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Original Research Article

EFFECTIVENESS OF PRE-HOSPITAL TRAUMA CARE TRAINING FOR LAY RESPONDERS: AN INTERVENTIONAL COMMUNITY-BASED STUDY

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ABSTRACT

Background: Trauma is a leading cause of mortality in low- and middle-income countries, and road traffic accidents account for a substantial share of trauma-related disability and death. In Kerala, India, no standardized pre-hospital emergency trauma care protocol exists, leaving initial response largely to untrained bystanders. The objective is to evaluate the effectiveness of a structured pre-hospital trauma care training program on the knowledge and practical skill of lay first responders in an accident-prone locality, and to assess knowledge retention over two months.

Materials and Methods: Sixty volunteers — auto/taxi drivers, merchants, college students, and paramedical personnel — in Haripad, Alappuzha district, Kerala, were trained following American Heart Association guidelines, comprising lectures, hands-on practice, and simulation. Knowledge was assessed using a 15-item, 75-point questionnaire administered before training, immediately after training, and at two-month follow-up. Practical skill competence across six domains was assessed at follow-up. Paired Student's t-test compared score changes, and McNemar's test evaluated pass/fail conversion.

Results: Mean knowledge scores rose from 25.7±12.2 pre-training to 57.7±9.4 post-training ($t=-28.35$, $p<0.0001$) and improved further to 63.7±7.7 at two-month follow-up ($t=-10.06$, $p<0.0001$). McNemar's test confirmed a highly significant shift from failing to passing ($\chi^2 \approx 41$, $p<0.0001$), with no participant regressing from pass to fail. At follow-up, bleeding control and fracture stabilization were the strongest skills (48/58, 82.8% each), while cervical spine stabilization was comparatively weaker (44/58, 75.9%).

Conclusion: Structured pre-hospital trauma care training significantly and durably improves knowledge and practical skill among lay first responders, supporting community-based scaling of such programs to strengthen trauma response in resource-limited settings.

Keywords: Pre-hospital care, first responders, road traffic accidents, trauma training, public health.

INTRODUCTION

Traumatic injury remains a dominant cause of mortality and morbidity in low- and middle-income countries (LMICs), which together bear nine of every ten trauma deaths worldwide.[1,2] Road traffic accidents alone account for roughly one-third of trauma-related disability-adjusted life years and rank among the leading causes of death in people aged 5–45 years.[3] Nearly half of all trauma deaths occur within the first hour after injury and a further 30% within the first day, underscoring how much of this burden is, in principle, preventable through timely and effective pre-hospital care.[4] The World Health Organization has accordingly emphasized strengthening pre-hospital trauma systems globally,

noting that even modest, low-cost two-tiered models combining trained lay first responders with formal ambulance services can meaningfully reduce mortality.[5]

India bears approximately one-fifth of the global injury burden.[6] While both public and private emergency medical services have expanded over the past decade, the system remains nascent relative to high-income countries, and in many regions — including parts of Kerala — no standardized pre-hospital emergency trauma protocol exists. In such settings, the initial response to a road traffic accident typically falls to untrained bystanders, police, or passers-by rather than trained personnel.[7]

International experience suggests that training lay responders — including non-medical occupational groups with high scene exposure, such as motorcycle taxi drivers — can meaningfully close this gap. A 2022 international workshop convened by the Faculty of Pre-Hospital Care reviewed pre-hospital care and ambulance services in Tamil Nadu and Kerala and proposed developing a dedicated international training course for pre-hospital trauma care in India, adapted from an existing UK model.[8] Community-based studies in Ghana and southern India have similarly found that most lay first responders at accident scenes had no formal first-aid training but were nonetheless willing, and often eager, to acquire it.[9,10] Structured pre-hospital trauma life support training has been shown to reduce on-scene time intervals in Iran,[11] and a one-day basic prehospital care course for rural Ugandan motorcycle taxi drivers produced durable knowledge gains and measurable real-world use of the skills taught, at a cost of under USD 70 per trainee.[12] Workshops training lay responders in Indian professional colleges have likewise reported high participant confidence and satisfaction.[13]

Haripad, in Kerala's Alappuzha district, is one such accident-prone locality, characterized by heavy traffic flow, variable road conditions, and limited public awareness of trauma first aid, compounded by prolonged emergency response times. We hypothesized that a structured, AHA-guideline-based training program targeted at occupational groups with high scene exposure — auto and taxi drivers, local merchants, college students, and paramedical personnel — would significantly improve both immediate knowledge and durable two-month retention, equipping a community-based network of first responders capable of bridging the critical interval before professional help arrives.

