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KNOWLEDGE, ATTITUDES, AND PRACTICE OF PRIMARY HEALTH CARE PHYSICIANS TOWARD ACUTE CORONARY SYNDROME IN THE EASTERN PROVINCE OF SAUDI ARABIA: 2018

Medicine

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ABSTRACT

Introduction: Acute Coronary Syndrome (ACS) is a leading cause of morbidity and mortality in Saudi Arabia (SA). This cross-sectional study assessed physicians' knowledge, attitudes, and practice regarding ACS.

Methodology: The study was conducted on general and family physicians in primary health centers (PHC) in Dammam and Khobar in Saudi Arabia's Eastern Province. Participants self-completed questionnaires. Descriptive statistics, associations, and predictors of practice were determined.

Results: Most physicians underwent electrocardiogram training (69.9%), 81.7% responded correctly regarding ACS diagnosis, and 58.8% regarding initial management. Two-thirds of physicians had positive attitudes. Higher numbers of ACS patients managed in PHCs, attending electrocardiogram training, and specialty were significantly associated with practice.

Conclusions: PHC physicians have better knowledge of diagnosis over initial management practices. Over two-thirds of physicians have a positive attitude. Previous experience is associated with a better knowledge score and positive attitude, which are predictors of practice.

KEYWORDS

Acute Coronary Syndrome, Physician, Saudi Arabia

INTRODUCTION

Coronary artery disease (CAD) is a leading cause of death in the Kingdom of Saudi Arabia (KSA). Acute coronary syndrome (ACS) describes a range of myocardial ischemic states including unstable angina (UA), ST-elevated myocardial infarction (STEMI) or non-STEMI (NSTEMI). The diagnosis and classification of ACS is based on a thorough review of clinical features, including electrocardiogram (ECG) findings and biochemical markers of myocardial necrosis. The term myocardial infarction (MI) according to the Third universal definition is"myocardial necrosis in the setting of acute myocardial ischemia". UA is defined as "the presence of ischemic symptoms without elevations in biomarkers and transient if any ECG changes"[3]. STEMI is differentiated from NSTEMI by the presence of persistent ECG findings indicating ST segment elevation. The term "syndrome" is useful as the initial presentation and early management of STEMI, NSTEMI, and UA frequently are similar. The prevalence of coronary heart disease (CHD) is 5.5% in the KSA, with prevalence in Men and women of 6.6% and 4.4%, respectively. Urban Saudis have a higher CHD prevalence (6.2%) compared to rural Saudis (4%)[4]. The prevalence of chest pain in primary care is 1%[5]. The diagnosis of ACS accounts for 12% of patients with chest pain in Primary Healthcare Centers (PHC). The most common causes of chest pain include chest wall pain (36%), reflux esophagitis (19%), pulmonary disease (5%), psychological (8%), and nonspecific chest pain (16%)[5].

Ischemic heart disease accounts for high economic burden in the KSA. The average cost is 40,164 Saudi Riyals (SAR) per patient admitted with ACS[6].

Between December 2005 and July 2006, the Saudi Project for Assessment of Coronary Events Registry, was the first registry in the KSA to examine patients with ACS. The study showed that patients diagnosed with ACS in KSA are 8–11 years younger than patients in ACS registries in developed countries[7].

It is essential to rapidly and accurately assess ACS[8]. Delayed treatment is a major contributor to morbidity and preventable complications as shown in numerous clinical trials[9]. All possible measures should be undertaken to minimize the time from symptom onset to the start of cardiologist intervention[10]. A study survey of 12,000 family physicians in the United States (US) indicated that the discrimination of ACS and less severe causes of chest pain is difficult for a general practitioner (GP)[11]. ACS diagnosis is difficult as the primary care patient often presents with unspecific symptoms and ACS may have vague symptoms or may even be silent[12]. In the PHC setting, management of patients presenting with chest pain is a common and challenging clinical problem. GPs must distinguish between patients with chest pain who require urgent management such as ACS and those with benign conditions[13]. An observational study including 202 patients with presumed ACS in the Netherlands showed that almost half of patients with chest pain had contacted their GP before visiting the emergency department (ED). In addition, patients had visited their GP one month preceding the chest pain for a chronic medical condition. The average time from onset of symptoms to the GP visit and transfer by ambulance to the ED door took 4 hours compared to 25 minutes by direct ambulance transfer from patient community location[14]. This places GPs in a unique position in the health care system when caring for patients with risk of cardiovascular events, in terms of both chronic and acute care on presentation of chest pain. According to the current guidelines, clinical assessment alone could be sufficient to confirm or exclude the diagnosis of ACS in patients with stable chest pain and low-risk factors. Clinical history and physical examinations should be the first step in clinical assessment and guide additional testing[15]. Although ACS cannot be ruled out in most cases by history taking and physical examination alone, it is not possible for the GP to simply refer fewer patients[16]. The basic clinical tools including history, physical examination, and ECG are currently widely acknowledged to allow early identification of ACS in low-risk patients who have less probability of ACS[17]. Electrocardiography and cardiac troponin tests have limited value in the PHC setting; the main diagnostic tools for patient presenting with chest pain will depend on history and physical examination[18]. Thus, GPs need to know the frequencies of differential diagnosis in the community. GP's assessment with the given differentials and findings from history and clinical examination should be combined to achieve a final diagnosis or a narrower list of differentials[19]. Electrocardiography has high specificity, but low sensitivity in clinical practice, and may lead to difficulty in ruling out ischemic heart disease IHD based on ECG alone[20]. Cardiac troponin levels also have low sensitivity during the early stages of ACS, which does not make it helpful when excluding high-risk patients[21].

