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AWARENESS AND KNOWLEDGE OF EMERGENCY ROOM UTILIZATION AMONG THE SAUDI ARABIA POPULATION

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Abstract:

Background: Emergency departments (EDs) are being used more frequently both in Saudi Arabia and worldwide in recent years which has been linked to the fact that about 50% of all ED cases are non-urgent patients. This study aimed to assess the awareness and knowledge surrounding emergency room utilization among the Saudi Arabian population, focusing on factors influencing ED use.

Methods: A cross-sectional study was carried out by using an online administered questionnaire at one point of time. The target sampling was Saudi population. Data was collected and analyzed by using Statistical Package for the Social sciences (SPSS).

Results: The study revealed that 89.3% of 702 participants recognized the ER as primarily for critical cases, with 71.2% indicating they would visit the ER when ill. Notably, 46.3% reported ER visits every 3 to 6 months, often citing limited primary care hours (34.0%) and resources (29.1%) as barriers. While 41.6% rated their ER experiences positively, 14.2% reported negative experiences. The leading reason for ER visits was fever without rash (50.1%), followed by chest pain and breathing difficulties. Overall, 57.0% exhibited low knowledge about ER use, whereas 27.2% and 15.8% had high and moderate knowledge levels, respectively. Knowledge levels correlated significantly with sociodemographic factors, including gender, age, nationality, marital status, employment, monthly income, education level, and region of residence.

Conclusion: This study highlights a concerning gap in knowledge about appropriate ED use among the Saudi population, with implications for healthcare delivery and patient education. Enhanced awareness initiatives addressing the distinction between urgent and non-urgent medical needs are essential to optimize ED resources and improve overall healthcare outcomes in the region.

Keywords: Emergency departments, Saudi Arabia, Non urgent patient, ER Utilization.

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Introduction:

Emergency departments (EDs) provide immediate access care for urgent medical conditions, and they are a crucial component of healthcare systems all around the world [1]. It's being used more frequently both in Saudi Arabia and elsewhere, in recent years it has been linked to the fact that majority of cases are non-urgent patients [2]. Although the majority of non-urgent patients are blamed for a rise in demand [3]. The patient flow in the ED is impacted by the gap between the ED capacity and the demand [4]. Obviously, good control of health is a necessary condition for enhancing healthcare [5].

According to estimates, one-third of patients who go to EDs have NU issues that transportable clinics [6]. Prior research found a significant number of NU visits in emergency departments (EDs) worldwide, with a median rate of 32.7% [7]. According to 26 articles about NU ED visits in the USA, 37% of ED visits (with a range of 8%–62%) were NU. Younger age, referral to the ED, greater accessibility compared to other healthcare facilities, and ignorance of other options, such as primary care facilities and referral to the ED were associated factors [8].
A recent study shows that many people in Riyadh Visit the ER lot for non-urgent causes. While some of them go to primary care unit immediately. Most of them visit the ER 1-2 days after the symptoms happened [9]. Furthermore, another survey done in the US that shows the most common visiting for adult patients with cancer, are those who present with breast, prostatic, and lung cancer. This survey also shows the most common patients with cancer who came to ED are older, more likely to be male, and more likely to be insured by Medicare. At least 3% of emergency visits connected to cancer are due to pneumonia, nonspecific chest discomfort, infections of the urinary tract, septicemia, and chronic pulmonary obstructive disorder [10]. Almalki et al. published a study in Saudi Arabia related to emergency department visits from patients who have diabetes. this study shows that the utilization of ED by diabetes patients increased by 21 percent from the year 2011 to 2015 [11].
Due to insignificant number related to our topic, especially Saudi Arabia we did this study to assess the awareness and knowledge of emergency room utilization among the Saudi Arabia population. Our study is focusing on whole Saudi population the other Previous researches have a few numbers of sample size.

Our study aims to assess the level of awareness and knowledge of emergency room utilization among the Saudi Arabia population, including factors such as understanding of the appropriate use of emergency services, knowledge of alternative care options, and awareness of the potential costs and consequences of emergency room visits.

