

# Post-Crash Trauma Care: First-Responder Training for the Traffic Police in Makwanpur, Nepal; A Pre and Post-Intervention Cross-Sectional Survey

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# Abstract

## Background

The World Health Organisation has estimated Nepal's road traffic fatality rate as one of the highest in South-East Asia. Road-crashes are the 7<sup>th</sup> leading cause of mortality in Nepal, but there is currently a lack of nationwide emergency medical services. We developed, designed and evaluated the feasibility of a first responder training programme for the traffic police in Nepal.

## Methods

39 traffic police officers in Makwanpur District participated in the study and 29 attended the 3-day first response course. A training needs assessment survey was conducted with participants prior to course design. A knowledge and confidence pre-test was followed-up by post-testing. Participants were supplied with a trauma-pack and asked to complete a report form when first-responder skills were used. Post-testing and follow-up survey were conducted at 6-months which explored experiences of applying first response skills.

## Results

Pre-course needs assessment showed that 97% of the participants believed that giving first-aid was their responsibility; 95% had experience of transporting road-crash victims to hospital with a range of injuries. Low levels of first-aid training and a lack of standardisation were reported. Knowledge and confidence levels were low in pre-test. Post-test knowledge scores improved by 40% to 75%. Confidence levels improved post-course but were reduced at 6-months. In the 6-month study period, participants attended 303 road-crashes. 44% of the participants had used at least one first-response skill from the course; applying skills on 92 occasions, though incident report-forms were frequently not completed.

## Conclusions

Delivering a first-response programme for the traffic-police is feasible. Knowledge could be retained and used, and skills were in frequent demand. Barriers to providing treatment included; patient already en-route to hospital; resistance from relatives or bystanders and competing police duties. Further studies will need to reinforce the need to capture the use of incident report forms when first responder skills are applied. It is feasible practically and financially to extend the training to cover other districts/all of Nepal as a low-cost measure to combat road traffic injury in the absence of formal emergency medical services.

## Background

Road traffic injuries (RTIs) globally kill more than 1.36 million people each year and leave between 20 and 50 million people with non-fatal injuries. They are the 8<sup>th</sup> leading cause of death among all age groups and distressingly, are the leading cause of death for children and young adults aged 5–29 years<sup>1</sup>.

It is estimated that more than 90% of all trauma related deaths occur in low-and middle-income countries (LMICs)<sup>2</sup>. There is a strong association between the risk of a road traffic death and a country's level of income; with an average rate of 27.5 deaths per 100,000 population, the risk is more than 3-times higher in low-income countries than in high-income countries where the average rate is 8.3 deaths per 100,000 population<sup>1</sup>. In their 2018 *Global status report on road safety*, the World Health Organisation (WHO) identified there has been no reduction in the number of road traffic deaths in any low-income country since 2013<sup>1</sup>.

The United Nations have categorised Nepal as one of the “*least developed*” countries of the world, indicating that it has low income and a scarcity of domestic financial resources<sup>3</sup>. RTIs are a significant public-health burden in Nepal, with increasing levels of morbidity and mortality<sup>4</sup>. In 2017 there were 7524 RTI deaths; 4.11% of all deaths in Nepal were attributed to transport injuries, making it the 7<sup>th</sup> leading cause of death in the country<sup>3</sup>.

An essential component in reducing mortality and morbidity for RTI victims is to have good post-crash, emergency care systems in place to ensure timely treatment. Effective care of the injured requires a series of time-critical actions, beginning with immediate activation of the emergency medical services (EMS), then continuing with care at the scene, prompt transport, followed by facility-based emergency care<sup>5</sup>.

Organised prehospital trauma care has been shown to be effective in reducing death and disability from RTI. A study comparing prehospital mortality rates identified that deaths occurred at higher rates in LMICs (81%) when compared with highly organised emergency medical services in high-income (59%) settings<sup>6</sup>.

Prehospital care in Nepal is sub-optimal, and with a few notable exceptions, there is a lack of regulated and standardised EMS systems<sup>7,8,9</sup>. Most ambulances are not crewed by trained emergency medical technicians or paramedics and are poorly equipped to manage trauma emergencies<sup>7,8</sup>. The majority of patients arriving in the emergency departments arrive by non-ambulance transport; taxi, private-vehicle, bus and motorbike<sup>7</sup>.

Research conducted in other LMICs has demonstrated that lay-people trained as first responders applying first aid skills at the scene of a road crash can make a significant difference to outcomes<sup>11</sup>. The WHO has stated that in countries with limited or delayed access to care, trained lay-responders can be an effective bridge to formal prehospital care<sup>5</sup>.