A recent cross-sectional study from Norway on 100 physicians working in PHC, reported that only 4% of patients with chest pain had ECG ordered by the GP. That study did not comment on the cause or the difficulty of ECG interpretation[22]. A qualitative study included 38 GPs from the Netherlands to assess their experience with cardiovascular consultation during out-of-hours care. Most GPs considered the consultations difficult. GPs showed defensive behavior, tension and uncertainty leading, which resulted in inappropriate over or under referrals[23].

A recent prospective study from 4 Norwegian casualty clinics collected data from structured telephone interviews with 100 primary care physicians to assess challenges in the diagnostic approach and

attitudes towards confidence of correct management of patients with acute chest pain towards hospital admission. The study concluded that most physicians did not follow the guidelines or evidence for diagnosis. The study also recommended continuous medical education, diagnostic approach, and risk assessment stratification in patients with chest pain in PHC[24].

A prospective observational study of 1085 individuals admitted to a hospital because of an ACS event in Brazil showed that patients presenting to the PHC were more likely to receive early aspirin therapy compared to those who presented to EDs directly. Although only 75% of GPs administered aspirin to patients with chest pain in the PHC before being transported to hospital, the study recommended that PHC units initiate treatment early and provide PHC with protocols and staff training. The study did not discuss any benefits of early or late aspirin use in PHC in term of complication outcome[25].

A study assessing ECG interpretation in general practice by GPs *versus* automated an ECG reader was performed on 902 ECGs in Denmark. The results indicated that GPs should pay more attention to acute ischemic changes in the form of ST segment deviation, T-wave inversion, or the presence of Q-waves. There was not sufficient evidence to recommend accepting solely automated ECG reader results without interpretation by the Gp[26].

A survey study in the US, involving 1211 GPs and cardiologists assessed knowledge and practices regarding drug therapy for acute MI. The study showed that GPs were less aware of some treatment benefits. The study recommended medical education, dissemination of guidelines, and involvement in community-based clinical trials[27].

Two validated cohort studies in Germany on 1199 patients in 74 PHCs and further validated with 672 patients in Switzerland, examined the ability of the PHC physician to exclude CHD in patient presenting with chest pain in PCS. The study helped to generate a simple prediction rule. It can help to rule out CAD in patients presenting with chest pain in primary care[28].

A secondary analysis of a cross-sectional diagnostic study of 1249 consultations in Germany assessed the diagnostic value of history and clinical findings relative to the diagnosis of CHD at PHCs. The study showed that ability of GP to diagnose ACS was moderate. It concluded that there are few studies on GP initial diagnostic accuracy of acute chest pain, especially in relation to the national CHD diagnostic reference[29].

A survey study in 1994 in the US, interviewed 1121 physicians, who were divided into two groups: cardiologists and generalists including family physicians. The study assessed the knowledge and practice differences among specialists and generalists regarding drug therapy in patients with MI. It showed that family physicians were markedly less aware and less certain about basic therapy for ACS. The study showed that physicians <40 years of age had greater knowledge of evidence-based therapies. It also recommended dissemination of clinical trial results at the primary care level[30].

A prospective cohort study in the US involving 890 physicians assessed the practice of care and outcomes between generalists and specialist physicians when treating patients with UA. The study showed that generalists were less likely to use resources such diagnostic tests, or initiate medication when compared to specialists, which lead to the recommendation of not to support generalists as the first point of contact role in the treatment of ACS[31].

A survey study in the US interrogating 8241 patients assessed patient's outcomes based on family physicians, cardiologist, and other associated factors as variables during treatment of MI. The study revealed that better general outcomes might result in caring facilities attending to larger volumes of patients with acute Mi[32].

A survey study in the US in 1993 investigated 4546 physicians to compare individual physician characteristics and to analyze patient and hospital factors when managing patients with acute MI. The study showed increasing unfavorable outcomes for every year since the graduation year of the treating physician. This may be due to the years that lapsed without training, which necessitate further continuous education[33].

A survey study in the US 2000 comprising 2215 participants examined the association of physician characteristics with use of aspirin in the management of acute MI. The study found that physicians >50 years are less likely to prescribe aspirin to eligible patients[34].

A systematic review of 62 articles in 2005 assessed relationship between medical knowledge, practice years, and physician age. The study showed that physicians with longer practice years may provide lower-quality care and may thus require quality improvement interventions[35].

A study in the US comprising 1045 physicians compared the knowledge and practice of primary care practitioners and emergency physicians in the treatment of acute MI. The study found that primary care practitioners had lower awareness and poor practice pattern for the management of ACS when compared to emergency physicians. These results illustrate the importance of training GPs in Eds[36].

Currently, the majority of studies of ACS in physicians in family medicine practice have focused on the ability of physicians to predict the cardiac causes in patients with chest pain and incorporating the risk factors to stratify patients risk. However, more evidence is needed to explore the physician's knowledge, attitude, practice toward ACS diagnosis, and initial management. .No previous studies in Saudi Arabia have specifically assessed knowledge, attitude, practice in the diagnosis and initial management of ACS among physicians in PHC. There are over 2300 PHC scattered across the Kingdom of Saudi Arabia and these play an important role in the health care system, with growing interest from the Ministry of Health (MOH) to develop this sector up to an estimated 25% increase by 2017, which will create more patient flow and shortage of health care providers.

