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Public Awareness Levels Regarding Cervical Spine Injury and the Suitable First Aid Response Among Adults in Makkah, Saudi Arabia

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Purpose: Cervical spine injuries (CSIs) are a growing concern, leading to severe and permanent disabilities. Educating the public about these injuries and appropriate emergency responses is crucial to prevent irreversible damage, minimize disability, and save lives, especially with the rising number of trauma victims worldwide. Herein, we assessed the awareness of CSIs, trauma identification, and first-aid procedures among adults in Makkah, Saudi Arabia.

Sample and Methods: This descriptive cross-sectional study included 591 participants aged 18 or older from Makkah, Saudi Arabia, selected using an online questionnaire and conducted between January and March 2024. We evaluated participants' knowledge and awareness levels about CSIs, analyzing variables such as personal data and first aid training using descriptive statistics, cross-tabulation, and Pearson chi-square tests.

Results: In total, 318 (53.8%) participants demonstrated good awareness of CSIs. Most (76.5%) identified road traffic accidents as a significant risk factor for CSIs. Additionally, 476 (80.5%) participants recognized that CSIs can involve spinal cord damage. Motor disability was acknowledged by 434 (73.9%) participants as a complication linked to CSIs, while 296 (50.1%) and 224 (37.9%) participants recognized sensory disability and respiratory problems as potential associated complications, respectively.

Conclusion: Our findings show that 53.8% of participants had an acceptable awareness level of CSIs, with road traffic accidents identified as the primary cause of spinal injuries. It is crucial to prioritize regular and organized public education and enforce strict road safety measures, particularly among the young, to mitigate the extensive physical, social, emotional, and economic consequences of this issue.

Keywords: awareness, cervical spine injury, road traffic accidents, Saudi Arabia

Introduction

The central nervous system (CNS) is crucial for governing the human body and regulating its functions to achieve optimal motor, sensory, and mental performance; it includes two components: the brain and the spinal cord (SC).[1] The spinal cord (SC) plays a vital role in the central nervous system, facilitating the transmission of nerve impulses between the brain and body. The SC is essential for normal bodily functions,[1] protected by the vertebral column (VC).[1–3] The VC contains seven cervical vertebrae, twelve thoracic vertebrae, five lumbar vertebrae, a single sacrum, and the coccyx.[1,4] Injury to the cervical vertebrae is particularly dangerous due to their limited space and flexibility, which makes them more prone to damage; unfortunately, such injuries are often among the most permanent.[4,5]

Spinal cord injury (SCI) often results in severe paralysis,[4,6] leading to a lifetime of medical complications and confinement to a wheelchair.[7,8] Moreover, SCI can cause a range of autonomic dysfunctions, affecting various bodily

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systems, such as cardiovascular, broncho-pulmonary, urinary, gastrointestinal, sexual, and thermoregulatory functions.[7] These dysfunctions contribute to higher mortality rates from cardiovascular and respiratory diseases among individuals with SCI.[7] Although some levels of success have been achieved in treating SCI, a complete and miraculous cure has not yet been achieved.[9] To prevent severe complications and complex treatment plans, providing proper first aid in these situations is essential.

Classification systems for spinal cord injuries (SCIs) are crucial for assessing injury severity, guiding treatment, and predicting outcomes. They have a significant impact on a person's mobility and bodily functions. Various classification systems have been developed to effectively assess and manage these injuries.[10] The ASIA Impairment Scale (AIS) is the gold standard for classifying spinal cord injuries. It was developed to standardize the assessment of neurological function and to guide treatment and rehabilitation. The AIS categorizes injuries into five grades (A to E) based on the presence of motor and sensory function below the level of injury. Grade A indicates a complete injury, while Grade E represents normal function. The Frankel Classification was one of the earlier systems used to assess the severity of spinal cord injuries (SCI) using a five-grade scale.[10] However, it was eventually replaced because it had limitations in distinguishing between certain grades and could not accurately reflect motor improvements over time. Various other classification methods have been proposed, including those by Bracken et al, Lucas and Ducker, and Klose et al. These systems often struggled with practical application and failed to account for sacral function, leading to their decline in use.[10]

