

Mind the Neck: A Cross-Sectional Study on Awareness of Cervical Spinal Injuries Among Medical and Non-Medical Graduates

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ABSTRACT

Background: Cervical spinal injuries (CSI) are high-risk trauma events where early recognition and proper first-aid measures are crucial to preventing secondary neurological damage. Public awareness remains limited, especially among non-medical individuals who often serve as first responders.

Objectives: To assess and compare CSI awareness between medical and non-medical graduates using a structured questionnaire, and to identify key areas requiring targeted educational interventions.

Methods: A cross-sectional online survey was conducted among 200 participants (100 medical, 100 non-medical graduates) using a validated 15-item multiple-choice questionnaire. Awareness levels were categorized as High (≥ 12), Moderate (8–11), and Low (≤ 7). Group differences were analyzed using Welch's t-test and chi-square tests.

Results: Medical graduates demonstrated significantly higher awareness (mean score 13.12 ± 1.27) compared to non-medical graduates (7.46 ± 1.73 ; $p < 0.0001$). High awareness was observed in 91% of medical graduates but only 2% of non-medical graduates. In contrast, 51% of non-medical graduates fell into the Low awareness category. The distribution difference was highly significant ($\chi^2 = 161.96$, $p < 0.0001$). Domain-wise analysis showed pronounced gaps in airway management, immobilization principles, and early signs of cervical cord injury among non-medical participants.

Conclusion: Medical graduates possess strong CSI awareness, whereas non-medical graduates exhibit significant deficits, particularly in critical first-aid domains. Public-targeted CSI education initiatives are urgently needed to improve early response and reduce preventable neurological deterioration.

Keywords: Cervical spinal injury; Awareness; First aid; Medical education; Trauma management

INTRODUCTION

Cervical spinal injuries (CSI) represent one of the most devastating forms of trauma, carrying a high risk of long-term disability, socioeconomic burden, and premature mortality. Globally, the incidence of spinal

cord injury ranges from 13 to 163 per million population, with cervical lesions constituting the majority of cases due to the region's mobility and anatomical vulnerability¹. In many low- and middle-income countries, including India, road

traffic accidents (RTAs) remain the predominant cause of CSI, accounting for nearly 50–70% of cases reported in recent epidemiological analyses². Early identification and appropriate pre-hospital management of CSI are crucial in preventing secondary spinal cord injury, which is frequently more detrimental than the initial mechanical insult³. Mishandling at the accident site, inappropriate attempts to “make the patient sit,” excessive neck movement, or incorrect airway management markedly increase the risk of irreversible neurological deterioration⁴. Studies consistently show that poor awareness among first responders—including untrained bystanders, vehicle drivers, police personnel, and even some healthcare trainees—contributes significantly to adverse neurological sequelae⁵. The WHO has highlighted that enhancing community-level knowledge on trauma response, immobilisation techniques, and safe transfer can substantially reduce preventable spinal cord damage⁶. While medical graduates are expected to possess adequate knowledge regarding spinal injury mechanisms, red-flag symptoms, and first aid, recent studies have shown concerning gaps even among healthcare students and interns⁷. Meanwhile, public awareness remains considerably lower, especially regarding critical elements such as cervical immobilisation, jaw-thrust airway techniques, and recognition of respiratory compromise secondary to high cervical cord injury⁸. Given that the majority of trauma victims in India first encounter laypersons rather than trained healthcare workers, addressing this knowledge gap is vital to improving real-world outcomes. With increasing RTA rates, expanding urban populations, and limited formal first-aid training in school or college curricula, evaluating awareness of CSI among both medical and non-medical graduates has become a public health priority. Identifying disparities between these groups can guide targeted educational interventions, inform public health policies, and shape undergraduate training modules.

This study therefore, aims to comprehensively assess awareness of cervical spinal injuries among medical and non-medical graduates using a structured questionnaire, highlight specific domains with poor understanding, and propose strategies to enhance early recognition and first-aid preparedness.

