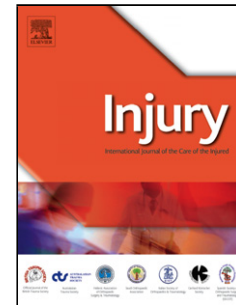


## Accepted Manuscript

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PII: S0020-1383(17)30371-6  
DOI: <http://dx.doi.org/doi:10.1016/j.injury.2017.06.007>  
Reference: JINJ 7272

To appear in: *Injury, Int. J. Care Injured*

Accepted date: 10-6-2017

Please cite this article as: Ologunde Rele, Le Grace, Turner Jim, Pandit Hemant, Peter Noel, Maurer David, Hodgson Sam, Larvin Joseph, Lavy Chris. Do trauma courses change practice? A qualitative review of 20 courses in East, Central and Southern Africa. *Injury* <http://dx.doi.org/10.1016/j.injury.2017.06.007>

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**Title:** Do trauma courses change practice? A qualitative review of 20 courses in East, Central and Southern Africa

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**Category:** Original Article

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## **Abstract:**

### **Background:**

Trauma courses have been shown to improve clinical knowledge and patient outcomes. However, little is known about the individual drivers of change in practice amongst course participants in their home clinic environment.

### **Methods:**

Front-line healthcare workers participated in a two-day Primary Trauma Care (PTC) course. Immediately after the course participants completed an evaluation survey on intended change in the management of trauma patients. Six months after the course, participants completed a survey on actual changes that had occurred.

### **Results:**

A total of 451 participants were sampled, with 321 responding at 6 months, from 40 courses across East, Central and Southern Africa. The most commonly reported intended change was the adoption of an ABCDE/systematic approach (53%). Six months after the course, 92.7% of respondents reported that they had made changes in their management, with adoption of an ABCDE/systematic approach (50.0%) remaining most common. 77% of participants reported an improvement in departmental trauma management, 26% reported an increase in staffing, 29% an increase in equipment and 68% of participants had gone on to train other healthcare workers in PTC.

### **Conclusion:**

The findings suggest that PTC courses not only improve individual management of trauma patients but also but is also associated with beneficial effects for participants' host institutions with regards to staffing, equipment and training.

## **Do trauma courses change practice? A qualitative review of courses in East, Central and Southern Africa**

**Keyword(s):** ATLS, Africa, Primary Trauma Care, Courses, Training, Trauma, Injury, COSECSA

### **Introduction**

Injury is the fifth leading cause of death globally with an estimated mortality of 4.8 million people in 2013 <sup>1</sup>. Injuries also confer significant morbidity with an estimated 973 million people in 2013 sustaining an injury significant enough to warrant a healthcare intervention <sup>2</sup>. A significant proportion of this burden of disease lies in sub-Saharan Africa with injury the cause of 9.6% of all deaths <sup>3,4</sup>. Current projections estimate that this burden of disease will only increase given the increasing growth in motorisation in the region <sup>1</sup>. Despite Africa's considerable disease burden it has only 0.5 surgeons (IQR 0.2-1.0) per 100,000 of the population <sup>5</sup>. Further compounding the challenges of a stretched workforce is the scarcity and sometimes lack of formal training in trauma management. As such, there exists a significant disparity between the necessity for and provision of adequate training in trauma management <sup>6,7</sup>.

Trauma management in high-income countries is protocol driven, based on the principles of the Advanced Trauma and Life Support (ATLS) Course developed by the American College of Surgeons <sup>8</sup>. The ATLS course has not been extensively incorporated into training programs in sub-Saharan Africa because of numerous limitations associated with healthcare training and practice in many low- and middle-income countries (LMICs) such as limited resources, funding and trained staff <sup>9</sup>. In order to address the need for improved trauma care and shortage of training in trauma management, the Primary Trauma Care (PTC) Foundation was established in 1997 <sup>10</sup>. The PTC course is endorsed by the WHO, who have published the course manual since 2003. The PTC

course, which has been delivered in over 60 countries to date, aims to train front-line health workers including clinical officers, paramedics, nurses and doctors in the basic principles of trauma management in order to reduce the devastating human cost of injury in LMICs <sup>10</sup>.