Several factors can cause SCI, with road traffic accidents (RTAs) being the leading cause globally, followed by falls.[11] Additionally, non-traumatic injuries like vertebral compression fractures can result from inflammation or malignancy affecting the SC. However, trauma, such as RTA, blunt, or penetrating injuries, is the most common cause of cervical spine injury in particular.[12,13] In 2007, global estimates reported between 133,000 and 226,000 new cases of SCI due to RTAs and violence.[14] RTAs pose significant public health concerns worldwide, leading to both temporary and permanent disabilities, and contributing to morbidity and mortality rates.[15–17] Saudi Arabia is experiencing a notable increase in RTAs, ranking second only to infectious diseases as a major medical issue.[18–20] With motor vehicles being the primary mode of transportation in Saudi Arabia, the country witnesses one fatality and four injuries per hour due to RTAs.[15,17] From 1971 to 1997, a total of 564,762 individuals in Saudi Arabia lost their lives or sustained injuries due to RTAs, representing approximately 3.5% of the country's entire population.[21,22] RTAs contribute 13% of the disability-adjusted life years (DALYs) in the Saudi population.[23,24]

The Kingdom of Saudi Arabia is a global leader in the region in terms of both human and physical losses resulting from RTAs.[25–27] Road traffic injuries account for 81% of hospital deaths in the Ministry of Health, with victims of RTAs occupying 20% of hospital beds. Over the past two decades, Saudi Arabia has documented 86,000 fatalities and 611,000 injuries resulting from RTAs, with 7% of these injuries resulting in permanent impairments.[21,22,26] Regions with the highest incidence of RTAs in Saudi Arabia include Riyadh, Jeddah, Makkah, Madinah, and Qassim.[22,27] A recent study examining 95,372 cases of RTAs documented by the Saudi Red Crescent Authority from 2016 to 2020 found that Makkah city has one of the highest incidences of RTAs, accounting for 24.5% of the total.[28] Enforcing seat belt legislation and stricter laws should lead to an immediate reduction in injuries and fatalities on Saudi Arabia's roads.[27] First aid is also crucial in reducing adverse effects on health and preventing loss of life in RTAs. Therefore, it is imperative to ensure that even the general public is adequately prepared to provide fundamental first aid.[29,30] Any action taken during an emergency by an individual sufficiently trained in first aid can prevent as much harm as possible and save lives.[29] According to a previous study on Saudi Arabia, 55% of the Saudi general population have moderate first aid knowledge.[31] This means that nearly half of the sample does not have sufficient knowledge about basic first aid, including how to provide first aid to a person in the event of a trauma, which may lead to serious complications in the event of a CSI.

There has been growing recognition of the significance of educating society about first aid, driven by the escalating number of trauma victims worldwide. Basic knowledge and practical experience can be crucial in preserving lives and preventing harm. Global governments have directed more attention toward trauma from RTAs, falls, and occupational injuries,[14,15] which can cause cervical spine injuries (CSIs). Although CSIs are not common compared to other types of injuries, they can cause severe and permanent disabilities.[32]

In cases of CSI, the first responder is typically a paramedic or a regular witness. Following an accident, the patient should stay still and move their neck as little as possible to maintain cervical spine stability, which is crucial throughout transportation.[33] A recent study in Saudi Arabia showed that fewer than one in three people were aware of first aid in such cases.[34] Many studies worldwide have shown that inappropriate stabilization of the injured cervical spine can lead to multisystem issues, increasing the likelihood of complications.[29,33,35]

CSIs can affect anyone and are typically caused by RTAs, falls, and occupational injuries. Addressing the lack of consistent findings in the literature regarding awareness levels of CSI and appropriate first aid interventions is crucial. Educating the public about these injuries and how to respond effectively in emergencies can prevent irreversible damage, minimize disability, or even save lives.[33] This study aims to assess the awareness of CSIs, the ability to identify signs of trauma, and understanding of proper first-aid procedures for CSIs among adults from Makkah, Saudi Arabia.

Materials and Methods

Study Design

Selection and Description of Participants

This descriptive cross-sectional study was conducted in Makkah, Saudi Arabia. Participants were randomly selected by distributing an electronic questionnaire to all adults aged 18 years or older who were willing to participate from January 1 to March 31, 2024. Participants were chosen using random convenience sampling, with the research objectives explained to them through the questionnaire. Participation was voluntary.