Materials and Methods:

Study design:
This study was a cross-sectional questionnaire survey, based on a structured questionnaire that was developed by authors. The study's population consisted of Saudi adults over the age of 18, participants were recruited in 2023-2024 from people receiving the questionnaire.

Sample size:
The sample size was estimated by using the Qualtrics calculator with a confidence level of 95%; the minimum sample size was minimum 384.

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Method for data collection and instrument (Data collection Technique and tools):
A cross-sectional survey was conducted using a self-administered questionnaire. The questionnaire was developed based on the questionnaire you sent, which contained 21 questions related to emergency room utilization. The questions covered various aspects of emergency room utilization such as the reasons, frequency, satisfaction, and alternatives of visiting the emergency room.
The questionnaire also included demographic questions such as age, nationality, marital status, employment status, monthly income, education level, and chronic diseases. The validity and reliability of the questionnaire were tested in a pilot study with 30 adults who were not part of the main sample. The Cronbach's alpha coefficient for the questionnaire was 0.83, indicating good internal consistency.

Scoring system:
Responses to questions on Knowledge and Attitude Emergency Room Utilization among the Saudi Arabian Population were given scores, in order to compare and correlate the tow components.

Knowledge score:
Prompted responses of the three sections on knowledge were considered for calculating knowledge score. The total score on knowledge was calculated by combining scores of the below-mentioned three sections of knowledge:
Knowledge regarding symptoms cause visiting ER: (Cold symptoms, Urgent symptoms, Emergent symptoms), Knowledge regarding ER definition, Action in case of they get sick how to handle that an emergency situation, action in case of an emergency, when will they go to the emergency, Barriers/reasons prevents patients going to primary health care centres. Maximum possible score for the Knowledge part was thus. 11+1+1+1=14
Knowledge regarding symptoms cause visiting ER:
Cold symptoms: (Runny nose, Fatigue, Cough, Sore throat).
Urgent symptoms: (fever without a rash, vomiting, persistent diarrhea, abdomen pain, wheezing or shortness of breath, sprains and strains, small cuts that may require stitches).
Emergent symptoms: (Chest pain or difficulty breathing, weakness/numbness on one side, slurred speech, fainting/change in mental state. serious burns, head or eye injury, broken bones and dislocated joints, fever with a rash, seizures, severe cuts that may require stitches, vaginal bleeding with pregnancy). Score 1 was given for the answers of emergent symptoms 1 by 1 and score 0 for urgent and cold symptoms. Maximum score possible for the section was 0+0+11=11.
ER definition: The emergency department is a department for medical treatment in hospitals for critical cases that cannot wait, score 1 was given if the answer was true, 0 for false and I don't know. Maximum score possible for the section was (1), minimum was (0). Action in case of they get sick how to handle that an emergency situation: score 1 for going to emergency and primary health care centers, 0 for going to pharmacy and online or telephone consultation. Maximum score possible for the section was (1), minimum was (0). Action in case of an emergency, when will they go to the emergency:
Respondents were asked about Action in case of an emergency, when will they go to the emergency. Scores were given as follows: Suddenly (1), one to two days (0), one to two weeks (0), almost a month (0), more than a month (0). Maximum score possible for the section was (1), minimum was (0).

Analyzes and entry method:
Data was entered on the computer using the "Microsoft Office Excel Software" program (2016) for windows. Data was then transferred to the Statistical Package of Social Science Software (SPSS) program, version 25 to be statistically analyzed.