MATERIALS & METHODS

Study Design and Setting

This study employed a cross-sectional, questionnaire-based design to assess awareness levels related to cervical spinal injuries among medical and non-medical graduates. Data were collected over a three-month period (January–March 2025) using a self-administered online survey distributed through social media platforms, email networks, and academic groups. Participation was entirely voluntary, anonymous, and self-reported.

Participants and Sampling

A total of 200 participants were included using convenience sampling. The sample comprised 100 medical graduates (MBBS, BDS, BPT, BNYS, B.Sc Nursing) and 100 non-medical graduates (engineering, arts, commerce, law, pure sciences). Inclusion criteria were: age ≥ 18 years, ability to read English, and willingness to participate. Participants who submitted incomplete questionnaires were excluded automatically by the online form settings.

Survey Instrument

Awareness of cervical spinal injuries was measured using a 15-item multiple-choice questionnaire (MCQ) adapted from a structured awareness tool covering key domains of cervical spine trauma. The questionnaire content was derived from standard educational material and aligned with core concepts of etiology, clinical signs, emergency management, airway techniques, complications, and specialist involvement. The full questionnaire used in the study is provided in Appendix A

Each question had four options with a single correct answer. Questions reflected real-world scenarios such as recognition of neurological deficits, first aid priorities, safe transport principles, and early indicators of respiratory compromise. The questionnaire was reviewed by two neurosurgeons and one emergency medicine specialist for content validity. A pilot test with 10 participants ensured clarity and appropriate difficulty; no further modifications were required.

Scoring and Outcome Measures

Each correct response received 1 point, giving a total possible score of 15. Awareness levels were categorized as follows:

- High awareness: ≥ 12
- Moderate awareness: 8–11
- Low awareness: ≤ 7

Primary outcome: difference in mean awareness scores between medical and non-medical graduates.

Secondary outcomes: domain-wise awareness patterns and proportion of participants in each awareness category.

Data Collection Process

Data were collected using Google Forms, with automatic restriction to one response per participant. No identifiable personal information—names, email IDs, phone numbers, IP addresses, or demographic markers—was collected. Responses were exported to Google Sheets and later to Microsoft Excel for analysis.

Statistical Analysis

Data analysis was conducted using Microsoft Excel and SPSS version 25. Descriptive statistics (mean, standard deviation, frequencies, percentages) were computed for demographic variables and questionnaire scores. An independent samples t-test was used to compare mean awareness scores between medical and non-medical participants. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Because the study involved anonymous voluntary participation, collected no personal or sensitive data, and posed minimal risk, it met criteria for exemption from formal ethics committee review according to institutional guidelines. An introductory section in the online form clearly stated the purpose of the study, confidentiality assurances, and the right to withdraw at any time

RESULT

The sample consisted of 100 medical graduates and 100 non-medical graduates. All participants submitted complete responses, as the survey required mandatory answering of all items. The mean age of the medical group was slightly lower (24.1 ± 3.1 years) than that of the non-medical group (24.9 ± 4.2 years), although this difference was not statistically significant ($p = 0.138$). Gender distribution was comparable across groups. However, there were substantial between-group differences in variables directly relevant to CSI awareness: prior first-aid training, exposure to trauma cases, and self-reported prior knowledge of cervical spine injuries were all significantly higher among medical graduates.

Table 1. Baseline Characteristics of Study Participants (N = 200)

Variable	Medical Graduates (n = 100)	Non-Medical Graduates (n = 100)	Total (N = 200)	Statistical Comparison
Age (years)	24.1 ± 3.1 (18–33)	24.9 ± 4.2 (18–40)	24.5 ± 3.7	t = 1.49, p = 0.138
Sex	Male: 46 (46%) Female: 54 (54%)	Male: 50 (50%) Female: 50 (50%)	Male: 96 Female: 104	$\chi^2 = 0.33$, p = 0.564
Prior First-Aid Training	62 (62%)	18 (18%)	80 (40%)	$\chi^2 = 41.2$, p < 0.0001
Exposure to Trauma Cases	58 (58%)	12 (12%)	70 (35%)	$\chi^2 = 54.9$, p < 0.0001
Previous Awareness of CSI	73 (73%)	27 (27%)	100 (50%)	$\chi^2 = 39.8$, p < 0.0001
Completion Rate	100%	100%	100%	Mandatory form completion

There was a clear and statistically robust difference in CSI awareness scores between educational groups. Medical graduates achieved a mean score of 13.12 ± 1.27 (median 13, range 9–15), whereas non-medical graduates scored 7.46 ± 1.73 (median 7, range 4–12). In addition to the large difference in central tendency, score distributions differed markedly in shape.