Questionnaire Tool

The questionnaire was adapted from a study by Al-Otaibi et al[4] and administered as a self-administered online survey using Google Forms in Arabic. It consists of three parts. The first part collected sociodemographic information, such as age, sex, social status, education level, income, and residency, along with a question about trauma response training. The second part assessed participants' awareness of CSIs, including their understanding of risk factors, consequences, etiology, clinical presentation, and initial management like immobilization. The third part gathered data on participants' attitudes toward first aid and immobilization for such injuries.

Sample Size Calculation

Calculator.net was used to determine the minimum number of samples required for this study. The population of adult residents in Makkah is approximately 5 million, as reported by the General Authority for Statistics in Saudi Arabia.[36] With a confidence interval level of 98%, an expected frequency percentage of 50%, and a design effect of 1, the sample size was calculated to be a minimum of 543 participants.

Ethical Approval

This study received approval from the Biomedical Research Ethics Committees of Umm Al-Qura University, with the ethical approval number HAPO-02-K-012-2024-02-2009, and was performed in accordance with the Declaration of Helsinki.

Informed Consent

In order to emphasize that the participants' involvement in the study was totally voluntary, the questionnaire began with a concise description of the study's objectives. The participants' identities were protected and kept anonymous; their names were not collected. Everyone who participated in the study gave their electronic consent.

Statistical Analysis

Data were collected and analyzed using SPSS version 21 (SPSS, IBM). Two-tailed statistical tests were used with an alpha level of 0.05, considering a result as significant if the *P*-value was ≤0.05. The assessment of overall knowledge and awareness levels about CSI involved aggregating scores from various accurate awareness items. Participants were

categorized as having poor awareness if they scored less than 60% of the overall score and as having good awareness if they scored 60% or more.[34] Study variables, including participants' personal data, educational level, work data, and first aid training, were analyzed using descriptive analysis techniques, such as frequency distribution and percentage calculation. Participants' knowledge, awareness, and practice regarding CSIs were tabulated, and their overall knowledge level was graphed. Cross-tabulation was used to display elements related to participants' awareness of CSI. The Pearson chi-square test was employed to determine the significance of these components, with the exact probability test used for small frequency distributions.

Results

A total of 591 eligible participants completed the study questionnaire. Participants' ages ranged from 18 to over 60 years, with a mean age of 28.6 ± 12.8 years. Of the participants, 401 (67.9%) were female. Regarding educational level, 217 (36.7%) were university students, 214 (36.2%) were university graduates, and 70 (11.8%) held a post-graduate degree. Monthly income below 5000 SR was reported by 317 (53.6%) participants, while 185 (31.3%) had a monthly income exceeding 10,000 SR. Urban residents comprised 573 (97%) of the participants; 339 (57.4%) were single and 237 (40.1%) were married. Only 88 (14.9%) participants reported receiving training in CSI first aid (Table 1).

Table 1 Personal Characteristics of Study Participants (n = 591)

Personal Data	No	%
Age in years		
18–30	350	59.2%
31–40	60	10.2%
41–50	58	9.8%
51–60	101	17.1%
> 60	22	3.7%
Sex		
Male	190	32.1%
Female	401	67.9%
Educational level		
University/below	66	11.2%
Diploma	24	4.1%
University student	217	36.7%
University graduate	214	36.2%
Post-graduate	70	11.8%
Monthly income		
<5000 SR	317	53.6%
5000–10000 SR	89	15.1%
>10000 SR	185	31.3%

(*Continued*)

Table 1 (Continued).

Personal Data	No	%
Residence		
Urban	573	97.0%
Rural	18	3.0%
Marital status		
Single	339	57.4%
Married	237	40.1%
Divorced/widow	15	2.5%
Are you trained in CSI first aid?		
Yes	88	14.9%
No	503	85.1%

Abbreviation: CSI, cervical spine injury.

Public Awareness of CSI, Makkah, Saudi Arabia

As shown in Table 2, 452 (76.5%) participants reported RTAs as the most common risk factor for CSIs, 476 (80.5%) were aware that CSIs can be accompanied by damage to SC, 449 (76%) knew that CSIs can result in lifelong disability, and 455 (77%) stated that early detection of injury to the cervical spine helps prevent complications. A total of 343 (58%) participants understood that a person with CSI may need lifelong medical and rehabilitative treatment, 427 (72.3%) said

Table 2 Public Awareness Regarding CSI

Awareness Items		No	%
What is the most common risk factor for CSIs?	Traffic accidents	452	76.5%
	Sports injuries	13	2.2%
	Inflammations	12	2.0%
	Tumors	15	2.5%
	I do not know	99	16.8%
Is it possible for CSIs to be accompanied by damage to the spinal cord?	Yes	476	80.5%
	No	5	0.8%
	I do not know	110	18.6%
Is it possible for CSIs to lead to lifelong disability?	Yes	449	76.0%
	No	18	3.0%
	I do not know	124	21.0%
Will a person with CSI require lifelong medical and rehabilitative treatment?	Yes	343	58.0%
	No	67	11.3%
	I do not know	181	30.6%

(*Continued*)

Table 2 (Continued).