The objectives of this study were to assess physician knowledge, medical background, clinical approach toward diagnosis and initial management of patients with ACS

- To determine physician attitude, self believe toward diagnosis and initial management of patients with ACS
- To measure practice of physician toward diagnosis and initial management of patients with ACS

METHODS
Study Setting
This cross-sectional descriptive study was conducted at the MOH's PHCs in Dammam and Khobar cities of the Eastern Province of Saudi Arabia from October 2017 to June 2018. All GPs and family physicians working in 44 PHCs in the sampled cities, who met the inclusion criteria, were included. .Overall, 203 male and female physicians (134 in Dammam and 69 in khobar) were eligible to participate in the study during the study period.

Exclusion Criteria
Any physician working administrative jobs not assigned to at least one clinic per week; in service during the first month of training post-employment or on vacation; any physician of other specialty than GP or family medicine (internal medicine, OB/GYN, dermatologist, ophthalmologist, ENT specialist, radiologist, pediatrician, general surgery specialist)

Pilot Study
Before data collection, a pilot study, testing the study's reliability ($\alpha=0.74$), was conducted on 40 family residents in Al-Aqrabia Center, Khobar. An online questionnaire was sent to residents, who were followed up to ensure good response. The questionnaire was revised after piloting, based on the residents' comments. Pilot respondents were excluded from the actual study.

Data Collection Tools and Methods
An electronic self-administrated, structured questionnaire was sent to all Physicians by e-mail and reinforced through WhatsApp messages. The researchers followed up with physicians to ensure good response and address any questions and the relative response rate was calculated.

Study variables
Independent variables: Socio-demographic data
Dependent variables: Knowledge, attitudes, practice

Tools Used

A self-structured questionnaire, which was validated by 7 consultants, consisted of the following 5 parts:

1. Socio-demographic participant data including: age, sex, last medical degree, rank of specialty, graduation year, previous experience, years of experience, ACLS course, ECG course, number of patients managed with ACS, number of patients/per week, number of clinics/week.
2. Participants' knowledge assessed through 15 true/false questions. The questions included 11 items regarding diagnosis knowledge and 5 items assessing initial management knowledge.
3. Participants' attitudes regarding their responsibility for diagnosis and initial management were assessed through 6 questions on a 5-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree).
4. Clinical practice was assessed through 12 questions on a 5-point Likert (never, rarely, monthly, weekly, and daily).

Coding and Scoring of the Questionnaire

- Responses to knowledge questions were coded as follows: True answer = 1; False and I don't know = 0.
- Attitude Responses to attitude-related items were coded as follows: Agree and Strongly agree = 1; Neutral = 2; Disagree and Strongly disagree = 3. The total attitude score was calculated and divided according to the mean to indicate either an overall positive (agree and strongly agree) and or negative (neutral, disagree and strongly disagree) attitude.
- Clinical practice questions were coded as follows: Never and Rarely responses = 1, Monthly = 2, Weekly and Daily = 3.

Data Analysis and Management

Overall, 153 questionnaires were checked, coded, and entered into a personal computer, and the data was analyzed using SPSS version 21. Continuous data were presented as means and standard deviations (SD) and categorical data was presented as frequencies and percentages. The t-test and ANOVA tests were used to determine the association of physicians' characteristics with knowledge and practice scores. The chi-square test was used to test the association of the attitude (positive or negative) with the physicians' characteristics. The correlation coefficient (r) was identified for all variables and linear regression was used to determine predictors of knowledge, attitude, and practice. The selected alpha level was .05 and statistical significance was determined by a P-value<0.05.

Ethical considerations

The study was conducted after IRP approval and acceptance by the MOH's administration. The data was kept confidential and used for research purposes only. Consent was obtained from all physicians who had the right to refuse or quit participation at any time.

RESULTS

A total of 164 responses were obtained from 203 participants, resulting in an 81% response rate. Eleven participants were excluded because they did not complete the survey or had a different specialty.

Characteristics of the PHC Physicians

Approximately 94% of the participants were ≤40 years and 62.7% were female. In total, 68% of the participants were GPs and 30.7% were family physicians. Approximately 81.7% of the participants did not have previous experience other than primary care clinics and over half (65.4%) of the participants had worked less than five years in a PHC. ECG course were attended by 69.9%, whereas only 36.6% had attended an ACLS course. About 80% of the participants had managed <10 patients with ACS per year. Table 1 describes the socio demographic and training factors of respondents.

Table 1: Characteristics of Physicians in PHCs in Dammam and Khobar, 2018

	N	(%)	Total n(%)
Age	84	54.9	153(100%)
<30 years	60	39.2	
31–40 years	9	5.9	
>41 years			
Sex	57	37.3	153(100%)
Male	96	62.7	
Female			

Last medical degree	104	68.0	153(100%)
MBBS	20	13.1	
Family medicine diploma	27	17.6	
Family medicine board	2	1.3	
Other			
Rank of specialty	135	88.2	153(100%)
Resident	16	10.5	
Specialist	2	1.3	
Consultant			
Graduation year of	113	73.9	153(100%)
last medical degree	40	26.1	
<9 years			
>9 years			
Previous experience other than PHC	28	18.3	153(100%)
Yes	125	81.7	
No			
Period of working in PHC	100	65.4	153(100%)
<5 years	32	20.9	
5–9 years	15	9.8	
10–14 years	6	3.9	
>15 years			
ACLS course	56	36.6	153(100%)
Yes	97	63.4	
No			
ECG course	107	69.9	153(100%)
Yes	46	30.1	
No			
Number of patients managed with ACS in the PHC per year	122	79.7	153(100%)
<10	23	15.0	
11–9	8	5.2	
>20			
Number of patients you see/week	66	43.1	153(100%)
<50	32	20.9	
51–99	17	11.1	
100 –149	38	24.8	
>150			
Days of clinic/week	10	6.5	153(100%)
One	16	10.5	
Two	22	14.4	
Three	16	10.5	
Four	89	58.2	
Five			