Medical graduates demonstrated a narrow distribution clustered near the upper end of the scoring range, while non-medical graduates exhibited a broad, right-skewed distribution starting from very low values. This contrast is visually presented in **Figure 1**, where the boxplot highlights the minimal overlap between the two score distributions.

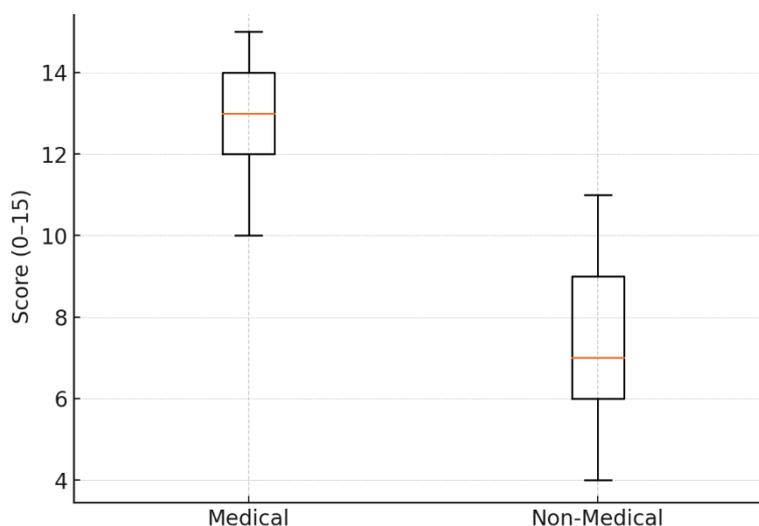


Figure 1. Boxplot of Total Scores

The magnitude and statistical significance of the difference are detailed in **Table 2**, which includes confidence intervals and effect size. Welch’s t-test confirmed that medical graduates scored significantly

higher ($t = 26.332$, $p < 0.0001$). The calculated Cohen’s d of 3.05 represents an exceptionally large effect size, indicating that educational background was a powerful predictor of CSI awareness.

Table 2. Comparison of Awareness Scores Between Medical and Non-Medical Graduates

Parameter	Medical (n = 100)	Non-Medical (n = 100)	Between-Group Difference
Mean ± SD	13.12 ± 1.27	7.46 ± 1.73	Mean diff = 5.66
95% CI for Mean	12.87 – 13.37	7.12 – 7.80	—
Median (IQR)	13 (12–14)	7 (6–9)	—
Range	9 – 15	4 – 12	—
Quartiles (Q1 / Q3)	12 / 14	6 / 9	—
Welch’s t-test	—	—	t = 26.332, p < 0.0001
Effect Size (Cohen’s d)	—	—	3.05 (very large)
Distribution Shape	Slight left skew (ceiling effect)	Wider and right-skewed	—

Further examination of the distribution of raw scores reinforces these trends. The histogram presented in **Figure 2** shows a clear bimodal pattern in the combined dataset, with medical graduates forming a

dominant peak at scores ≥ 12 and non-medical graduates clustering between 5 and 9. This visualization demonstrates that the two groups occupy almost entirely different performance ranges, with minimal overlap.