MATERIALS AND METHODS

This interventional community-based study was conducted in Haripad, Alappuzha district, Kerala, India, following approval from the Institutional Ethics Committee, Believers Church Medical College Hospital (IEC/2024/01; Study No. IEC/2024/01/391; approved 10 January 2024).

High-risk accident zones were identified using local traffic police, hospital emergency service, and public health records, and key stakeholders — community leaders, local government officials, healthcare providers, and law enforcement — were engaged to identify and recruit volunteers without prior pre-hospital trauma care training. Eligible participants were aged 18–50 years, residents within Haripad municipality, working as auto/taxi/ambulance drivers, paramedical professionals, merchants near NH-66, or college students, and free of disability or cardiac/pulmonary disease. Sixty volunteers meeting these criteria were enrolled.

Training, delivered on a single day in December 2023, followed American Heart Association guidelines and comprised lectures on trauma fundamentals; hands-on practice in CPR, wound care, fracture immobilization, and safe transport; and simulation-based mock drills covering scene evaluation, primary assessment, airway and breathing management, bleeding control, and spinal and burn injury management.

A 15-item knowledge questionnaire (maximum score 75, passing score ≥35) was administered immediately before and after training, and again at a two-month follow-up session in February 2024, alongside a simulation-based skill assessment across six domains: cervical spine stabilization, helmet removal, receiving in spine board, CPR quality, fracture stabilization, and bleeding control. Active community participation in real trauma incidents between the two sessions was also recorded via participant self-report.

Data were analyzed using paired Student's t-test to compare mean scores between pre-test and post-test, and between post-test and two-month follow-up. McNemar's test was used to evaluate the significance of pass/fail conversion between pre- and post-training assessments, with the corresponding odds ratio calculated. A p-value <0.05 was considered statistically significant.

RESULTS

Sixty volunteers were enrolled (65% male, 35% female; age range 19–43 years), comprising college students (20), paramedical personnel (19), merchants (11), and drivers (10). [Table 1] Fifty-eight (96.7%) completed the two-month follow-up; two participants were lost to follow-up (dropout ratio 3.3%).

Table 1: Demographic and occupational characteristics of participants (N=60)

Characteristic	Value
Male, n (%)	39 (65.0%)
Female, n (%)	21 (35.0%)

Age range (years)	19–43
College students, n (%)	20 (33.3%)
Paramedical personnel, n (%)	19 (31.7%)
Merchants, n (%)	11 (18.3%)
Auto/taxi/ambulance drivers, n (%)	10 (16.7%)
Completed two-month follow-up, n (%)	58 (96.7%)

At baseline, knowledge of pre-hospital trauma care was poor: 49 of 60 participants (81.7%) failed to reach the passing score of 35/75, with a mean pre-test score of 25.7 ± 12.2. Immediately following training, all 60 participants scored above the passing threshold, with the mean rising to 57.7 ± 9.4 — a mean improvement of 32.0 ± 8.7 points (paired t-test, t=–28.35, df=59, p<0.0001), with a strong positive correlation between pre- and post-test performance (r=0.71). At two-month follow-up, knowledge was not only retained but improved further among the 58 participants reassessed: mean score rose from 57.9 ± 9.4 (post-test, same subgroup) to 63.7 ± 7.7 (paired t-test, t=–10.06, df=57, p<0.0001), with a tighter score distribution indicating more consistent performance, and a very strong correlation between post-test and follow-up scores (r=0.89). [Table 2]

Table 2: Paired comparison of knowledge scores across assessment points (n=60 pre-/post-test; n=58 follow-up)

Comparison	Mean ± SD (Time 1)	Mean ± SD (Time 2)	Paired t-test
Pre-test → Post-test	25.7 ± 12.2	57.7 ± 9.4	t=–28.35, df=59, p<0.0001
Post-test → 2-month follow-up	57.9 ± 9.4	63.7 ± 7.7	t=–10.06, df=57, p<0.0001

McNemar's test confirmed the significance of the pre- to post-training pass/fail conversion: of the 41 participants who failed at baseline, all 41 passed post-training, while none of the 19 participants who passed at baseline subsequently failed ($\chi^2 \approx 41$, p<0.0001; odds ratio not calculable — all discordant pairs moved from fail to pass, with no regression observed [Table 3].