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Results:

Table (1) displays various demographic parameters of the participants with a total number of (702). The mean age of participants is 32.9 years, with a standard deviation of 12.3 years, suggesting a predominantly younger demographic, with 54.1% under the age of 30. Gender distribution shows a significant female majority at 69.8%, highlighting a potential area for further exploration regarding gender-specific issues or biases within the sampled population. The marital status breakdown indicates that a substantial 55.7% are married, while 37.3% are single, which may influence social dynamics and support systems among participants. Employment figures point to a near-even split, with 51.9% identifying as non-employed, a statistic that raises important questions about job availability and economic conditions in the region. Additionally, the monthly income distribution reveals that nearly half (49.1%) of participants earn 4000 SAR or less, indicating a prevalent economic challenge within the cohort, while a significant portion (36.5%) earns more than 8000 SAR, suggesting a potential divide in socioeconomic status. Educational attainment varies, with 53.4% holding a university degree, illustrating a relatively high level of education among participants, yet also revealing a noteworthy 4.4% who are uneducated. Lastly, the regional data indicates a disproportionate representation from the Eastern region at 47.4%, which may reflect demographic concentrations pertinent to the study's context.

Table (1): Sociodemographic characteristics of participants (n=702).

Parameter		***No.***	***Percent (%)***
Age (Mean: 32.9, STD: 12.3)	18 to 22	161	22.9
	23 to 30	219	31.2
	30 to 40	141	20.1
	more than 40	181	25.8
Gender	Female	490	69.8
	Male	212	30.2
Marital status	Single	262	37.3
	Married	391	55.7
	Divorced	36	5.1
	Widowed	13	1.9
Occupational status	Employed	338	48.1
	Non-employed	364	51.9
Monthly income	4000 SAR or less	345	49.1
	4001 to 8000 SAR	101	14.4
	More than 8000 SAR	256	36.5
Education level	Primary	8	1.1
	Intermediate	21	3.0
	High school	160	22.8
	Diploma	67	9.5
	University	375	53.4
	Master’s degree or higher	40	5.7
	Uneducated	31	4.4
Region of residence	Northern region	71	10.1
	Southern region	179	25.5
	Central region	78	11.1

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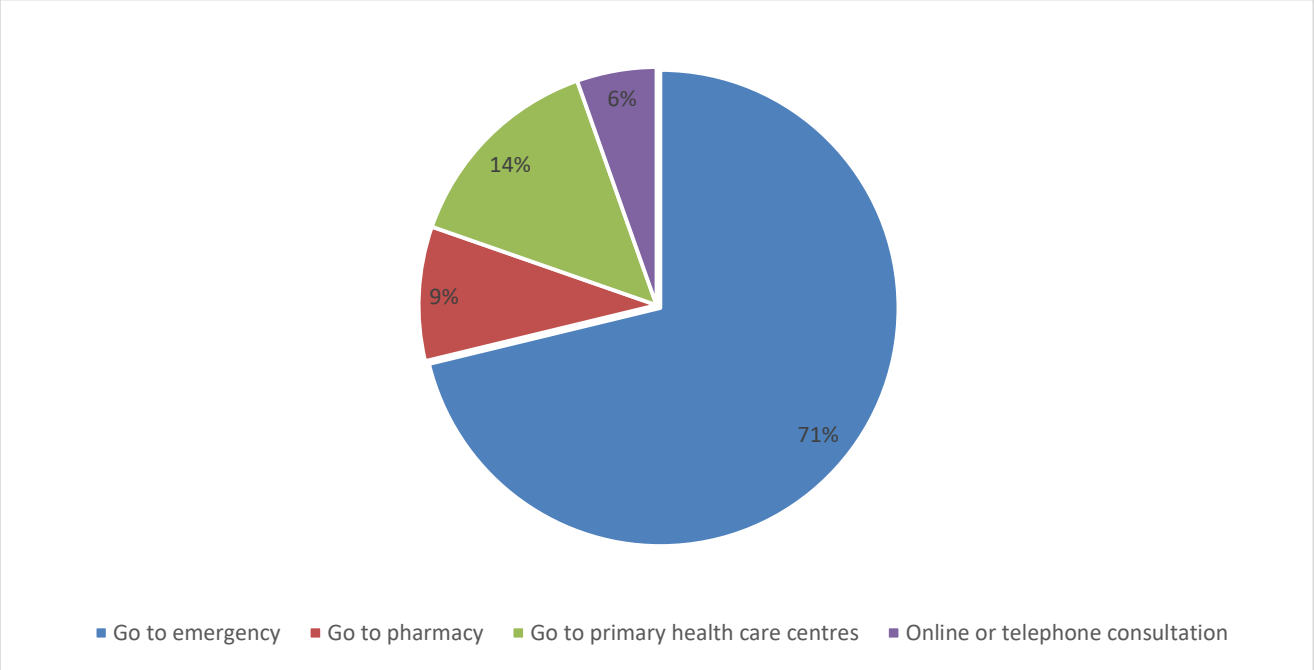
	Eastern region	333	47.4
	Western region	41	5.8