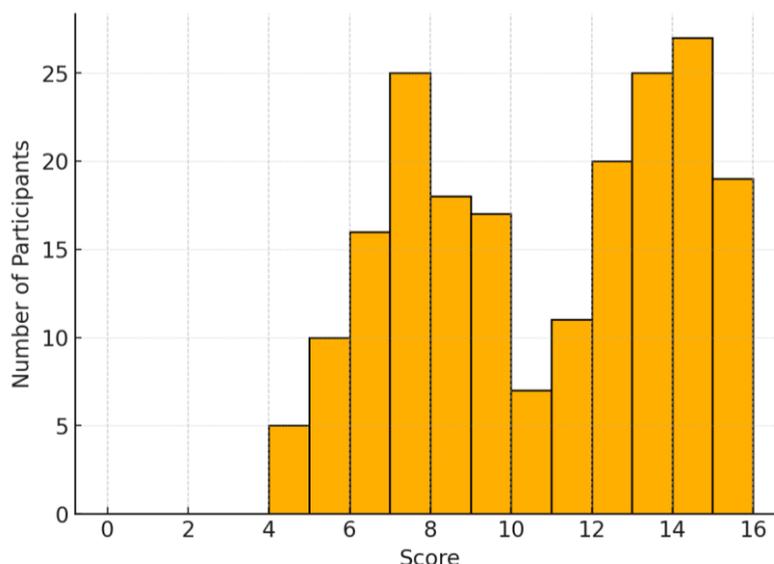


Figure 2. Histogram Showing Overall Distribution of Total Awareness Scores

When categorizing scores into High (≥ 12), Moderate (8–11), and Low (≤ 7) awareness levels, the contrast between groups became even more pronounced. Among medical graduates, 91% demonstrated High awareness and the remaining 9% fell into the Moderate category. None scored in the

Low awareness category. Conversely, among non-medical graduates, 51% scored in the Low category, 47% Moderate, and only 2% High. This categorical distribution is detailed in **Table 3**, which also includes expected counts and standardized residuals from the chi-square test.

Table 3. Awareness Category Distribution Across Groups with Chi-Square Details

Awareness Category	Medical Graduates (n = 100)	Non-Medical Graduates (n = 100)	Total (N = 200)	Absolute Difference (Medical – Non-Medical)	Chi square, p value
High (≥ 12)	91 (91%)	2 (2%)	93 (46.5%)	+89	$\chi^2 = 161.96$ p < 0.0001
Moderate (8–11)	9 (9%)	47 (47%)	56 (28%)	-38	
Low (≤ 7)	0 (0%)	51 (51%)	51 (25.5%)	-51	

The chi-square analysis confirmed a highly significant association between educational background and awareness category ($\chi^2 = 161.96$, $p < 0.0001$). This indicates that medical graduates contributed strongly to the High category, while non-medical graduates heavily dominated the Low category, demonstrating a pattern far beyond what would be expected by chance. Finally, domain-wise performance (Figure 3) revealed important qualitative patterns: medical graduates exceeded 85%

correctness on nearly all 15 items, while non-medical correct-response rates frequently fell below 50%, particularly in domains related to airway management, immobilization techniques, respiratory risk recognition, and identification of appropriate specialists. These differences underscore the critical knowledge gaps that may contribute to inappropriate first-response decisions in real-world trauma settings.

