Journal of Pioneering Medical Sciences
Received: July 27, 2025 | Accepted: August 05, 2025 | Published: September 05, 2025
Volume 14, Issue S02, Pages 19-29

DOI https://doi.org/10.47310/jpms202514S0204



Knowledge and Attitude towards First Aid Measures among Female Drivers in Saudi Arabia: A Cross-Sectional Study

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Abstract: **Background:** With road crashes contributing significantly to national fatalities, enhancing first aid preparedness is crucial. This study focuses on female drivers in Saudi Arabia, a newly emerging group following the 2018 lifting of the driving ban for women. The influx of new drivers underscores the need for essential first aid skills. By assessing knowledge, awareness, and attitudes toward first aid, this study identifies educational gaps and proposes targeted interventions. Female drivers were chosen due to their pivotal role as new participants in the driving landscape and their potential to enhance community safety through improved first aid awareness. **Methods:** A cross-sectional survey was conducted among 831 female drivers across Saudi Arabia, using self-administered questionnaires distributed via social media. All participants provided informed consent prior to participation. The survey assessed participants' knowledge of first aid measures, attitudes toward first-aid training, and personal experiences with emergencies. Data analysis was performed using SPSS version 27, applying descriptive and inferential statistics to summarise variables and explore associations between demographic factors and first aid knowledge. **Results:** The study identified substantial gaps in first aid knowledge and training among 831 female drivers in Saudi Arabia, despite 798 (96%) participants recognizing its importance. Only 233 (28%) had formal first aid training, and 345 (42%) knew correct CPR procedures. Key deficiencies included knowledge of bleeding control (308, 37%) and safe removal of injured individuals from vehicles (214, 26%). Confidence in providing first aid was low, with 235 (28%) participants reporting no confidence and only 44 (5%) feeling very confident. Sociodemographic factors, such as age, education, and driving experience, significantly influenced awareness and knowledge scores. **Conclusion:** There is an urgent need for targeted educational interventions to address key gaps in first aid knowledge among female drivers in Saudi Arabia. Integrating first aid training into the driver's licensing process and promoting regular public health campaigns can enhance emergency preparedness and road safety. These findings emphasize the importance of policy-driven approaches to ensure that all drivers, especially female drivers, are equipped with essential first aid skills, ultimately contributing to more comprehensive driver education and improved emergency response outcomes.

Key Words: First Aid measures, Female Drivers, Awareness, Attitudes, knowledge, Saudi Arabia

INTRODUCTION

In today's fast-paced world, emergencies such as road crashes can occur unexpectedly, requiring immediate first aid to minimize injuries until professional help arrives. First aid skills, such as CPR, choking management, and heat stroke treatment, are essential for healthcare professionals and the general population. Car drivers, in particular, are more likely to encounter such emergencies due to the increasing number of road crashes worldwide [1]. Globally, the Eastern Mediterranean Region accounts for 11% of road crash fatalities, with 125,781 deaths annually [2]. Despite implementing preventive measures, Saudi Arabia ranks

among the countries with the highest rates of mortality and morbidity from road crashes. Fatalities account for 4.7% of all deaths in the Kingdom, with the rate rising from 17.4 to 24 deaths per 100,000 individuals over the past decade [3,4]. In 2019, the Saudi Ministry of the Interior reported 437,602 road crashes, with over 37% occurring in Riyadh, the capital city [5].

In the event of an accident, bystanders providing first aid can play a critical role in saving lives and minimizing harm until professional assistance arrives [6]. However, knowledge of first aid and preparedness among drivers in Saudi Arabia remains a significant concern. This issue is particularly relevant for female drivers, who represent a new and growing cohort since the 2018 policy change allowing women to drive. While this milestone has greatly increased the number of female drivers, studies indicate that many may lack sufficient awareness of first aid measures, posing challenges to their safety and preparedness [7]. Research by Al-Garawi *et al.* further highlights that new female drivers, particularly those who recently obtained licenses, are more likely to be involved in accidents, underscoring the need for targeted interventions [8].

This study aims to assess the first aid knowledge and attitudes of female drivers in Saudi Arabia, particularly in the post-2018 context. By identifying gaps in preparedness, the findings will guide the development of targeted educational programs to improve first aid awareness and skills, ultimately reducing the impact of road crashes and enhancing road safety.

Objectives

- To assess the level of awareness of first aid measures among drivers in Saudi Arabia
- To assess the extent of knowledge of first aid measures among drivers in Saudi Arabia
- To assess the attitudes of drivers towards first aid training and its importance
- To identify factors associated with first aid awareness, knowledge, and attitudes among drivers in Saudi Arabia
- To explore policy implications and recommend strategies for integrating first aid training into driver education programs

Literature Review

First aid knowledge and its application play a crucial role in emergency situations, particularly in high-risk environments such as road crashes (RTAs). Drivers, who are often the first responders at accident scenes, require adequate first aid awareness and skills to provide immediate care before professional medical help arrives. However, multiple studies across different regions have highlighted gaps in first aid knowledge, training, and willingness to provide assistance. This literature review synthesizes findings from various studies to understand the extent of first aid awareness, training levels, and factors influencing drivers' knowledge and attitudes toward first aid.

