11] Quick DASH scores were calculated by standard protocol.[11] The lower the score, the better is the outcome for the patient. In known groups, scores <25.4 were consistent with no limitations in activity and scores <27.5 were consistent with no limitations in work.[11] Similarly, in known groups scores >48.6

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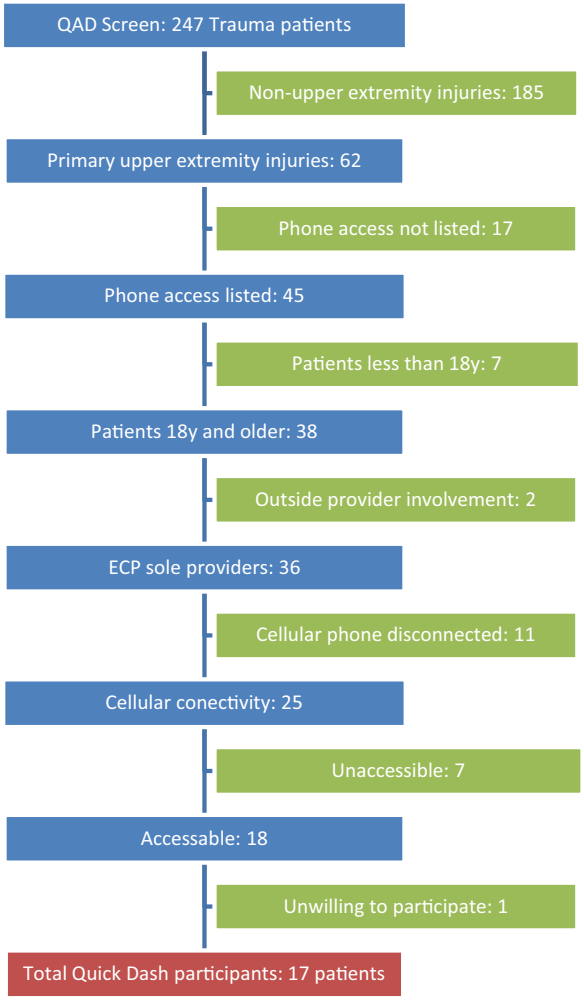

Figure 1 Summary of patient selection process. QAD, quality assurance database; ECP, emergency care practitioner; DASH, disabilities of arm, shoulder and hand.

were consistent with limitations in activity and scores >52.6 were consistent with limitations in work.[11]

Quick DASH was administered by a third party hospital nurse, fluent in both English and the local language, Runyankore. She was initially vetted and given subsequent training in the administration of the survey by the GECC onsite Research Coordinator. Although a formal translation of the survey was not generated, the administrator was instructed to ask each of the questions in the same way with each patient. The time frame for data collection was measured from the initial injury presentation and ranged from 1 to 13 months. Additionally, each of the patients was screened for any previous injury or limitation to the limb prior to their presentation to the hospital EC.

The primary assessed outcome was the ability of patients to return to work without limitation following upper extremity injury treatment. This was used as the patient-centred marker of successful management of the injury. At the conclusion of the on-site study, the database was de-identified and analysis was performed.

The initial assessment was based upon the Quick DASH score and basic metrics surrounding these (e.g. mean, range, and SD) data. As the Quick DASH score is its own internally validated outcome measure that does not discriminate based upon injury type, location in the upper extremity, age of patient or time to follow-up; we continued to use basic metrics when analysing outcomes regarding these variables. Additional analysis was done using a bivariate regression and descriptive statistics due to the small patient pool. Primary outcomes relative to these factors were examined along a continuous scale, but were subsequently categorized as ideal (no limitation in work), moderate (mild to some limitation in work) or poor (work limited) based on the defined metrics provided by Quick DASH. Because the study's data were not distributed normally, the data were summarized with nonparametric techniques as well as standard parametric tools and then compared.