Awareness Items		No	%
Does early detection of CSI help prevent complications?	Yes	455	77.0%
	No	17	2.9%
	I do not know	119	20.1%
Can proper treatment at the accident site prevent permanent spinal cord injuries?	Yes	427	72.3%
	No	31	5.2%
	I do not know	133	22.5%
My correct response might help those affected.	Yes	520	88.0%
	No	9	1.5%
	I do not know	62	10.5%
Can CSIs affect the patient's quality of life for life?	Yes	413	69.9%
	No	31	5.2%
	I do not know	147	24.9%
I will try not to move the injured person and call 997?	Yes	543	91.9%
	No	11	1.9%
	I do not know	37	6.3%
CSIs complications	Sensory deficit	296	50.1%
	Motor deficit	437	73.9%
	Urinary incontinence	174	29.4%
	Stool incontinence	163	27.6%
	Respiratory problems	224	37.9%
	Smell and taste problems	81	13.7%
	I do not know	143	24.2%

Abbreviation: CSI, cervical spine injury.

that proper treatment at the accident site prevents permanent SCIs, and 520 (88%) mentioned that a quick and accurate response might help those affected. Furthermore, 413 (69.9%) stated that CSIs affect the patient's quality of life, and 543 (91.9%) reported that they will try not to move the injured person and call 997. Regarding CSI complications, the most reported complications included motor deficit 437 (73.9%), sensory deficit 296 (50.1%), respiratory problems 224 (37.9%), urinary incontinence 174 (29.4%), and stool incontinence 163 (27.6%).

As illustrated in Table 3, 214 (36.2%) participants identified an inability to move the hand as a sign of an SCI in the neck, while 196 (33.2%) recognized numbness. Regarding first aid for CSIs, 211 (35.7%) mentioned reducing the movement of the injured person while transporting them from the scene of the accident, and 314 (53.1%) indicated that they would call 997. When asked about the safest way to manage a person with an SCI, 434 (73.4%) stated they would keep the injured person in the same position if the place was safe until help arrived, while 107 (18.1%) were unsure. Additionally, 516 (87.3%) selected "deal with an injured person who needs resuscitation" when asked how to manage such a situation.

Table 3 Public Awareness Regarding CSI, Continued

Awareness Items		No	%
CSI signs	Inability to move the hand	214	36.2%
	Numbness	196	33.2%
	Pain in arms	141	23.9%
	Neck deformities	106	17.9%
	All of these	350	59.2%
CSI first aid	Reducing the movement of the injured person while transporting him from the scene of the accident	211	35.7%
	Call 997	314	53.1%
	Changing the patient's position	8	1.4%
	I do not know	58	9.8%
What is the safest way to deal with the person with spinal injury?	Keep the injured person in the same position if the place is safe until help arrives	434	73.4%
	Correcting the wrong posture of the body by stretching the arms, neck, and legs	46	7.8%
	Making the patient sit	4	0.7%
	I do not know	107	18.1%
How do you deal with injured person who needs resuscitation?	Carrying the injured person into a transport vehicle without taking precautions to transport him to the hospital	7	1.2%
	Do nothing	12	2.0%
	I do not know	56	9.5%
	Call 997, start resuscitating the patient, and make sure not to move the patient	516	87.3%
Diseases that increase CSI risk	Rheumatoid arthritis	431	72.9%
	Morbid obesity	275	46.5%
	Diabetes mellitus	122	20.6%
	Down syndrome	132	22.3%
If the injured person is conscious and responsive with a suspicion of cervical vertebrae injury, what I will do?	Reassure and tell him not to move	468	79.2%
	Check if he can move his neck	36	6.1%
	Try to change his position	5	0.8%
	I do not know	82	13.9%

Abbreviation: CSI, cervical spine injury.