In 2012, the University of Oxford partnered with the College of Surgeons of East, Central and Southern Africa (COSECSA) to improve the standard of training in trauma management and musculoskeletal injuries within the region that covers the 10 COSECSA countries (Burundi, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia and Zimbabwe). Through the support of the UK Department for International Development (DFID) and the Tropical Health Education Trust (THET) the COSECSA Oxford Orthopaedic Link (COOL) was established to deliver the PTC course. This qualitative study aims to explore the impact that attendance at a PTC course has on participants' practice of trauma management in their home clinic environment.

## **Methods**

The PTC course runs over 2 days and is taught through the medium of lectures, moulages (practical sessions with actors), small group scenarios and practical skills stations where the "ABCDE" approach to trauma management is introduced and explained. Experienced and trained clinicians, working on a voluntary basis, deliver the courses. In order to improve the sustainability of the course it is taught within a 5-day programme consisting of a 2:1:2 format where the initial 2 day PTC course is followed by a 1 day instructor course. The instructor course is aimed at teaching candidates, who had either been put forward by their departmental heads as potential instructors or had demonstrated good clinical and leadership skills over the last 2 days, how to deliver the course to new trainees. The 1 day instructor course is followed by another 2 day PTC course that the newly trained instructors help run. The cascading 2:1:2 course model is described in further detail elsewhere <sup>11</sup>.

Front-line healthcare workers participated in a 2 day PTC course. Immediately after the course participants completed a paper evaluation survey on intended changes in the management of trauma patients. Six months after the PTC course, an electronic survey on actual changes that had occurred, administered via the online survey engine (surveymonkey), was sent to course participants. This survey was to determine personal clinical, departmental, equipment and staff changes that course attendees had observed 6 months after participating in the PTC course. The survey explored both qualitative and quantitative responses. A total of 100 2 day PTC courses as described above were run over a four-year period in the ten countries (2012-2016) with more than 2000 individuals trained. 451 participants' immediate post-course surveys, from a sample of ten courses (two courses per COSECSA country), were selected for analysis. All 6-month post-course surveys were included in analysis.

Computerised spreadsheet tools were used to generate descriptive statistics using Excel for Mac 2011; version 13.3.4 (Microsoft, Redmond, WA, USA). Qualitative responses were analysed using a framework in behaviour change devised and validated by Cane et al. which consists of the following domains; knowledge, skills, social/professional role and identity, beliefs about capabilities, optimism, beliefs about consequences, reinforcements, intentions, goals, memory, attention and decision processes, environmental context and resources, social influences, emotions and behavioural regulation <sup>12</sup>. Using this framework, a descriptive thematic analysis was conducted <sup>13,14</sup> based on definitions defined by the American Psychological Association <sup>15</sup>. The results were discussed in depth between three authors (R.O, G.L & C.L) in an iterative process until conceptual saturation was reached and the finalisation of major thematic results through a data reduction process by consensus.

Changes in management of trauma cases were grouped under the following headings: ABCDE, systematic approach and triage; improvement of specific skills; improvement of staff, training and systems; improvement of equipment; and other. Responses to perceived departmental changes

were grouped under the following headings; personnel/teams, physical changes and patient management. Reported staff changes are presented quantitatively but common themes amongst the qualitative responses are also presented. Responses to changes in equipment were grouped under the headings Airway, Breathing, Circulation and other significant equipment, as was most applicable. Participants' reported involvement in training after the PTC course is reported quantitatively in terms of number of people trained.

### *Ethics*

The Medical Sciences Inter Divisional Research Ethics Committee, Research Services, University of Oxford gave ethical approval for the study. All course attendees gave written informed consent to participate in the study. No identifiable data has been reported in the manuscript. The sponsors of the study did not play any role in study design, data collection, data analysis, data interpretation, or writing of the manuscript. The corresponding author had final responsibility for the decision to submit the manuscript for publication.

### **Results**

Of the sample of 451 participants' immediate post course surveys, 66% were male and 34% were female. An array of cadres was represented amongst the participants with doctors (56.1%), nurses (21.8%), clinical officers (8.9%), and medical students (9.8%) across 95 hospitals in the 10 COSECSA countries. At the 6 month stage 321 participants, across 86 hospitals in the 10 COSECSA countries, had completed responses from the survey monkey questionnaire. We present below results of both the immediate post course survey and the 6 month survey under the following sub-categories; 1. Changes in trauma management; 2. Departmental changes; 3. Staff changes; 4. Equipment; 5. Mortality/morbidity; and 6. Training.

