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Trauma Quality Improvement in Low and Middle Income Countries of the Asia–Pacific Region: A Mixed Methods Study

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Abstract

Background Quality Improvement (QI) programs have been shown to be a valuable tool to strengthen care of severely injured patients, but little is known about them in low and middle income countries (LMIC). We sought to explore opportunities to improve trauma QI activities in LMIC, focusing on the Asia–Pacific region.

Methods We performed a mixed methods research study using both inductive thematic analysis of a meeting convened at the Royal Australasian College of Surgeons, Melbourne, Australia, November 21–22, 2010 and a pre-meeting survey to explore experiences with trauma QI activities in LMIC. Purposive sampling was employed to invite participants with demonstrated leadership in trauma care to provide diverse representation of organizations and countries within Asia–Pacific.

Results A total of 22 experts participated in the meeting and reported that trauma QI activities varied between countries and organizations: morbidity and mortality conferences (56 %), monitoring complications (31 %), preventable death studies (25 %), audit filters (19 %), and statistical methods for analyzing morbidity and mortality (6 %). Participants identified QI gaps to include paucity of reliable/valid injury data, lack of integrated trauma QI activities, absence of standards of care, lack of training in QI methods, and varying cultures of quality and safety. The group highlighted barriers to QI: limited engagement of leaders, organizational diversity, limited resources, heavy clinical workload, and medico-legal concerns. Participants proposed establishing the Asia–Pacific Trauma Quality Improvement Network (APTQIN) as a tool to facilitate training and dissemination of QI methods, injury data management, development of pilot QI projects, and advocacy for quality trauma care.

Conclusions Our study provides the first description of trauma QI practices, gaps in existing practices, and barriers to QI in LMIC of the Asia–Pacific region. In this study we identified opportunities for addressing these challenges, and that work will be supported by APTQIN.

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Introduction

Injury is a major global public health problem. Each year, 5.8 million people die from injury, and many more are disabled [1, 2]. The burden is especially large in low and middle income countries (LMIC), where over 90 % of

injury deaths occur [1, 3, 4]. To lower this unacceptable burden, a spectrum of actions is needed, including better surveillance and research, increased implementation of road safety and other forms of injury prevention, and strengthening of trauma care (care of the injured) [5].

Quality improvement (QI) programs have been shown to be valuable administrative tools with which to strengthen the care of severely injured patients in trauma centers and trauma systems in high income countries (HIC) [6]. They have also shown promise as a means of lowering trauma mortality in LMIC, at an affordable cost and in a sustainable fashion [6, 7]. However, beyond the activities of some local champions, very little is known about the status of current trauma QI activities or the challenges to improving the quality of trauma care in LMIC [8].

We therefore organized a two day meeting with senior and influential leaders directly involved with the organization of trauma services in both a clinical and administrative capacity from a range of LMIC across the Asia–Pacific region to explore opportunities to improve QI activities. The primary aim of the study was to review trauma QI practices in LMIC, identify gaps in existing practices, explore barriers to QI, and develop potential strategies by which to address these challenges.

Materials and methods

This study was conducted using a mixed methods methodology [9]. First, meeting participants were administered a pre-meeting survey [10]. Second, a facilitated meeting using open-ended questions was conducted and recorded for qualitative analysis [11]. Four specific questions pertaining to trauma QI in LMIC across the Asia–Pacific region were addressed:

(1) What trauma QI practices are currently employed?
(2) What are the perceived gaps in current trauma QI practices?
(3) What are the perceived barriers to trauma QI?
(4) What potential strategies could be implemented to address the perceived gaps and barriers to trauma QI?

Participants

Purposive sampling was employed to invite to participants who had demonstrated leadership in the delivery and/or improvement of trauma care, and who had diverse expertise and roles in countries within the World Health Organization's (WHO) South-East Asia (SEAR) and Western Pacific Regions (WPR) [12, 13]. The SEAR and WPR regions were selected to limit the geographic scope of the meeting, facilitate participant travel in conjunction with the National Trauma Research Institute/Australasian Trauma Society's annual scientific congress, Trauma 2010 [14], and to promote ongoing regional collaboration. It was anticipated that the participants would act as leaders, promoting trauma QI programs in their own countries and the region (Appendix 1).

