

# Assessment of Knowledge and Perceptions of Sickle Cell Disease in Eastern Province, KSA

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## Abstract

**Purpose:** The research aimed to empirically test the assessment of knowledge and perceptions of Sickle cell disease in the Eastern Province of Saudi Arabia. **Methodology:** A cross-sectional research design was employed to collect data from 1310 citizens of the eastern province of Saudi Arabia. Descriptive, independent sample T-test, ANOVA, and Post Hoc (Scheffé) tests were conducted using SPSS software. **Findings:** The results show moderate awareness across the information, knowledge, and perception domains. Findings also show significant differences based on gender, age, education level, and sources of information. Younger participants and those with higher education demonstrated better awareness, while females reported higher concern about Sickle cell disease. **Implications:** Based on the study findings targeted educational interventions and broader public health campaigns are recommended to enhance community understanding and improve Sickle cell disease prevention efforts. The study with findings highlighted a need for targeted educational programs that should focused on the younger and less educated populations to increase the awareness for Sickle cell disease.

**Keywords:** Sickle Cell Disease, Knowledge, Information, Saudi Arabia.

## INTRODUCTION

Genetics plays a greater or lesser role in most of the diseases. Diversity of our DNA and variations in how that DNA functions, along with the environment (which includes lifestyle), contribute to disease processes. Although genetic disorders are individually rare, they account for about 80% of rare disorders.<sup>[1]</sup> The genetic disorder becomes an important problem around the world among the 300000 to 400000 people. In other words, the sickle cell disease also becomes a crucial disease hemoglobinopathy worldwide.<sup>[2]</sup> Along with the global issue, it is also become a important disease in the Arab world (Saudi Arabia) including SCD, and glucose-6-phosphate dehydrogenase.<sup>[3]</sup>

The specific genetic mutation that occurs when GAG is altered to GTG leads to a significant amino acid

substitution in chain of the hemoglobin especially in the 6th position. This substitution results with the hydrophobic valine is replaced with hydrophilic glutamic.

<sup>[2]</sup> Referred to as hemoglobin S (HbS), this modified form of hemoglobin possesses distinct characteristics due to this molecular change.<sup>[4]</sup> These properties are responsible for the consequential symptoms associated with sickle cell anemia, including persistent pain, organ injuries, diminished quality of life, shortened lifespan, and, most notably, vaso-occlusive crises that cause painful episodes.

<sup>[5]</sup> Within this disease, red blood cells (RBCs) are damaged

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due to polymerization of deoxygenated hemoglobin S (HbS) therefore giving them their abnormal structure.<sup>[5]</sup> The disease can occur due to homozygosity for HbS as it is inherited in an autosomal recessive way.<sup>[6]</sup> Information about the prevalence of SCD in Saudi Arabia is irregular, but studies have reported that SCD is a relatively common genetic disorder in this part of the world. In comparison to other Middle Eastern countries,<sup>[7]</sup> Saudi Arabia has one of the highest prevalence rates of sickle cell disease SCD, at approximately 4.50%, according to Hamed *et al.*<sup>[8]</sup>. In certain places, up to 1.4% of people had SCD, whereas the carrier status for the disease varied from 2% to 27%. SCD in Saudi Arabia was initially noted in the 1960s in the Eastern province.<sup>[6]</sup> As a result, numerous national and regional screening studies were launched to ascertain the clinical traits and prevalence of SCD genes in various parts of Saudi Arabia.<sup>[9]</sup> Like many Arab nations, Saudi society is predominantly tribal, with large families and a high percentage of consanguineous marriages at such an early age.<sup>[10]</sup> Consequently, these populations will eventually exhibit the recessive gene of hereditary problems. Thus, there's a chance that this community will face major health problems.