#### *1. Changes in trauma management*

The most commonly reported intended changes immediately following the PTC course were: adopting an ABCDE or systematic approach (52.8%), improving staffing, training and systems (14.0%) and improving specific skills (13.1%). At the 6 months post-course stage, 92.7% of participants said they had made changes in their management of trauma patients, with adoption of an ABCDE or systematic approach the most commonly reported (50.0%). 3.1% of respondents said they had not made a change and 4.1% were unsure. Participants' intended changes immediately after the course are compared with the self-reported changes 6 months post-course in Figure 1.

In line with the validated framework employed, to evaluate behaviour change by descriptive thematic analysis, participant responses were categorised into 10 main themes; knowledge, skills, social/professional role and identity, beliefs about capabilities, optimism, beliefs about consequences, intentions, environmental context and resources, social influence and behaviour regulation (Table 1).

Qualitative responses were analysed using a framework in behaviour change

## *2. Departmental changes*

Six months after the PTC course 77% of respondents reported an improvement in departmental or institutional changes relating to trauma management, with the the biggest category (30%) reporting a moderate improvement, as shown in Figure 2. Of those that reported an improvement in the management of trauma, factors pertaining specifically to patient management and improved teamwork were most commonly reported, as shown in Table 2.

## *3. Staff changes*

Only 26% of respondents stated that there had been an increase in staffing in their trauma team 6 months after attending the PTC course. However many respondents did report other improvements

in staff including improved skills, better teamwork and communication and improved pre-hospital care. Common themes reported by Individual course participants are shown in table 3.

#### *4. Equipment*

At 6 months, the majority of respondents (57%) did not report an improvement in the equipment available in their department for resuscitation of trauma patients, whilst 14% were not sure if there had been any improvement. However, 29% of respondents did report the availability of additional equipment, with the most commonly reported new items being airway adjuncts and cervical collars. A summary of all commonly reported new equipment at 6 months is shown in table 4.

#### *5. Mortality/morbidity*

Very few respondents had reliable data on changes in mortality or morbidity at 6 months following the PTC course, however 24.8% of them reported that they perceived a change in the mortality/morbidity rates of trauma patients within their department.

#### *6. Training*

Six months after the course the majority (68%) of respondents reported that they had subsequently been involved in training other healthcare workers at their institutions whether formally or informally; of these the majority (33%) trained 1-4 individuals as shown in Figure 3.

### **Discussion**

A number of studies have assessed the impact of trauma courses on participants' performance in cognitive, clinical, and surgical skills with many showing an improvement in trauma management <sup>16-21</sup>. Our findings support these studies but also identify the specific changes reported by course participants.

The thematic analysis on the behavioural change of course participants 6 months after the PTC course identified four main themes of improved knowledge, improved skills, improved beliefs about capabilities and behavioural regulation, whereby course participants had altered specific practices as a direct result of having attended the course. These findings are similar to others reported in the literature. Pemberton et al., through interviewing course participants 4 months after a Trauma Team Training (TTT) course, identified four main themes: empowerment/disempowerment, an increase in knowledge, improved inter-professional teamwork, and perceived improved patient care <sup>22</sup>.

We found that the majority of course participants had adopted an ABCDE or systematic approach to their management of trauma patients, which is consistent with best practice guidance as outlined in the World Health Organisation's Guidelines for Essential Trauma Care <sup>23</sup>. These findings also mirror those of a study conducted by O'Reilly et al. that found a "systematic approach to trauma care" was the most common response theme from participants asked to state the most important lesson or skill that they had learnt following a TTT course <sup>24</sup>. Improving specific skills was found to be the second most commonly reported outcome at 6 months which is also in keeping with findings from previous studies <sup>22,24</sup>. Although improvement in specific skills was found to be a commonly reported outcome at 6 months, studies have shown that attrition of knowledge and clinical skills occurs irrespective of age, gender or speciality <sup>25-27</sup>, however there is some evidence to suggest that high trauma patient volume may maintain cognitive knowledge and clinical performance in this context <sup>28</sup>.