Data collection

Data were collected in November 2010 by pre-meeting survey and recording of meeting observations and deliberations (written minutes and audiotape transcripts) [10, 11]. An electronic survey mailed to participants was designed to collect basic professional information, current injury care resources, and trauma QI activities, and to solicit information about gaps and barriers to trauma QI in LMIC [10] (Appendix 2). The survey instrument was developed from semi-structured interviews with injury and quality of care experts, and it was pre-tested to assess face validity, clarity, length, and completeness [10, 15].

The agenda for the two day meeting, facilitated by the investigators, included a presentation of background information collected from the survey and discussion of gaps and barriers to trauma QI and strategies to address these challenges [11, 16]. Participants were organized into small country-based groups in which they discussed meeting questions and then presented their ideas to the larger group [17]. Ideas contributed by participants were noted by the investigators; similar small group suggestions were collated and further discussed by the larger group [12]. Support staff who manually documented deliberations and decisions compared findings and resolved any differences. The audio tape recording of the meeting was transcribed verbatim.

Data analysis

Data analysis was performed in two phases: a descriptive summary of survey data followed by qualitative analysis of the meeting proceedings [10, 11, 18]. First, survey data were summarized using proportions. Statistical analyses were performed with a statistical software package (Stata version 10.0 StataCorp, College Station, TX). Second, two investigators (H.T.S., R.G.) independently (to increase reliability) analyzed the content of the meeting proceedings (minutes and transcripts) according to standard principles of qualitative research, drawing on inductive thematic analysis [11, 18]. Codes were grouped into categories. From the categories, concepts were developed to support a theory. The goal of the analyses was to identify gaps in existing trauma QI practices, explore barriers to QI, and identify potential strategies with which to address these challenges. Ethics approval was obtained from the

University of Calgary's Conjoint Ethics Review Committee. Workshop participants provided written consent.

Results

Twenty-two participants from seven LMIC (China, India, Malaysia, Philippines, Sri Lanka, Thailand, Vietnam—representing over 85 % of the population in the SEAR [1.5 billion people] and WPR [1.6 billion people]) attended the meeting, as did eight observers and facilitators from Australia and Canada (Appendix 1) [19]. Participants were surgeons ($n = 13$), emergency medicine physicians ($n = 7$), and nurses ($n = 2$) who worked in capital cities ($n = 13$) or regional centers ($n = 9$) and had experience in trauma QI ($n = 13$). Participants summarized their perceptions of existing trauma QI practices in their countries (Table 1). Practices varied between countries and the capital cities, regional centers, and rural areas within countries. Injury data collection and QI practices were reported to be most common in capital cities and regional centers. Morbidity and mortality conferences were the most frequently reported QI activity. A few participants reported the use of preventable death studies, quality of care audits, audit filters, and statistical analyses of injury morbidity and mortality.

The results from our qualitative analyses are organized into three parts: description of perceived gaps in existing trauma QI practices (Table 2), identification of perceived barriers to trauma QI (Table 2), and presentation of potential strategies to improve trauma QI (Table 3).

Gaps in existing trauma quality improvement practices

Paucity of reliable and valid injury data

Discussion about the challenges of obtaining reliable and valid injury data arose among the participants. Injury data collection varied between countries, with some having advanced systems of data collection and others working on implementing data collection. QI activities were reported to be limited by existing data, chiefly, a lack of data registries, limited data elements within registries, data collection errors, and limited documentation within medical records (e.g., adverse events). Existing organization of medical records and the absence of electronic tools (e.g., electronic patient lists) was felt to be an important limitation for data collection. Participants highlighted a lack of consensus about what kinds of data are required for QI and how data elements are defined. An important question for many participants was who should be responsible for data recording: health care providers, researchers, dedicated QI

Table 1 Participant reporting of trauma quality improvement practices in Asia–Pacific

Characteristic	Capital cities (%)	Regional centers (%)	Rural areas (%)
Injury data collection			
Injury			
Type	94	65	27
Mechanism	80	47	14
Severity	73	33	8
Processes of care			
Prehospital	73	56	31
Emergency department	75	56	23
Surgical department	81	58	8
Intensive care unit	80	50	8
Outcomes of care			
Complications	80	56	15
Length of hospital stay	87	68	50
Hospital mortality	87	68	50
Degree of recovery from injury	62	33	8
Quality improvement activities			
Morbidity and mortality conferences	81	53	17
Preventable death studies	37	12	0
Quality of care audits	31	29	0
Audit filters	25	23	0
Statistical analysis of morbidity and mortality	19	6	8