A cross-sectional study involving 343 participants from Sharjah, a city in the United Arab Emirates, revealed intriguing insights into public awareness of first aid. While a significant majority of respondents recognized the term "first aid," the study identified notable gaps in their practical knowledge and application of first aid techniques. This suggests that, despite familiarity with the concept, further education and training are essential to enhance the community's ability to respond effectively in emergencies. Most participants were under 40 years old, and over half were male. Although 94.2% knew the term, only 49.7% knew the ambulance number and 52.43% thought moving a victim without aid was appropriate. Regarding attitudes, 34.86% were unwilling to provide first aid for road crashes (RTA). The primary reasons for unwillingness were a lack of knowledge and fear of legal consequences. However, most participants (83.78%) expressed interest in first aid training to improve their knowledge and attitudes. In short, while basic awareness existed, further education was deemed necessary to address shortfalls in knowledge and increase willingness to assist, especially in high-risk situations like RTAs [9].

An additional descriptive study was conducted among commercial drivers operating in and around the Haldwani Block of Uttarakhand, India involving a sample of 267 participants. While the majority of study participants were familiar with basic first aid terms like "first aid" and its life-saving benefits, formal training levels were very low with just 1.2% having received it. The emergency number was known by 98.4% of drivers. Correct knowledge of first aid principles like who, when and where was 66.3% and 90.1% respectively. Most (81.7%) knew of the Good Samaritan law's protections. Breathing maintenance and chest compressions were prioritized by 38.9% and 22.2%. However, only a sixth knew airway obstruction signs and a third the recovery position. Around half (57.9%) knew how to stop severe bleeding but three-fourths (73.4%) that splints are used in fractures. In summary, recognition of first aid's importance was high but practical skills to apply it remained lacking among the majority without training. The majority (96%) of study participants believed first aid should be immediately provided to road crashes (RTA) victims on-scene. However, 1.6% declined to provide aid, and 5.3% were uncertain. Fear of police persecution was the primary reason for unwillingness cited by 94.7%, while 5.3% cited lack of knowledge. Most (92.1%) thought laypeople should receive first aid training. Willingness to be trained was high at 90.5%. In summary,the recognition that prompt aid at RTAs is crucial was strong. But without training, fears of legal repercussions deterred some from assisting due to uncertainties around what constitutes appropriate care. The training was overwhelmingly viewed as a solution to boost confidence and willingness to help in emergencies [10].

A descriptive cross-sectional study was carried out in 2021 among taxi drivers and conductors at the New Taxi Park in Kampala City, Uganda. A total of 345 participants were recruited, with the majority being male (n = 338, 98%)

and aged between 18 and 45 years (76.5%). Although 97.7% (n = 337) had heard about first aid, only 19.4% (n = 67) had prior first aid training. The overall mean knowledge score was 40.1% (SD = 14.5%), with 29.9% (n = 103) having good knowledge (≥50%). Participants who had witnessed more than five accidents) an OR % 95, 2.9 = CI = 1.7–4.8, p (0.001>and those with first aid kits) aOR % 95, 1.7 = CI = 1.0–3.0, p = 0.38) were more likely to have good knowledge. In contrast, those with an education level below post-secondary, such as primary (AOR = 0.2, 95% CI = 0.1–0.5, p≤0.001) and secondary) an OR % 95, 0.2 = CI = 0.1– 0.6, p = 0.001), were less likely to have good knowledge. Approximately 97% of participants perceived first aid as important, and 93% were willing to undergo training; however, only 69% were willing to provide first aid. Only 181 (52.5%) had ever attended to accident victims [11].

The research design selected for the study was a quasi-experimental approach. The setting was a chosen school/college within a selected city. The sample included drivers, who were selected using simple probability random sampling. A structured knowledge questionnaire was utilized to collect data from the sampled participants. The results showed that in the pre-test, out of 30 drivers, the majority (26, or 86.66%) had poor knowledge, 4 (13.33%) had average knowledge, and 0 (0%) had good knowledge regarding first aid. In the post-test, the analysis of the drivers' knowledge scores revealed a shift, with the majority (23, or 76.66%) having average knowledge, 7 (23.33%) having good knowledge, and 0 (0%) having poor knowledge regarding first aid [11].

A cross-sectional study with stratified cluster recruitment examined first aid knowledge and actions of 785 taxi drivers in Addis Ababa, Ethiopia representing 4.7% of the city's 16,600 drivers. About half of respondents had good first aid knowledge, but only 44.3% reported helping an injured victim in the past year. Drivers with first aid training were 5 times more likely to assist than untrained drivers, with an adjusted odds ratio (AOR) of 5.02. Drivers demonstrating adequate first aid knowledge also had an AOR of 5.50, meaning they were 5 times more likely to provide help. Taxi drivers carrying a first aid kit in their vehicle had an AOR of 5.20, so they were 5 times more likely to offer first aid as well. In summary, the study found that drivers with training, sufficient knowledge, or a first aid kit were much more likely to help injured people than those without these resources [12].