As shown in figure 1, The figure provides critical insights into the awareness and knowledge of emergency room utilization among the population in Saudi Arabia, highlighting the predominant behavioral responses to potential medical emergencies. The data shows that a significant majority, 500 respondents, indicated that their first course of action in the event of illness would be to go directly to an emergency room. This suggests a strong inclination towards seeking immediate and professional medical attention, which is reflective of an understanding of the urgency typically associated with acute health situations. In contrast, the number of individuals opting for alternative healthcare options—such as visiting a pharmacy (64 respondents), pursuing primary health care centers (100 respondents), or opting for online or telephone consultations (38 respondents)—remains relatively low. This disparity in choices may indicate a lack of awareness regarding the roles and effectiveness of these alternatives, or possibly an ingrained perception that emergencies necessitate in-person emergency care.

Figure (1): Illustrate how participants handle an emergency health situation.



As illustrated in table (2), The data presented provides a comprehensive overview of various parameters related to chronic illnesses, medical insurance status, and the symptoms prompting visits to the emergency room (ER) among a sample of 702 individuals. A noteworthy observation is the predominance of non-chronic illnesses, with 80.8% of respondents reporting no chronic conditions, while diabetes and hypertension were identified in 8.1% and 6.0% of the population, respectively. This suggests a relatively low prevalence of serious chronic health conditions within the studied cohort. Regarding medical insurance, a significant majority (60.5%) of the participants indicated lacking insurance, which may have implications for their access to healthcare and the subsequent use of emergency services. The data further outlines the variety of medical insurance providers, highlighting that a substantial portion relies on the Ministry of Health, yet a considerable fraction remains uninsured.

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In terms of symptoms leading to ER visits, the findings reveal that fever without a rash was the most common reason, cited by 50.1% of respondents, closely followed by chest pain or difficulty breathing and wheezing or shortness of breath, reflecting critical health issues that necessitate immediate medical attention. Additionally, the prevalence of serious conditions such as broken bones and dislocated joints, alongside abdominal pain and fainting, underscores the diverse and urgent health needs present within this population. The overlap in reported symptoms indicates a complex interplay of health concerns, suggesting that the reasons for seeking emergency care are often multi-faceted.

Table (2): Parameters related to insurance and symptoms cause visiting ER (n=702).

Parameter		***No.***	***Percent (%)***
Chronic illness *	Non	567	80.8
	Diabetes	57	8.1
	Hypertension	42	6.0
	Asthma	24	3.4
	others	51	7.3
Medical insurance	No	425	60.5
	Yes	277	39.5
Medical insurance provider	No	377	53.7
	Ministry of health	144	20.5
	National guard	31	4.4
	Military department	16	2.3
	Security forces department	7	1.0
	Private sector	127	18.1
Symptoms cause visiting ER *	Abdomen pain	243	34.6
	Chest pain or difficulty breathing	270	38.5
	Broken bones and dislocated joints	277	39.5
	Fainting/change in mental state	252	35.9
	Vaginal bleeding with pregnancy	247	35.2
	Seizures	213	30.3
	Serious burns	267	38.0
	Severe cuts that may require stitches	203	28.9
	Slurred speech	129	18.4
	Head or eye injury	262	37.3
	Fever with a rash	176	25.1
	Sprains and strains	65	9.3
	Wheezing or shortness of breath	280	39.9
	Persistent diarrhoea	210	29.9
	Fever without a rash	352	50.1
	Weakness/numbness on one side	115	16.4
	Skin rash	213	30.3
	Vomiting	176	25.1