Table 2 Trauma quality improvement gaps and barriers

Gaps	Barriers
Paucity of reliable and valid injury data	Limited engagement of leaders
Lack of integrated trauma quality improvement activities	Organizational diversity
Absence of standards of care	Limited resources
Lack of training in quality improvement methods	Heavy clinical workload
Limited organizational cultures of quality and safety	Medico-legal concerns

Table 3 Potential strategies to improve trauma quality improvement

Strategies
Support network for trauma quality improvement
Engage leadership
Education
Standardize injury data
Pilot projects

staff, or non-health care related organizations such as police or security organizations. Finally, some participants indicated that there was a lack of awareness about data such that existing data were sub-optimally incorporated into trauma QI.

"We need data. You say that you are providing good quality care, but how do you prove that? Thailand showed that their survival rates were quite high, but then further lowered their mortality and had data to show it."

Lack of integrated trauma quality improvement activities

All participants indicated that trauma QI activities are being performed in their countries, but that there is room for improvement. Specifically, participants reported that many activities are performed in isolation by individual clinical departments, disciplines, or organizations with limited cooperation between stakeholders. For example, morbidity and mortality conferences are frequently performed within individual clinical departments, but without representation by other professionals who also participated in patient care. One explanation for a "silo" approach to QI was that groups were "protective of their turf." As a result, actions taken to address quality concerns ("loop closure") were reported to be suboptimal.

"Trauma quality improvement requires an integrated approach, but there is currently a lack of communication, preventing quality improvement across the spectrum … Each Department has its own morbidity and mortality conference … so you have the neurosurgeons [with] their own approach, [and] the general surgeons [with] their own approach, but they do not talk to each other."

Absence of standards of care

Several participants raised the issue of a lack of standards of care. For them, the absence of quality of trauma care standards makes QI difficult and produces variation between individual clinicians and organizations. This gap was further complicated by a lack of perceived accountability for quality of care.

"What are [the] minimum acceptable standards of care? We don't have any. Hospitals are unwilling to set quality of care standards and explore their weaknesses."

Lack of training in quality improvement methods

Limited training and experience with QI was reported as another important gap in existing systems. Participants indicated that most clinicians are unfamiliar with QI, do not understand QI terminology, and may not even be aware of the role of QI in improving patient care. Education of clinicians in basic QI concepts and the role that QI programs can provide was perceived to be very important.

"People do not know what quality improvement is. I represent the best of the hospital[s] in my country, but before I came here, if you would have asked me what quality improvement is, I did not know what I would discuss."

Limited organizational cultures of quality and safety

Participants from different countries and regions within countries described a diversity of health care cultures. However, a common theme was that quality and safety of patient care were generally not important components of the culture. Some participants described their health care cultures using terms such as "hierarchical," "reactive," or "punitive." Some organizations were reported to be unwilling to explore controversies or deficiencies in the care provided to injured patients, fearing criticism or legal rebuke. These factors contributed in some countries to suspicion of QI and an unwillingness to accept recommendations for QI.

"I have worked in different parts of the [country] throughout my career and I have not seen a single place where [trauma QI] is positively oriented… It leads [to] hierarchical traditions especially in surgeons. When the senior consultant talks it is the end of the story. This is how the system exists."

Barriers to trauma quality improvement

Limited engagement of leaders

Participants indicated that QI was a low priority in most countries. They indicated that clinical and organizational leaders provided varying degrees of support for the concept, but were primarily focused on other health care issues. Limited ability to engage leaders in trauma QI makes it difficult to obtain commitment from health ministries, to encourage administrations to participate in QI, or to foster communication, coordination, and networking of clinical groups.

Organizational diversity

Participants noted that considerable diversity in QI and clinical care existed between countries and between organizations within countries. Infrastructure, funding, and organization of both clinical work and QI were noted to vary. This was complicated by large differences in patient populations and clinical workload. Furthermore, in many countries central coordination of trauma care was reported to be limited. Participants highlighted that patient care should be adapted to local circumstances, but that the absence of uniform policies, guidelines, and protocols impairs communication among centers and creates a barrier to effective trauma QI. Without a common approach, QI is very difficult.