The reviewed studies collectively highlight critical gaps in first aid knowledge and application, despite widespread awareness of its importance across diverse populations. Despite widespread recognition of the importance of first aid, many individuals lack the practical knowledge and training necessary to respond appropriately in critical scenarios. A recurring theme across various regions is that while people are generally familiar with first aid concepts, such as emergency numbers and basic life-saving techniques, they often lack detailed knowledge about specific interventions like airway management, recovery positions, and handling severe bleeding. This gap is particularly evident in high-risk environments, such as road crashes, where immediate and effective first aid can be life-saving.

Studies on this topic are limited and vary widely based on their demographics and methodology. Furthermore, studies comparing self-perceived versus actual knowledge are also required. This highlights the need for robust studies with a focus on different demographics and regions.

METHODS

Study Design

A cross-sectional study design was employed to assess first aid knowledge, awareness, and attitudes among female Saudi Arabian drivers. The inclusion criteria were adult female Saudi drivers aged 18 years or older with valid driving licenses. Participants unable to complete the surveys due to cognitive impairments or language barriers were excluded.

Data Collection

Data were collected using a self-administered questionnaire distributed via social media platforms from September to October 2024. Informed consent was obtained from all participants before completing the questionnaire. Participants responded to the best of their knowledge and ability.

Questionnaire Design

The questionnaire was developed based on existing literature and expert input, focusing on three main domains: awareness, attitudes, and knowledge of first aid. A pilot study with 100 participants was conducted to test the reliability and validity of the questionnaire. The analysis indicated a Cronbach's alpha value greater than 0.7, demonstrating adequate internal consistency. Feedback from the pilot study informed modifications to improve clarity and question relevance.

Sample Size Calculation

The sample size was calculated to be 384 participants, assuming a 50% proportion of female drivers with adequate first aid knowledge, a 5% margin of error, and a 95% confidence level. To account for potential non-responses and missing data, the sample size was increased by 10%, resulting in a total of 419 participants. This ensured representation across demographic groups and adequate statistical power.

A priori power analysis for t-tests (two groups, two-tailed) indicated that a sample size of 220 (110 per group) would achieve 95% power to detect an effect size (d) of 0.5, with $\alpha = 0.05$. This ensured a sufficient sample size of at least 110 across key demographic categories for subgroup analyses. For categories where the sample size was less than 110, similar categories were combined to ensure adequate sample sizes for analysis. For example, divorced and widowed participants were combined into a "separated"

category, and participants with secondary education or lower were grouped into a "secondary or less education" category.

Pilot Study

A pilot study was conducted with 100 female drivers in Saudi Arabia to assess the clarity, reliability, and content validity of the questionnaire. These participants were not included in the main study to avoid bias. Feedback from the pilot study led to refinements in wording, response scales, and layout, enhancing comprehension and accuracy i.e content validity. The results demonstrated strong internal consistency (Cronbach's alpha = 0.74), supporting the tool's validity and reliability for use in the main study.

Statistical Analysis

Descriptive Statistics: Descriptive statistics were used to summarize the demographic characteristics of the participants, including frequencies and percentages for categorical variables (e.g., gender, age group, marital status, educational level, etc.). Continuous variables such as age were reported using medians and interquartile ranges (IQRs), as the data were not normally distributed.

Scoring For Awareness Attitudes and Knowledge

- **Awareness (1-17 points):** Questions assessed prior training, understanding of first aid procedures, and familiarity with first aid kit contents. Items were scored based on correct responses (Table 1)
- **Attitudes (0-3 points):** Items evaluated the perceived importance of first aid knowledge, mandatory training requirements, and interest in driver-specific training
- **Knowledge (2-12 points):** Questions focused on correct first aid steps for common emergencies, such as controlling bleeding, aiding accident victims, and knowledge of emergency numbers

Inferential Statistics

For inferential statistics, Kruskal-Wallis tests were performed to compare the knowledge and awareness scores across different demographic groups (e.g., age, residence area, marital status, educational level, and years of driving experience). The Kruskal-Wallis test was chosen because it is a non-parametric method appropriate for comparing more than two independent groups when the dependent variable is ordinal or continuous but not normally distributed.

Table 1: First Aid Awareness, Attitudes, and Knowledge Scoring Criteria

Questions	Correct Answer	Scoring
Awareness Scoring Criteria (1-17)		
Have you received any formal training in first aid?	Yes	+1
Do you know the correct procedures for performing cardiopulmonary resuscitation (CPR)?	Yes	+1
Can you identify steps to control bleeding for an injured person?	Yes	+1
Do you know how to safely remove an injured person from a car after an accident?	Yes	+1
Are you familiar with the contents of a first aid kit?	Yes	+1
If yes, please list some items that should be in a first aid kit. (N=355)	Adhesive Gauze	+1
	Scissors	+1
	Plaster	+1
	Cotton	+1
	Bandage	+1
	Medication	+1
	Medical Swabs	+1
How confident are you in your ability to provide first aid in an emergency? (Scale: 1-5, where 1 is not at all confident, and 5 is very confident)	Not at all	+1
	Slightly confident	+2
	Somewhat confident	+3
	Confident	+4
	Very confident	+5
Attitude Scoring Criteria (0-3)		
Do you think having sufficient knowledge of first aid is important for drivers?	Yes	+1
Do you think first aid training should be a mandatory requirement for a driver's license?	Yes	+1
Would you be interested in attending a first aid training course specifically designed for drivers?	Yes	+1
Knowledge Scoring Criteria (2-12)		
What is the ambulance number in Saudi Arabia?	997	+1
What are the correct steps to help a traffic accident victim?	Make sure the person is breathing properly	+1
	Call emergency medical services	+1
	Try to stop the bleeding	+1
	check if the victim is conscious/awake	+1
	The victim must be moved from the scene of the accident	+1
	Transport victims to a hospital	+1
	Try to give fluids to drink	+1
What actions should be taken if someone is bleeding?	Apple direct pressure to the wound	+1
	Call emergency medical services	+1
	Apply heating to the wound such as using a heating pad	+1
	Trying to remove foreign bodies from the wound	+1

A p-value of less than 0.05 was considered statistically significant.