Description of PHC physicians' knowledge

Table 2 shows 67.3% of surveyed doctors knew when troponin can diagnose MI. About 72% knew that using a clinical prediction tool may aid in diagnostic decisions. Most doctors (83%) were aware of typical anginal pain characteristics. Approximately 68% understood the relationship of position to pain severity. Three-quarters (73.9%) knew that there were other more common causes of chest pain than ACS. Although 64.7% did not know heart auscultatory findings that increase likelihood of ACS, more than three-quarters were aware of STEMI is characteristic on ECG. Over 69.9% knew how STEMI progresses on ECG. Half (55.6%) thought that creatine kinase-MB is not a preferred marker for ACS diagnosis. Less than 60.1% of the studied sample was aware of the sex differences on typical presentation.

Table 2: Participants' responses to the diagnosis knowledge questions

	Diagnosis knowledge		Frequency n(%)
1	Troponin pattern for myocardial infarction diagnosis	True	103(67.3)
		False	50(32.7)
2	Using clinical prediction tool for risk assessment	True	111(72.5)
		False	42(27.5)
3	Typical anginal pain characteristics	True	127(83)
		False	26(17)
4	Pain related to position	True	104(68)
		False	49(32)
5	Other common causes of chest pain than ACS	True	113(73.9)
		False	40(26.1)

| 6	Heart auscultation finding	True	54(35.3)
		False	99(64.7)
7	STEMI is characteristic on ECG	True	118(77.1)
		False	35(22.9)
8	STEMI progresses on ECG	True	107(69.9)
		False	46(30.1)
9	Creatine kinase MB is not a marker for ACS diagnosis	True	85(55.6)
		False	68(44.4)
10	Sex variance for typical presentation	True	92(60.1)
		False	61(39.9)

Table 3 shows that 60.8% half of the participants knew that oxygen supplementation was not the initial therapy and 54.9% knew which saturation level to start oxygen. Less than 64.1% were aware of the correct aspirin dose. Over half (57.5%) did not know of the association of morphine therapy with mortality. Furthermore, a similar percentage (53.6%) of participants were aware of NTG dose and route of administration.

Table 3: Participants' responses to the initial management knowledge questions

	Initial Management Knowledge		Frequency *n* (%)
1	Oxygen supplementation	True	93(60.8)
		False	60(39.2)
2	Aspirin	True	98(64.1)
		False	98(64.1)
3	Oxygen saturation	True	84(54.9)
		False	69(45.1)
4	Analgesia	True	65(42.5)
		False	88(57.5)
5	Nitroglycerin	True	82(53.6)
		False	71(46.4)

Figure 1 shows that the majority of participants (81.7%) responded correctly in the diagnosis knowledge evaluation. The total initial management knowledge questions were correct in 58.8% . Overall, correct answers of knowledge questions were approximately 74.5%.
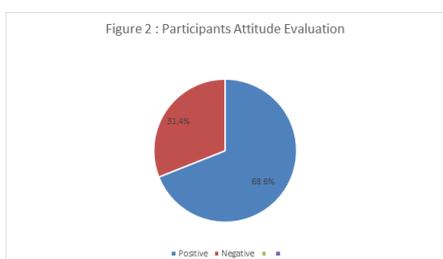
Figure 1: PHC physicians' answers to knowledge items
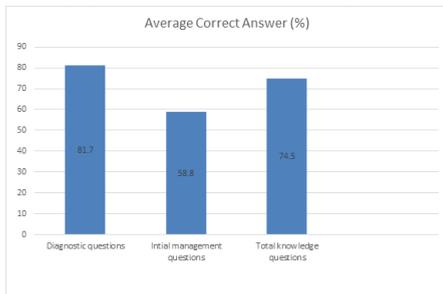
Description of PHC physicians' attitude

Approximately two-thirds (68.6%) of physicians had a positive attitude.(Figure 2)

Figure 2: Attitudes of PHC physicians Dammam and Khobar, 2018

As shown in Table 4, 99 (64.7%) participants believed that it was their responsibility to deal with patients with ACS. Overall, 114 (74.5%) were willing to start the recommended initial medication and the majority (128 [83.5%]) would follow a national guideline. About 113 (73.9%) think that patients should visit the ED rather than the PHC, as only 52 (34%) believe PHC resources are suitable for initial management. The majority (126 [82.3%]) considered ACS a common health problem encountered in PHCs.

Table 4: The participants' responses to attitude questions

ATTTITUDE	Negative n(%)	Positive n(%)
It is my responsibility to deal with a patient with ACS.	54(35.3)	99(64.7)
I am willing to start the recommended initial medication at the PHC for ACS patients.	39(25.5)	114(74.5)
I think following a national guideline will help me in the management of ACS patients.	25(16.4)	128(83.5)
I think patients with chest pain should visit the Emergency Department rather than the PHC.	40(26.2)	113(73.9)
I think that the availability of PHC resources makes the PHC suitable for initial management of patients with ACS	101(66)	52(34)
Do you consider ACS an uncommon health problem encountered at the PHC?	126(82.3)	27(17.7)