The Nepal Injury Research Centre (NIRC) was established in Nepal in 2017 through a research grant from the National Institute for Health Research in the United Kingdom. The aim of NIRC is to build capacity and capability for research to inform effective injury prevention and first response across all sectors of Nepali life and work. As part of this aim, a First Response Reference Group (FRRG) has been formed. The FRRG is a panel of 16 experts and key stakeholders involved in EMS, first response and first-aid services in Nepal. These experts were recruited due to their position in government institutions, their recognised expertise and following recommendation by governmental officials. The FRRG advocate for excellence in

first response through the application of research evidence to the National Advisory Committee for Injury Prevention and Control. At an early meeting of the FRRG, members identified training of the police as first responders as one of the top 5 areas for prioritisation.

Following a road traffic collision the Nepal Traffic Police (NTP) are usually the first official response and reliable presence at the scene<sup>8</sup>. In our study, we sought to develop, design and evaluate the feasibility of a bespoke first-responder trauma training programme for the NTP. There is limited research on injuries occurring to residents of Nepal, including road traffic injuries<sup>10</sup>. There is a paucity of research on the traffic-police officers' experience of, and training in, providing emergency care at the crash scene.

## Methods

This study used a before and after cross-sectional survey design and was conducted in the Makwanpur district in Province 3, South of Kathmandu, Nepal. The district has a population of 420,000, with 45% being children <18 years of age. The district centre is Hetauda, where 20% of the district's total population live<sup>12</sup>. Makwanpur district has a mixed geographical terrain, ranging from low-land (<500 m) to high hills (up to 3500 m)<sup>14</sup> and it reflects the range of socio-economic settings found in Nepal<sup>15</sup>, thus results from studies in this district have the potential to be generalizable to other districts across Nepal.

The study team worked with the Nepal Red Cross Society (NRCS), an established non-profit organization and auxiliary to the government in the humanitarian field. Based in Kathmandu, the NRCS has extensive experience in providing first-aid training for community groups, businesses and government bodies<sup>13</sup>.

The study participants were traffic police officers from Makwanpur district. Provision of first aid is made explicit in the NTP mission objectives<sup>16</sup>. The study sample aimed to include all operational traffic police officers in the district. The study was designed with three phases; Phase 1 – the pre-intervention phase; Phase 2 – the intervention phase; Phase 3 – the post-intervention phase.

### Phase 1: Pre-intervention Phase

A training needs assessment of individual traffic police personnel working in Makwanpur district was conducted. A structured questionnaire (a combination of open and closed questions) was used to conduct face-to-face surveys with individual traffic police personnel (Additional File 1). The survey explored their prior training in first aid and experience of transporting and/or providing first aid to injured persons. All operational traffic police in the district were invited to participate in the study. All interviews in phase 1 and phase 3 were conducted in the Nepali language by Nepalese researchers.

The information from the survey was then used to inform the design and content of a 3-day Trauma First Responder Course. Written agreement was entered into with the NTP at national and local levels for the traffic police officers to participate. It was anticipated that not all of them would be able to engage with the training, because of the need to maintain an operational presence on the roads in the district.

A bespoke trauma-focussed first responder programme (Additional File 2) was developed and planned incorporating content guidance from two main sources; the International Federation of Red Cross and Red Crescent Societies International First Aid and Resuscitation Guidelines 2016<sup>17</sup> and the WHO Basic Emergency Care Course 2018<sup>18</sup>. The course participants' level of previous knowledge and experience were factors when deciding the content.

## **Phase 2: Intervention Phase**

A three-day Trauma First Responder Training Course was organised in two groups from 19-24 May 2019. A 20-question pre-test exploring the participant's first aid knowledge and a 5-question Likert confidence scale was conducted before the training (Additional File 3). Immediately after completion of the training, a post-test using the same questions was completed. In addition, an evaluation of the overall training programme was also collected at the conclusion of the training.

Scores for the pre-test and post-test assessments were pooled for the cohort of police officers, so that no individual officer was at risk of being penalised for their level of knowledge.

Four, fully-packed, trauma response backpacks were supplied to be carried in each of the district traffic police vehicles. The NRCS trainers also distributed incident report forms to all course participants to be completed after each patient encounter for the six month period of follow-up after the training (Additional File 4). Posters encouraging participants to complete the forms were distributed to the district police stations.

## **Phase 3: 6-month Follow-up**

A RE-AIM evaluation<sup>19</sup> was conducted at 6-months post-training, to assess the extent to which the participants had incorporated first response skills gained from the training into practice. The participants were individually surveyed to evaluate their experience of applying first response skills in the field (Additional File 5). The participants also re-took the post-test to analyse their retention of first aid knowledge and self-perceived confidence levels. Incident report forms were collected from the police stations.

To assess the potential costs of providing first response training to all traffic police in Nepal, we measured resources used, and the costs incurred of all aspects of the first responder training programme e.g.. training materials, equipment, training personnel, and requirements.

# **Results**

## **Phase 1: Pre-intervention Phase**

As part of the training needs analysis, all 39 traffic police officers were surveyed about their experience of being trained in and applying first aid. 38 (97%) of the 39 agreed that first-aid was part of their responsibilities.