Data analysis was performed using IBM SPSS version 27.0.1. which facilitated the calculation of descriptive and inferential statistics, as well as the generation of relevant tests and p-values.

RESULTS

Demographic Characteristics and Driving Experience of Female Drivers in Saudi Arabia

The study included 831 Saudi female drivers. The largest age group was 20–29 years (34.9%), and participants were geographically distributed, with the highest representation from the Central Region (24.1%). Nearly half (45.7%) were married, and the majority (59.2%) held a bachelor's degree. Driving experience varied: 37.9% had 1–5 years of experience, while 33.0% had less than one year. A sedan was the most commonly driven vehicle (50.1%) (Table 2).

First Aid Awareness and Training

A significant knowledge gap was identified, as 72.0% had not received formal first aid training. Among those trained (28.0%), the primary sources were the Saudi Red Crescent Authority (26.6%) and online platforms (44.6%). Awareness of key first aid procedures was low, with only 41.5% knowing correct CPR procedures, 37.1% understanding bleeding control, and 25.8% knowing how to safely remove an injured person from a car.

Confidence in providing first aid was generally low, with 28.3% reporting no confidence. The internet was the most common source of first aid knowledge (78.9%), yet 83.8% had never received driving-specific first aid training (Table 3, Figure 1–2).

Attitudes Toward First Aid Training

Most participants (96.0%) agreed that first aid knowledge is crucial for drivers, and 80.5% supported making first aid training mandatory for obtaining a license. Interest in attending first aid courses was high (86.8%), with only 4.6% citing time constraints or lack of available courses as barriers (Table 4).

First Aid Knowledge and Experiences

Although 65.9% correctly identified the Saudi ambulance number, only 9.1% had encountered situations requiring first aid while driving, mostly related to traffic accidents. Satisfaction with first aid response was mixed, with 35.5% being very satisfied and 18.4% dissatisfied (Table 4).

Table 2: Demographic Characteristics and Driving Experience of Female Drivers in Saudi Arabia

Parameters		N	Table
Gender	Female	831	100.0%
Age	29 - 20	290	34.9%
	39 - 30	213	25.6%
	49 - 40	168	20.2%
	59 - 50	160	19.3%
Nationality	Saudi	831	100.0%
Residence area	Central Region	200	24.1%
	Eastern Region	175	21.1%
	Northern Region	145	17.4%
	Southern region	153	18.4%
	Western Region	158	19.0%
Marital status	Married	380	45.7%
	Separated (divorced)	127	15.3%
	Single	264	31.8%
	Widow	60	7.2%
Educational level	Bachelor's	492	59.2%
	Diploma	115	13.8%
	Middle	4	0.5%
	Postgraduate studies	66	7.9%
	Primary	47	5.7%
	secondary	83	10.0%
	Uneducated	24	2.9%
How many years have you been driving?	1- 5 years	315	37.9%
	10-15 years	110	13.2%
	5-10 years	132	15.9%
	Less than 1 year	274	33.0%
How often do you drive a vehicle per week (on average)?	1-3 times a week	323	38.9%
	4-5 times a week	138	16.6%
	6-7 times a week	104	12.5%
	More than 7 times a week	266	32.0%
What kind of car do you usually drive?	4x4	208	25.0%
	Sedan	416	50.1%
	Other	202	24.3%
	A truck	5	0.6%

Table 3: Awareness and Sources of First Aid Knowledge Among Female Drivers in Saudi Arabia

Parameters		N	Table %
Awareness			
Have you received any formal training in first aid?	No	598	72.0%
	Yes	233	28.0%
If yes, where did you get this training (N=233)	Saudi Red Crescent Authority	62	26.6%
	Hospitals	27	11.6%
	Educational Institutions	20	8.6%
	Workplace	10	4.3%
	Saudi Heart Association	14	6.0%
	Other	104	44.6%
Do you know the correct procedures for performing cardiopulmonary resuscitation (CPR)?	No	486	58.5%
	Yes	345	41.5%
Can you identify steps to control bleeding for an injured person?	No	523	62.9%
	Yes	308	37.1%
Do you know how to safely remove an injured person from a car after an accident?	No	617	74.2%
	Yes	214	25.8%
Are you familiar with the contents of a first aid kit?	No	476	57.3%
	Yes	355	42.7%
If yes, please list some items that should be in a first aid kit. (N=355)	Adhesive Gauze	293	84.9%
	Scissors	228	66.1%
	Plaster	44	12.8%
	Cotton	204	59.1%
	Bandage	136	39.4%
	Medication	93	27.0%
	Medical Swabs	115	33.3%
How confident are you in your ability to provide first aid in an emergency? (Scale: 1-5, where 1 is not at all confident, and 5 is very confident)	Not at all	235	28.3%
	Slightly confident	225	27.1%
	Somewhat confident	237	28.5%
	Confident	90	10.8%
	Very confident	44	5.3%
Sources of First Aid Information			
Where do you usually get information about first aid kit	Internet	656	78.9%
	Books	86	10.3%
	Training Courses	264	31.8%
	Health Services	190	22.9%
Have you ever received first aid information specific to driving scenarios?	No	696	83.8%
	Yes	135	16.2%
If yes, where did you get this information? (N=135)	Internet/Social Media/YouTube	83	61.5%
	Training courses	42	31.1%
	University	10	7.4%

