

Sickle Cell Disease Management in Primary Health Care Centers, Knowledge, Attitude and Practice among Physicians, Qatif, Eastern Province, Kingdom of Saudi Arabia

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Abstract: ***Introduction:** There are numerous and different types of studies done on the management of Sickle Cell Disease, although they have been made on a hospital basis whether in Saudi Arabia or worldwide, whereas when searching the literature for primary health care centres based, data was limited. **Methods:** This is a cross-sectional study conducted in Qatif region, Eastern Province, KSA, in the period between May 2019- May-2020. Primary health centers (36 centers) belonging to MOH in Qatif region with approximately 160 physicians were included in this study. Primary health care physicians including general practitioners, family medicine diplomas, and board-certified were surveyed. Other physician's specialties working in PHC such as radiologists, pediatricians, and dentists were excluded. Total coverage sampling was used with an electronic questionnaire were sent by emails and mobile messaging programs. The dependent variables were PHC physicians' level of knowledge towards SCD management, attitude towards SCD management, and practices towards SCD management. **Results:** Out of 111 participants included from PHC Centers in Qatif and Dammam sectors, 44.1 % are males and 55.9 % are females. Most of the participants were 25-35 years old while only 2.7 % were above 55 years old. The participants were selected from Qatif region, based on the inclusion criteria, because SCD is common mainly in Qatif region. About 95.5 % of the participants were Saudis. **Conclusion:** Although three-quarters of the doctors answered the majority of questions correctly, the level of knowledge is considered inadequate regarding SCD, particularly in aspects of screening and management of SCD patients. Despite the positive attitudes regarding SCD treatment, the majority of doctors were not confident in the effect of treatment on patients' quality of life. Practices such as referral to the hematologists and prescription of folic acid were the most commonly reported practices.*

Keywords: Sickle Cell Disease Primary Health Care Centers Knowledge, Attitude, and Practice Qatif, Eastern Province, Kingdom of Saudi Arabia

List of Abbreviations

SCD	Sickle Cell Disease
MOH	Ministry of Health
PHC	Primary Health Care
SPSS	Statistical Package for the Social Sciences
QCH	Qatif Central Hospital
KSA	Kingdom of Saudi Arabia
IRB	Institutional Research Board
NICE	National Institute for Health and Care Excellence
ANOVA	Analysis of Variance
MRA	Magnetic Resonance Angiogram
MRI	Magnetic Resonance Imaging
TCD	Trans-Cranial Doppler

1. Introduction

Sickle cell disease (SCD) is an autosomal recessive disease defined as ‘a group of haemoglobin disorders in which the sickle beta-globin gene is inherited’, and associated with high morbidity and mortality (1).

SCD affects 20-25 million people globally (2). Regions and countries such as Mediterranean region, India, sub-Saharan African region, and kingdom of Saudi Arabia are considered as high prevalence areas, with region-to-region variations in the prevalence reaching as high as 45% in Uganda (3). Since it is first reported in the Eastern Province in Saudi Arabia in 1960s (4), SCD continues to be a major health issue in the

country requiring special attention as it has been shown associated with significant increase in emergency department visits compared to the general population (5), whereas deaths under the age of 30 years in SCD patients accounted for 73% (6). The prevalence of the disease has been estimated to be 1.4%, while the trait conditions range between 2 to 27%, among the country with the highest prevalence being in the eastern and southern regions (7).

Continuous comprehensive care for sickle cell disease patients is crucial. It involves: complete medical history and examination, investigations, health education, vaccinations, prophylactic antibiotics, modification of help-seeking behaviours, and screening for complications (8).

Management of acute health issues in SCD patients mainly acute painful crisis, represents a complex medical challenge based on the three principles of adequate hydration, adequate analgesia, and treatment of the precipitating factors, and contributing comorbidities (9).

Hydroxyurea is one of the main medications used for chronic management for SCD in matched criteria patients (10). In Saudi Arabia; initiation, monitoring and dosage modification for hydroxyurea are done in hospitals by hematologists.

Both international guidelines (Evidence-Based Management of Sickle Cell Disease: Expert Panel Report, 2014 (11),

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National Institute for Health and Care Excellence (NICE) quality standard on sickle cell disease), and national guidelines (The Management of Sickle Cell Disease Guideline Panel Members Saudi Expert Panel 2015) has been developed.