The importance of knowing about genetic diseases in general and their awareness is becoming more and more crucial in the modern-day setting.<sup>[6]</sup> Public awareness can reduce the high incidence of such genetic disorders among these nations, as this type of knowledge can be utilized to better handle the disease and its development in the early stage, genetic disorders that can affect blood components are no exception, more specifically SCD.<sup>[8]</sup> Along with this importance and practical issue in Saudi Arabia, previous studies have also paid little attention to empirical studies in the context of Saudi Arabia<sup>[11-13]</sup> with a focus on other countries. On the other hand, previous studies also majorly focused on descriptive analysis or correlation but these studies have limited attention to independent sample t-tests and ANNOVA. In addition, previous studies also have mixed results.<sup>[14-19]</sup> These previous studies have shown a significant gap in empirical studies addressing certain practical issues, as much of the existing research tends to focus on other countries. This lack of localized research highlights the need for more Saudi-specific investigations that could better address the unique cultural, social, and economic factors at play within the country.<sup>[20,21]</sup> Thus, based on previous gaps, as per the researcher's knowledge, and despite the importance of genetic disorders in Saudi Arabia, there is no such related data in the eastern region of Saudi Arabia. Accordingly, this study aimed to estimate the level of awareness towards SCD, which might help to create a database that could be important in raising awareness inside the community for healthier future generations. The study's significance that research contributed to critically filling the gap in the existing literature through focusing on the specific context of Saudi Arabia and utilizing empirical approaches that have been

underexplored in previous research. While prior studies have concentrated on other countries and primarily employed descriptive or correlational analyses, this research contributed to estimating the level of awareness towards SCD which offers a more comprehensive understanding through advanced statistical methods such as independent sample t-tests and ANOVA. The study with methodology not only contributes valuable data on SCD awareness levels within Saudi Arabia but also creates a foundation for informed interventions. Practically, this research could also serve as a crucial tool for public health initiatives, allowing policymakers and healthcare professionals to develop targeted strategies for raising awareness and promoting healthier lifestyles. Ultimately, the study's findings could also contribute to establishing a comprehensive database that supports the creation of a well-informed community, laying the groundwork for healthier future generations in Saudi Arabia. The study was further divided into four chapters, literature review which discussed the previous studies, research methodology which discussed the research design, and data collection methods. Data analysis and results were analyzed data and interpreted the results. Lastly, discussion of the findings and implications of the study.

## LITERATURE REVIEW

Sickle Cell Disease (SCD) is a highly genetic condition that involves the manufacture of abnormal hemoglobin, called hemoglobin.<sup>[22]</sup> This condition causes red blood cells to be deformed into a sickle-like structure and has several effects on health. Common complications of SCD are stroke and also various other serious medical conditions.<sup>[23]</sup> The disease has significant social and economic implications, including increased healthcare costs and a reduced quality of life for those affected.<sup>[22]</sup> Knowledge and perceptions surrounding SCD play a critical role in management and prevention strategies. It is thus important for one to know how different populations perceive the disease to design better ways of educating the populace about the disease and the ways of preventing it.<sup>[24]</sup> The Health Belief Model for instance postulates that people will practice particular health behavior if they believe, the danger rate associated with a particular disease and if also, implementing that behavior will reduce the danger rate of getting that sickness.<sup>[25-27]</sup> In the context of SCD, individuals with a higher understanding of the disease's implications may be more inclined to seek medical advice, adhere to treatment regimens, and participate in screening programs.<sup>[28,29]</sup> Ibiyoye<sup>[30]</sup> further emphasized that knowledge of such perceptions of SCD can give an insight into the extent to which people would be willing to embrace preventive measures and health-seeking behaviors. There are various empirical studies have been conducted on SCD in various regions and these studies found mixed results. Brown *et al.*<sup>[31]</sup> investigate their research on SCD. For this purpose, data were collected through survey instruments. These findings show that perception and knowledge of SCD were

statistically different. Mukinayi Mbiya *et al.*<sup>[32]</sup> further researched to explore the awareness and attitudes toward SCD among healthcare providers. For this purpose, data was collected from professionals in the healthcare sector. The results findings show that respondents have a low level of knowledge among the healthcare providers in SCD but there were many knowledge deficits about the complications of SCD and the possible management options. This finding also emphasized that healthcare providers need to enhance their awareness of SCD so that they can be well-equipped to offer information and care to patients with SCD.

Hassan and AhmedQalawa<sup>[33]</sup> explored studies to test the awareness of diseases. For this data was collected from primary sources where findings indicated that most of the respondents showed poor health literacy on SCD. They further concluded that these findings could be useful in implementing SCD education in universities to enhance young adults' knowledge as potential a future practitioners. Druye *et al.*<sup>[34]</sup> also conducted a study to understand the awareness of SCD among teachers. The results revealed that a significant number of teachers had limited knowledge about SCD, which could affect their ability to provide adequate support for affected students. These findings emphasized that educational institutions should focus on the importance of SCD to increase awareness about this disease. Alzahrani *et al.*<sup>[6]</sup> further conducted a study on SCD where data was collected through a survey instrument to test the knowledge about SCD. The key findings show that the younger generation is more knowledgeable as compared to elders. These findings further showed that respondents who were more educated also had more knowledge about SCD. This highlights the importance of tailoring education initiatives to specific demographic groups to ensure maximum impact.