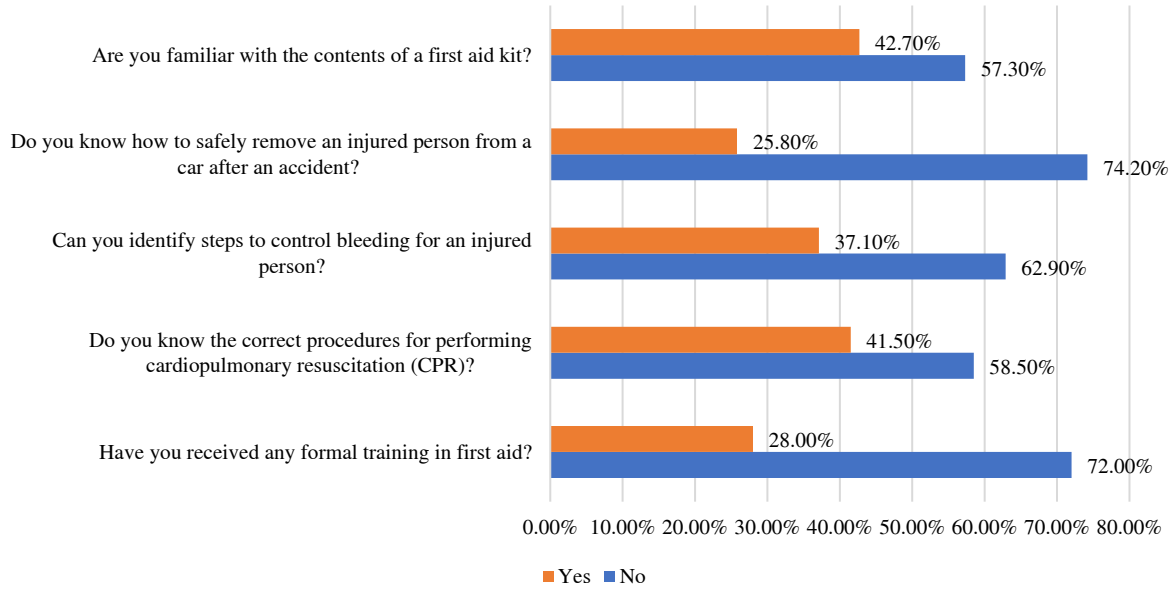


Figure 1: Awareness of First Aid Knowledge and Skills

Table 4: Attitudes, Knowledge, and Experiences with First Aid Among Female Drivers in Saudi Arabia

Parameters		N	%
Attitude			
Do you think having sufficient knowledge of first aid is important for drivers?	No	33	4.0%
	Yes	798	96.0%
Do you think first aid training should be a mandatory requirement for a driver's license?	No	162	19.5%
	Yes	669	80.5%
Would you be interested in attending a first aid training course specifically designed for drivers?	No	110	13.2%
	Yes	721	86.8%
What barriers, if any, are there to obtaining first aid training? (N=721)	No Barriers	603	83.6%
	Payment and time	45	6.2%
	Time and lack of announced courses on a regular basis	33	4.6%
	There is not enough awareness about the subject.	16	2.2%
	The courses are not accredited or by unqualified people - the place where the course is held is not suitable - the time is not appropriate	14	1.9%
	Incompetence in teaching and explaining ACLS, BLS	7	1.0%
	Individuals' lack of interest in its importance	3	0.4%
Knowledge			
What is the ambulance number in Saudi Arabia?	997	548	65.9%
What are the correct steps to help a traffic accident victim?	Make sure the person is breathing properly	619	74.5%
	Call emergency medical services	701	84.4%
	Try to stop the bleeding	479	57.6%
	check if the victim is conscious/awake	619	74.5%
	The victim must be moved from the scene of the accident	232	27.9%
	Transport victims to a hospital	305	36.7%
	Try to give fluids to drink	36	4.3%
What actions should be taken if someone is bleeding?	Apple direct pressure to the wound	630	75.8%
	Call emergency medical services2	702	84.5%
	Apply heating to the wound such as using a heating pad	57	6.9%
	Trying to remove foreign bodies from the wound	154	18.5%
Experience with First Aid Services			
Have you ever been in a situation where first aid services were needed while driving?	No	755	90.9%
	Yes	76	9.1%
If yes, please briefly explain the situation. You can leave the question blank. (N=76)	Child choking on a small object	1	1.3%
	I had an accident and my neck was injured.	4	5.3%
	I was hit on the road and called an ambulance	27	35.5%
	Traffic accidents and injured people we encounter on the roads	44	57.9%
How satisfied were you with the response of the first aid services in that situation? (1 means not at all satisfied, 5 means very satisfied) (N=76)	Very dissatisfied	8	10.5%
	Dissatisfied	14	18.4%
	Neutral	27	35.5%
	Very satisfied	27	35.5%