There are numerous and different types of studies done on the management of SCD, although they have been made on hospital basis whether in Saudi Arabia or worldwide, whereas when searching the literature for primary health care centres based, data was limited, including one study regarding patients' awareness about sickle cell anaemia, but lacking any studies regarding knowledge, attitude, and practice among physicians in PHCs toward management of SCD (12).

2. Methods

A cross sectional study conducted in Qatif region, Eastern Province, KSA, in the period between May 2019- May-2020. Thirty-six Primary Care centers in Qatif area that approximately 160 physicians working on these centers were included in this study. Primary health care physicians including general practitioners, family medicine diploma, and board certified were surveyed. Other physician's specialties working in PHC such as radiologist, pediatrician, and dentists were excluded. Total coverage sampling was used with electronic questionnaire were sent by emails and mobile messaging programs. The dependent variables were PHC physicians' level of knowledge towards SCD management, attitude towards SCD management, and practices towards SCD management. Independent variables included demographic and background variables data such as age, gender, nationality, level of education, working experience years, average of SCD encountered per week.

The study was conducted via an electronic questionnaire that were sent to the targeted physicians including a consent, aim of the study, explanations, and confidentiality research standards. The questionnaire consists of 4 parts; demographic data, knowledge, attitude, and practice. It is based on the expert panel guidelines for sickle cell disease 2014, NICE guidelines and the Saudi panel of expert guideline.

Testing the reliability and validity of the test were conducted through the questionnaire being distributed to family medicine residents in Family Medicine Academy, First health cluster in Eastern Province. The results of pilot were not included in the final research results.

Data were entered and analyzed by SPSS 23 edition. Continuous data were presented as means and standard deviations, and categorical as frequencies and percentages. The t-test and ANOVA test were used to determine the association of physicians' demographic data with knowledge and practice scores. A chi-square test was used to test the association of attitude (positive or negative) with physician's' demographic data. A linear regression was used to assess the significant predictors.

IRB were obtained from MOH EP IRB. Research data were kept confidential, and for research purpose only. Consent

was taken from all participants before stating the study. Participants allowed leaving the study at any time.

3. Results

Out of 111 physicians included from PHC Centers in Qatif and Dammam sectors, 44.1% are males and 55.9% are females. Most of the physicians were 25-35 years old while only 2.7% were above 55 years old. The physicians were selected from Qatif region, based on the inclusion criteria, because SCD is common mainly in Qatif region. About 95.5% of the participants were Saudis. Regarding the last certification degree obtained, 62.2% had only a bachelor degree, while 28.8% with a degree from Family Medicine certified practitioners. However, only, 42.3% of the participants reported previous training in SCD. The average of patients seen per month was <400 patients encountered by the majority of the included doctors. About 84% of the doctors encountered 1-5 patients with SCD per week (table 1).

The overall score of knowledge for all respondents ranged from 6 to 19 with mean (SD) = 13.97 (2.27). If the mean score for a respondent ≥ 12.6 ($\geq 60\%$ correct answers), the respondent was considered to have high knowledge. The score below this cut-off point was an indication of low knowledge about SCD. Based on this cut-off point, 74.8% of the respondents had a high knowledge about SCD. Table 2 shows the level of knowledge about causes and prevention of SCD among the health professionals in PHCs (6 items). A high level of knowledge about the importance of meningococcal and streptococcal vaccination in SCD patients was reported among 81% and 90% of the respondents, respectively. There was a low knowledge that SCD is caused only by the hemoglobin SS with 44.1% of the respondents incorrectly answered this question.

Table 3 demonstrates the knowledge about clinical presentation and diagnosis in SCD among the health professionals in PHCs (5 items). The highest percentage of correct answers (96%) was in the item of signs related to assessment of acute chest syndrome such as chest pain, fever, or signs and symptoms of hypoxia. The lowest percentage of correct answers (9.0%) reported in the item "SCD patient with temperature $> 38.5^{\circ}\text{C}$ (101°F) considered as an emergency". About a half of the doctors knew that Hand Foot Syndrome is one of the earliest presentations of SCD, and more than half were aware about the use of Trans-Cranial Doppler (TCD).