Another empirical study examined gender differences in knowledge and perceptions of SCD.<sup>[35]</sup> The researchers used a mixed-methods approach, combining quantitative surveys and qualitative interviews to collect comprehensive data from male and female participants, and the results showed that there was no statistical difference in the findings, indicating that both genders have the same information about the disease. It was also further highlighted that further research could be explored in other countries to know the variation in results. To assess the respondent's knowledge about SCD, further research was conducted by Surti *et al.*<sup>[16]</sup>. For this purpose, to collect the data respondents used the stratified sampling technique where data was collected using survey instruments. The results showed a positive and significant correlation between education level and SCD information. They further concluded that where individuals have more effective educational backgrounds then they are more likely to have greater awareness about SCD. The same results were also found in the study where they also found that when individuals have greater attention to educational improvement then their attention towards SCD also increased.<sup>[5,19,36]</sup> This emphasizes the need for targeted educational interventions that consider

individuals' educational backgrounds to enhance overall awareness and understanding of SCD.

Further study conducted to evaluate the awareness of SCD.<sup>[17]</sup> For this purpose, researchers used the survey instrument to collect data about the SCD. Their findings show that when individuals are provided greater interventions in the improvement of education level then their awareness towards SCD significantly increases. They claimed that as the study was restricted to a single nation, its conclusions could not be applied to other nations. They also suggested that additional research should be conducted in other nations to determine the variations in findings, particularly in Arab nations. Moreover, Shahin *et al.*<sup>[37]</sup> conducted on an assessment of knowledge about the SCD. These findings show that gender has a significant difference in the information on SCD. Further, their results concluded that males have greater knowledge of SCD as compared to the female. They also explained that there were higher levels of ignorance concerning SCD, and a majority of the women reported having developed a lot of fear and myths about the disease.

In another study<sup>[5,19,38,39]</sup> found significant differences based on the education level of respondents. They also emphasized the importance of incorporating SCD education into healthcare curricula has been highlighted across various studies. By equipping future healthcare providers with a thorough understanding of SCD, it is possible to improve patient care and support for individuals living with the disease. To this end, the formulation of a continuous professional education program for healthcare practitioners with a focus on SCD is highly desirable.<sup>[40-42]</sup> These previous studies have shown that assessment of knowledge and perception of Sickle disease reveals significant variations in different populations. These studies' literature suggests that enhancing awareness and understanding of SCD among parents, healthcare professionals, students, and the general population is important for improving health outcomes and quality of life for individuals affected by the disease. These previous studies highlighted a need for further research especially in the context of Saudi Arabia where previous studies have limited attention.

## RESEARCH METHODS AND SAMPLING TECHNIQUES

The study used the quantitative research approach where data was collected through survey instruments. From September to December 2023, a cross-sectional online survey was done with people who are over eighteen and live in the Eastern Province of the Kingdom of Saudi Arabia. Informed consent was cited on the front page of the survey. A sample consisting of (1310) citizens of the study population was chosen. The sample was randomly selected from the data of the total study population.

### Demographic Profile

Table 1 predicted results show the demographic profile of the respondents. In the demographic profile, there is a 49% representation of females (642) and 51% of males (668) in

the sample. The majority of participants are between the ages of 40 and 49 (29%), followed by those between the ages of 30-39 (24.2%) and 18-29 (21.1%). 37.6% of people only have a secondary education, whilst 33.7% have a higher education level. Social media stands as the most popular information source (33.6%), followed by family doctors (26.1%) and TV/newspapers/radio (17.4%). The above results are predicted in following Table.1 below,

**Table 1: Demographic Distribution.**

Variable	Variable Level	N	%
Gender	Male	668	51.0
	Female	642	49.0
Age	18-29	276	21.1
	30-39	317	24.2
	40-49	380	29.0
	50-59	248	18.9
	60 and above	89	6.8
Education level	Elementary	86	6.6
	Intermediate	291	22.2
	Secondary	492	37.6
	Higher education	441	33.7
	Health care centers	0.0	0.0
Source of Information	Family doctor	342	26.1
	Social media	440	33.6
	Official governmental websites	208	15.9
	Scientific lectures	92	7.0
	Private hospitals	0.0	0.0
	TV/Newspaper/Radio	228	17.4
	Other	0.0	0.0
<b>Total</b>		1310	100

### Questionnaire Survey

The questionnaire includes two main parts. First part comprises sociodemographic information and independent variables for the sample members to determine the

variables. (age, gender, education level, place of residence, source of information about SCD. The second part includes phrases of the questionnaire, consisting of 22 paragraphs distributed on three domains depicting the role of society in evaluating knowledge and awareness of SCD among members of society in Saudi Arabia.