The vast majority of participants, at 6 months, reported that they had noticed improvements in the management of trauma patients within their department. The most commonly reported themes included increased awareness of the PTC protocol; better teamwork and a greater presence of PTC trained staff. With over 68% of respondents reporting that they had participated in the training of other staff within their institution, the cascading model of training that has occurred may well explain the departmental benefits that have been reported. Significantly, 31 respondents who had trained other colleagues reported training 15 or more individuals.

Change in clinical management and service delivery on a health systems level is influenced by numerous factors including, but not limited to, educational interventions such as the PTC course. Other factors including trainer and trainee specific traits, such as motivation and enthusiasm may play a role. In addition, country-specific factors such as healthcare priorities, funding and health system organisation may influence the degree to which change in clinical management is implemented or observed. Our findings do suggest that the PTC course was associated with changes in participants' host institution including improvements in the availability of equipment and in staffing levels. These improvements cannot be directly attributable to the PTC course but it would appear that participants who had attended the course may have petitioned their departments for additional staff and equipment. This study indicates that the PTC course is associated with improvements in multiple domains of trauma practice and management. However, the PTC course is specifically aimed at trauma training in resource-limited environments and as such the changes observed must be interpreted in light of this. The degree of change observed may not necessarily be similar in environments with well-developed trauma management systems. Furthermore, we did not stratify survey responses by cadre and as such the focus of different staff and their ability to effect change may influence the observations reported.

### *Limitations*

Our study had a number of limitations. Changes at 6 months were self-reported and lacked response integrity validation; as such they may be vulnerable to reporting bias. There was a fall in response rate from immediately post-course to 6 months post-course; as such individuals with a higher than average interest in the subject may have been more likely to respond. The cohort at 6 months may not be identical to the initial cohort sampled. Consequently results at 6 months may be vulnerable to comparison bias and therefore may not necessarily be generalisable. Our study did not employ focus groups or interviews and as such there is a limited ability to triangulate data within

the study. Furthermore, the scarce published research in the field of our paper limits the ability to draw comparisons with multiple sources of research and so strengthen the conclusions drawn.

## **Conclusion**

The PTC course has been shown to not only improve participants' self-reported management of trauma patients but has been shown to also be associated with beneficial effects for participants' host institutions with regards to improved staffing, increased equipment and training of staff. This study demonstrates the strengths of evaluating the qualitative benefits of trauma management courses. Whilst our study focused on qualitative perceptions of change further research is needed to determine how course participants' self-reported improvements in trauma management translate into quantifiable improvements in actual clinical care and patient outcomes and to further investigate the drivers behind behavioural change within the clinical setting.

**Author contribution:** GL and CL were involved in study conception, design and acquisition of data. RO, GL, JT, HP, NP, DM, SH, JL and CL were involved in data analysis and interpretation. RO, GL and CL were involved in drafting the manuscript and critical revision for important intellectual content. All authors gave final approval of the version to be published.

**Funding:** The COSECSA Oxford Orthopaedic Link (COOL) programme is funded by the UK Department for International Development (DFID) through the Tropical Health Education Trust (THET) Health Partnership Scheme.

**Conflict of interest:** The authors have no conflict of interest to declare.

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#### Figure Legends:

**Figure 1.** Course participants ‘intended changes’ immediately after the PTC course compared with self-reported actual changes 6 months after the course