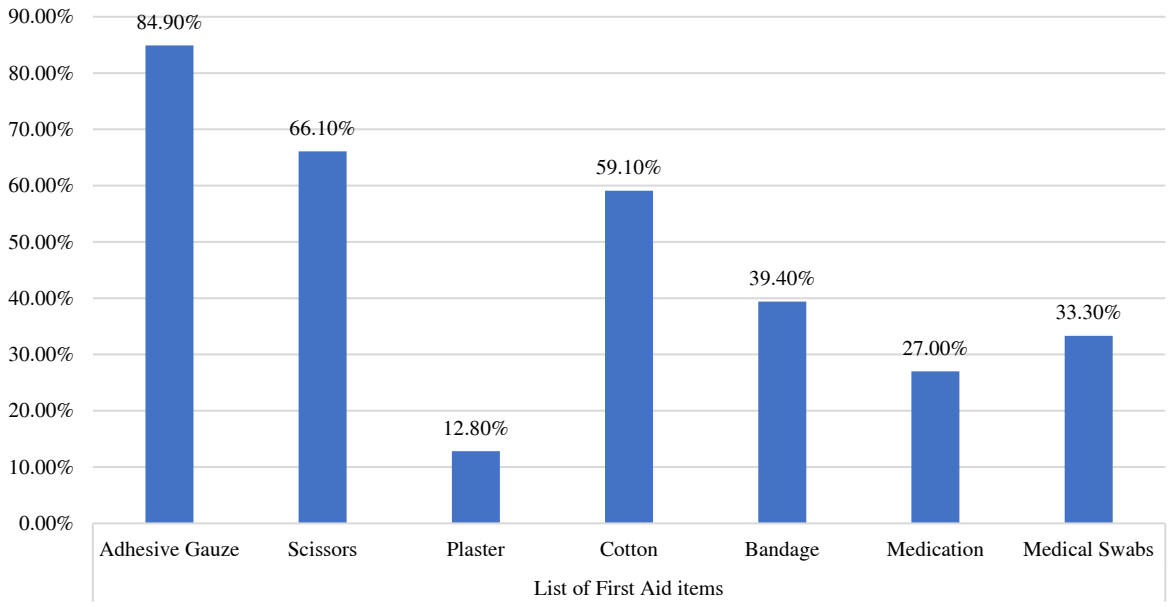


Figure 2: Items of First Aid Kit Contents

Table 5: Association Between Sociodemographic Characteristics and First Aid Awareness Scores

Parameters		Awareness Score (1-17)		
		Median	IQR	p-value[κ]
Age	29 - 20	5.00	2.00-8.00	<0.001*
	39 - 30	3.00	1.00-7.00	
	49 - 40	5.00	2.00-7.00	
	59 - 50	8.00	5.00-10.00	
Residence area	Central Region	4.00	2.00-7.00	0.001*
	Eastern Region	5.00	2.00-7.00	
	Northern Region	6.00	2.00-9.00	
	Southern region	5.00	2.00-8.00	
	Western Region	6.00	3.00-9.00	
Marital status	Married	6.00	2.00-8.00	0.056
	Separated/Widowed	5.00	2.00-9.00	
	Single	4.00	2.00-7.00	
Educational level	Bachelor's	5.00	2.00-8.00	0.033*
	Postgraduate -Diploma	6.00	2.00-8.00	
	Secondary or less level of education	4.00	2.00-7.00	
How many years have you been driving?	1- 5 years	5.00	2.00-8.00	0.015*
	5-10 years	6.50	3.00-10.00	
	10-15 years	4.00	2.00-8.00	
	Less than 1 year	5.00	2.00-8.00	
How often do you drive a vehicle per week (on average)?	1-3 times a week	5.00	2.00-7.00	0.099
	4-5 times a week	6.00	2.00-8.00	
	6-7 times a week	4.00	2.00-8.00	
	More than 7 times a week	5.00	2.00-9.00	
What kind of car do you usually drive?	4x4	7.00	3.00-9.00	<0.001*
	A truck	6.00	6.00-6.00	
	Other	5.00	2.00-8.00	
	Sedan	4.00	2.00-7.00	

[κ]Independent Samples Kruskal-Wallis test, *p<0.05, Significant

Table 6: Association Between Sociodemographic Characteristics and First Aid Attitude Scores