## First Aid Training and Equipment

Just over two-thirds of the participants (n=25; 64.1%) said they had received no training in first-aid. Of those that had received the training (n=14; 35.9%), the median (IQR) time since they had last received the training was 3 (1, 9) years. The median (IQR) length of the training was 8 (4, 24) hours. The first aid training was provided by a number of different organisations outlined in Table 1.

Table 1:

Organisations Providing First-Aid Training to the Traffic Police in Makwanpur

| <i>First Aid Training Organisation</i>            | <i>Number Trained (n=14)</i> |
|---|------------------------------|
| <i>Police (in-house) Trainer</i>                  | 5                            |
| <i>Nepal Red Cross Society</i>                    | 3                            |
| <i>Other provider:</i>                            | 6                            |
| <i>Alka Hospital</i>                              | 3                            |
| <i>B &amp; B (Baidya &amp; Banskota) Hospital</i> | 1                            |
| <i>Chure Hill Hospital</i>                        | 1                            |
| <i>Don't Know</i>                                 | 1                            |

Of the 14 participants who had been trained in applying first aid, 7 (50%) said they had no access to first-aid equipment at the time of interview. Of those that had access to a first aid pack, the equipment mainly included wound dressings and triangular bandages.

### Experience of First Aid and Transporting the Injured

Of the 14 trained in first aid, 7 (50%) had applied first aid in the previous 12 months. In that time period, first aid skills were applied a median (IQR) frequency of 50 (3, 99) times per participant. Of the 39 participants, 37 (95%) had experience of transporting RTI victims to hospital with a wide range of injuries. These injuries are listed in Figure 1:

The participants who had been trained in first-aid and who had access to some first aid equipment (n=7) were asked about what difficulties they faced when doing first aid at the scene of a road traffic collision (RTC). Three topics emerged; (1) lack of equipment; (2) lack of an ambulance for transport; (3) fear of criticism from the public when giving care.

### Phase 2: Intervention Phase

Twenty-nine participants were released from operational duties to attend the 3-day first responder course, thus reducing the initial sample by 10 (25.6%). They were asked to complete a 20-question pre-test about their knowledge of first aid.

### Pre-Test Knowledge of First-Aid

Nearly all the participants (n=28, 96.5%) were able to correctly identify the purpose of first aid, but less than a quarter (n=8, 20.7%) were able to list the correct sequence of first aid priorities at a crash scene.

Around a third of the participants (n=10, 34.5%) correctly identified how to open the airway, however over two-thirds (n=27, 93.1%) knew how to check for breathing. Two participants (6.9%) knew the correct ratio of chest compressions to rescue breaths for cardiopulmonary resuscitation (CPR), but 11 knew the correct chest compression rate.

Just over a quarter of the participants (n=8, 27.6%) knew to prioritise applying direct pressure to a bleeding wound, however nearly three-quarters (n=21, 72.4%) knew some of the signs of shock. Five (17.2%) of the participants knew when to apply a tourniquet. Seven (24.1%) of the participants know not to give people something to eat or drink when they were in shock.

When identifying priorities in mass-casualty situations, 12 (41.4%) of the participants gave the correct answer. However, 17 (58.6%) were able to identify the correct colour of the triage label for a given incident. A summary of pre-test knowledge scores are shown in Table 2.

Table 2:

Pre-First Aid Course Knowledge Scores

| <b><i>Variables</i></b> | <b><i>N</i></b> | <b><i>Median</i></b> | <b><i>Mean</i></b> | <b><i>Minimum Score</i></b> | <b><i>Maximum Score</i></b> | <b><i>Standard Deviation (SD)</i></b> |
|-------------------------|-----------------|----------------------|--------------------|-----------------------------|-----------------------------|---------------------------------------|
| <i>Pre-test score</i>   | 29              | 33.32%               | 35.51%             | 14.16%                      | 59.98%                      | 10.98                                 |

### Pre-Test Confidence in Applying First Aid

Confidence levels in applying first-aid across a range of skills in practice was low, with a mean average confidence level (confident or very confident) of 32.6% (Table 3).

Table 3:

## Pre-First-Aid Course Confidence Levels

| <i>Confidence in</i>                                     | <i>Extremely unconfident</i> | <i>Not confident</i> | <i>Neutral</i> | <i>Confident</i> | <i>Very confident</i> |
|--|------------------------------|----------------------|----------------|------------------|-----------------------|
| <b>1.</b> <i>Performing CPR? (n=29)</i>                  | 5                            | 4                    | 14             | 5                | 1                     |
| <b>2.</b> <i>Using dressings and tourniquets? (n=28)</i> | 6                            | 6                    | 7              | 8                | 1                     |
| <b>3.</b> <i>Moving and handling patients? (n=28)</i>    | 0                            | 2                    | 10             | 11               | 5                     |
| <b>4.</b> <i>Managing broken bones? (n=29)</i>           | 5                            | 8                    | 9              | 5                | 2                     |
| <b>5.</b> <i>Using the recovery position? (n=29)</i>     | 4                            | 7                    | 10             | 8                | 0                     |

**Post-Test Knowledge of First Aid**

The post-test comprised of the same 20 multi-choice questions on the participants knowledge of first-aid as the pre-test.