**Figure 2.** Reported departmental change in trauma management 6 months following the PTC course

**Figure 3.** Number of healthcare workers in trauma centres trained by PTC participants 6 months after the PTC course

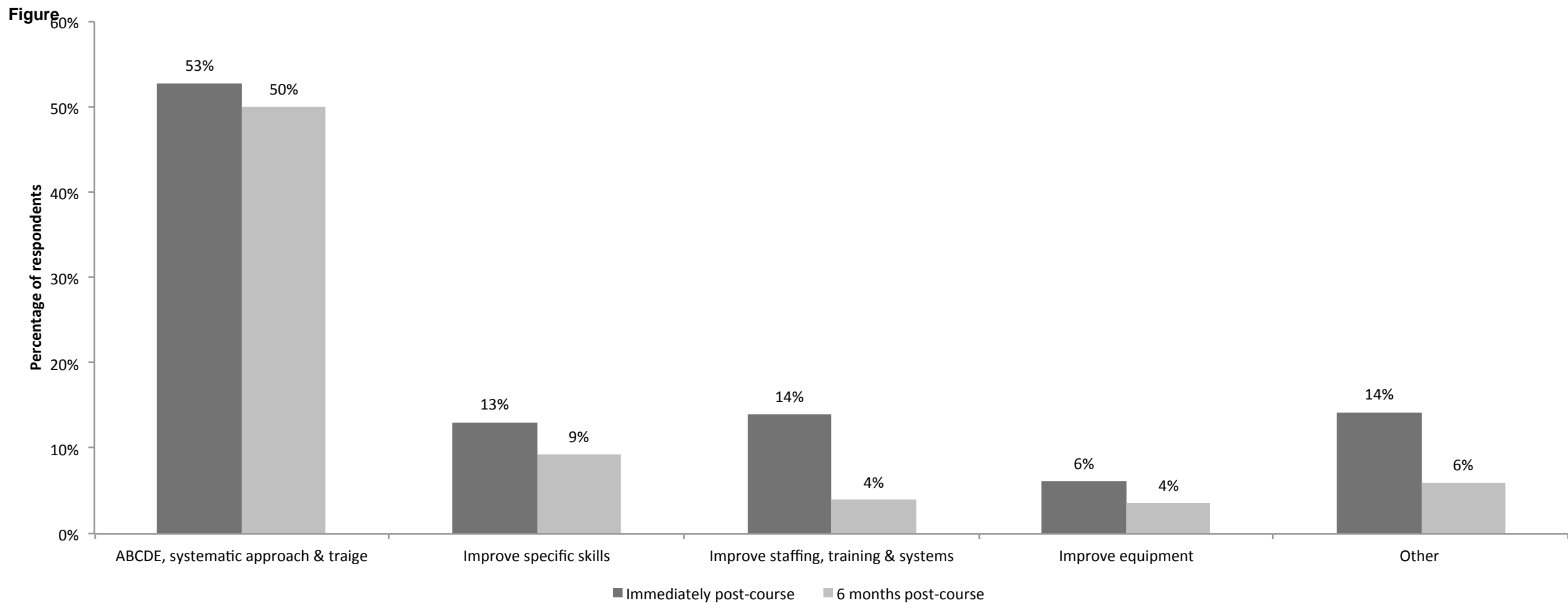
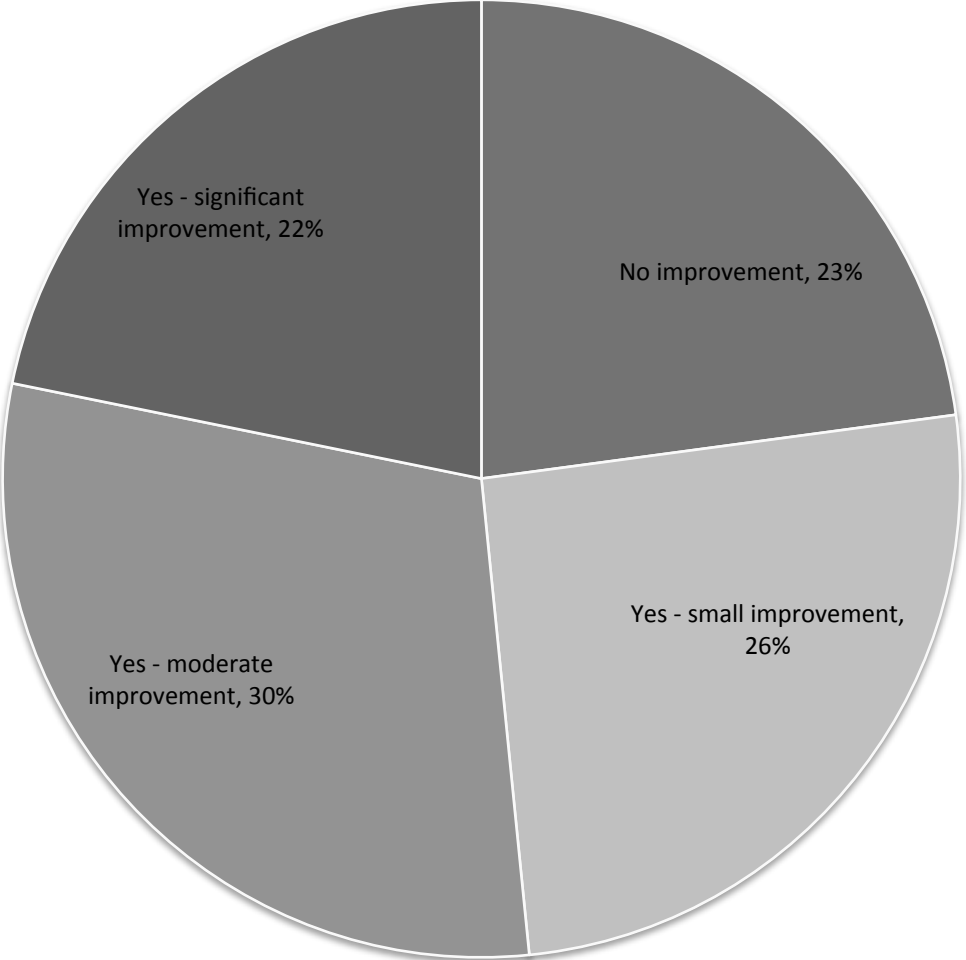
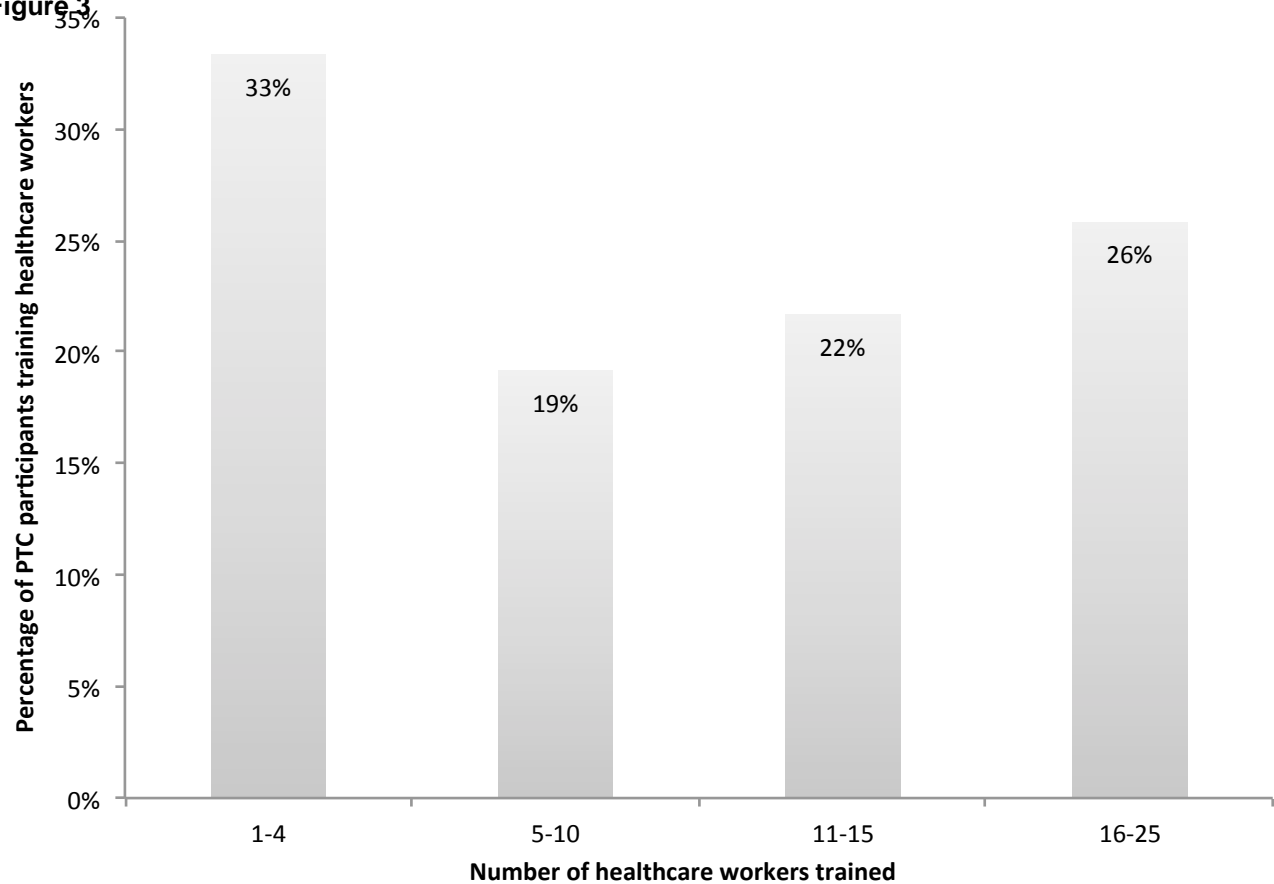