### Pre-Testing and Pilot Test

Prior to concluding the survey instrument, it was validated by putting it in front of a group of referees who were experts in the same field. They were asked to evaluate the phrases based on their grammatical integrity, clarity, and applicability to the domains they implied. With 22 phrases dispersed across three domains—Knowledge, Information about SCD, and Perceptions and personal opinions—the final form of the questionnaire was modified in light of the arbitration’s outcomes, taking into consideration the arbitrators’ feedback. Furthermore, questionnaire was approved by the scientific research ethics committee of the Deanship of Scientific Research at King Faisal University. When the questionnaire was finalized by the specialist, it was tested to check the reliability of the construct. For the internal reliability of the construct Cronbach alpha and, Pearson correlation coefficient was extracted between the degrees of each phrase with the degree of its domain, by applying the tool to a survey sample of 30 citizens, as shown in Table (2). The findings displayed in Table (2) indicate that, at a significance level of (0.01), all correlation coefficients between phrase scores and domain scores were positive and significant, ranging from (0.489 to 0.877). The analysis’s findings support the questionnaire’s validity as well as its reliability, showing that all correlation coefficients are statistically significant

**Table 2: Construct Correlation Coefficients.**

Phrases	Correlation Coefficients	Significance
<b>Knowledge</b>		
Have you ever heard of Genetic diseases?	0.504**	0.004
“Have you ever heard of Sickle cell disease?”	0.877**	0.000
<b>Information about Sickle Cell Disease</b>		
“Sickle cell disease is one of blood diseases?”	0.522**	0.003
“There are different types of Sickle cell disease?”	0.621**	0.000
“Sickle cell disease is a genetic disease?”	0.787**	0.000
“Sickle cell disease is an infectious disease?”	0.635**	0.000
I am familiar with causes of Sickle cell disease	0.643**	0.000
Do you know the difference between being a carrier of a disease or an infected person	0.561**	0.001
Is it necessary for both parents to have sickle cell trait to give birth to an affected child?	0.706**	0.000
Is there a cure for Sickle cell disease?	0.554**	0.001
Is there a relationship between sickle cell disease and dietary pattern?	0.595**	0.001
Do you think sickle cell disease is fatal?	0.602**	0.000
<b>Perceptions and Personal Opinions</b>		
There is relationship between endogamy marriage and sickle cell disease	0.594**	0.001
I am aware of the existence of specialized tests to detect genetic diseases	0.548**	0.002
There are specialized centers in your region for testing for sickle cell disease	0.687**	0.000
It is possible that infection occurs through blood transfusion	0.489**	0.008
Education and health education are among the best ways to prevent sickle cell disease	0.774**	0.000
Pre-marital screening is one of the best ways to prevent sickle cell disease	0.841**	0.000
A genetic test should be performed before marriage	0.802**	0.000
Radio, television and newspaper are one of the best ways to increase people’s awareness of sickle cell disease	0.551**	0.004
Social media and mobile phone applications are one of the best ways to increase people’s awareness of sickle cell disease	0.696**	0.000
Educational health lectures are one of the best ways to increase people’s awareness of sickle cell disease	0.831**	0.000

Furthermore, to calculate the consistency coefficient, the questionnaire was applied to a sample of 30 citizens, by using the Cronbach Alpha equation, the consistency coefficient was calculated for each of the sub-domains as in Table (3). Through Table (3), it is evident that all consistency values are acceptable and can be reliable in assessing knowledge and awareness of SCD among community members in the Eastern province of Saudi Arabia.