Table 4:

## Post-First Aid Course Knowledge Scores

| <i>Variables</i>       | <i>N</i> | <i>Median</i> | <i>Mean</i> | <i>Minimum Score</i> | <i>Maximum Score</i> | <i>Standard Deviation (SD)</i> |
|------------------------|----------|---------------|-------------|----------------------|----------------------|--------------------------------|
| <i>Post-test score</i> | 29       | 73.30%        | 74.86%      | 54.14%               | 96.64%               | 10.79                          |

The post-test showed a marked improvement in first-aid knowledge (Table 4); more than doubling the mean average scores to 74.86%; an increase of 39.35%. There were improved results across all the questions and key subject areas.

**Post-Test Confidence - Applying First Aid**

Post-test confidence levels also showed an improvement in confidence with an average of 88%; an improvement of 45% on the pre-test score (Table 5).

Table 5:

## Post First-Aid Course Confidence Levels

| <i>Confidence in</i>                                     | <i>Extremely unconfident</i> | <i>Not confident</i> | <i>Neutral</i> | <i>Confident</i> | <i>Very confident</i> |
|--|------------------------------|----------------------|----------------|------------------|-----------------------|
| <b>1.</b> <i>Performing CPR? (n=29)</i>                  | 0                            | 0                    | 3              | 9                | 17                    |
| <b>2.</b> <i>Using dressings and tourniquets? (n=29)</i> | 1                            | 1                    | 2              | 10               | 15                    |
| <b>3.</b> <i>Moving and handling patients? (n=29)</i>    | 0                            | 0                    | 1              | 8                | 20                    |
| <b>4.</b> <i>Managing broken bones? (n=29)</i>           | 0                            | 1                    | 4              | 8                | 16                    |
| <b>5.</b> <i>Using the recovery position? (n=29)</i>     | 1                            | 1                    | 3              | 8                | 16                    |

### Phase 3: Post-Intervention Phase

#### Experience of Applying First Aid Skills

Twenty-seven participants were interviewed at the 6-month follow-up point. Two traffic police officers were lost to follow-up as they had been transferred to alternative police duties.

Participants (n=27) reported that they had attended a total of 303 RTCs where people had been injured during the six month period of follow up. 12 participants (44.4%) stated that they had applied first-aid to RTI victims on 92 occasions, with a median frequency of 2.5 (IQR 1,8) times in that time period. The most frequently used skills were; scene assessment, patient assessment, haemorrhage control, extricating patients from the wreckage and providing reassurance (psychological first-aid). 81% (n=22) stated they had access to first-aid equipment.

#### Perceived Barriers to Applying First-Aid

Several issues emerged when exploring barriers to providing first response care at the scene of RTCs.

- Delays in arriving at the scene meant that patients were already transported to hospital by the public. Reasons for the delay included late notification and lack of transportation to the scene, although the frequency of these issues was not identified.
- Pressure from the public to just transport the victim and not deliver first aid. Some participants felt that they should have a badge on their uniform to show the public they were trained first responders and that this may reassure the public that it was appropriate to allow the police officer to perform first aid.

- Competing police duties. Participants identified that sometimes they had to prioritise other activities at the scene, such as clearing the road, mapping the RTC and arranging transportation before they could administer first aid.
- Lack of support from senior officers. Participants felt that there was a lack of encouragement to do first-aid from more senior ranks within the police force.
- Lack of equipment/stretchers. Participants said that they sometimes arrived on scene without first-aid equipment. Reasons cited were that they did not respond in a police vehicle or in the haste to get to the scene, they had left the trauma pack at the police station. There are only 4-police vehicles available across the whole district.

## Knowledge and Confidence

The mean average first aid knowledge score at 6 months was 57.05%, a drop of 17.81% from the post-course (Table 7). No particular question or key subject area identified any particular weakness.

Table 7:

First Aid Knowledge Scores at 6-months

| <i>Variables</i>       | <i>N</i> | <i>Median</i> | <i>Mean</i> | <i>Minimum Score</i> | <i>Maximum Score</i> | <i>Standard Deviation (SD)</i> |
|------------------------|----------|---------------|-------------|----------------------|----------------------|--------------------------------|
| <i>Post-test score</i> | 27       | 54.98%        | 57.05%      | 30.00%               | 89.96%               | 14.08                          |

The confidence level averaged 67% at 6 months; a drop of 21% from the post-course (Table 8).