Figure 2



**Figure 3**



**Table 1.** Thematic analysis of behaviour change six months after the PTC course

Framework Domain (Definition) *	Example quotes from survey
<b>Knowledge</b>  (An awareness of the existence of something)	<p>"Doing a primary survey first and taking care of the life threatening conditions in order of priority."</p> <p>"I took the training while still in medical school. After I graduated, I started practicing what I learnt."</p> <p>"I have stuck to the ABCDE principles of trauma management and have kept on reassessing the patient before moving to the next step."</p> <p>"Adopting a systematic approach of ABCDE and early initiation of oxygen therapy."</p> <p>"I have learnt to prioritise patients in order of their severity."</p> <p>"I have learnt that airway assessment goes together with cervical spine stabilisation."</p> <p>"The ABCDE approach became my priority: before, a bleeding patient confused me and instead of starting on airway review I jumped to IV insertion then to how to stop the bleeding."</p> <p>"I now reassess the ABC each time I notice deterioration in the condition of a patient I am resuscitating."</p> <p>"More cautious of cervical spine injury and airway."</p>
<b>Skills</b>  (An ability or proficiency acquired through practice)	<p>"How to transport a patient with spinal trauma."</p> <p>"Stabilising the patient before referral to a central hospital."</p> <p>"Improved secondary survey... pupils, abdomen, chest, and pelvis. I can do this much faster."</p> <p>"Ability to recognise danger signs."</p> <p>"Started inserting intraosseous needles for fluid resuscitation."</p> <p>"Technique for cervical spine immobilisation."</p> <p>"Technique of log rolling trauma patients."</p> <p>"Better at chest drain insertion."</p>
<b>Social/Professional Role and Identity</b>  (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting)	<p>"Communication skills as team leader."</p>

<p><b>Beliefs about Capabilities</b></p> <p>(Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use)</p>	<p>"I'm more aware of how to manage a patient quickly but efficiently."</p> <p>"My skills and approach to patients have tremendously improved."</p> <p>"Improvement in management of trauma patients especially in the principles of doing primary and secondary survey."</p> <p>"Improved my patient assessment ruling out neck trauma."</p> <p>"I am faster at primary surveys, and more organised. I am much more hands-on and interested in trauma emergencies."</p> <p>"I can manage spinal injury patients better."</p> <p>"I am more efficient."</p> <p>"I'm more aware of how to manage a patient quickly but efficiently."</p>
<p><b>Optimism</b></p> <p>(The confidence that things will happen for the best or that desired goals will be attained)</p>	<p>"Major change is that my confidence is high and I am now more systematic and organised and I am not afraid of a severely injured trauma patient."</p>
<p><b>Beliefs about Consequences</b></p> <p>(Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)</p>	<p>"Following ATLS protocol, I have saved the majority of my trauma patients."</p>
<p><b>Intentions</b></p> <p>(A conscious decision to perform a behaviour or a resolve to act in a certain way)</p>	<p>"Use of Primary and secondary surveys to determine my next course of action."</p>
<p><b>Environmental Context and Resources</b></p> <p>(Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour)</p>	<p>"Team participation to stabilise patients."</p> <p>"Establishment of a trauma team focused on management of patients and training."</p> <p>"Availability of resuscitation bag in the ambulance."</p> <p>"We have the required emergency equipment needed in place."</p> <p>"We are now keeping neck collars in the casualty department."</p>
<p><b>Social Influences</b></p> <p>(Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)</p>	<p>"I've shared what I learnt with my colleagues as it helps me in decision making."</p>
<p><b>Behavioural Regulation</b></p> <p>(Anything aimed at managing or changing objectively observed or measured actions)</p>	<p>"I administer bolus IV saline to patients involved in road traffic accidents which I was not doing before."</p> <p>"I am now more systematic when managing trauma cases."</p> <p>"I always re-perform the primary survey whenever a patient deteriorates before moving on to the secondary survey."</p>

"I have started managing trauma patients by stabilising their airway."