****Results may overlap***

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The data presented in figure (2), which illustrates the frequency of emergency room visits among the Saudi Arabian population over the course of a year, offers valuable insights into public health awareness and utilization patterns. With a significant number of respondents indicating that they visit the emergency room once every three to six months (325 individuals), it suggests a potential delineation between necessity and frequency that merits further exploration. The substantial cohort of individuals who reported visiting the emergency room once a month (233 individuals) raises pertinent questions regarding the underlying factors driving such frequent utilization; it may reflect a lack of accessible primary care services or indicate a prevailing tendency to utilize emergency services for non-urgent health issues. Conversely, the smaller groups comprising those who visit two to four times a month (74 and 35 individuals, respectively) could highlight cases of more acute health conditions or chronic illnesses requiring consistent monitoring and intervention.

Figure (2): Illustrates the rate the participants have visited the ER this year.

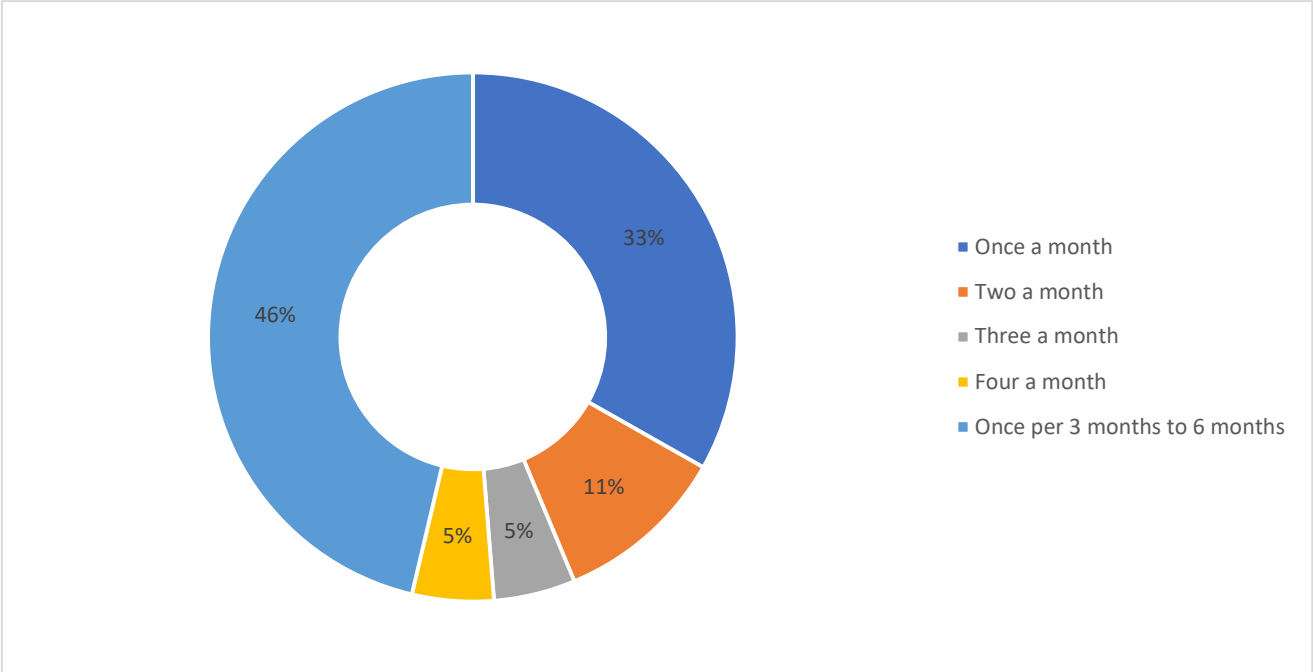

Table (3) reveals insightful perspectives into the perceptions and behaviors of participants regarding emergency room (ER) evaluation, encompassing a sample size of 702 individuals. A noteworthy finding is that a significant majority, 89.3%, accurately recognized the emergency department's primary role as a facility dedicated to medical treatment for critical cases, indicating a strong foundational understanding of what constitutes an emergency situation. When faced with illness, an overwhelming 71.2% of respondents indicated that they would choose to go directly to the emergency department, while a minority opted for alternatives such as pharmacies or primary health care centers. This preference underscores the perceived urgency and seriousness of emergencies among participants. Additionally, the data reveals that a substantial portion of individuals, 74.4%, would seek emergency care immediately when crises arise, suggesting a general instinct to respond swiftly to health emergencies. However, the time it takes to access a physician is noteworthy; while 60.8% reported being seen within 15 to 30 minutes, a non-trivial 27.2% could achieve immediate access, indicating variable experiences of care delivery within the emergency setting. Furthermore, patterns of ER utilization

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throughout the year reveal a diverse range of engagement, with 46.3% of participants visiting the ER once every 3 to 6 months, contrasting with 33.2% who reported monthly visits, which raises questions about underlying health issues that might necessitate such frequency. Barriers to accessing primary health care centers were identified, with limited working hours (34.0%) and limited medical resources (29.1%) cited most frequently, suggesting systemic issues that could hinder appropriate utilization of healthcare services. Finally, the assessment of the ER experience varied among participants, revealing that while 41.6% reported good to excellent experiences, a concerning 14.2% rated their experiences as bad.