Table 8:

First Aid Confidence Levels at 6-months

| <i>Confidence in</i>                                     | <i>Extremely unconfident</i> | <i>Not confident</i> | <i>Neutral</i> | <i>Confident</i> | <i>Very confident</i> |
|--|------------------------------|----------------------|----------------|------------------|-----------------------|
| <b>1.</b> <i>Performing CPR? (n=27)</i>                  | 0                            | 0                    | 11 (41%)       | 7 (26%)          | 9 (33%)               |
| <b>2.</b> <i>Using dressings and tourniquets? (n=27)</i> | 0                            | 0                    | 11 (41%)       | 7 (26%)          | 9 (33%)               |
| <b>3.</b> <i>Moving and handling patients? (n=27)</i>    | 0                            | 0                    | 1 (3%)         | 11 (41%)         | 15 (56%)              |
| <b>4.</b> <i>Managing broken bones? (n=27)</i>           | 0                            | 4 (15%)              | 11 (41%)       | 9 (33%)          | 3 (11%)               |
| <b>5.</b> <i>Using the recovery position? (n=27)</i>     | 0                            | 0                    | 4 (15%)        | 8 (30%)          | 15 (56%)              |

## Incident Report Forms

Only 4 incident report forms were collected in the 6-month data collection period, completed by three (11%) of the 27 staff available for follow up. A range of reasons for not completing the forms were given. Forgetting and time pressure were the most common. Lack of support and reinforcement from senior managers was also cited, along with thinking someone more senior would complete the documentation.

## Training Course

None of the course participants felt that any of the course content should be dropped, although 41% (n=7) felt that the course should be longer.

## Discussion

The RE-AIM framework<sup>19</sup> has become widely recognized across a range of disciplines as a valuable tool to guide development and evaluation of public health interventions intended for wider dissemination. The acronym stands for Reach, Effectiveness, Adoption, Implementation, and Maintenance which together are used here to help determine the impact of the first responder training intervention for the traffic police in Makwanpur District.

### Reach

The bespoke first responder trauma training programme reached three-quarters of the targeted population; operational traffic police officers in the district. Co-operation from the district police inspector ensured a high take-up of course places, but reach was naturally affected by the need to maintain a police presence on the roads. The enthusiasm for the training was a reflection of how so many of the participants felt that applying first aid skills was a part of their responsibilities. Indeed, first aid is made explicit in the NTP mission objectives which state that the police should “*Render assistance to public in various stressful conditions such as prompt first aid to accident victims*”<sup>16</sup>.

### Efficacy

Within the RE-AIM framework<sup>19</sup>, effectiveness is defined as the success rate of the intervention to achieve its intended goal(s). In our study, we sought to develop, design and evaluate the feasibility of a bespoke first-responder trauma training programme for the traffic police in Nepal.

We have shown that we were able to develop and design a first-responder course focussed on managing traumatic injuries at RTCs. Studies examining first-aid training curricula in LMICs have shown significant heterogeneity<sup>11</sup>. Our study was designed using subject expertise and local expert knowledge and adaptation of pre-existing curricula<sup>17,18</sup>, and took into account the prior knowledge and experience of the

course participants. The course combined theory with 'hands-on' simulation. Simulation is a key training modality in learning trauma care<sup>11</sup>.

The pre-intervention data showed that Nepal traffic police were attending road traffic crashes and transporting casualties with limited or no first aid training and limited emergency resources. The range of injuries include wounds and bleeding, fractures and head and internal injuries. This is not uncommon in LMICs<sup>20,21,22,23,24</sup>. Previous studies have shown that where casualties are treated and/or rushed to hospital by untrained police or bystanders, they have much poorer outcomes and are more likely to die than if looked after by emergency medical personnel or trained first responders<sup>24,25,26,27</sup>.

Three-quarters of the participants had received no previous first aid training. Therefore, unsurprisingly, pre-intervention levels of first aid knowledge and confidence were low and for those participants that had received first aid training, there was no common course length or fixed refresher period. Experts have identified that there is little evidence addressing the best length of time for a first aid course<sup>28</sup>. Instead advising that the individual needs of the learner or learner group will dictate the course content and hence the course duration. Many of the course participants said they would have liked it to be longer. Our 3-day training was based on the balance of achieving the course learning outcomes, against the need to maintain traffic police operations.

The knowledge of first aid and confidence in applying those skills in practice improved significantly post-intervention. This dropped a little at 6-months, but not to pre-intervention levels. At follow-up, some of the participants in our study identified the need for refresher training and indeed, this is an important part of retaining knowledge and confidence. Research conducted with lay first-aiders in Nepal has found that retention of first aid skills reduces significantly over time and concluded that first aid skills should be refreshed annually<sup>29</sup>. Other studies have shown increased retention of knowledge and self-assessed confidence in refresher training at 6-months<sup>30,31</sup>. Frequency of retraining must be based on a balance between the need to maintain skills and the practicalities, including financial, involved in mandating refresher courses at frequent intervals.

## **Adoption**

The training programme was delivered at the Police headquarters in Hetauda. The training was conducted by local and national trainers from the Nepal Red Cross Society, using the curriculum developed by NIRC. Participants were commended for their high level of enthusiasm and motivation<sup>32</sup>. The local police commander also participated on most of the training days. National support for the research was also gained and permission given by the National Traffic Police Headquarters (Traffic Directorate) in Kathmandu.