Description of PHC physicians' practice

Table 5: The participants' responses to practice questions

Questions PRACTICE	Never /Rarely n(%)	Monthly n(%)	Weekly / daily n(%)
Do you take targeted history and physical examination in patient with chest pain?	6(3.9)	21(13.7)	126(82.3)
Do you follow guidelines in diagnosis and initial management of ACS?	10(6.6)	43(28.1)	100(65.3)
Do you consult a senior physician before Managing a patient with chest pain?	9(5.9)	30(19.6)	114(74.5)
Do you start patients with ACS on oxygen?	8(5.3)	35(22.9)	110(71.9)
Do you start patients with ACS on aspirin therapy?	9(5.9)	24(15.7)	120(78.4)
Do you give patient with ACS nitroglycerine for pain control?	14(9.1)	37(24.2)	102(66.7)
Do you start patient with ACS on IV morphine for pain control?	47(30.7)	60(39.2)	46(30)
Do you order 12-leed ECG for every patient with chest pain?	18(11.7)	36(23.5)	99(64.7)
Will you depend on your ECG interpretation skills to diagnose acute ECG ischemic changes?	28(18.3)	54(35.3)	71(46.4)
Would you order cardiac markers for ACS, If available in your PHC?	15(9.8)	22(14.4)	116(75.8)
Would you order an ambulance for fast patients transfer	5(3.3)	19(12.4)	129(84.3)
Are you aware of the emergency protocol in your PHC setting?	52(34)	51(33.3)	50(32.7)

The majority of participants (82.3%) take history and physical examination before managing patients with ACS (Table 5) and 65.3% of participants practiced following the guidelines. Three-quarters of respondents (74.5%) would consult a senior physician. The percentage of physicians who would start patients with oxygen, aspirin, and nitroglycerine treatment was 71.9%, 78.4%, and 66.7%, respectively; whereas, only 30.7% of physicians would start morphine. About 64.7% of participants order ECG for every patient with chest pain; whereas, less 46.4% depended on their ECG interpretation skills. Three-quarters of participants (75.8%) ordered cardiac markers, if available. The majority of physicians (84.3%) transferred patients by ambulance for specialist care. Only 32.7% of physicians followed the emergency protocols for patients with chest pain in the PHC.

Table 6 shows that age >30 years of the participants had a significant effect on diagnosis knowledge (P=0.006), as did the period of working in PHC between 5–10 years (P=0.000). Attending an ECG course had a significant effect on diagnosis knowledge (P=0.000). Age of the

participants between 30–40 years had a significant effect on initial management knowledge (P=0.038) as did greater than >9 years from graduation of the physician (P=0.001). In addition, the working in a PHC between 5 and 10 years was significant (P=0.003). Attending ACLS and ECG courses both have significant effects on initial management knowledge (P=0.005, 0.009), respectively. The more number of patients managed with ACS in the PHC and the number of patients seen per week both have significant effects on initial management knowledge (P=0.007, 0.01, respectively).

Table 6: Association of PHC physicians' characteristics with diagnosis knowledge and initial management knowledge scores

	Diagnosis knowledge		Initial management knowledge	
	Mean±SD	P-value	Mean±SD	P-value
Age ≤30 years 31–40 years ≥41 years	6.6±2.5 7±2.7 4±3.0	0.006**	2.5±1.4 3.1±1.6 2.7±1.7	0.038**
Sex Male Female	6.3±2.5 6.8±2.8	0.276*	2.6±1.4 2.8±1.6	0.502*
Last medical degree MBBS Family medicine Diploma Family medicine board Other	6±2.6 6.5±2.1 5.7±2.2 3±1.4	0.279**	2.7±1.7 2.7±1.3 3±1.3 2±1.4	0.800**
Rank of specialty Resident Specialist Consultant	6.7±2.7 6.6±3.1 5±0.00	0.697**	2.8±1.5 2.3±1.5 3±1.4	0.470**
Graduation year of last medical degree <9 years >9 years	6.4±2.7 7.2±2.8	0.121**	2.5±1.5 3.5±1.5	0.001**
Previous experience other than PHC Yes No	6.8±1.9 6.6±2.9	0.666*	2.7±1.3 2.8±1.6	0.764*
Period of working in PHC ≤5 years 6–9 years 10–14 years ≥15 years	6.5±2.6 8±2.5 5.7±2.8 3.8±2.6	0.000**	2.5±1.5 3.6±1.5 2.7±1.6 2.8±1.6	0.003**
ACLS Course Yes No	6.1±2.5 7±2.8	0.072*	2.3±1.2 3±1.7	0.005*
ECG Course Yes No	7.2±2.5 5.4±2.8	0.000*	3±1.5 2.3±1.5	0.009*
Number of patients Managed with ACS in the PHC per year ≤10 11–19 >20	6.4±2.7 7.8±2.7 6.9±2.9	0.076**	2.5±1.5 3.7±1.6 3±1.4	0.007**
Number of patients you See per week ≤49 50–99 100–149 ≥150	6.1±2.6 6.9±2.8 8.0±1.4 6.6±3.0	0.066**	2.3±1.4 2.8±1.4 3.4±1.6 3.2±1.8	0.01**
Days of clinic per week One Two Three Four Five	6.3±2.1 5.3±2.8 6.4±2.6 6.1±3.3 7.1±2.6	0.128**	3.1±1.4 2.1±1.3 2.5±1.4 2.3±1.6 3±1.7	0.138**

* T–test
** ANOVA
***Chi–square

Table 7 shows that previous experience other than PHC, have significant effect on the attitude toward patient managing with ACS

(P=0.037). Rank of specialty has significant effect on practice (P=0.006). Attending both ACLS course, ECG course has significant effect on practice (P=0.005, P=0.000) respectively. Managing ten to twenty patients with ACS per year, has significant effect on practice (P=0.014).