Limited resources

Resource limitations were universally described as an important barrier to trauma QI and included limited funding, lack of trained clinical and QI personnel, limited facilities and equipment, and in some cases a lack of dedicated trauma services. Some participants noted that resource limitations placed important time constraints on QI activities. Others reported that QI was simply not feasible given the resources available. Limited infrastructure presents challenges in establishing mechanisms for the development and maintenance of trauma registries, even to the point that there are no personnel for data entry. Participants highlighted the challenges of prioritizing the use of limited resources to provide patient care versus improving the quality of patient care.

"In a country where there's no money, I am sure that the ministry will not spend their money [on QI]. Where do you want to spend the money, in patient care or data care?"

Heavy clinical workload

Participants described large volumes of clinical work as an important barrier to effective QI. Some indicated that their institutions were responsible for providing care for large populations of patients relative to the number of available providers. This severely restricts available time for activities other than direct patient care. To complicate matters, financial reimbursement schedules discourage QI. Participants perceived that other clinical activities were reimbursed at higher levels than providing trauma care, and that QI activities are reimbursed at even lower levels, if at all. As a result, key clinicians are infrequently available to review deaths or adverse events, or to address other quality of care concerns, let alone to develop new QI strategies.

"All cases cannot be discussed [at morbidity and mortality conference] because of the volume… If we had two or three patients that is fine, but we have 30–40 deaths in a month, and if we do a meeting once in 3 months for 3 h how many patients can you discuss? It is just impossible."

Medico-legal concerns

A minority of participants identified medico-legal worries as an important barrier to QI. They indicated that concerns about legal discovery limited the scope of QI activities in an important way. For example, in some institutions morbidity and mortality findings were restricted to departmental members, never shared outside of the department. Similarly, in other organizations QI activities, including morbidity and mortality conferences, were purposefully "not documented" to protect participants from discovery.

"The most common excuse for not documenting these [morbidity and mortality conferences] is access of data for [litigation] purposes."

Potential strategies to improve trauma quality improvement

Support network for trauma quality improvement

Participants identified the value of meeting with colleagues from different centers and countries as a mechanism for improving trauma QI. Specifically, they noted that establishing a support network would improve trauma QI through several mechanisms: (1) alleviate what many perceived as working in isolation with limited support from local colleagues or organizations, (2) provide opportunities for learning from the experiences of other participants, (3) motivate participants to improve local QI programs, (4) provide opportunities for coordinating QI activities so as to explore economies of scale (e.g., data management software) or potential for implementing standard policies (e.g., guideline implementation), (5) facilitate QI education and continuing medical education through workshops or courses, (6) help participants explore approaches for supporting local QI activities, and (7) promote a better understanding

of QI in the field of trauma. Participants concluded the meeting by establishing the Asia–Pacific Trauma Quality Improvement Network (APTQIN).

Engage leadership

Participants identified the importance of engaging institutional leadership to promote high quality trauma care. Suggestions to accomplish this included adding trauma to the scope of existing non-trauma QI activities (e.g., hospital quality and safety teams), establishing infrastructure (e.g., multidisciplinary trauma committee) to attract participants in QI, identifying and targeting key administrators or clinicians as potential leaders in the effort, identifying local and national organizations with relevant interests that may provide guidance or support the goals of QI, and gathering people with a mutual interest in QI. A response to these suggestions would allow for the establishment of critical masses of like-minded individuals to work toward improving the quality and safety of trauma care.

"We also agreed that we should identify key [people] when we go back there and that is not exclusive to surgeons… critical mass is not the number, it is the personality that is involved…"

Education

Participants identified the importance of advancing trauma QI through educational efforts, particularly by increasing awareness of QI among health providers. Participants identified three specific education goals: (i) Recruit and educate individuals for specific QI activities to improve the quantity and quality of personnel working in QI. This should include instruction in how to analyze and use data for understanding injury patterns and advocacy, and should lead to establishment of QI administration programs. (ii) Work on changing the culture of organizations through promoting greater awareness of QI among staff. Such an effort would foster a culture of safety and quality. (iii) Train future champions and leaders of trauma QI using a two pronged strategy: (1) incorporate QI training into frequently held trauma conferences through workshops or pre-conference courses, and (2) introduce QI into undergraduate and specialist medical education so as to familiarize clinicians with basic terminology and concepts.