Regarding conditions that increase the risk of CSI, 431 (72.9%) mentioned rheumatoid arthritis, 275 (46.5%) mentioned morbid obesity, 132 (20.6%) mentioned Down syndrome, and 20% mentioned diabetes mellitus. When encountering a conscious and responsive injured person with a suspected cervical vertebrae injury, 468 (79.2%) reported that they would reassure the patient and advise them not to move. Overall, 318 (53.8%) of the study participants demonstrated a good awareness of CSI and first aid, while 273 (46.2%) had a poor awareness level (Figure 1).

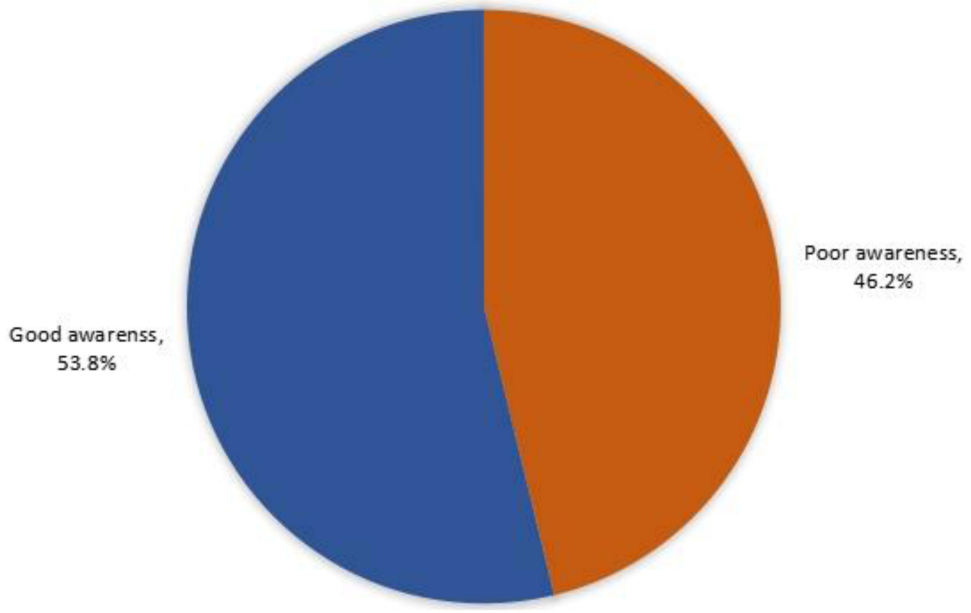

Figure 1 Overall public awareness level about cervical spine injury (CSI).
Abbreviations: SC, The spinal cord; CSI, cervical spine injury; RTAs, road traffic accidents; DALYs, disability-adjusted life years.

Participants' Preparedness and Practice for CSI in Makkah, Saudi Arabia

As illustrated in Table 4, 282 (47.7%) of the study participants indicated that they would provide aid for people injured in traffic or fall accidents. Additionally, 473 (80%) participants stated that they would take preventive measures for SCIs with unconscious patients. Furthermore, 542 (91.7%) reported that they would call 997 for help and then start providing

Table 4 Participants' Preparedness and Practice for CSI

Practice	No	%
Will you aid for people injured in traffic or fall accidents?		
Yes	282	47.7%
No	67	11.3%
May be	242	40.9%
Will I take preventive measures for unconscious patients with spinal injury?		
Yes	473	80.0%
No	118	20.0%
Should I call 997 and ask for help, then start providing first aid to the injured person?		
Yes	542	91.7%
No	49	8.3%
Will I be careful not to move the injured person incorrectly to keep the spine stable and keep it as one unit during transport to prevent the injury from getting worse?		
Yes	572	96.8%
No	19	3.2%

Abbreviation: CSI, cervical spine injury.

first aid to the injured person. Moreover, 572 (96.8%) stated they would be careful not to move the injured person incorrectly to keep the spine stable and maintain it as one unit during transport to prevent the injury from worsening.

Factors Associated with Participants' Awareness About CSI, Makkah, Saudi Arabia

As shown in Table 5, 214 (61.1%) participants aged 18–30 years exhibited an overall good awareness of the injury compared with 10 (45.5%) participants aged over 60 years, with a statistically significant difference (P = 0.001). Furthermore, 151 (69.6%) university students demonstrated a good awareness level compared with 31 (47%) university students with a lower level of education (P = 0.001).