Parameters		Attitude Score (0-3)		
		Median	IQR	p-value[κ]
Age	29 - 20	3.00	2.00-3.00	<0.001*
	39 - 30	3.00	3.00-3.00	
	49 - 40	3.00	2.00-3.00	
	59 - 50	3.00	3.00-3.00	
Residence area	Central Region	3.00	2.00-3.00	0.142
	Eastern Region	3.00	2.00-3.00	
	Northern Region	3.00	3.00-3.00	
	Southern region	3.00	3.00-3.00	
	Western Region	3.00	3.00-3.00	
Marital status	Married	3.00	2.00-3.00	0.911
	Separated/Widowed	3.00	2.00-3.00	
	Single	3.00	2.00-3.00	
Educational level	Bachelor's	3.00	3.00-3.00	<0.001*
	Postgraduate -Diploma	3.00	3.00-3.00	
	Secondary or less level of education	3.00	2.00-3.00	
How many years have you been driving?	1- 5 years	3.00	2.00-3.00	0.007*
	5-10 years	3.00	2.00-3.00	
	10-15 years	3.00	3.00-3.00	
	Less than 1 year	3.00	3.00-3.00	
How often do you drive a vehicle per week (on average)?	1-3 times a week	3.00	2.00-3.00	0.367
	4-5 times a week	3.00	2.00-3.00	
	6-7 times a week	3.00	2.00-3.00	
	More than 7 times a week	3.00	2.00-3.00	
What kind of car do you usually drive?	4x4	3.00	3.00-3.00	<0.001*
	A truck	1.00	1.00-1.00	
	Other	3.00	2.00-3.00	
	Sedan	3.00	2.00-3.00	

[κ]Independent Samples Kruskal-Wallis test, *p<0.05, Significant

Table 7: Association Between Sociodemographic Characteristics and First Aid Knowledge Scores

Parameters		Knowledge Score (2-12)		
		Median	IQR	p-value[κ]
Age	29 - 20	7.00	5.00-8.00	<0.001*
	39 - 30	6.00	4.00-7.00	
	49 - 40	5.50	4.00-7.00	
	59 - 50	6.00	5.00-7.00	
Residence area	Central Region	6.00	4.00-7.00	0.037*
	Eastern Region	6.00	5.00-8.00	
	Northern Region	6.00	5.00-7.00	
	Southern region	6.00	4.00-8.00	
	Western Region	6.00	5.00-8.00	
Marital status	Married	6.00	4.00-7.00	<0.001*
	Separated/Widowed	6.00	5.00-8.00	
	Single	7.00	5.00-8.00	
Educational level	Bachelor's	6.00	5.00-7.00	0.923
	Postgraduate -Diploma	7.00	3.00-8.00	
	Secondary or less level of education	6.00	5.00-8.00	
How many years have you been driving?	1- 5 years	6.00	5.00-8.00	0.008*
	5-10 years	6.00	5.00-7.00	
	10-15 years	7.00	5.00-7.00	
	Less than 1 year	6.00	4.00-8.00	
How often do you drive a vehicle per week (on average)?	1-3 times a week	6.00	5.00-8.00	0.838
	4-5 times a week	6.00	5.00-8.00	
	6-7 times a week	6.00	5.00-7.00	
	More than 7 times a week	6.00	5.00-7.00	
What kind of car do you usually drive?	4x4	6.00	5.00-7.00	0.064
	A truck	4.00	4.00-4.00	
	Other	6.50	3.00-9.00	
	Sedan	6.00	5.00-7.00	

[κ]Independent Samples Kruskal-Wallis test, *p<0.05, Significant

Key Associations with First Aid Awareness, Attitudes, and Knowledge

- **Awareness:** Higher scores were observed among older participants (50–59 years) (p<0.001), residents of the Western Region (p = 0.001), and those with postgraduate diplomas (p = 0.033). Driving experience of 5–10 years (p = 0.015) and vehicle type (4x4) (p<0.001) were also significantly associated with better awareness (Table 5).
- **Attitudes:** Positive attitudes were more common among younger participants (20–29 years) (p<0.001), those with higher education (p<0.001), and individuals with less than one year (p = 0.007) or more than 10 years of driving experience (p<0.001) (Table 6).
- **Knowledge:** Younger drivers (20–29 years) (p<0.001), singles (p<0.001), and those with 10–15 years of driving experience (p = 0.008) had the highest knowledge scores. Unlike awareness and attitudes, educational level was not significantly associated with knowledge scores (p = 0.923, not significant) (Table 7)

These findings highlight critical gaps in first aid knowledge among female drivers, emphasizing the need for structured, accessible training programs (Table 2-7, Figure 1-2).

DISCUSSION

This study investigated the knowledge, attitudes, and awareness of first aid measures among female drivers in Saudi Arabia. The findings revealed significant gaps in first aid knowledge and training, despite widespread recognition of the importance of first aid skills among participants.These findings align with the study's objective of identifying gaps in first aid knowledge, emphasizing the need for improvements in training programs.

This study reveals significant gaps in first aid knowledge and training among female drivers in Saudi Arabia, despite their high educational attainment and recognition of the importance of first aid. A majority (72%) of participants lacked formal training, with notable deficiencies in CPR knowledge (37.1%), bleeding control (25.8%), and safe removal of injured persons (25.8%). Regional and demographic disparities were observed, with younger and Western-region participants scoring higher in awareness.

One notable finding was the participants' reliance on the Internet (78.9%) as a primary source of first-aid knowledge, reflecting the limited accessibility of formal training programs. This underscores the need for structured, widely available, and accessible first-aid training initiatives [13]. Additionally, only 16.2% of participants had received first-aid information specific to driving scenarios, despite the high prevalence of road crashes. These results emphasize the urgent need for driver-specific first-aid training programs tailored to real-life road emergencies, which could be incorporated into driver education curricula.