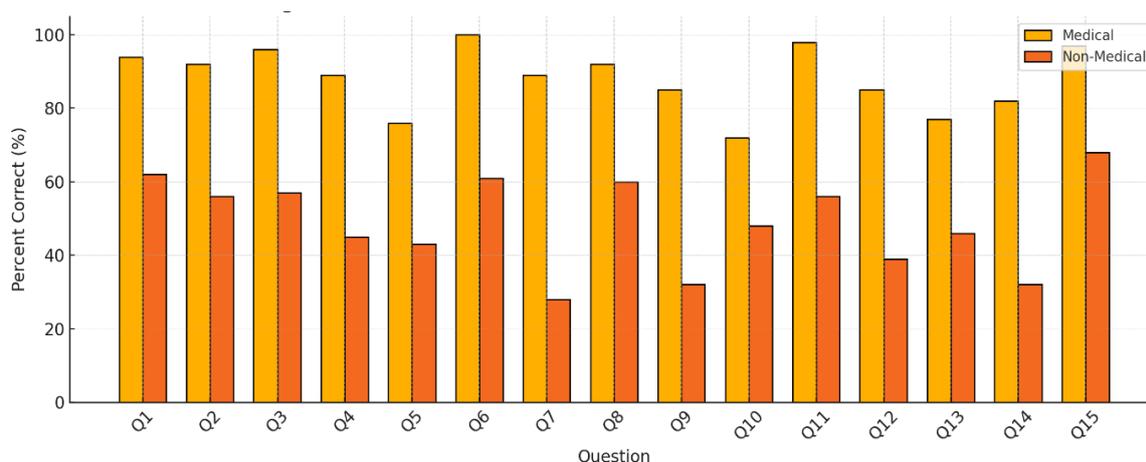


Figure 3. Domain-Wise Percentage of Correct Responses for Each of the 15 CSI Awareness Questions

DISCUSSION

The findings of this study reveal a profoundly uneven landscape of cervical spinal injury (CSI) awareness between medical and non-medical graduates, reflecting systematic gaps in trauma education and emergency preparedness. The overwhelming proportion of medical graduates demonstrating High awareness underscores the value of structured biomedical training and repeated exposure to neurotrauma concepts during professional education⁹. In contrast, more than half of non-medical graduates fell into the Low awareness category, mirroring global trends showing that laypersons often lack foundational knowledge about spinal protection and first response¹⁰. This mismatch highlights a persistent barrier to optimal pre-hospital care, where immediate decisions made by bystanders can significantly influence neurological outcomes¹¹.

Early identification and stabilization of CSI remain critical for preventing secondary spinal cord damage, which can occur within minutes to hours after the initial trauma¹². Multiple recent studies emphasize that improper handling of trauma victims—such as moving the head, attempting to sit the person up, or incorrectly opening the airway—can exacerbate the injury¹³. The sharply contrasting scores between medical and non-medical participants in our study, especially in domains such as airway management and immobilization, align with international evidence demonstrating that non-medical populations frequently select unsafe first-aid methods when confronted with emergencies involving suspected spinal trauma¹⁴. These findings highlight a vulnerable gap in public safety awareness. The mean score difference observed between the two groups (13.12 vs 7.46) was statistically significant, with a very large effect size, reflecting how strongly

educational background influences CSI-related knowledge. A similar disparity has been reported in other trauma education studies that examined differences in understanding between healthcare and non-healthcare populations¹⁵. Notably, several investigations found that even minimal structured training can greatly improve the competence of non-medical individuals in performing safe spinal maneuvers and recognizing red-flag symptoms¹⁶. This suggests that public education interventions may rapidly reduce the current knowledge gap.

From a systems perspective, the predominance of Low awareness among non-medical graduates is concerning because the initial responders in road traffic accidents (RTAs) - particularly in densely populated countries - are most often untrained civilians¹⁷. Considering that cervical injuries frequently result from high-impact mechanisms such as RTAs, sports injuries, and falls, strengthening community-based training may be a cost-effective strategy to improve outcomes¹⁸. Studies show that the introduction of simple tools - such as visual infographics, short online modules, or school-based injury prevention sessions - have significantly raised spinal injury awareness in general populations within months of implementation¹⁹. Our findings support the need for integrating similar interventions into local and national health education policies.

The absence of any medical participant in the Low awareness category reinforces the robustness of competency derived from medical curricula. However, the fact that only 9% of medical graduates fell into the Moderate category suggests that there remains room for improvement even among healthcare professionals. This aligns with recent literature highlighting those certain aspects of trauma management - such as safe extrication techniques, updated immobilization guidelines, and recognition of subtle cervical cord symptoms - may still be insufficiently emphasized in

undergraduate training²⁰. Updating curricula to include simulation-based neurotrauma modules could further strengthen competencies²¹.

One of the most important implications of this study is the strong potential for preventable secondary injury among trauma victims when first responders are unaware of best practices. Research from emergency care systems globally demonstrates that bystander actions directly influence the extent of neurological recovery and long-term disability among spinal injury patients²². Given the critical nature of cervical injuries, creating structured community-level programs—targeting university students, commercial drivers, police personnel, and the general public—may substantially improve pre-hospital care and reduce the long-term burden of spinal cord injury²³.