Table 5 Factors Associated with Participants' Awareness About CSI

Factors	Overall Awareness Level				*P* value
	Poor		Good		
	No	%	No	%	
Age (years)					0.001*
18–30	136	38.9%	214	61.1%	
31–40	41	68.3%	19	31.7%	
41–50	28	48.3%	30	51.7%	
51–60	56	55.4%	45	44.6%	
> 60	12	54.5%	10	45.5%	
Sex					0.146
Male	96	50.5%	94	49.5%	
Female	177	44.1%	224	55.9%	
Educational level					0.001*
University/below	35	53.0%	31	47.0%	
Diploma	16	66.7%	8	33.3%	
University student	66	30.4%	151	69.6%	
University graduate	123	57.5%	91	42.5%	
Post-graduate	33	47.1%	37	52.9%	
Monthly income					0.001*
< 5000 SR	127	40.1%	190	59.9%	
5000–10000 SR	57	64.0%	32	36.0%	
> 10000 SR	89	48.1%	96	51.9%	
Residence					0.197^
Urban	262	45.7%	311	54.3%	
Rural	11	61.1%	7	38.9%	

(*Continued*)

Table 5 (Continued).

Factors	Overall Awareness Level				*P* value
	Poor		Good		
	No	%	No	%	
Marital status					0.001*^
Single	130	38.3%	209	61.7%	
Married	134	56.5%	103	43.5%	
Divorced/widow	9	60.0%	6	40.0%	
Are you trained for CSI first aid?					0.002*
Yes	27	30.7%	61	69.3%	
No	246	48.9%	257	51.1%	

Notes: *P*: Pearson X^2 test. ^: Exact probability test. *$P < 0.05$ (significant).
Abbreviation: CSI, cervical spine injury.

A good awareness of the injury was observed among 190 (59.9%) participants with low income compared with 32 (36%) participants with an average income level (P = 0.001). Similarly, 209 (61.7%) of single respondents exhibited an overall good awareness of CSIs compared with 40% of divorced respondents (P = 0.001). A total of 61 (69.3%) participants who were trained for CSI first aid had an overall good awareness level compared with 257 (51.1%) who were not trained (P = 0.002).

Distribution of Participants' Practice and Preparedness by Their Awareness About CSI, Makkah, Saudi Arabia

As shown in Table 6, 187 (58.8%) participants had good awareness and were prepared to provide first aid to people injured in traffic or fall accidents compared with 95 (34.8%) participants with poor awareness (P = 0.001). Additionally, 269 (84.6%) of those with good awareness indicated that they would take preventive measures for unconscious patients

Table 6 Distribution of Participants' Practice and Preparedness by Their Awareness About CSI

Practice	Overall Awareness Level				*P* value
	Poor		Good		
	No	%	No	%	
Will I aid people injured in traffic or fall accidents?					0.001*
Yes	95	34.8%	187	58.8%	
No	38	13.9%	29	9.1%	
May be	140	51.3%	102	32.1%	
Will I take preventive measures for unconscious patients with spinal injury?					0.003*
Yes	204	74.7%	269	84.6%	
No	69	25.3%	49	15.4%	

(*Continued*)

Table 6 (Continued).

Practice	Overall Awareness Level				*P* value
	Poor		Good		
	No	%	No	%	
Should I call 997 and ask for help, then start providing first aid to the injured person?					0.028*
Yes	243	89.0%	299	94.0%	
No	30	11.0%	19	6.0%	
Will I be careful not to move the injured person incorrectly to keep the spine stable and keep it as one unit during transport to prevent the injury from getting worse?					0.004*^
Yes	258	94.5%	314	98.7%	
No	15	5.5%	4	1.3%	

Notes: *P*: Pearson X^2 test. ^Exact probability test. *$P < 0.05$ (significant).
Abbreviation: CSI, cervical spine injury.

with SCIs, whereas 204 (74.7%) of those with poor awareness reported the same (P = 0.003). Regarding calling for help, 94% of participants with good awareness about CSI stated that they would call 997 and start providing first aid, while 243 (89%) of those with poor awareness reported the same intention (P = 0.028). Furthermore, 314 (98.7%) of those with good awareness expressed that they would be careful not to move the injured person incorrectly to keep the spine stable during transport, compared with 258 (94.5%) of those with poor awareness (P = 0.004).