Results

There were initially 25 patients with upper extremity repairs who met inclusion criteria. Of this initial 25, 18 patients (72%) were reachable by phone. Only one of these patients declined to participate and hence a total of 17 patients (68%) were able to complete the Quick DASH. The patients

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ranged in age from 18 to 69 years and 15 of these patients (88.2%) were male.

After gathering the raw data, an initial review of our findings demonstrated that there was likely a patient interpretive error with three of the question stems. Namely, due to a differing conception of time, the statement "in the last week," was interpreted to mean "in the week following the initial injury," rather than the intended "in the week prior to being contacted." This error was subsequently corrected and the survey re-administered. These data were then formerly collected and submitted to our research team. The following analysis is based upon these data.

When considered together the mean Quick Dash Score was 28.86 with a SD of 14.65 and range of 5 to 56.8. The median for this group was 34.1. Further analysis was done by categorizing patients into functional outcome groups (Table 1).

Patients with Quick Dash scores < 27.5 were considered by the outcome measure standard to have no limitations regarding work and hence were deemed the optimal outcome ("No Work Limitation" in Table 1). Patients with scores >27.5 but <52.6 were considered to have a range of minimal to moderate limitations working as defined by the standards of the Quick DASH. Hence, their outcomes were deemed intermediate ("Some Work Limitation" in Table 1). There was only one patient who had a "high" score >52.6 ("Work Limited" in Table 1) and hence significant limitations regarding work. This patient was a 45-year-old male who has sustained a severely displaced clavicle fracture and multiple soft tissue injuries secondary to a road traffic accident. Although his follow-up time was eight months, the initial chart indicated a need for orthopaedic intervention, which was subsequently not completed after his admission.

A total of eight patients were categorized within the optimal outcome group. The mean Quick DASH Score was 16 with a SD of 8.62, a range of 5–25 and a median of 15.7. Similarly, a total of eight patients were categorized within the intermediate outcome group. The mean Quick DASH Score was 38.2 with a SD of 3.9, a range of 31.4–45.5, and a median of 36.4. Within the grouping there was no association between the age at which the patient presented and the Quick DASH Outcome. The mean age in the optimal outcome group was 37 years (SD of 17 years) and that in the intermediate outcome group was 33 years (SD of 12 years). There was however, a trend towards improved outcomes with greater healing time. On average each month of healing time was equivalent to a single digit decrease in Quick DASH score (Fig. 2).

The Quick DASH Scores are strongly associated with the type of injuries the patient sustained (Table 2 & Fig. 3). The patients who presented with subluxations had a mean score of 6.25 with equal distributions about this central tendency. Similarly, patients with simple lacerations had a mean of 15.16, but left skew indicative of a lean towards lower scores and hence better outcomes. Conversely, patients who presented with complex lacerations had a mean score of 33.95, but a right skew was indicative of a larger grouping of numbers with higher Quick DASH scores and hence worse outcomes. Finally, patients who presented with fractures (in our study all fractures were secondary to high impact trauma) had the highest mean value of 46.6 with an even distribution. These patients clearly had the least favourable outcomes recorded.

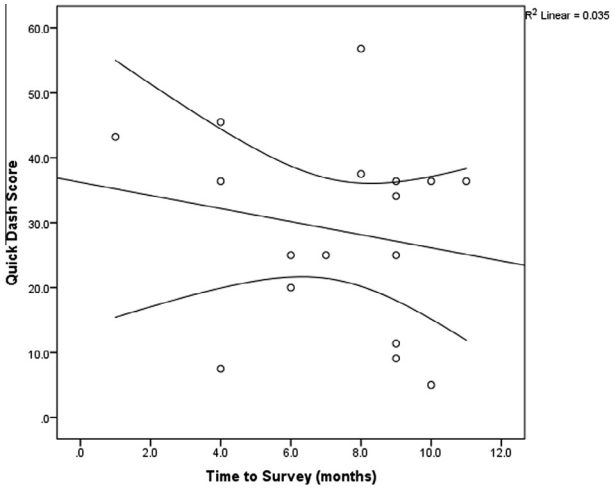

Figure 2 All outcome Quick DASH scores vs. healing times. DASH, disabilities of arm, shoulder and hand.