Table 7: Association of PHC physicians' characteristics with Attitude and Practice scores

	Attitude	Practice		Practice	
	Positive attitude *n*(%)	Negative attitude *n*(%)	P-value	Mean±SD	P-value
Age <30 years 31–40 years >40 years	58(55.2) 4(39.0) 6(5.7)	26(54.2) 19(39.6) 3(6.3)	0.912***	3.8±0.6 3.9±0.7 3.4±0.4	0.168**
Sex Male Female	35(33.3) 70(66.7)	22(45.8) 26(54.2)	0.314***	3.8±0.6 3.9±0.6	0.467*
Last medical degree MBBS Family medicine Diploma Family medicine board Other	74(70.5) 14(13.3) 16(15.2) 1(1.0)	60(62.5) 6(12.5) 11(22.9) 1(2.1)	0.647***	3.9±0.6 3.9±0.3 3.6±0.8 3.3±0.5	0.177**
Rank of specialty Resident Specialist Consultant	97(92.4) 8(7.6) 0(0.0)	38(79.2) 8(16.7) 2(4.2)	0.128***	3.9±0.6 3.7±0.7 2.5±1.2	0.006**
Graduation years from last medical degree <9 years >9 years	75(71.4) 30(28.6)	38(79.2) 10(20.8)	0.652***	3.8±0.6 4±0.6	0.102*
Previous experience other than at PHC Yes No	24(22.9) 81(77.1)	4(8.3) 44(91.7)	0.037***	3.9±0.4 3.8±0.7	0.618*
Period of working in PHC <5 years 5–9 years 10–14 years >15 years	65(61.9) 24(22.9) 12(11.4) 4(3.8)	35(72.9) 8(16.7) 3(6.3) 2(4.2)	0.432***	3.8±0.6 4±0.8 3.8±0.4 3.5±0.4	0.178**
ACLS course Yes No	36(34.3) 69(65.7)	20(41.7) 28(58.3)	0.480***	3.6±0.6 3.9±0.6	0.005*
ECG course Yes No	73(69.5) 32(30.5)	34(70.8) 14(29.2)	0.361***	4±0.6 3.5±0.6	0.000*
Number of patients managed with ACS at the PHC per year <10 10–19 ≥20	82(78.1) 17(16.2) 6(5.7)	40(83.3) 6(12.5) 2(4.2)	0.532***	3.8±0.6 4.1±0.8 3.8±0.6	0.014**
Number of patients you see per week <50 50–99 100–149 >150	42(40.0) 19(18.1) 14(13.3) 30(28.6)	13(27.1) 3(6.3) 8(16.7) 3(6.3)	0.069***	3.7±0.6 3.8±0.7 4.1±0.5 3.9±0.7	0.118**
Days of clinic per week One Two Three Four Five	7(28.6) 9(8.6) 16(15.2) 11(10.5) 62(59.0)	3(6.3) 7(14.6) 6(12.5) 5(10.4) 27(56.3)	0.836***	3.7±1.0 3.4±0.6 3.8±0.5 3.7±0.5 3.9±0.6	0.056**

* T–test
** ANOVA
***Chi–square

Table 8 shows the years after graduation from the last medical degree significantly correlated with physician total knowledge (P=0.016), as did attending ACLS and ECG courses (P=0.023, P=0.000,

respectively), and the number of patients managed with ACS and seen per week (P=0.035, P=0.026, respectively). The total knowledge score was significantly correlated with physician attitude and practice (P=0.015, P=0.000, respectively). Previous experience other than at the PHC was significantly correlated with attitude (P=0.037) as was the physician's rank of specialty (P=0.006). Attending ACLS and ECG courses each significantly correlated with the physician's practice (P=0.005, P=0.000, respectively), as was the number of patients managed with ACS in the PHC per year (P=0.005), and the average

days of clinic per week (P=0.018).
Table 9 shows graduation year of last medical degree and practice were predictors of physician total knowledge (P=0.037, P=0.000), Previous experience other than PHC was a predictor of attitude level (P=0.037). Attitude was correlated with practice (P=0.021). Physician rank of specialty was significantly correlated with practice (P=0.010). Attending an ACLS course was significantly correlated with the physician's practice (P=0.041). Both total knowledge and attitude of physicians were predictors of practice (P=0.000, P=0.021)

Table 8: Correlations between PHC physician characteristics and between knowledge, attitudes, and practice, 2018