Training the traffic police is not only feasible, but has the capacity to have a long term impact on clinical outcomes. When applied correctly, first aid treatment for trauma victims has been reported to show significantly reduced mortality and morbidity<sup>26,33,34,35,36</sup>.

Knowledge and confidence improved as a result of the training and this was carried through in to the field, with participants using their new skills frequently during the study period. It was found that police officers were not only applying first aid skills in practice, but were often the rescuer, extricating the RTI victim from the wreckage. Moving and handling patients were areas where they maintained self-confidence through the post intervention phase.

## **Implementation**

At the program level, training was delivered as intended by the trainers from the NRCS in strict adherence to the training curriculum, to ensure intervention fidelity. Having the trainers from NRCS was advantageous as the trainers were confident and had many years of experience providing first aid training across Nepal.

The training was conducted with oversight by the NIRC team and it was evaluated by the trainee at its conclusion. Feedback on the training experience showed the majority of the participants rated the training's overall value as either '*excellent*' or '*good*'. The training was flexible whilst maintaining fidelity to the original planned timings and duration so as to meet with the other competing duties of the traffic police.

The cost of three-day first responder training course (including the trauma pack) was £3,682.87 (£127 per trainee). A summary of the first responder training course costs and associated trauma pack components are listed in Table 9.

Table 9:

## First responder training programme costs

| <i>Activity items</i>   | <i>Quantity</i> | <i>Total (£)</i> |
|---|-----------------|------------------|
| <i>Trainee travel allowances</i>                              | 29              | 328.41           |
| <i>Trainers wages</i>   | 5               | 314.44           |
| <i>Transportation</i>   | 2               | 87.15            |
| <i>Food and accommodation costs for trainees and trainers</i> | 34              | 1,110.70         |
| <i>Training materials</i>                                     |                 |                  |
| <i>Stationery and certificate</i>                             | 29              | 95.66            |
| <i>Gloves and mask</i>  | 29              | 33.39            |
| <i>Pocket resuscitation face mask</i>                         | 4               | 9.36             |
| <i>Vinyl disposable bag valve mask (adult)</i>                | 4               | 42.96            |
| <i>Cardiopulmonary resuscitation manikins</i>                 | 4               | 775.20           |
| <i>Trauma pack</i>  | 3               | 885.60           |
| <b><i>Total</i></b>   |                 | <b>3682.87</b>   |

The training was implemented at a reasonable cost, indicating that it would be feasible and sustainable to roll out in other districts. All items in the trauma pack were low-cost and can be easily obtainable locally (Additional File 6).. There is limited reporting on implementation and resourcing costs associated with first responder training making it difficult to compare our findings with those of similar studies<sup>23,37,38,39</sup>. A study in Uganda in 2008 reported the cost of a 1-day, basic first-aid course for lay people including the police was approximately US\$27 per participant<sup>23</sup>. Although higher than the costs in Uganda, the estimated cost of extending the training to cover other districts/all of Nepal compares favourably with the significant direct costs of road traffic injuries in Nepal<sup>40</sup>.

## Maintenance

There were a number of barriers and facilitators to maintaining the application of first-responder skills to RTI victims. At an organisational level, the support both locally and nationally was essential for this type of intervention to succeed. There was a change of local police leadership part-way into the research that may have impacted on the level of support locally. Participants identified that they hadn't always felt supported or encouraged to apply their new first responder skills in practice.

Although the traffic police are frequently the first official presence at the scene of the RTC, delays in being activated and arriving on scene were identified by participants as factors resulting in the RTI victim being removed from the scene prior to their arrival. The lack of an identifiable, national, 3-digit phone number to summon the emergency services promptly may be a contributory factor to these delays. Walker *et al*<sup>7</sup> have reported some success with the introduction of the '102' number in Kathmandu and other regions. As the general public are frequently on scene before the police, having trained *community* first responders also makes intuitive sense. Research in other LMICs has shown this is feasible and can make a difference<sup>11,21,26,27</sup>.

Having arrived on scene, although participants were able to frequently apply their skills for patient care, they sometimes felt pressured by the public to prioritise transferring the patient to hospital. There was a lack of public recognition that they were trained first responders, and that providing first aid may be more beneficial than immediate transportation. Possible solutions to this problem would be wearing an identifiable first responder badge on their uniform and, if expanded nationally, a publicity campaign to inform the general public of their additional role.

Post-incident, there was a limited return of incident report forms. As time pressures and forgetting were identified as reasons, this would require greater reinforcement in training, and for the process to be built in to the systematic reporting of RTCs and enforced by senior staff, were the training to be rolled out nationally.

## **Strengths and Limitations**

Strengths of this study include that the course was designed after the training needs assessment, and that it was based on published guidance. It was delivered by experienced and recognised first aid trainers. There was good interest and co-operation from the district police and the participants which resulted in three-quarters of officers being trained, and we were able to follow up 27/29 (93%).