The items of knowledge about management of SCD among the doctors in PHC centers are presented in table 4. Generally, the knowledge was good in many items such as indication of routine blood transfusion and the routine treatment of acute painful episodes with 97.3% of the respondents answered correctly. However, the knowledge was low in items such as "if intravenous hydration is superior to oral hydration in acute painful crisis" and "if priapism is an indication for acute simple blood transfusion", with 18.5% and 47.7% correct answers, respectively.

Table 5 presents the study finding in regards to the attitudes of the PHCs' doctors towards SCD. The percentages of

agreement were high for items that reflect high awareness of the doctors towards SCD importance (86%), necessity of patients' education (91%), and necessity of doctors' training on SCD (87%). However, lower agreement was reported in appropriateness of current PHC facilities to manage SCD (12.6%) and professional confidence to manage SCD (35.1%). About 80% believed applying Saudi national guideline for SCD in practice will be extremely helpful.

The common practices of the health doctors in management of patients with SCD are presented in table 6. About referral of patients, 89% of the doctors always refer suspected acute chest syndrome patients to ER, while only 21% always refer SCD patients to the hospital for health maintenance evaluations and investigation. Regarding the prescription practices, 75% of the doctors said they always prescribe folic acid tablets for all SCD patients, while only 11% said they always prescribe prophylactic antibiotics for pediatric SCD patient up to age of 5 years. About 54% of the doctors claimed they always prescribe NSAIDs for SCD patient with mild to moderate pain who report relief with NSAIDs and do not have contraindications. The counselling about hydroxyurea was always offered by 20% of the doctors; and the health education to SCD patients was claimed to be always practiced by 35% of the doctors.

Table 7 demonstrates association between the respondents' characteristics and their knowledge about SCD using t-test. There were no significant differences between males and females in regards to the mean scores of the knowledge towards SCD. Saudi primary care physicians had lower scores in knowledge regarding SCD in comparison to non-Saudis but the difference was not statistically significant. The respondents who had previous training in SCD recorded significant higher scores than those who had no training ($p=0.010$).

The associations between the respondents' characteristics and their knowledge about SCD (using One-way ANOVA) were presented in table 8. No significant differences were detected when comparing means scores of knowledge between age groups ($p=0.660$), years of experience ($p=0.352$), and average of patients encountered per month ($p=0.908$). About last training certificate, the scores were significantly lower among doctors with bachelor in comparison to those with family medicine certified practitioners. In addition, there was a significant difference between groups of average of SCD you encounter per week. However, due to very small number of participants in groups (6-10 patients) and (>10 patients) the post hoc test could not be conducted.

We used the multiple linear regressions to model the association between the respondents' characteristics and their overall score of knowledge about SCD. We included in the model only variables showed significant associations in the bivariate analysis using t-test and ANOVA. The predictors such as last training certificate and MOH sector preserve their statistical significance. In contrast, predictors such as previous training on SCD and average of SCD patients per week have lost their significant association with the level of doctors' knowledge. The adjusted R² of 0.17

means that these three predictors accounted for 17% of the changed in knowledge about SCD (table 9).

4. Discussion

The findings of the present study revealed that the overall score of knowledge arrange from 6 to 19 with mean (SD) = 13.97 (2.27). Similarly, a mean overall score of SCD knowledge 11.3 (with maximum score of 17) was reported among Nigerian community health workers (13). Moreover, in the Nigerian female health workers, mean level of knowledge about complications of SCD among pregnant women was 4.3, from a maximum score of 6, which indicated a good level of knowledge (14).

Based on a predetermined cut-off point in this study ($\geq 60\%$ correct answers), about 75% of the respondents had a high knowledge about SCD. In Brazil, about 75% of a sample of doctors and nurses were found aware about SCD. The scores of correct answers were high ($>60\%$) in all aspects of disease epidemiology, clinical manifestations, and management. However, the highest score (71.6%) was in the questions about epidemiology of the disease (15).

There was a low knowledge that SCD is caused only by the hemoglobin SS with only 55.9% of the respondents correctly answered this question. The findings of study that assessed the knowledge of American community health students revealed that 92.7% were aware about inheritance pattern of SCD (16). Similarly, about 92% of Nigerian community health workers were aware about the inheritance pattern of SCD (13).