Table (3): participants' ER evaluation (n=702).

Parameter		***No.***	***Percent (%)***
Emergency Definition: (The emergency department is a department for medical treatment in hospitals for critical cases that cannot wait.)	True	627	89.3
	False	32	4.6
	I don't know	43	6.1
If you get sick how to handle an emergency situation?	Go to emergency	500	71.2
	Go to pharmacy	64	9.1
	Go to primary health care centres	100	14.2
	Online or telephone consultation	38	5.4
In case of an emergency, when will you go to the emergency?	Suddenly	522	74.4
	One to two days	131	18.7
	One to two weeks	14	2.0
	Almost a month	11	1.6
	More than a month	24	3.4
How long does it take you to get in physician?	Immediately	191	27.2
	15-30 min	427	60.8
	30-45 min	54	7.7
	More than 45 min	30	4.3
How many times have you come to the emergency during the year?	Once a month	233	33.2
	Two a month	74	10.5
	Three a month	35	5.0
	Four a month	35	5.0
	Once per 3 months to 6 months	325	46.3
Barriers/reasons prevents patients going to primary health care centres	Limited medical resources	204	29.1
	Limited working hours	239	34.0
	Unqualified medical services	124	17.7
	No centre available in my neighbours	135	19.2

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ER assessment	Bad	100	14.2
	Accepted	190	27.1
	Good	189	26.9
	Very good	126	17.9
	Excellent	97	13.8

The data presented in Table 4, which illustrates the knowledge and awareness regarding emergency room score results among a sample population, reveals a concerning trend in the distribution of knowledge levels. A predominant portion of the respondents, comprising 57.0%, reported a low level of knowledge, indicating a significant gap in understanding crucial information that could influence patient outcomes in emergency care settings. This stark contrast is further highlighted by the modest figures representing those with high and moderate levels of knowledge, at 27.2% and 15.8%, respectively.

Table (4): Shows knowledge and awareness about emergency room score results.

	Frequency	**Percent**
High level of knowledge	191	27.2
Moderate level	111	15.8
Low level of knowledge	400	57.0
Total	702	100.0

Table (5) shows that knowledge level regarding ER has statistically significant relation to gender (p value=0.0001), age (p value=0.0001), nationality (p value=0.0001), marital status (p value=0.0001), employment status (p value=0.0001), monthly income (p value=0.001), education level (p value=0.0001), and region of residence (p value=0.032)

Table (5): Relation between knowledge level regarding ER and sociodemographic characteristics.