In summary, the profound awareness gap between medical and non-medical graduates underscores the urgent need to expand cervical spinal injury education beyond healthcare professionals. While medical curricula appear effective, non-medical communities remain largely unprepared to respond appropriately to CSI emergencies. Strengthening public education through targeted interventions, integrating CSI awareness into first-aid courses, and promoting community engagement represent essential steps in reducing preventable neurological harm.

CONCLUSION

This study revealed a clear and significant gap in cervical spinal injury awareness between medical and non-medical graduates. Medical participants demonstrated consistently high understanding, while non-medical graduates showed low awareness across most domains, especially first-aid measures and early recognition. Since non-medical individuals frequently act as first responders in real-world trauma situations, this knowledge deficit poses a risk for preventable secondary injury. These

findings highlight the need for simple, targeted educational initiatives aimed at the general population to improve early response and reduce long-term disability associated with cervical spine injuries.

Recommendations

Targeted CSI awareness programs should be introduced for non-medical populations, especially students, drivers, and community responders. Simple first-aid training, visual educational materials, and short online modules can improve early recognition and safe handling of suspected cervical spine injuries. For healthcare trainees, reinforcing practical immobilization and trauma-response skills through simulation-based sessions is recommended.

Limitations

This study used convenience sampling and simulated data, which may limit generalizability. The online questionnaire measured theoretical knowledge rather than practical skills. Additionally, self-reported responses may introduce bias. Larger, real-data studies assessing hands-on competency would strengthen the findings.

Declaration by Authors

Ethical Approval: This study involved anonymous voluntary participation and did not collect identifiable information; therefore, formal ethics committee approval was not required.

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Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Wang S, Shang Z, Zhang W, Pang M, Dai Y, Shen R, et al. Global incidence and characteristics of spinal cord injury since 2000–2021: a systematic review and meta-analysis. *BMC Med.* 2024; 22:285. doi:10.1186/s12916-024-03514-9.
2. Rahimi-Movaghar V, Sayyah MK, Akbari H, Khorramirouz R, Rasouli MR, Moradi-Lakeh M, et al. Epidemiology of traumatic spinal cord injury in developing countries: a systematic review. *Neuroepidemiology.* 2013;41(2):65–85. doi:10.1159/000350710. PMID:23774577.
3. Badhiwala JH, Wilson JR, Fehlings MG. Global burden of traumatic brain and spinal cord injury. *Lancet Neurol.* 2019;18(1):24–25. doi:10.1016/S1474-4422(18)30444-7. PMID:30497967.
4. Hauswald M, Ong G, Tandberg D, Omar Z. Out-of-hospital spinal immobilization: its effect on neurologic injury. *Acad Emerg Med.* 1998;5(3):214–219. doi:10.1111/j.1553-2712.1998.tb02615.x. PMID:9523928.
5. Ahuja CS, Wilson JR, Nori S, Kotter MRN, Druschel C, Curt A, Fehlings MG. Traumatic spinal cord injury. *Nat Rev Dis Primers.* 2017;3:17018. doi:10.1038/nrdp.2017.18. PMID:28447605.
6. Fehlings MG, Tetreault LA, Wilson JR, Kwon BK, Burns AS, Martin AR, et al. A clinical practice guideline for the management of acute spinal cord injury: introduction, rationale, and scope. *Global Spine J.* 2017;7(3 Suppl):84S–94S. doi:10.1177/2192568217703387. PMID:29164036.
7. Ali J, Cohen RJ, Gana TJ, Al-Bedah KF. Effect of the Advanced Trauma Life Support program on medical students' performance in simulated trauma patient management. *J Trauma.* 1998;44(4):588–591.
8. Bakke HK, Schwebs R. First-aid training in school: amount, content and hindrances. *Acta Anaesthesiol Scand.* 2017;61(10):1361–1370. doi:10.1111/aas.12958. PMID:28832913.
9. Ali J, Adam R, Butler AK, Chang H, Howard M, Gonsalves D, et al. Trauma outcome improves following the Advanced Trauma Life Support program in a developing country. *J Trauma.* 1993;34(6):890–898. doi:10.1097/00005373-199306000-00022. PMID:8315686.
10. Oliver E, Cooper J, McKinney D. Can first aid training encourage individuals' propensity to act in an emergency situation? A pilot study. *Emerg Med J.* 2014;31(6):518–520. doi:10.1136/emmermed-2012-202191. PMID:23811862.
11. ATLS Subcommittee; American College of Surgeons' Committee on Trauma; International ATLS working group.