Discussion

This study assessed public awareness and understanding of CSIs and proper first-aid procedures. SCIs remain a significant contributor to health deterioration, leading to untimely mortality and prolonged debilitation.[37] Failure to acknowledge and address these injuries can lead to life-altering and permanent neurologic implications.[38] The quality of immediate care significantly affects the effectiveness of treating a person with a CSI.[39] Effective management of patients with potential CSIs begins with an initial assessment.[40] In cases where inexperienced responders excessively manipulate the spine in the presence of an unstable SCI, a secondary CSI commonly occurs.[40]

In this study, 60% of participants were aged between 18 and 30 years, with a gender distribution of 67.9% female and 32.1% male respondents. The majority, 70%, had attained higher education, while 30% reported a household income below the national average. Furthermore, most respondents resided in urban areas, which may influence their exposure to educational resources regarding cervical spine injuries. Our study results showed that 53.8% of the participants exhibited an acceptable awareness level of CSIs and first aid. Recent studies of public awareness regarding cervical spine injuries (CSIs) vary across different populations. For instance, a study documented a low awareness rate of 31.8% among participants in Abha City, Saudi Arabia, emphasizing the urgent requirement for educational interventions to enhance public knowledge about CSIs.[34]

Our study results showed that 53.8% of the participants exhibited an acceptable awareness level of CSIs and first aid. Furthermore, most participants knew the safest way to manage these injuries and could identify signs of cervical injuries. Almost all participants showed awareness regarding the administration of first aid to an injured person requiring resuscitation, which is consistent with the findings of a 2024 cross-sectional study that found that 70.2% of medical students at Umm al-Qura University in Makkah City demonstrated commendable awareness levels.[41] However, this finding contrasts with a 2021 study reporting a low level of public awareness (31.8%) regarding CSI in Abha City, Saudi Arabia.[34] The inconsistency could be related to the public's understanding and level of education, which may not consider the magnitude of the condition and its related complications.

Our study findings highlighted RTAs as the predominant risk factor for CSIs, alongside other factors contributing to long-term medical treatment, rehabilitation, or lifelong disability. Specifically, 76.5% of participants identified road accidents as the primary risk factor for CSIs. Furthermore, a majority of participants (80.5%) were aware of the potential for CSIs to result in SC damage, with 76% acknowledging the risk of long-term impairment. In Saudi Arabia, RTAs are the leading cause of cervical fractures and the most prevalent type of spinal fracture.[42] These fractures are a key driver of functional disability.[27] Additionally, 88% of participants recognized the importance of providing the correct response to assist an injured individual, whereas 91.9% stated that they would refrain from moving an injured person and instead call for emergency assistance, which aligns with the Mohammed Hasan Bangash study, where 96.4% of participants concluded that the primary approach should be to immobilize the individual experiencing a spinal cord injury.[43]

Regarding preparedness, 47.7% of participants expressed readiness to assist with CSIs resulting from traffic or fall incidents. Moreover, the majority (80%) indicated that they would employ preventive measures when caring for unconscious patients with SCIs. Additionally, 91.7% expressed willingness to promptly call for assistance by contacting 997 and then providing necessary first aid. These findings are consistent with Tawakul et al's study.[41] The vast majority (96.8%) indicated that they would handle an injured person with the utmost care, keeping the spine stable and intact during transport to prevent further injury, aligning with the results of previous studies.[34,41]

The study also highlighted correlations between participants' characteristics and their knowledge levels concerning CSIs. Specifically, 61.1% of respondents aged 18–30 showed a strong understanding of these injuries, a finding that differs from Al-Otaibi's earlier research. Additionally, university students demonstrated higher overall awareness (69.6%) compared to individuals with lower education levels (47%).[34] Contrary to the expectation that higher income would equate to better awareness, the study found no direct link between income and CSI awareness: participants with low income displayed a higher awareness level (59.9%) than those with average income (36%). Trained participants showed substantial knowledge of CSI first aid, with 69.3% exhibiting strong understanding, aligning with Richelle Williams' research on athletic trainers' knowledge of spine injury care. Participants who had completed continuing education courses also demonstrated greater knowledge than those who had not.[44]

We investigated the impact of awareness on participants' practices and preparedness and found that 58.8% of participants with a strong understanding of first aid were prepared to administer it to individuals involved in traffic or fall accidents, compared with only 34.8% of those with inadequate knowledge. Interestingly, 84.6% of individuals with good awareness and 74.7% of those with poor awareness still indicated that they would implement preventive measures for unconscious patients with SCIs. Moreover, regardless of their awareness level, 94% of participants with strong awareness and 89% with weak awareness expressed their intent to call 997 for help and administer first aid to the injured. A significant proportion of individuals, specifically 98.7% of those with adequate awareness and 94.5% of those with inadequate awareness, expressed that they would exercise caution while transporting an injured person by maintaining spinal stability and unity, thus preventing any further deterioration of the injury.