Asking participants to recall the frequency of using first aid skills is at risk of under-reporting or over-reporting due to recall bias. The limited number of contemporaneous incident report forms has meant a reliance on data from the self-reported use of first responder skills across the 6-month follow up period. Although it is clear that participants have been applying their first-aid skills; without the forms, it is not possible to determine the validity of their responses.

## **Conclusions**

Nepal is a country with a heavy burden of mortality and morbidity from road traffic injuries. The pre-intervention data showed that traffic police were attending road traffic crashes and transporting casualties with limited or no standardised first-aid training and limited emergency resources. We were able to develop and design a first-responder course for the traffic police, focussed on managing traumatic injuries at RTCs. The participants in the training increased their knowledge of first-aid and their confidence in applying those skills.. They then went on to frequently perform first-aid at the crash scene.

Essential to the success of this is support from police senior management both nationally and locally. Further studies will need to reinforce the need to capture the use of incident report forms when first responder skills are applied. The cost of the three day first responder training course was minimal and the estimated cost of extending the training would compare favourably with the significant burden of the direct costs of road traffic injuries in Nepal.

Thus, it is feasible practically and financially to extend the training to cover other districts/all of Nepal as a low-cost measure to combat road traffic injury in the absence of formal emergency medical services.

## **List Of Abbreviations**

RTI - Road Traffic Injury

LMIC - Low & Middle Income Countries

WHO - World Health Organisation

EMS - Emergency Medical Services

NIRC - Nepal Injury Research Centre

FRRG - First Response Reference Group

NTP - Nepal Traffic Police

NRCS - Nepal Red Cross Society

CPR - Cardio Pulmonary Resuscitation

RTC - Road Traffic Collision

RE-AIM - Reach, Effectiveness, Adoption, Implementation, and Maintenance

NIHR - National Institute for Health Research

## **Declarations**

### **Ethics approval and consent to participate**

Ethical approval was obtained from the Ethical Review Board of Nepal Health Research Council and from the Faculty Research Ethics Committee of University of the West of England, Bristol.

### **Consent for publication**

Not applicable

## Availability of data and materials

The datasets supporting the conclusions of this article are included within the article and its additional files.

## Competing interests

The authors declare that they have no competing interests.

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## Authors' contributions

The study was conceived by JM, GS, AB and SJ. The study design, methods and data analysis plan were drafted by AB, GS and JM and refined and implemented with SJ and EJ., KPG and RR provided technical and practical input for delivery of the training intervention and wrote the training report. EJ and AB collected the data. Data analysis was undertaken by AB and GS. GS drafted and finalised the manuscript. All authors contributed to drafts and approved the final manuscript.