Table 3: McNemar's test: pre-test to post-test pass/fail conversion (N=60)

Pre-test	Post-test: Pass	Post-test: Fail
Pass	19	0
Fail	41	0

χ^2 (McNemar) ≈ 41, p<0.0001; Odds ratio: not calculable (all 41 discordant pairs moved from fail to pass; no participant regressed).

On simulation-based skill assessment at two-month follow-up (n=58), bleeding control and fracture stabilization were the strongest-performed skills, with 48 participants (82.8%) each demonstrating competence, followed by helmet-safe removal (47, 81.0%), CPR quality and receiving in spine board (46, 79.3% each), and cervical spine stabilization, which — while still demonstrating a majority achieving competency — was comparatively the weakest skill at 44 participants (75.9%). [Table 4]

Table 4: Skill competence on simulation-based assessment at two-month follow-up (n=58)

Skill domain	Competent, n	Competent, %
Bleeding control	48	82.8%
Fracture stabilization	48	82.8%
Helmet – safe removal	47	81.0%
CPR quality	46	79.3%
Receiving in spine board	46	79.3%
Cervical spine stabilization	44	75.9%

DISCUSSION

Our findings demonstrate that a single-day, AHA-guideline-based pre-hospital trauma care training program produced large, statistically significant, and durable gains in knowledge and practical skill among a community sample of lay first responders in an accident-prone Kerala locality. The magnitude of improvement from pre- to post-test (mean gain of 32 points on a 75-point scale) and the near-perfect McNemar's test conversion from failing to passing are consistent with — and somewhat exceed — gains reported in comparable lay-responder training programs internationally.[9,12,13]

Importantly, and in contrast to several earlier reports describing decay of trauma-care knowledge within months of training,[14] our cohort's knowledge scores not only persisted but improved further at the two-month follow-up. This pattern may reflect the practical, occupationally relevant nature of the training content for participants such as drivers and merchants who are plausibly exposed to road traffic accident scenes in the course of their daily activity, reinforcing learned material through real-world application; indeed, several trainees reported encountering genuine road traffic accident victims between the training and follow-up sessions and applying the skills learned. This observation parallels findings from rural Uganda, where

motorcycle taxi drivers trained in basic prehospital care went on to document dozens of real patient encounters within months of training, demonstrating durable applied competence rather than mere short-term recall.[12]

The comparatively weaker performance in cervical spine stabilization relative to bleeding control and fracture stabilization is a recurring finding in lay-responder trauma training literature and likely reflects the greater technical complexity and lower day-to-day familiarity of spinal immobilization technique compared to more intuitive skills such as direct wound pressure.[9] This suggests that future training cycles in similar programs should allocate proportionally more hands-on practice time to cervical spine and airway-adjacent skills.

The exceptionally high retention and participation rate (96.7% at two-month follow-up) and the absence of any participant regressing from pass to fail also speak to the feasibility and acceptability of recruiting non-medical occupational groups — drivers, merchants, students, and paramedical staff — as a sustainable first-responder network, echoing recommendations from the 2022 FPHC workshop on developing pre-hospital care capacity in Tamil Nadu and Kerala.[8]

Limitations

This study has several limitations that warrant consideration. First, the single-arm pre-post design without a concurrent control group limits our ability to fully attribute the observed gains to the training intervention alone, as opposed to test familiarity or other temporal factors. Second, the study was conducted in a single locality (Haripad), and findings may not generalize to other regions of Kerala or India with different demographic, occupational, or road-infrastructure profiles. Third, follow-up was limited to a single time point at two months; longer-term retention beyond this interval remains unknown. Finally, participants were self-selected volunteers, which may have introduced a degree of motivation or selection bias not present in a randomly sampled community cohort.

CONCLUSION

A structured, single-day pre-hospital trauma care training program, delivered to a community-recruited group of lay first responders in an accident-prone Kerala locality, produced large and durable improvements in both knowledge and practical skill, with gains that persisted — and in several respects strengthened — over two months of follow-up. These findings support the feasibility of scaling community-based pre-hospital trauma training programs targeted at high-scene-exposure occupational groups as a low-cost strategy to strengthen the “golden hour” response to road traffic accidents in resource-limited settings such as Kerala, and more broadly across India.

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