Strengths and Limitations

Our study used multiple data collectors to improve the reliability of findings and minimize potential biases and errors that could arise from a single individual's perspective or data collection methodology. Additionally, focusing on a specific category streamlined the search process and improved the accuracy of the responses provided. The final sample exceeded the assigned number to minimize the risk of a sample size shortage in case of any possible loss. The questionnaire included multiple items to comprehensively assess CSI awareness among the adult population of Makkah, Saudi Arabia. Furthermore, several factors, such as age, sex, educational level, and monthly income status, were measured to determine their association with participant awareness. These findings can guide future educational plans to target populations with poor awareness of these factors.

The study's small sample size may not accurately reflect the community's overall knowledge level. The use of an online questionnaire can introduce selection bias due to self-selection, as individuals with greater awareness or interest in the topic are more likely to participate, potentially skewing the results. Additionally, access to technology may limit participation from certain demographics, such as those with lower socioeconomic status or older populations, further affecting the representativeness of the sample. These factors highlight the importance of considering alternative data

collection methods in future research to ensure more accurate and comprehensive assessments of awareness levels. In addition, the lack of similar international studies makes it challenging to compare and contextualize outcomes on a global scale. There is substantial potential for future research on this topic. Expanding the sample size to include a broader demographic could provide more accurate insights into awareness levels on both national and international scales. These findings could serve as a foundation for developing programs to improve overall awareness effectively.

Conclusion

In conclusion, this study revealed that 53.8% of adults in Makkah possess a good awareness of CSIs. However, there is a clear need for effective educational programs aimed at increasing awareness and teaching appropriate first-aid responses, especially among those with lower awareness levels. Road traffic accidents (RTAs) were identified as the primary cause of spinal cord injuries, highlighting the necessity for regular, structured public education and strict enforcement of road safety measures, particularly targeting young people. Adopting a public health perspective on RTA prevention could significantly mitigate the physical, social, emotional, and economic repercussions of this pervasive issue. The study also suggests that enhancing public awareness can lead to earlier recognition of CSIs, more effective initial care, and improved adherence to safety protocols, all of which contribute to better patient outcomes.

Future Research Directions

Future studies should be conducted on an international scale to gain a broader understanding of global awareness regarding this issue. Additionally, longitudinal studies are recommended to evaluate the effectiveness of educational programs over time. Providing funding and resources for research and innovation aimed at developing and implementing effective strategies to reduce the incidence and mortality rates associated with RTAs would also be beneficial.

While raising awareness is crucial, it is equally important to translate that awareness into actionable steps. This study considered the necessity of providing actionable knowledge, particularly regarding first-aid responses and adherence to safety protocols. The results underscored the importance of not only increasing awareness but also equipping individuals with the practical skills needed to respond effectively to CSI situations. Future research will focus on evaluating the impact of awareness programs on actual behaviors, such as proper first-aid application and compliance with road safety measures. This approach will help assess how effectively awareness translates into real-world actions, ultimately improving the effectiveness of educational initiatives.

Given that our institution does not have its own hospital, its role in CSI management is focused on research and educational contributions rather than direct clinical care. Without a dedicated hospital, the university advances CSI knowledge through rigorous research and by partnering with external hospitals and healthcare providers. Through its research center, the university develops and shares best practices for CSI management across various stages—from community response to hospital care—without directly administering treatment.

In the community setting, the university prioritizes public awareness initiatives and first-aid training programs to equip individuals with basic response skills. For the ambulance and retrieval phases, it provides training resources and conducts studies that help shape best practices for first responders. In hospital care, the university collaborates closely with healthcare facilities to evaluate treatment protocols, develop rehabilitation guidelines, and promote a multidisciplinary approach to CSI management. Although it does not provide clinical services, the university's research and educational efforts play a significant role in improving CSI management and patient outcomes through education, training, and collaborations that benefit external medical institutions.

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Disclosure

The authors report no conflicts of interest in this work.

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