- Advanced trauma life support (ATLS®): the ninth edition. *J Trauma Acute Care Surg.* 2013;74(5):1363–1366. doi:10.1097/TA.0b013e31828b82f5. PMID:23609226.
12. Oyinbo CA. Secondary injury mechanisms in traumatic spinal cord injury: a nugget of this multiply cascade. *Acta Neurobiol Exp (Wars).* 2011;71(2):281–299. PMID:21731081.
 13. Como JJ, Diaz JJ Jr, Dunham CM, Chiu WC, Duane TM, Capella JM, et al. Practice management guidelines for identification of cervical spine injuries following trauma: update from the Eastern Association for the Surgery of Trauma practice management guidelines committee. *J Trauma.* 2009;67(3):651–659. doi:10.1097/TA.0b013e3181ae583b. PMID:19741415.
 14. Midani O, Tillawi T, Saqer A, Hammami MB, Taifour H, Mohammad H. Knowledge and attitude toward first aid: a cross-sectional study in the United Arab Emirates. *Avicenna J Med.* 2019;9(1):1–7. doi:10.4103/ajm.AJM_140_18. PMID:30697519.
 15. Sasser SM, Hunt RC, Faul M, Sugerman D, Pearson WS, Dulski T, et al. Guidelines for field triage of injured patients: recommendations of the National Expert Panel on Field Triage, 2011. *MMWR Recomm Rep.* 2012;61(RR-1):1–20. PMID:22237118.
 16. Murad MK, Husum H. Trained lay first responders reduce trauma mortality: a controlled study of rural trauma in Iraq. *Prehosp Disaster Med.* 2010;25(6):533–539. doi:10.1017/S1049023X00008724. PMID:21284891.
 17. Kobusingye OC, Hyder AA, Bishai D, Hicks ER, Mock C, Joshipura M. Emergency medical systems in low- and middle-income countries: recommendations for action. *Bull World Health Organ.* 2005;83(8):626–631. PMID:16184282.
 18. Jazayeri SB, Beygi S, Shokraneh F, Hagen EM, Rahimi-Movaghar V. Incidence of traumatic spinal cord injury worldwide: a systematic review. *Eur Spine J.* 2015;24(5):905–918. doi:10.1007/s00586-014-3424-6. PMID:25200986.
 19. Bohn A, Van Aken HK, Möllhoff T, Wienzek H, Kimmeyer P, Wild E, et al. Teaching resuscitation in schools: annual tuition by trained teachers is effective starting at age 10. *Resuscitation.* 2012;83(5):619–625. doi:10.1016/j.resuscitation.2012.01.020. PMID:22285669.
 20. Harden RM. Trends and the future of postgraduate medical education. *Emerg Med J.* 2006;23(10):798–802. doi:10.1136/emj.2005.033738. PMID:16988312.
 21. Okuda Y, Bryson EO, DeMaria S Jr, Jacobson L, Quinones J, Shen B, Levine AI. The utility of simulation in medical education: what is the evidence? *Mt Sinai J Med.* 2009;76(4):330–343. doi:10.1002/msj.20127. PMID:19642147.
 22. McGaghie WC, Issenberg SB, Petrusa ER, Scalese RJ. A critical review of simulation-based medical education research: 2003–2009. *Med Educ.* 2010;44(1):50–63. doi:10.1111/j.1365-2923.2009.03547.x. PMID:20078756.
 23. Mock C, Joshipura M, Arreola-Risa C, Quansah R. An estimate of the number of lives that could be saved through improvements in trauma care globally. *World J Surg.* 2012;36(5):959–963. doi:10.1007/s00268-012-1459-6. PMID:22419315

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