**Table 3: Alpha Values.**

Domain	Number of Phrases	Cronbach Alpha
Knowledge	2	0.784
Information about sickle cell disease	10	0.853
Perceptions and personal opinions	10	0.865

### Data Analysis

The current study used the following statistical indicators i.e. “arithmetic average, standard deviation, Pearson correlation coefficient, Cronbach’s alpha coefficient of stability, the use of the independent samples T-test, the One-Way ANOVA and the Post Hoc (Scheffé) test” using SPSS (IBM, Armonk, NY, USA). The answer to the phrases of the questionnaire addressed to the respondent varied according to the domains, and the level of response were classified on the terms of the questionnaire as follows: The first and second domains (knowledge, information about SCD, the level of satisfaction on the expressions of this domain has been classified into 3 levels as follows:

**Table 3: Knowledge, Information about SCD.**

Low	Moderate	High
1 - 1.66	1.67 – 2.33	2.34 – 3.00

On the other hand, for the third domain (perceptions and personal opinions), level of satisfaction to the phrases of

this domain has been classified into 3 levels as follows:

**Table 4: Perceptions and Personal Opinions.**

Low	Moderate	High
1.991 -	2.992.0 -	4.03.0 -

## EMPIRICAL RESULTS

### Level of Assessment of Knowledge and Awareness about SCD among Community Members in the Eastern Province through Descriptive Analysis

This study included a total of 1310 participants, the data obtained from their responses were analyzed, and the arithmetic average and standard deviations were calculated for the respondents on the questionnaire assessing knowledge and awareness of SCD, as shown in table (4). Table.4 presents the results of three variables about SCD knowledge, information about SCD, and perception and personal opinions along with corresponding arithmetic averages, standard deviations, and degrees of satisfaction. Table 4 results show that awareness regarding [SCD] across all three domains is generally moderate. The “knowledge” domain has an average score of 1.94 with a standard deviation of 0.48, reflecting moderate awareness but a slightly more consistent response among participants. The “information about SCD domain shows a higher average of 2.16 with a standard deviation of 0.59, indicating moderate awareness, though with more variability in responses. Lastly, the “perceptions and personal opinions” domain has the highest average at 2.82, with a standard deviation of 0.55, suggesting that while perceptions about SCD are still moderate, participants show relatively stronger opinions or awareness in this area. These results highlight the need for targeted interventions to improve knowledge and perceptions about SCD in the community. The above results are predicted in Table.4 below,

**Table 4: The Arithmetic Average and Standard Deviations to Measure the Level of Assessment of Knowledge and Awareness Towards SCD for the Study Sample Members in the Main Domai.**

Number	Domain	Arithmetic Average	Standard Deviation	Degree of Satisfaction
1	Knowledge	1.94	0.48	moderate
2	Information about SCD	2.16	0.59	moderate
3	Perceptions and personal opinions	2.82	0.55	moderate

### Level of Assessment of Knowledge and Awareness about SCD According to Different Variables

In this section, first analyses were conducted individually like gender, education, and age then analyzed through the combined model.

#### Individual Variables Analysis Gender Perspective

In order to analyze the total knowledge and awareness of the participants according to sociodemographic traits, here in this study we first studied the influence of gender on knowledge. The arithmetic average, standard deviations, and the t-test were calculated for two independent samples as shown in Table (6). We found apparent differences

in the arithmetic average of the level of assessment of knowledge and awareness of SCD according to gender. There were no statistically significant differences at the level of significance ( $\alpha \leq 0.05$ ) according to the gender variable in the knowledge domain, where the significance value (0.78) associated with the T-test = 1.762 (higher than the level of statistical significance) ( $\alpha \leq 0.05$ ) that is, the average assessment of knowledge and awareness of SCD does not differ according to the gender in the domain of knowledge. Interestingly there were a statistically significant differences at the level of significance ( $\alpha \leq 0.05$ ) in the arithmetic average assessment of knowledge and awareness towards SCD according to the gender variable in the domain of information about (SCD) and also in

the domain of personal perceptions and opinions, where the significance value (0.17) and (0.001) associated with the (T-test = 2.392) and (T-test=3.348) respectively, and both are less than the level of statistical significance ( $\alpha \leq 0.05$ ), meaning that the average assessment of knowledge

and awareness of SCD varies according to gender in the domain of information about SCD and also in the focus of perceptions and personal opinions, and the differences were in favor of males in both domains. The above results are predicted in Table.6,

**Table 6: Means, Standard Deviations, and t-test to Measure the Level of Assessment of Knowledge and Awareness Towards SCD According to the Gender Variable.**