		Rank of specialty	Graduation year	Previous experience	Period working in PHC	ACLS	ECG	Number of patients managed with ACS	Number of patients seen per week	Average days of clinic per week	Knowledge	Attitude	Practice
Rank of specialty	Pearson Correlation	1	-0.049-	-0.075-	0.266**	0.157	0.077	0.029	-0.050-	0.058	-0.057-	-0.116-	-0.221-**
	Sig. (2-tailed)		0.548	0.356	0.001	0.053	0.346	0.721	0.537	0.478	0.482	0.154	0.006
	N	153	153	153	153	153	153	153	153	153	153	153	153
Graduation year	Pearson Correlation	-0.049-	1	-0.012-	0.398**	0.143	0.033	0.077	0.290**	0.223**	0.194*	-0.037-	0.133
	Sig. (2-tailed)	0.548		0.880	0.000	0.077	0.683	0.345	0.000	0.006	0.016	0.652	0.102
	N	153	153	153	153	153	153	153	153	153	153	153	153
Previous experience	Pearson Correlation	-0.075-	-0.012-	1	-0.013-	-0.061-	0.015	-0.098-	-0.041-	-0.204-*	0.010	0.169*	0.041
	Sig. (2-tailed)	0.356	0.880		0.872	0.450	0.850	0.229	0.619	0.011	0.906	0.037	0.618
	N	153	153	153	153	153	153	153	153	153	153	153	153
Period working in PHC	Pearson Correlation	0.266**	0.398**	-0.013-	1	0.070	0.018	0.199*	0.400**	0.237**	-0.012-	0.119	-0.014-
	Sig. (2-tailed)	0.001	0.000	0.872		0.387	0.824	0.014	0.000	0.003	0.883	0.142	0.865
	N	153	153	153	153	153	153	153	153	153	153	153	153
ACLS	Pearson Correlation	0.157	0.143	-0.061-	0.070	1	0.094	0.232**	0.109	0.091	0.184*	0.058	0.225**
	Sig. (2-tailed)	0.053	0.077	0.450	0.387		0.250	0.004	0.179	0.263	0.023	0.480	0.005
	N	153	153	153	153	153	153	153	153	153	153	153	153
ECG	Pearson Correlation	0.077	0.033	0.015	0.018	0.094	1	-0.060-	0.036	0.222**	0.293**	0.077	0.299**
	Sig. (2-tailed)	0.346	0.683	0.850	0.824	0.250		0.463	0.657	0.006	0.000	0.344	0.000
	N	153	153	153	153	153	153	153	153	153	153	153	153
Number of patients managed with ACS	Pearson Correlation	0.029	0.077	-0.098-	0.199*	0.232**	-0.060-	1	0.306**	0.181*	0.171*	-0.006-	0.144
	Sig. (2-tailed)	0.721	0.345	0.229	0.014	0.004	0.463		0.000	0.026	0.035	0.937	0.077
	N	153	153	153	153	153	153	153	153	153	153	153	153
Number of patients you see per week	Pearson Correlation	-0.050-	0.290**	-0.041-	0.400**	0.109	0.036	0.306**	1	0.539**	0.179*	0.149	0.154
	Sig. (2-tailed)	0.537	0.000	0.619	0.000	0.179	0.657	0.000		0.000	0.026	0.066	0.057
	N	153	153	153	153	153	153	153	153	153	153	153	153
Average days of clinic per week	Pearson Correlation	0.058	0.223**	-0.204-*	0.237**	0.091	0.222**	0.181*	0.539**	1	0.169*	0.056	0.191*
	Sig. (2-tailed)	0.478	0.006	0.011	0.003	0.263	0.006	0.026	0.000		0.037	0.488	0.018
	N	153	153	153	153	153	153	153	153	153	153	153	153
Knowledge	Pearson Correlation	-0.057-	0.194*	0.010	-0.012-	0.184*	0.293**	0.171*	0.179*	0.169*	1	0.197*	0.634**
	Sig. (2-tailed)	0.482	0.016	0.906	0.883	0.023	0.000	0.035	0.026	0.037		0.015	0.000
	N	153	153	153	153	153	153	153	153	153	153	153	153
Attitude	Pearson Correlation	-0.116-	-0.037-	0.169*	0.119	0.058	0.077	-0.006-	0.149	0.056	0.197*	1	0.301**
	Sig. (2-tailed)	0.154	0.652	0.037	0.142	0.480	0.344	0.937	0.066	0.488	0.015		0.000
	N	153	153	153	153	153	153	153	153	153	153	153	153
Practice	Pearson Correlation	-0.221-**	0.133	0.041	-0.014-	0.225**	0.299**	0.144	0.154	0.191*	0.634**	0.301**	1
	Sig. (2-tailed)	0.006	0.102	0.618	0.865	0.005	0.000	0.077	0.057	0.018	0.000	0.000	
	N	153	153	153	153	153	153	153	153	153	153	153	153

Table 9: Multiple regression analysis of knowledge, attitude, and practice, 2018.

Model	Knowledge				Attitude				Practice			
	Unstandardized coefficients	P-value	95% confidence interval		Unstandardized coefficients	P-value	95% confidence interval		Unstandardized coefficients	Sig P-value	95% confidence interval	
	B		Lower Bound	Upper Bound	B		Lower Bound	Upper Bound	B		Lower Bound	Upper Bound
Specialty	1.040	0.212	-0.598-	2.679	-0.929-	0.356	-2.910-	1.053	-3.977-	0.010	-6.998-	-0.957-
Graduation year	1.398	0.037	0.082	2.713	-1.570-	0.053	-3.160-	0.019	0.131	0.918	-2.377-	2.640
Previous experience	0.042	0.950	-1.299-	1.383	1.616	0.047	0.021	3.211	0.530	0.678	-1.986-	3.046
ACLS	-0.166-	0.763	-1.248-	0.917	0.328	0.620	-0.977-	1.633	2.088	0.041	0.085	4.090
Knowledge	.	.	.	.	0.056	0.587	-0.147-	0.259	1.020	0.000	0.755	1.285
Attitude	0.038	0.587	-0.101-	0.178	.	.	.	.	0.302	0.021	0.045	0.559
Practice	0.289	0.000	0.214	0.365	0.125	0.021	0.019	0.231	.	.	.	.

respectively.

DISCUSSION

CAD including ACS is a major cause of morbidity and mortality worldwide. Chest pain related to the heart can present with various forms including atypical symptoms[12]. All measures should be taken to minimize time from onset to advanced interventions[10]. To achieve better outcomes, the present study assessed primary care physicians' knowledge, attitude, and practice toward ACS and their associated factors.