The highest percentage of correct answers (96%) was in the item of signs related to assessment of acute chest syndrome such as chest pain, fever, or signs and symptoms of hypoxia. Similarly, a good level of awareness about clinical manifestations was found among American community health students with 84.9% were able to describe the clinical features of SCD (16). The awareness about clinical manifestations (such as anemia, recurrent pain and jaundice) among Nigerian community health workers ranged from 78% to 89% (13).

In the present study, more than half of the doctors were aware about the use of Trans-Cranial Doppler (TCD) in SCD screening. A study recruited 141 physicians treating children with SCD found 92% of the doctors in agreement with use of TCD for screening of children with SCD (17). The awareness about SCD among Nigerian doctors was inadequate with 65.1% knew about national screening program (18). However, the knowledge about prenatal screening was very low in Nigerian community health workers where only 32.4% were aware about prenatal screening and 26.4% knew about neonatal screening (13).

The percentages of agreement were high for items that reflect high awareness of the doctors towards SCD importance (86%), necessity of patients' education (91%), and necessity of doctors' training on SCD (87%). A study among doctors from the United States found the highest correctly answered question was about the importance of antibiotic prophylactic therapy in children with SCD or with

sickle cell trait, which were answered correctly by 97.1% and 96.4% of the physicians (19). While in the present study, only 11% said they always prescribe prophylactic antibiotics for pediatric SCD patient up to age of 5 years. About 29% of Nigerian doctors were found not aware about the national guidelines of SCD management (18). Congolese doctors, the adherence to the guidelines regarding management of SCD crisis was low with only 44% claimed they adhere to the guidelines (21). The majority of the doctors treated acute anemia with red blood cell transfusion (21), while in this study 80.2% of the physicians agreed that applying the national guideline will be helpful.

In the present study, the respondents who had previous training in SCD recorded significant higher knowledge than those who had no training. Doctors training in screening, diagnosis, and management of SCD was described as "barely adequate or inadequate" by 19.6%, 28.5%, and 39.3% of American obstetricians and gynecologists, respectively (20). In the present study, 42.3% of the doctors claimed that they have been trained in SCD practice. Thus, the majority (65%) said they feel confident to manage an SCD patient. The lack of training was highlighted by 79% Congolese doctors as the main obstacle of SCD management (21).

About 80% believed applying Saudi National Guideline for SCD in practice will be extremely helpful. About 67% of American physicians stated that they were not highly familiar with national guidelines about TCD screening of SCD (17)., while 97% of American obstetricians and gynecologists reported they routinely screened patients from African origin for SCD (20). In case of one of the parents screened positive for SCD, another parent is screened. If both parents tested positive, 90% of the American obstetricians and gynecologists referred the child to a hematologist (20). This similarity about importance of applying guideline that help practitioner to give better patient care in referring of patients with SCD, 89% of the doctors always refer suspected acute chest syndrome patients to ER, while only 21% always refer SCD patients to the hospital for health maintenance evaluations and investigation. In a study investigated reasons of not recommending use of TCD for SCD screening, physicians stated referral of SCD patients to hematologists as the most common reason (17). The referral practice was very low in Nigerian health facilities where only 15.2% of PHC centers referred SCD patients to a tertiary hospital (13).

Regarding the prescription practices, 75% of the doctors said they always prescribe folic acid tablets for all SCD patients. A lower percentage of American obstetricians and gynecologist (56.2%), who have previously treated an SCD patient, knew the recommended daily dose of folic acid for pregnant mothers with SCD (20). A lower level of knowledge was reported among Nigerian community health workers with only 37.4% had knowledge about the role of folic acid and antibiotics in the management of crisis in SCD patients.

There were no significant differences between males and females in regards to the mean scores of the knowledge towards SCD. Gender was non significantly associated with

level of knowledge of American physicians regarding antibiotic prescription guidelines (19). A similar levels of knowledge in males and females were found among Nigerian health workers (13).

In our study Saudi health workers had lower scores (less knowledge) towards SCD than non-Saudi health workers but the difference was not statistically significant. Similarly, American physicians from different race were not statistically different in the knowledge about antibiotic prescription among children with SCD (19). There were no significant differences in the level of knowledge between religious groups in Nigerian female health workers (14).