Unlike injury type, the data do not support any association between laceration location and outcome. Although, there are well-established baselines for recovery rates relative to the area of the limb that has been affected by injury, our data demonstrated significant consistency about the mean, median and range.

Discussion

The Quick DASH Survey provides qualitative assessment of injuries and repairs of injuries in the upper extremity. Our aim was to apply this accepted metric in a rural sub-Saharan community to evaluate patient centred outcomes in this atypical setting. Specifically we sought to evaluate the relative success of non-physician clinicians at getting community members back to work following upper extremity injuries. It is already accepted that loss of function relative to manual labour has financial repercussions on both the individual and their family.[8–10] Hence, one key function of Emergency Care is to

Table 1 Functional outcome groups.

	No work limitation	Some work limitation	Work limited
Number of patients	8	8	1
Mean & SD score	16 ± 8.62	38.4 ± 3.94	n/a
Range of scores	5–25	34.1–45.5	56.8
Median score	15.7	36.4	n/a
Mean age at injury	37	33	45
Range of ages	20–69	18–47	n/a
Average time to follow up in months	7.5	7	8

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Table 2 Range of Quick DASH scores by injury type.

	No work limitation N (%)	Some work limitation N (%)	Work limited N (%)
Simple laceration	3 (37.5)	0 (0)	0 (0)
Complex laceration	3 (37.5)	7 (87.5)	0 (0)
Subluxation	2 (25)	0 (0)	0 (0)
Fracture	0 (0)	1 (12.5)	1 (100)

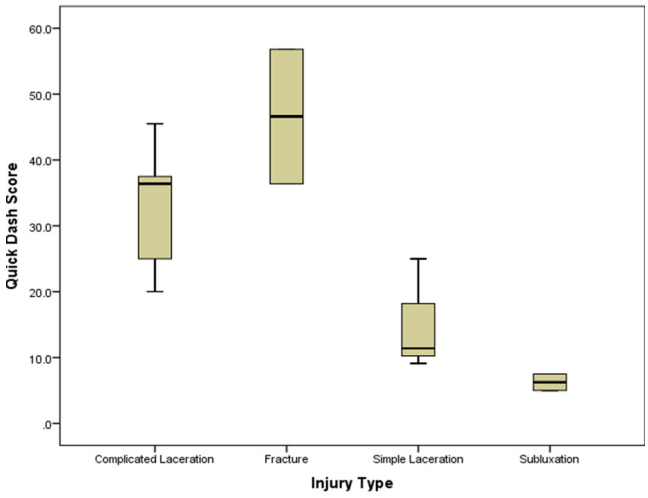

Figure 3 Range of Quick DASH scores by injury type (bolded lines depict medians). DASH, disabilities of arm, shoulder and hand.

effectively repair injuries that could otherwise undermine a patient's functional capacity relative to work or labour.

Based on our pilot data we found that ECPs, trained through the GECC emergency care programme, were able to manage a wide array of upper extremity injuries with good patient oriented outcomes. Specifically, when the ECPs were required to manage subluxations or simple lacerations they were able to perform these repairs with mean Quick DASH scores of 6.25 and 15.17 respectively. These values are both well below the threshold for returning to work without limitation. Similarly, the ECPs were also able to perform complex laceration repairs well with a mean Quick DASH score of 33.95. Although this fits into the range of some limitation in work, it is still well below the limit for disability preventing labour. Our pilot data also suggest that the patients with fractures tended to have worse outcomes. While this is not surprising, the small N and limitations of available clinical data (i.e. radiographs to confirm fracture type and displacement, formal testing to determine ligamentous injury, etc.,) make it difficult to determine the cause of the worse outcomes in these patients. Of our two patients with fractures one was able to receive a pre- and post-reduction radiograph and his outcome score was a 36.4 with a time to follow-up of ten months. Our other patient who presented with fracture was unable to get indicated radiographic studies due to the limitations of the setting. His outcome score was 56.8. Although his injury (clavicle fracture) does not require complex reduction in the EC, it is unclear if the injury required operative fixation or if there were associated nerve injuries that limited his return to work. In spite of this fracture outcome, the general trends presented in this pilot are suggestive that non-physician clinicians can effectively manage upper extremity injuries.