Data was compiled from a total of 153 respondents. Dammam and Alkobar PHC, Eastern Province, Saudi Arabia were included. The majority of participants were <40 years of age (94.1%) and 62.7% were female physicians, of which the majority were GPs (88.2%).

The survey results showed a higher diagnosis knowledge score (81.7%) compared to an initial treatment knowledge score (58.8%). Although, a lower score of treatment knowledge was also reported, indicating that family practitioners were less knowledgeable and less certain about key MI treatments. This finding highlights the need to involve more generalist physicians in clinical trials, particularly if they are a part of the health care system as most treatment guidelines are directed towards cardiologists[30].

Our study showed that physicians aged between 30–40 years was associated with better scores of initial management and diagnosis knowledge (P=0.006, P=0.038, respectively), which is similar to a previous survey reporting that physicians <40 years of age had greater knowledge of evidence-based therapies (P<0.05)[30].

Our study showed that 68.6% of the respondents had on average positive attitude towards ACS, possibly due to concerns about therapeutic complications and evolving patterns of treatment.

Our study showed that physicians' practice involving taking proper history and performing physical examination is 82.3%. Physicians who would start oxygen therapy was 71.9%. Overall, 64.7% of physicians ordered ECG and 65.3% stated that they currently adhere to diagnostic guidelines and initial management, while only 32.7% followed emergency protocols. A previous study showed that a generalist was less likely to use resources such as diagnostic tests or initiate treatment compared to specialists, which discouraged recommendation of generalists as the first contact in the treatment of ACS[31].

In the present study, the average number of patients with ACS managed in the PHC was associated with better initial management knowledge and practice. Similarly, a previous study revealed that a factor for better general outcomes was the presentation of larger numbers of patients with acute MI to caring facilities[32].

Our study showed that the number of years from the achievement of the last medical degree was significantly associated with knowledge (P=0.001). A similar, study showed unfavorable outcomes for every year since the graduation year of the treating physician[33]. This may be due to the lengthy years that lapse without training and indicates the need for continuous education.

Our study showed the percentage of physicians who would prescribe aspirin at the recommended dosage for patient with ACS was 78.4% and this was not significantly associated with age or practice. In contrast, physicians >50 years were reported to be less likely to prescribe aspirin to eligible patients (P=0.001)[34].

Our study showed that 86.3% of physician had worked <10 years in a PHC. A period of 5–10 years of service at a PHC was significantly associated with diagnosis and initial management knowledge (P=0.000, P=0.003, respectively). Indeed, a systematic review showed that the fewer number of years the physician worked, the higher the level of quality care[35]. Therefore, physicians who worked for many years may require quality improvement interventions.

The present study showed that 87.7% of physicians had no previous experience other than in PHC. Although previous experience can contribute to improving attitude, our study showed that 91.7% of respondents without previous experience actually scored a negative attitude (P=0.037). Primary care practitioners have been reported to have lower awareness, poorer practice patterns for the management of ACS when compared to emergency physicians[36]. These results illustrate the importance of training GPs in emergency medicine.

Our study showed that 39.9% of physicians were unaware that women usually exhibit an atypical presentation of ACS. Furthermore, 35.2% of attending physicians would not order ECG for patients presenting with chest pain. Only 46.7% would rely on their ECG interpretation skills. Attending an ECG course was significantly associated with physician practice of both ordering and interpreting ECG (P=0.000). Taken together the above tells us that there will be a percentage of female patients who will present with atypical chest pain that will unnoticed and will not be subjected to ECG. Furthermore, there was also a percentage of physicians who would not be willing to order ECG for patients with chest pain or will be hesitant to interpret results, despite 70% of physicians having attended an ECG course. This leads us to recommend promotion of structural ECG courses.

Study Strengths
To the researcher's knowledge, this is the first study in Saudi Arabia to assess knowledge, attitudes, and practice regarding ACS in PHC settings.

Limitations
We encountered some limitations. For example, this study did not assess the obstacles or barriers facing physicians regarding diagnoses and management of ACS. In addition, we did not have any information about whether or not physicians had previous experience in cardiac centers or if they had participated in workshops and chest pain training courses as a source of information. Conversely, the sample size of the study was small and did not represent the entire Eastern sector.

CONCLUSION
This study showed that PHC physicians have better diagnostic knowledge than initial management knowledge. Over two-thirds of physicians have a positive attitude, which is associated with previous experience that in turn is associated with a better knowledge score. Knowledge and attitude are predictors of practice. Thus, we recommend a comprehensive study to assess the level of physician's knowledge, attitude, and practice regarding ACS, using a dedicated questionnaire based on the degree of specialty. In addition, we

recommend that to promote the abilities of health care providers in our country, additional educational resources such as observed training in high-volume patient EDs with advanced cardiac facilities, and chest pain treatment guideline are necessary. Finally, a conduct well-structured interactive advanced ECG course is required.

List of Abbreviations:

ECG: Electrocardiography
ACS: Acute Coronary Syndrome
STEMI: ST-Elevated Myocardial Infarction
NSTEMI: Non-ST Elevated Myocardial Infarction
GP: General Practitioner
MOH: Ministry of Health
KSA: Kingdom of Saudi Arabia
PHC: Primary healthcare center
CHD: Coronary heart disease
IHD: Ischemic heart disease
ASA: Acetylsalicylic acid
NG: Nitroglycerin
SPSS: Statistical Package for the Social Sciences
ED: Emergency departments
OB/GYN: Obstetrics and gynecology
ENT: Ear, nose and throat
IRB: Institutional review board

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