Standardize injury data

Establishing standardized injury data was identified as a key strategy. Meeting participants outlined that agreement on a reliable and valid data systems was paramount for trauma QI. Specifically, this would include decision on a minimal data set, key performance indicators, identification of appropriate low cost software options, development of standardized and simple data collection forms, electronic recording of data if possible, establishment of local and central trauma registries with dedicated data entry personnel, and data quality checks and training and awareness around data utilization, including benchmarking. In addition, participants highlighted the need for updating existing measures of quality of care.

"Integrating injury surveillance data collection with trauma quality improvement data collection is an important way to get quality improvement. We need to establish trauma registry minimum data requirements, develop registries and get assistance on how to use the data."

Pilot projects

Participants identified the importance of establishing pilot QI projects that could serve as tests and demonstrations for QI. Finding small sums of money to support pilot projects was thought to be more feasible than targeting larger more expensive QI activities. Furthermore, successful projects that were shown to be feasible and associated with improved care could plausibly attract additional resources. Participants highlighted the work of Dr. Chadbunchachai from Thailand as an excellent example of how to build trauma QI in small incremental steps from the ground up [7, 20, 21].

"A small fund in the beginning allowed us to provide documents and help train personnel and hospital clinicians. … We had a group of only two doctors and a couple of nurses. We started a small simple project to establish an information system … we were able to get some skill [and obtain] a second period of support for inter-hospital triage process improvement. This was the beginning."

Discussion

Principal findings

This article provides the first description of perceived gaps and barriers to trauma QI and potential strategies to address these challenges in LMIC of the Asia–Pacific region. The results are derived from both quantitative (pre-meeting survey) and qualitative (thematic analysis of meeting transcripts) analyses of a meeting of senior and influential leaders to explore opportunities to improve trauma QI activities in LMIC of the Asia–Pacific region. Participants reported that trauma QI activities are currently performed to varying degrees in different countries and different institutions and organizations within countries. Trauma QI gaps and barriers identified included limited injury data, lack of training in QI methods, heavy clinical workloads,

and organizational cultures focused on medico-legal worries. Opportunities to improve and expand existing trauma QI activities were identified and included collection of reliable and valid injury data, training providers in QI methods, development of integrated QI programs, and encouraging organizational cultures of quality and safety. A regional trauma QI network was identified as a potential tool to support local and regional activities, and participants agreed to establish the APTQIN.

The results of our study need to be considered within the context of the existing literature. Previous studies have demonstrated that there are large discrepancies in injury outcomes between countries of different economic levels. For example, Mock et al. [22] reported overall mortality rates among severely injured patients (defined as injury severity score $\geq$9) of 35 % in the United States (high-income), 55 % in Mexico (middle-income), and 63 % in Ghana (low income). Similarly, in a study of patients with injury severity scores 15–24, mortality was six times higher for patients in low income locations than in high income locations [23]. Improvements in injury control have significantly lowered rates of injury-related deaths in many HIC [24, 25]. These have been achieved across the spectrum of injury control, ranging from surveillance and primary prevention to medical management from the moment of injury to the time of recovery. Larger opportunities for improvement exist in LMIC, where injury rates are far higher than in HIC, and where most of the world's people live and only limited injury control activities have been undertaken.

Our study adds to the existing literature by highlighting opportunities to improve trauma care in LMCI through trauma QI practices (many of which could also be applied in HIC). First, standardizing injury data is a first step in improving injury care. Injury control activities cannot be effectively conducted without adequate assessments of their impact [25]. Development of reliable and valid minimal data sets that include key performance indicators are essential for effective injury surveillance, targeting interventions, and assessing their success or failure. Implementation of simple and standardized data collection forms and basic software programs need not be expensive. Second, increasing awareness and understanding of QI among health providers and organizational leaders is important for effective QI. For example, the essential trauma care project is an effort to set low-cost minimum standards for trauma care services worldwide [26]. Education could encourage local implementation of QI efforts, evaluation of their effectiveness (and modification for local needs), and it could also engender a culture of safety and quality in injury care within local resource constraints. Third, engaging people in leadership roles to understand the importance of injury-associated morbidity and mortality is likely to promote better quality of care and greater injury control efforts. Organizational leadership that understands the ramifications of injury are more likely to drive QI efforts and demonstrate interest in prevention strategies [25]. Fourth, although QI efforts need to be locally responsive, there is tremendous opportunity for capacity-building through strategic alliances at national and regional levels. The APTQIN aims to support local QI efforts by providing a forum for knowledge and experience exchange, increasing QI capacity through workshops and training and coordinating the development and dissemination of trauma QI tools.