No significant differences were detected when comparing means scores of knowledge between respondents with different years of experience. These findings are in agreement with the results of the American study assessed the effect of years of experience in the knowledge about antibiotic prescription for children with SCD (19). Similarly, no significant effect of the length of service on knowledge about SCD in a sample of Nigerian community health workers (13). Among Nigerian health workers, the difference in the knowledge of SCD complications during pregnancy between doctors and nurses was found statistically non-significant, while the difference between them (doctors and nurses) and other health workers was statistically significant (14).

No significant differences were detected when comparing means scores of knowledge between doctors with different average of patients encountered per month. Differently, the interaction term between pediatric specialty and the average number of SCD patients encountered by the pediatrician was found significantly related to the knowledge about antibiotic prescription (19).

The logistic regression for significant predictors in the present study such as last training certificate and MOH sector preserve their statistical significance, while variables such as previous training on SCD and average of SCD patients per week have lost their significant association with the level of doctors' knowledge. The importance of training was highlighted by an American study conducted logistic regression to predict factors influencing the prescription antibiotic prescription in SCD patients. Pediatric specialty and type of practice, medical school practice, were found significantly associated with recommended prescribing behavior (19).

In Saudi Arabia, to the best of our knowledge, this is the first study aimed to assess the knowledge, attitudes and practices regarding SCD among medical practitioners. The available studies focused on the knowledge assessment among general population (22), students (23), and SCD patients (12).

5. Conclusion

Although three quarters of the doctors answered the majority of questions correctly, the level of knowledge is considered inadequate regarding SCD, particularly in aspects of screening and management of SCD patients. Despite of the

positive attitudes regarding SCD treatment, the majority of doctors were not confident in the effect of treatment on patients' quality of life. Practices such as referral to the hematologists and prescription of folic acid were the most commonly reported practices.

6. Recommendations

- Conduction of educational programs targeting patients to improve management of sickle cell disease.
- Conduction of training programs aimed at improving knowledge among primary health care physicians regardless of gender, nationality or years of experience since these variables had no significant differences in knowledge about SCD.
- Motivating the implementation of Saudi national guideline for SCD in practice, since most PHC's physicians' though it will be so helpful in dealing with SCD patients.
- Because of reported low rate of referral to the hospital for health maintenance evaluations and investigation, advocacy of clear referral policy is important.

7. Acknowledgement

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8. Conflict of Interests

The authors declared no conflict of interests.

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Table 1: Demographic and background characteristics of the respondents (n=111)

Respondents' characteristic	Frequency	Percent (%)
Gender		
Male	49	44.1
Female	62	55.9
Age group		
25-35	68	61.3
36-45	33	29.7
46-55	7	6.3
>55	3	2.7
Sector		
Qatif	108	97.3
Dammam	3	2.7
Last certification degree obtained		
Bachelor	69	62.2
Family Medicine Diploma	4	3.6
Family Medicine Board	32	28.8
Others	6	5.4
Nationality		
Saudi	106	95.5
Non-Saudi	5	4.5
How many years have you been working in PHC centers?		
Less than 1 year	2	1.8
1 to 5 years	35	31.5
More than 5 years	74	66.7
Have you ever been trained in SCD practice?		
Yes	47	42.3
No	64	57.7
What is the average of SCD you encounter per week?		
None	13	11.7
1-5 patients	93	83.8
6-10 patients	3	2.7
> 10 patients	2	1.8
8. What is the average of all patients you encounter per month?		
Less than 400	72	64.9
401 - 800	30	27.0
More than 800	9	8.1

Table 2: The knowledge about causes and prevention of SCD among the doctors in PHCs (6 items)

Item	Frequency	Percent (%)
Sickle cell disease (SCD) mode of inheritance is an autosomal dominant		
Correct answers	84	75.7
Incorrect answers	27	24.3
SCD is caused only by the hemoglobin SS		
Correct answers	62	55.9
Incorrect answers	49	44.1
Health maintenance screening include all the following: Immunizations, Physical exam, Lab evaluations, MRI/MRA, Pulmonary function tests, Echo cardiogram, Neurologic- neuropsychological testing, Avascular Necrosis, retinal examination.		
Correct answers	87	78.4
Incorrect answers	24	21.6
In Premarital counselling of couples one with beta thalassemia trait and her/his partner with sickle cell trait, your advice will be (safe marriage).		
Correct answers	81	73.0
Incorrect answers	30	27.0
Meningococcal vaccine should be given, if not administered in the previous 3 years.		
Correct answers	90	81.1
Incorrect answers	21	18.9
All SCD patients have to be vaccinated against streptococcus pneumonia.		
Correct answers	100	90.1
Incorrect answers	11	9.9