"We've started on the job training of colleagues."

"Systematic approach, undertaking interventions with appropriate guidelines."

"More organised management of trauma patients with better outcomes."

"Accurate triaging of multiple trauma victims."

"I think more about what injuries to look out for and as a result, I am more systematic."

\* = Definitions are derived from the American Psychological Associations' Dictionary of Psychology (15).

**Table 2.** Reported departmental changes 6 months after the PTC course

Personnel/teams	Physical changes	Patient management
<ul style="list-style-type: none"> <li>• “Nurses can now also triage, resuscitate and manage patients.”</li> <li>• “Staff are now quicker in responding to trauma cases.”</li> <li>• “Senior health workers at all levels now respond faster to calls from their juniors.”</li> <li>• “Permanent dedicated emergency team in the accident and emergency room.”</li> <li>• “Greater presence of PTC trained staff in the emergency department.”</li> <li>• “Fewer calls to the anaesthetic team as more people trained in basic airway management.”</li> <li>• “Establishment of a resuscitation team.”</li> <li>• Establishment of a trauma team.</li> <li>• “Improved communication and teamwork.”</li> <li>• “Improvement in communication between the hospital and its peripheries, as well as triage.”</li> <li>• “Early involvement of multi-disciplinary team in management of trauma patients.”</li> </ul>	<ul style="list-style-type: none"> <li>• “Plans underway to construct an emergency reception.”</li> <li>• “Orthopaedic theatre”</li> <li>• “A&amp;E department”</li> <li>• “Anaesthesia department”</li> <li>• “Established a triage area”</li> <li>• “Opened a casualty department”</li> <li>• “New dedicated room for trauma patients.”</li> </ul>	<ul style="list-style-type: none"> <li>• “More people are aware of and practice the PTC protocol.”</li> <li>• “Ensuring a primary and secondary survey is done appropriately.”</li> <li>• “Better co-ordination in the management of trauma patients.”</li> <li>• “Systematic approach to trauma patient management.”</li> <li>• “More efficient in managing trauma patients.”</li> <li>• “Urgency in treating trauma patients.”</li> <li>• “Early detection of the signs of intra-abdominal haemorrhage.”</li> <li>• “Increase in the frequency of review of trauma patients. ”</li> <li>• “Improvements in patient outcomes have been observed, as there has been better management of trauma cases.”</li> </ul>

**Table 3.** Reported staffing changes 6 months after the PTC course

Staff changes
<ul style="list-style-type: none"> <li>• "More nurses can now manage trauma cases adequately."</li> <li>• "Recruitment of more doctors."</li> <li>• "Full-time nurse for emergency reception."</li> <li>• "More staff on standby in case of emergencies."</li> <li>• "ED has Emergency medicine residents and seniors."</li> <li>• "Assignment of a permanent senior surgeon."</li> <li>• "Additional staff."</li> <li>• "The number of medical practitioners graduating from colleges is more than before the course."</li> <li>• "Plans to engage a medical doctor for emergency medicine only."</li> <li>• "Dedicated orthopaedic resident for the emergency department."</li> <li>• "New emergency physicians."</li> </ul>

**Table 4.** Reported improvements in equipment 6 months after the PTC course

Airway	Breathing	Circulation	Other significant equipment
Airway adjuncts (e.g. oropharyngeal airway)	Oxygen cylinder/concentrator	Echocardiography machines	Cardiorespiratory patient monitors
Cervical collars	Bag-valve masks	Defibrillators	FAST ultrasound machine
Intubation kits	Chest drains	Fluids warmers	Pneumatic anti-shock garment
Suction machines	Ventilator machines	Blood pressure cuffs	Spinal board
	Facemasks/Nasal cannulae	Intra-osseous puncture kits	Resuscitation trolley
		IV Fluids	X-ray machine
			Ambulance