Limitations of the method

There are several limitations to this study. First, participants were from capital cities and regional centers in LMIC of the Asia–Pacific region, and thus the findings may not be generalizable to other settings. Second, some people may question whether sampling 22 participants from seven countries reflects the views of health care providers in the countries of Asia–Pacific. However, purposive sampling of participants was employed to ensure representation of diverse expertise, roles, and organizations. Furthermore, saturation of themes occurred during analysis of the meeting proceedings, suggesting that it is unlikely that important concepts were missed [11, 18]. Third, our study only included physicians and nurses, although they are key front line health providers of trauma care. Fourth, research studies employing mixed methods have not been frequently reported in the trauma literature and may be unfamiliar to readers. Nevertheless, these reliable and valid methodologies [9, 11, 18] have been used successfully in health services research [27–29].

Conclusions

Around the world, countries are faced with a quietly growing injury epidemic [1, 2]. Yet remarkably, little is known about trauma QI programs in LMIC. Our mixed methods study involved a landmark meeting of multiple key stakeholders from seven countries across the Asia–Pacific region and achieved a record of gaps, barriers, and strategies for trauma QI. Participants agreed to build on current trauma QI activities in their own institutions, and to provide leadership in the spread of trauma QI program development across the region by establishing the APTQIN. The network will focus on expanding QI activities using a region-wide approach tailored to local settings by assisting members in disseminating trauma QI materials, promoting collaborations, and facilitating linkages with

participants, institutions and organizations, and countries not represented at the meeting as an important step toward reducing the burden of injury in LMIC.

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Conflicts of interest None.

Appendix 1 Meeting participants

Country	Institution	Individual/role
China	Longgang District People's Hospital, Shenzhen	Dr. Zhang Guixi (participant)
	Longgang Central Hospital, Shenzhen	Dr. Xiofeng Shi (participant)
India	Academy of Traumatology, Ahmedabad	Dr. Manjul Joshipura (co-chair)
	Fortis Hospital, New Delhi	Prof. Yashbir Dewan (participant)
		Prof. Sanjeev Dua (participant)
	All India Institute of Medical Sciences, New Delhi	Dr. Deepak Gupta (participant)
	Safdarjung Hospital, New Delhi	Dr. Sivashanmugam Dhandapani (participant)
Malaysia	Sg. Buloh Hospital	Dr. Nik Ahmad (participant)
		Dr. Subariah Faizah (participant)
		Dr. Faisal Salikin (participant)
		Dr. Mohd Salleh Shukrudeen (participant)
Philippines	Philippines General Hospital, Manila	Prof. Eric Talens (participant)
		Dr. Rafael Consunji (participant)
		Dr. Orlando Ocampo (participant)
		Dr. Shiela Macalindong (participant)
Sri Lanka	College of Surgeons, Colombo	Dr. Ranjith Ellawala (participant and facilitator)
Thailand	Khon Kaen Hospital, Khon Kaen	Dr. Witaya Chadbunchachai (participant and facilitator)
		Dr. Tawatchai Impool (participant)
		Ms. Nueng-Na-Suwan Wilanwan (participant)
		Ms. Pumiprabu Watchara (participant)
	Makarak Hospital, Kanchanaburi	Dr. Tanachet Kungsapatkul (participant)
Vietnam	Duc Giang Hospital, Hanoi	Dr. Thai Son Nguyen (participant and facilitator)
Australia	The Alfred, Melbourne	Prof. Russell Gruen (co-chair)
		Dr. Frank McDermott (observer)
		Dr. Gerard O'Reilly (facilitator)
		Ms. Jennifer Burchill (observer)
		Ms. Kylie Chou (observer)
		Dr. Meng Tuck Mok (observer)
Canada	Foothills Medical Centre, Calgary	Dr. Andrew Kirkpatrick (observer)
		Dr. Henry Stelfox (facilitator)

1.

1. Where do you geographically work within your country?

- ◯ Capital City
- ◯ Regional center
- ◯ Rural Region

Other (please specify):

2. What is your clinical role in trauma care? (select ALL that apply)

- ☐ Clinical Trainee
- ☐ Emergency Medicine Physician
- ☐ Intensive Care Physician
- ☐ Nurse
- ☐ Surgeon

Other (please specify)

3. What is your administrative / organizational role in trauma care?

4. How are injuries / trauma defined in your country (for purposes of identifying or counting injured patients)? Please be specific (i.e. ISS > X, ICD codes etc).