The study revealed overwhelmingly positive attitudes toward first-aid training. Most participants (96%) believed first-aid knowledge is essential for drivers, and 80.5% supported making first-aid training mandatory for obtaining a driver's license. These findings suggest a high level of motivation and readiness among female drivers to enhance

their first-aid skills, representing an opportunity for policymakers to introduce mandatory first-aid training programs as part of the licensing process.

The study's demographic analysis highlights a predominantly young and well-educated sample of female drivers, with 34.9% aged between 20 and 29 years and 59.2% holding at least a bachelor's degree. However, the limited first aid knowledge observed among participants, despite their educational attainment, underscores a gap in health education integration within academic curricula and public awareness campaigns in Saudi Arabia. The fact that 70.9% of participants had not received formal first aid training reflects a systemic shortfall in accessible training opportunities, particularly for women, who only recently gained the legal right to drive in 2018.

Sociocultural factors may also influence the observed deficiencies in first aid knowledge. Traditional gender roles and societal norms in Saudi Arabia may have historically limited women's exposure to emergency response scenarios and training opportunities [7]. Additionally, the reliance on domestic helpers or male family members for transportation before 2018 could have reduced the perceived need for women to acquire first aid skills. These contextual factors emphasize the importance of targeted interventions to bridge the knowledge gap and promote first aid as an essential skill for all drivers, irrespective of gender.

Similarly, attitude scores were consistently high across all demographics, reflecting the universal recognition of the importance of first-aid skills among female drivers. The association between longer driving experience and higher awareness and knowledge scores highlights the importance of exposure to driving-related scenarios in fostering first-aid preparedness.

The findings align with studies conducted in other Middle Eastern and global contexts, which similarly report a lack of first aid knowledge and confidence among drivers. For instance, Al-Qerem *et al.* [14] found that nearly half of drivers in Jordan lacked basic CPR knowledge. A study from Sharjah similarly found that newly licensed drivers exhibited lower preparedness for road emergencies [15]. These parallels highlight a global deficiency in first aid education, exacerbated by logistical barriers such as time constraints, cost, and lack of accessible training centres—barriers also identified in this study.

Interestingly, the regional variation in awareness and knowledge scores observed in this study, with participants from the Western region scoring highest, suggests disparities in access to health education and training programs across Saudi Arabia. Similar geographic disparities have been reported in other countries, underscoring the need for equitable distribution of resources and initiatives to ensure nationwide coverage.

The findings of this study carry significant implications for public health policy and driver safety initiatives in Saudi Arabia. First, integrating mandatory first aid training into the driver's licensing process could ensure that all drivers possess basic emergency response skills. This approach has been successfully implemented in countries such as Norway, where first aid certification is a prerequisite for obtaining a driver's license [16]. Adopting a similar policy in Saudi Arabia could significantly enhance first-aid preparedness and reduce the morbidity and mortality associated with traffic crashes.

Second, workplace-based first aid training programs could serve as an effective model for Saudi Arabia. Third, public health campaigns leveraging mass media and social media platforms could raise awareness about the importance of first aid and promote available training opportunities.

Given the study's finding that 78.9% of participants relied on the internet for first aid information, digital platforms represent a promising avenue for disseminating educational content and resources. Collaborative efforts between government agencies, healthcare organizations, and community groups could amplify the reach and impact of these campaigns.

Limitations and Future Directions

This study has limitations. Self-reported data may introduce bias. Additionally, the study's sample groups are not balanced, which could affect the interpretation of findings and limit the comparability of results across different participant demographics. The representativeness of the sample is also uncertain, which may impact the generalizability and reproducibility of the results. Future studies could consider stratified sampling techniques to improve representation and ensure more reliable comparisons.

The cross-sectional design prevents causal inferences, and selection bias is possible, particularly since social media recruitment may have overrepresented younger, more educated individuals. Future research should assess the long-term impact of first-aid training on drivers' knowledge and emergency response. Comparative studies on online vs. in-person training could help identify the most effective methods. Additionally, qualitative research on barriers to training uptake and studies evaluating first-aid interventions' effects on injury severity and survival rates would provide valuable insights for policy and practice.

CONCLUSION

This study underscores the urgent need to improve first aid knowledge and training among female drivers in Saudi Arabia. Sociocultural factors, logistical barriers, and systemic gaps in public health education contribute to the observed deficiencies. Significant gaps in first aid knowledge and training among female drivers in Saudi Arabia were identified, with a notable lack of formal training and essential first aid skills. Despite widespread acknowledgement of the importance of first aid, practical knowledge and confidence to act in emergencies were deficient. To bridge these gaps, first aid training should be integrated into the driver licensing process. Awareness campaigns, especially targeting female drivers, along with digital platforms for accessible training, are essential. Collaborations with road safety and health

organizations will ensure long-term sustainability. These steps will significantly improve first aid knowledge and preparedness.

Ethics Approval and Consent to Participate

This study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (IRB) of Ethical committee, Majmaah University, Al Majmaah city, Riyadh Region, Saudi Arabia.

Conflict of Interest

The authors declare that no conflict of interest exists.

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