Table (3): The knowledge about clinical presentation and diagnosis of SCD among the doctors in PHCs (5 items)

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Items	Frequency	Percent (%)
Hand Foot Syndrome is one of the earliest presentations of SCD.		
Correct answers	54	48.6
Incorrect answers	57	51.4
People with an acute painful sickle cell episode are assessed for acute chest syndrome if they have 1 or more of the following: abnormal respiratory signs or symptoms, chest pain, fever, or signs and symptoms of hypoxia.		
Correct answers	107	96.4
Incorrect answers	4	3.6
SCD patient with temperature > 38.5° C (101°F) considered as an Emergency.		
Correct answers	10	9.0
Incorrect answers	101	91.0
Any acute neurologic symptom other than mild headache, even if transient, requires urgent evaluation.		
Correct answers	100	90.1
Incorrect answers	11	9.9
Trans-Cranial Doppler (TCD) is a non-invasive ultrasonographic technique used to measure velocities of the internal carotid or middle cerebral arteries.		
Correct answers	62	55.9
Incorrect answers	49	44.1

Table 4: Knowledge about management of SCD among the included doctors in PHC centers (10 items)

Items	Frequency	Percent (%)
Hydroxyurea could be offered to SCD patients from age 9 months regardless of clinical severity.		
Correct answers	18	16.2
Incorrect answers	93	83.8
Hydroxyurea to be initiated with history of severe or recurrent acute chest syndrome.		
Correct answers	89	80.2
Incorrect answers	22	19.8
Hydroxyurea to be initiated in adult SCD patients with history of pain that interferes with daily activities and quality of life.		
Correct answers	107	96.4
Incorrect answers	4	3.6
In pregnant and breast feeding SCD patient, hydroxyurea should be discontinued.		
Correct answers	68	61.3
Incorrect answers	43	38.7
Routine blood transfusion is recommended for all SCD patients.		
Correct answers	108	97.3
Incorrect answers	3	2.7
Priapism is an indication for acute simple blood transfusion.		
Correct answers	53	47.7
Incorrect answers	58	52.3
Aplastic crisis indicates acute exchange blood transfusion.		
Correct answers	63	56.8
Incorrect answers	48	43.2
The treatment of acute painful episodes is mainly adequate hydration and adequate analgesia.		
Correct answers	108	97.3
Incorrect answers	3	2.7
Acute Chest Syndrome managed such as vaso-occlusive crises.		
Correct answers	79	71.2
Incorrect answers	32	28.8
In acute painful crisis, intravenous hydration is superior to oral hydration.		
Correct answers	21	18.9
Incorrect answers	90	81.1

Table 5: The attitudes of the PHCs' doctors towards SCD

Item	Frequency	Percent (%)
SCD is a major health concern in the region		
Neutral or disagree	16	14.4
Agree	95	85.6
PHC physicians can manage most of the SCD patients' health issues.		
Neutral or disagree	64	57.7
Agree	47	42.3
PHC physicians need more training to manage most of the SCD patients' health issues.		
Neutral or disagree	15	13.5
Agree	96	86.5
The current PHC facilities (medication, investigations, ...etc.) are appropriate to manage most of the SCD patients' health issues.		
Neutral or disagree	97	87.4
Agree	14	12.6

The management of SCD patients in PHC centers can improve their quality of life.		
Neutral or disagree	39	35.1
Agree	72	64.9
Hospitals are the only places to manage SCD patients		
Neutral or disagree	58	52.3
Agree	53	47.7
I am competently managing my SCD patients.		
Neutral or disagree	72	64.9
Agree	39	35.1
I believe applying Saudi national guideline for SCD in practice will be extremely helpful.		
Neutral or disagree	22	19.8
Agree	89	80.2
I think that cognitive behavioral therapy can be beneficial for SCD patients.		
Neutral or disagree	33	29.7
Agree	78	70.3
I think that health education is important for SCD patients with chronic pain.		
Neutral or disagree	10	9.0
Agree	101	91.0