5. What age criteria are generally employed in your country to define an adult trauma patient?

6. What age criteria are generally employed in your country to define a pediatric trauma patient?

Appendix 2 Survey instrument

7. Please indicate what are the most frequent types of trauma (using a 5 point scale ranging from rare to very common) that result in severe injury (hospitalization, disability or death) in your country (to the best of your knowledge)?

	Capital Cities	Regional Centers	Rural Areas
Motorcar			
Motorcycle			
Pedestrian			
Bicycle			
Sport			
Burns			
Assault / Violent			
Suicide			
Explosives / Blast			
Falls			

Other (please specify)

8. Which of the following trauma services are available in your country (check all that apply)?

	Capital Cities	Regional Centres	Rural Areas
Emergency Medical System	☐	☐	☐
Systems of Triage	☐	☐	☐
Inter-Hospital Transfers	☐	☐	☐
Designated Trauma Hospitals	☐	☐	☐
Resuscitation Facilities (e.g. trauma rooms in emergency department)	☐	☐	☐
Designated Trauma Teams (responsible for immediate assessment & management of trauma patients)	☐	☐	☐
Trauma Team Activation Criteria	☐	☐	☐
Intensive Care Units	☐	☐	☐
Rehabilitation Facilities	☐	☐	☐

Other (please specify)

Appendix 2 continued

9. Have you previously had any involvement with quality improvement activities (trauma or non-trauma)?

◯ Yes

◯ No

Please Describe Your Involvement

10. To what extent does data collection regarding injured patients occur in your country? Please respond to the different domains of possible data collection selection one of three possible answers (Yes, No, Don't know).

	Capital Cities	Regional Centers	Rural Areas
Type of injury			
Mechanism of injury (e.g. blunt vs. penetrating)			
Severity of injury			
Nature of prehospital care (processes)			
Nature of emergency department care (processes)			
Nature of surgical care (processes)			
Nature of ICU care (processes)			
Complications of care (e.g. surgical site infections)			
Length of hospital stay			
Mortality			
Degree of recovery from injury (e.g. disability or functional status)			

Other (please specify)

Appendix 2 continued

11. Who monitors the injured patient data collection (select ALL that apply)?

	Capital Cities	Regional Centers	Rural Areas
No data collection	☐	☐	☐
No data monitoring	☐	☐	☐
Clinicians involved in patient care	☐	☐	☐
Hospital	☐	☐	☐
Professional society	☐	☐	☐
Government	☐	☐	☐

Other (please specify)

12. To what extent (using a 5 point scale ranging from never to very common) are the following trauma quality improvement activities used in your country?

	Capital Cities	Regional Centers	Rural Areas
Morbidity and mortality conferences			
Preventable death studies			
Monitoring complications (e.g. surgical site infections)			
Quality of care audits (reviewing medical records for quality of care)			
Audit filters (measures of processes & outcomes of care e.g. time to OR for major hemorrhage)			
Statistical methods for analyzing morbidity or mortality (e.g. benchmarking)			

13. Can you please identify what you believe are the MOST IMPORTANT NEEDS for trauma quality improvement in your country (please suggest as many as possible - brain storming to start workshop?

Suggestion #1

Suggestion #2

Suggestion #3

Suggestion #4

Suggestion #5

Appendix 2 continued

14. Can you please identify what you believe are the MOST IMPORTANT BARRIERS to trauma quality improvement in your country (please suggest as many as possible - once again brain storming to start workshop?

Suggestion #1

Suggestion #2

Suggestion #3

Suggestion #4

Suggestion #5

15. Briefly describe what you are hoping to get from this workshop.

Appendix 2 continued

2.

End of Survey.

Thank you!