The data presented in the pilot study expand the literature on the role of advanced practice non-physician clinicians in low-income settings. Our group previously reported on the use of ketamine for procedural sedation by these providers.[6] However, there is little other literature describing task shifting for acute care in these settings. Nevertheless, there are numerous publications from high-income settings examining the role of advanced practice non-physician clinicians. These manuscripts have demonstrated that these providers can effectively and safely perform procedural sedations, participate as members of the critical care team, assist in major surgical procedures, and perform invasive bedside procedures.[4,12–14] Given the paucity of doctors in most low-income countries, especially in rural areas, it will be important to examine the role non-physician clinicians can play in acute care. This pilot study suggests that these clinicians can provide effective care for upper extremity injuries with good outcomes; however, given the small "N" this finding should be confirmed in a larger study.

Although this study used a retrospective design, it does not have some of the limitations that typically affect such studies. For example there was no particular area of confounding within QAD itself, as all patients cared for in the EC are entered into the QAD. Although the socio-economics of access could be argued, the vast majority of patients seen in the Karoli Lwanga Hospital are subsistence farmers, so there is minimal variability in type of work and access to secondary resources.

The main limitation arises from our low "N" and the potential confounding associated with our selection criteria. As noted, we initiated our QAD search and found 62 patients with treated upper extremity injuries. However, given the DASH age criteria, required phone access and chart review this number dropped to 25 patients. Our "N" was further reduced to 18 since seven patients no longer had phone access. Given this narrowing it is possible that the patient group evaluated is not truly representative of the initial 62 patients treated within our given time frame. Despite this limitation, the broad array of patient ages (18–69), injury types, primary ECP treatment providers and the built-in reliability of the Quick DASH encourages one to accept these limitations as inherent in a pilot of this size.

Another potential limitation to this pilot is that the Quick DASH has never been applied to rural Africa with a nominal native speaker population. This unique application required some innovation relative to the administration of the survey. Although the DASH/Quick DASH Manual[11] has specific instructions relating to the cross-cultural use of the survey as well as a procedure for the translation of the document, we were unable to follow these exactly. The local language is Runyankore, which has approximately 300,000 native speakers only and hence an official written translation was impossible to

generate. Similarly, given the rural location of hospital and surrounding districts as well as the socio-economic-education limitations of most of the patients, it was not feasible to administer a written document in person. The nurse administering the survey underwent an initial training and initially surveyed our entire patient base. After evaluating inconsistencies we subsequently re-administered the survey and then evaluated these data. This is in keeping with the DASH/Quick DASH Manual instructions. Although we stayed true to the essence of the translation process, we recognize the inherent complications associated with our unique approach. Despite this, authors[15,16] have noted the utility of using oral translation services in the administration of surveys.

The final limitation is that the Quick DASH was designed to be used with a pre- and post-intervention survey to examine the efficacy of operative repairs. However, multiple authors[15,17–19] in both developed and resource-limited settings have also used the Quick DASH as a post intervention tool. This suggests that a single administration of the survey is a viable method of comparing patient outcomes.

In low resource settings, where patients tend to rely on manual labour for income and survival, functional outcomes after upper extremity injury carry enormous economic significance for the individual and community as a whole. Data from this pilot study suggest that non-physician clinicians trained in emergency care are able to manage a wide range of upper extremity injuries with good functional outcomes. A more detailed prospective analysis of upper extremity injuries with attention to barriers to optimal care (i.e. lack of availability of needed infrastructure such as radiographs, versus lack of knowledge or skill of providers) would provide more detailed information about how to improve outcomes for these patients. Such an undertaking would also provide more data about the success of non-physician clinicians in managing these injuries where specialty services are unavailable.

Conflicts of interest

The authors declare no conflict of interest.

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