Parameters		***Knowledge level***		***Total (N=702)***	***P value****
		Low level	**Moderate or high**		
Gender	Female	257	233	490	0.0001
		64.3%	77.2%	69.8%	
	Male	143	69	212	
		35.8%	22.8%	30.2%	
Age	22 to 18	73	88	161	0.0001
		18.3%	29.1%	22.9%	
	23 to 30	114	105	219	
		28.5%	34.8%	31.2%	
	30 to 40	95	46	141	
		23.8%	15.2%	20.1%	
	more than 40	118	63	181	
		29.5%	20.9%	25.8%	

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Nationality	Saudi	367	296	663	0.0001
		91.8%	98.0%	94.4%	
	Non-Saudi	33	6	39	
		8.3%	2.0%	5.6%	
Marital status	Single	110	152	262	0.0001
		27.5%	50.3%	37.3%	
	Married	251	140	391	
		62.7%	46.4%	55.7%	
	Divorced	28	8	36	
		7.0%	2.6%	5.1%	
	Widowed	11	2	13	
		2.8%	0.7%	1.9%	
Employment status	Non employed	164	200	364	0.0001
		41.0%	66.2%	51.9%	
	Employed	236	102	338	
		59.0%	33.8%	48.1%	
Monthly income	4000 SAR or less	173	172	345	0.001
		43.3%	57.0%	49.1%	
	4001 to 8000 SAR	63	38	101	
		15.8%	12.6%	14.4%	
	More than 8000 SAR	164	92	256	
		41.0%	30.5%	36.5%	
Education level	Primary	6	2	8	0.0001
		1.5%	0.7%	1.1%	
	Intermediate	17	4	21	
		4.3%	1.3%	3.0%	
	High school	80	80	160	
		20.0%	26.5%	22.8%	
	Diploma	40	27	67	
		10.0%	8.9%	9.5%	
	University	202	173	375	
		50.5%	57.3%	53.4%	
	Master's degree or higher	24	16	40	
		6.0%	5.3%	5.7%	
	Uneducated	31	0	31	
		7.8%	0.0%	4.4%	
Region of residence	Northern region	35	36	71	0.032
		8.8%	11.9%	10.1%	
	Southern region	118	61	179	
		29.5%	20.2%	25.5%	
	Central region	48	30	78	
		12.0%	9.9%	11.1%	
	Eastern region	176	157	333	

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		44.0%	52.0%	47.4%	
	Western region	23	18	41	
		5.8%	6.0%	5.8%	

P value was considered significant if ≤ 0.05.

Discussion:

Emergency departments (EDs) are being visited more frequently nowadays than in previous years in several societies. Therefore, it is alleged that there are significant delays in delivering care to ED patients. Longer waiting times are correlated with poor patient satisfaction. A systematic review published in 2009 indicated that the prevalence of inappropriate ED use ranged from 20% to 40%, and that there was a link between age and income, according to 31 publications published 12 years prior to this study [12]. Another cross-sectional study conducted in England in 2013 discovered that 11.7% of ED visits between April 2011 and March 2012 were inappropriate, with the age group highest in early childhood and declining throughout late adolescence and young adulthood [13]. Thus, we aimed in this study to assess the level of awareness and knowledge of emergency room utilization among the Saudi Arabian population.