Appendix 2 continued

References

1. World Health Organization (2008) The global burden of disease. WHO, Geneva
2. Murray CJ, Lopez AD (1996) Global health statistics: a compendium of incidence, prevalence and mortality estimates for over 200 conditions. Harvard University Press, Cambridge
3. The World Bank Group (2009) The World Bank Country Classification. http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html. Accessed 13 May 2011
4. Murray CJ, Lopez AD (1997) Mortality by cause for eight regions of the world: global burden of disease study. Lancet 349(9061):1269–1276
5. Mock C, Joshipura M, Goosen J, Lormand JD, Maier R (2005) Strengthening trauma systems globally: the essential trauma care project. J Trauma 59:1243–1246
6. Juillard CJ, Mock C, Goosen J, Joshipura M, Civil I (2009) Establishing the evidence base for trauma quality improvement: a collaborative WHO-IATSIC review. World J Surg 33:1075–1086. doi:10.1016/j.amjsurg.2009.09.021
7. Chadbunchachai W, Saranrittichai S, Sriwiwat S, Chumsri J, Kulleab S, Jaikwang P (2003) Study on performance following key performance indicators for trauma care: Khon Kaen Hospital 2000. J Med Assoc Thai 86:1–7
8. Stelfox HT, Bobranska-Artiuch B, Nathens A, Straus SE (2010) Quality indicators for evaluating trauma care: a scoping review. Arch Surg 145:286–295
9. O'Cathain A, Murphy E, Nicholl J (2010) Three techniques for integrating data in mixed methods studies. Br Med J 341:c4587
10. Burns KE, Duffett M, Kho ME, Meade MO, Adhikari NK, Sinuff T, Cook DJ (2008) A guide for the design and conduct of self-administered surveys of clinicians. Can Med Assoc J 179: 245–252
11. Pope C, Mays N (1999) Qualitative research in health care, 2nd edn. BMJ Books, London
12. Bryman A (2004) Social research methods, 2nd edn. Oxford University Press, Oxford
13. World Health Organization (2007) Working for health: an introduction to the World Health Organization. World Health Organization, Geneva
14. Australasian Trauma Society (2010) Trauma 2010. Crows Nest Publishing, New South Wales. http://traumasociety.com.au/meetings.html. Accessed 10 March 2011
15. Feinstein AR (1987) The theory and evaluation of sensibility. Clinimetrics, Yale University Press, New Haven, pp 141–166
16. Horn L, Tzanetos K, Thorpe K, Straus SE (2008) Factors associated with the subspecialty choices of internal medicine residents in Canada. BMC Med Educ 8:37
17. Jones J, Hunter D (1995) Consensus methods for medical and health services research. Br Med J 311(7001):376–380.
18. Strauss AL (2003) Qualitative analysis for social scientists. Cambridge University Press, Cambridge
19. World Health Organization (2012) Countries. http://www.who.int/countries/en/. Accessed 30 January 2012
20. World Health Organization (2010) Strengthening care for the injured: success stories and lessons learned from around the world. WHO, Geneva
21. Chadbunchachai W, Sriwiwat S, Kulleab S (2001) The comparative study for quality of trauma treatment before and after the revision of trauma audit filter, Khon Kaen Hospital 1998. J Med Assoc Thai 84:782–790
22. Mock CN, Jurkovich GJ, nii-Amon-Kotei D, Arreola-Risa C, Maier RV (1998) Trauma mortality patterns in three nations at different economic levels: implications for global trauma system development. J Trauma 44:804–812; discussion 812–814
23. Mock CN, Adzotor KE, Conklin E, Denno DM, Jurkovich GJ (1993) Trauma outcomes in the rural developing world: comparison with an urban level I trauma center. J Trauma 35:518–523
24. Maier RV, Rhodes M (2001) Trauma performance improvement. In: Rivara FP, Cummings P, Koepsell TD, Grossman DC, Maier RV (eds) Injury control. Cambridge University Press, Cambridge
25. Mock C, Joshipura M, Quansah R, Arreola-Risa C (2007) Advancing injury prevention and trauma care in North America and globally. Surg Clin N Am 87:1–19
26. World Health Organization (2004) Guidelines for essential trauma care. WHO, Geneva
27. Campbell R, Quilty B, Dieppe P (2003) Discrepancies between patients' assessments of outcome: qualitative study nested within a randomised controlled trial. Br Med J 326(7383):252–253
28. Lewin S, Glenton C, Oxman AD (2009) Use of qualitative methods alongside randomised controlled trials of complex healthcare interventions: methodological study. Br Med J 339:b3496
29. Adamson J, Ben-Shlomo Y, Chaturvedi N, Donovan J (2009) Exploring the impact of patient views on "appropriate" use of services and help seeking: a mixed method study. Br J Gen Pract 59(564):e226–e233