Table 6: The practices of the PHCs' doctors in regards to SCD

Items	Frequency	Percent (%)
I prescribe folic acid tablets for all my SCD patients.		
Always	83	74.8
Usually	23	20.7
Sometimes	5	4.5
Rarely or never	0	0
I make sure that all my SCD patients received their indicated vaccinations.		
Always	44	39.6
Usually	48	43.2
Sometimes	17	15.3
Rarely or never	2	1.8
I offer health education to all my SCD patients.		
Always	39	35.1
Usually	45	40.5
Sometimes	24	21.6
Rarely or never	3	2.7
I consider each SCD patient with temperature $>38.5^{\circ}\text{C}$ (101°F) as an Emergency.		
Always	50	45.0
Usually	40	36.0
Sometimes	20	18.0
Rarely	1	.9
I refer my SCD patients to the hospital for health maintenance evaluations and investigation		
Always	23	20.7
Usually	26	23.4
Sometimes	51	45.9
Rarely or never	11	9.9
46. I request urgent evaluation if any acute neurologic symptom occurs other than mild headache, even if transient.		
Always	68	61.3
Usually	30	27.0
Sometimes	8	7.2
Rarely or never	5	4.5
I offer counselling about hydroxyurea to SCD patients.		
Always	21	18.9
Usually	29	26.1
Sometimes	35	31.5
Rarely or never	26	23.4
I refer suspected acute chest syndrome patients to ER.		
Always	99	89.2
Usually	11	9.9
Rarely	1	0.9
I prescribe prophylactic antibiotics for pediatric SCD patient up to age of 5 years.		
Always	12	10.8
Usually	11	9.9
Sometimes	18	16.2
Rarely	25	22.5
Never	45	40.5
I prescribe NSAIDs for SCD patient with mild to moderate pain who report relief with NSAIDs and do not have contraindications.		

Always	60	54.1
Usually	38	34.2
Sometimes	10	9.0
Rarely or never	3	2.7

Table 7: Association between the respondents' characteristics and their knowledge about SCD using t-test

The characteristics of the respondents	Knowledges score of the respondents**			
	Mean score	SD	Test statistic	P value
Gender				
Male	14.0	2.5	0.111	0.912
Female	14.0	2.0		
Nationality				
Saudi	13.9	2.2	-0.63	0.530
Non-Saudi	14.6	2.9		
Previous training in SCD				
Yes	14.6	2.2	2.54	0.013*
No	13.5	2.9		
Sector				
Qatif	14.1	2.3	2.6	0.010*
Dammam	10.7	1.0		

*Statistically significant difference

**Score range = 6 – 19 and mean (SD) = 13.97 (2.27)

Table 8: Association between the respondents' characteristics and their knowledge about SCD (using One-way ANOVA)

The characteristics of the respondents	Knowledge scores of the respondents***			
	Mean score	SD	Test statistic(F)	P value
Age group				
25-35	13.8	2.4	0.54	0.660
36-45	14.3	1.8		
46-55	14.3	2.9		
>55	13.3	2.3		
Last training certificate				
Bachelor**	13.4	2.3	5.6	0.001*
Family Medicine Diploma	14.3	2.6		
Family Medicine Board	15.3	1.7		
Others	13.8	1.3		
What is the average of SCD you encounter per week?				
None	12.9	1.7	6.4	0.013*
1-5 patients	14.1	2.3		
6-10 patients	14.7	2.3		
> 10 patients	15.0	2.8		
Years of experience				
Less than 1 year	15.0	1.4	1.1	0.352
1 to 5 years	13.5	2.4		
More than 5 years	14.1	2.2		
What is the average of all patients you encounter per month?				
Less than 400	13.9	2.5	0.096	0.908
401 - 800	14.1	1.8		
More than 800	14.1	2.0		

*Significant difference

***Score range = 0 – 21 and mean =12.4 (2.3)

** Using Tukey post-hoc test, the significant difference was between bachelor holders and holders of family medicine board.

Table 9: Multiple linear regression modeling for the association between the respondents' characteristics and their overall score of knowledge about SCD

Predictors	Effect size	P value
Model		
Intercept	0.692	0.000
Last training certificate	0.082	0.033
MOH sector	0.040	0.042
Have you ever been trained in SCD practice?	0.029	0.086
What is the average of SCD you encounter per week?	0.029	0.388
R Squared = 0.23 (Adjusted R Squared = 0.17)		