Regarding the knowledge and awareness about emergency room use among the studied participants, a significant 89.3%out of 702 participants recognized that the ER's primary role is treating the critical cases, while 71.2% would directly visit the ER when ill, reflecting a sense of urgency. Patterns showed 46.3% visited the ER every 3 to 6 months, with barriers to primary care cited as limited hours (34.0%) and resources (29.1%). Overall, 41.6% rated their ER experience positively, yet 14.2% reported negative experiences. Additionally, Fever without rash was the leading reason for ER visits (50.1%), followed by chest pain and breathing difficulties, highlighting urgent health needs. Collectively, a predominant portion of the respondents, comprising 57.0%, reported a low level of knowledge. High and moderate levels of knowledge were 27.2% and 15.8%, respectively. Regarding the relation between knowledge level regarding ER and sociodemographic characteristics, we have found that knowledge level regarding ER has statistically significant relation to gender (p value=0.0001), age (p value=0.0001), nationality (p value=0.0001), marital status (p value=0.0001), employment status (p value=0.0001), monthly income (p value=0.001), education level (p value=0.0001), and region of residence (p value=0.032). On the other hand, a study was undertaken in Saudi Arabia in 2019 to assess public awareness of ER, and they employed an online questioner that had been pre-designed [14]. They discovered that, while the majority of people (87.5%) understood the difference between an ER and an outpatient clinic, the majority of people feel that an ER is a place where they can get medical care quickly and unexpectedly. Another study was undertaken in 2015 by researchers from King Abdul-Aziz Hospital, King Fahd Hospital, and Thaghor Hospital.[15] According to this survey, patients prefer ER treatments over primary care because of primary health care centres' inadequate service and resources (60.8%) and limited working hours (50.4%). These findings align with the research of Mosadeghrad (2019), who identified similar factors influencing ED choice, emphasizing the importance of location and quality of care perception [16]. In a recent study [17] exploring knowledge and awareness regarding emergency room (ER) use, significant disparities were noted compared to our findings. Among 915 respondents in Saudi Arabia, only 12.9% exhibited low knowledge levels about ER functions, contrasting with the 57.0% low knowledge rate observed in the our study. Despite a higher percentage (90.9%) expressing a preference for primary health care (PHC) visits compared to the 71.2% inclined to visit the ER in the current study, the reasons for ER utilization revealed parallels; both studies identified urgent health needs—such as fever and chest pain—as primary motives. Notably, the study

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highlighted that barrier like appointment unavailability and a lack of thorough investigation at PHCs prompted patients to select for EDs. Additionally, a study assessing awareness and utilization patterns of Urgent Care Clinics (UCCs) [18], only 25.35% of 288 participants were familiar with the term, with common cold being the primary reason for visits. Notably, over half of the respondents (53.42%) used UCCs 1-3 times in the preceding three months, reflecting a similar trend of frequent healthcare visits seen in the emergency room study. While barriers to accessing primary care were highlighted, with 54.55% of participants citing difficulties in booking appointments, the findings underscore the necessity for improved awareness and accessibility in urgent care services, which parallels the trends observed in emergency room utilization.

Conclusion:

This study illuminates the awareness and knowledge surrounding ER utilization among the Saudi Arabian population, revealing significant insights into the factors influencing patient behavior and healthcare access. Overall, while a substantial majority of respondents recognized the primary role of the ER in treating critical cases, 57.0% exhibited low knowledge levels regarding appropriate ER use, indicating a critical need for enhanced educational initiatives. Differences in knowledge were statistically significant across various demographic factors, highlighting potential areas for targeted intervention. The reliance on ER services over primary healthcare, attributed to barriers such as limited access and resources in primary care, underscores a pressing concern for the healthcare system in Saudi Arabia. Addressing the identified knowledge gaps and alleviating barriers to primary healthcare access could promote more appropriate ER utilization, ultimately improving patient outcomes and enhancing overall healthcare efficiency. Further research is warranted to explore the implications of these findings and develop effective awareness programs tailored to the needs of diverse population segments.

Acknowledgement:

We thank the participants who all contributed samples to this study.

Ethical approval:

An informed consent was obtained from each participant after explaining the study in full and clarifying that participation is voluntary. Data collected were securely saved and used for research purposes only.

Funding:

There was no external funding for this study.

Conflict of interests:

The authors declare no conflict of interest.

Informed consent:

Written informed consent was acquired from each individual study participant.

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Data and materials availability:

All data associated with this study are present in the paper.

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