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## Table

Table 6 not available with this version

## Figures

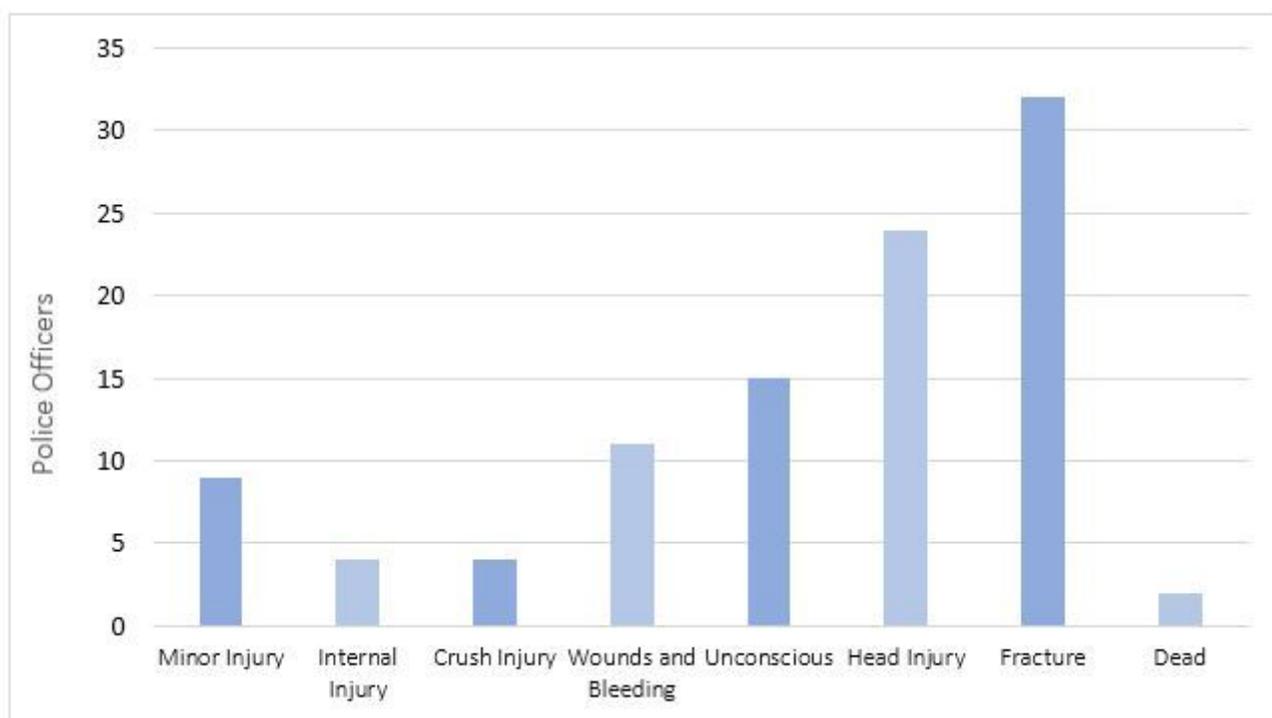
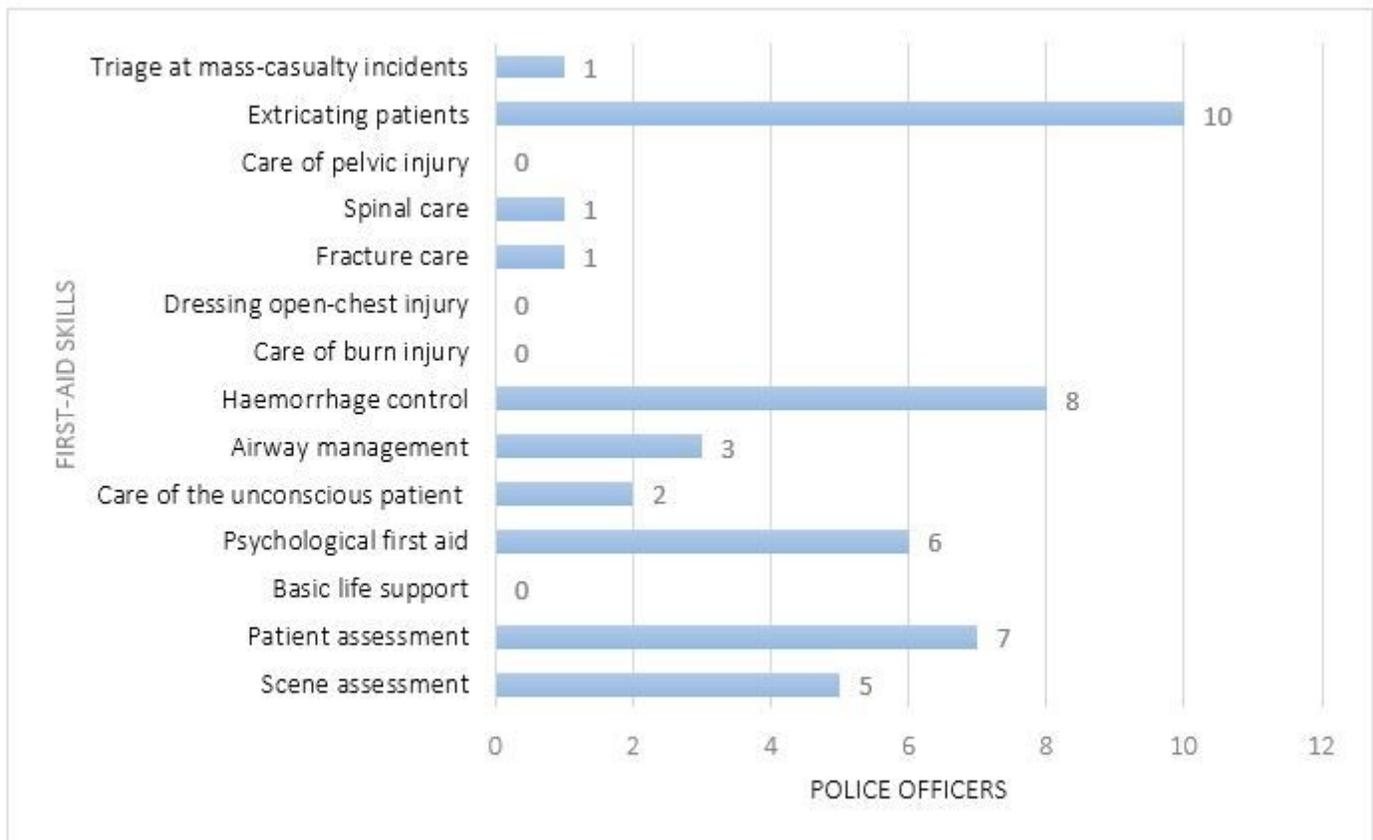


Figure 1

## Road Traffic Injuries Transported to Hospital by Traffic Police in Makwanpur



**Figure 2**

First Aid Skills Applied in Practice

## Supplementary Files

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- [AdditionalFile1TrainingNeedsAnalysis.docx](#)
- [AdditionalFile2FirstResponderCourseCurriculum3day.docx](#)
- [AdditionalFile3Preandposttrainingquestionnaire.docx](#)
- [AdditionalFile4Postincidentpatientreportform.docx](#)
- [AdditionalFile5Followupinterview.docx](#)
- [AdditionalFile6TraumaPackContents.docx](#)