Domain	Gender	Arithmetic Average	Standard Deviation	t-test	Sig.
Knowledge	Male	2.19	0.59	1.762	0.078
	Female	2.13	0.59		
Information about sickle cell disease	Male	1.97	0.49	2.392	0.017
	Female	1.91	0.46		
perceptions and personal opinions	Male	2.87	0.54	3.348	0.001
	Female	2.77	0.56		

**Age Perspective**

To study the influence of age on knowledge and awareness about SCD, here the arithmetic average and standard deviations were calculated and a One-Way ANOVA test was performed, as shown in table (7). Results revealed that there are statistically significant differences in the arithmetic average assessment of knowledge and awareness

towards SCD according to the age variable and on all domains, where the significance value associated with the F test is less than the level of statistical significance ( $\alpha \leq 0.05$ ), which indicates that average rating for knowledge and awareness of SCD varies with age. The above results are predicted in Table.7 below,

**Table 7: The Results of One-Way ANOVA to Detect the Presence of Statistically Significant Differences to Measure the Level of Knowledge Assessment and Awareness of SCD According to the Age Variable.**

Domain	Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F	Sig.
Knowledge	Between groups	42.649	4	10.662	33.376	0.000
	Within groups	416.892	1305	0.319		
Information about sickle cell disease	Between groups	7.466	4	1.866	8.457	0.000
	Within groups	288.020	1305	0.221		
perceptions and personal opinions	Between groups	37.613	4	9.403	34.538	0.000
	Within groups	355.298	1305	0.272		

**Table 8: Scheffé Test Results for Dimensional Comparisons of Arithmetic Means of the Age Variable.**

Domain	Age Levels	Mean Difference	Sig.
Knowledge	18-29	30-39	0.24476*
		40-49	0.39716*
		50-59	0.51195*
	30-39	60	0.45434*
		40-49	0.15240*
		50-59	0.26719*
Information about sickle cell disease	18-29	60	0.20958*
		40-49	0.11551*
		50-59	0.21913*
	30-39	60	0.17838*
		40-49	0.16079*
		50-59	0.17742*
Perceptions and personal opinions	18-29	40-49	0.35994*
		50-59	0.44967*
		60	0.47478*
	30-39	40-49	0.18252*
		50-59	0.27225*
		60	0.29736*

\* Significant at ( $\alpha \leq 0.05$ )

To further analyze the influence of age levels for statistically significant differences in the arithmetic average assessment on knowledge and awareness about SCD, we performed Scheffé’s method (table 8). Results

revealed that there are statistically significant differences at the level of significance ( $\alpha \leq 0.05$ ) between the means on the knowledge domain. Between the age variable level (18-29) and the age variable levels (40-49, 50-59, 60 and

above) and in favor of the age level (18-29). Furthermore, significant differences were observed between the age variable level (30-39) and the age variable levels (40-49, 50-59, 60 and above) and in favor of the age level from (30-39). From this result it is evident that there are statistically significant differences between the means in the domain of information about SCD. We also noticed a statistically significant differences between the means in the domain of perceptions and personal opinions, and in favor of the age level from (18-29) and (30-39). The

above results are predicted in Table.8.

Level of education unsurprisingly, had an influence on participant’s assessment of knowledge and awareness towards SCD. The One-Way ANOVA test (table 9) showed that there were statistically significant differences between the means of the answers of the study sample individuals and on all domains, where the significance value associated with the F test is less than the level of statistical significance ( $0.05 = \alpha$ ). The above results are predicted in Table.9 below.

**Table 9: Mono-analysis of Variance to Reveal the Presence of Statistically Significant Differences to Measure the Level of Knowledge Assessment and Awareness of SCD According to the Level of Education Variable.**

Domain	Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F	Sig.
Knowledge	Between groups	7.927	3	2.642	7.641	0.000
	Within groups	451.615	1306	0.346		
Information about sickle cell disease	Between groups	2.571	3	0.857	3.822	0.010
	Within groups	292.915	1306	0.224		
perceptions and personal opinions	Between groups	7.003	3	2.334	7.900	0.000
	Within groups	385.907	1306	0.295		

### Education Perspective

To further analyze the influence of Level of education for statistically significant differences in the arithmetic average assessment on knowledge and awareness about SCD, we performed Scheffé’s method (table 10) and we

found that there are statistically significant differences at the level of significance ( $\alpha \leq 0.05$ ) between the averages on the knowledge, information about SCD and perceptions and personal opinions domains, and in favor of the level of higher education.

**Table 10: Scheffé test results for Dimensional Comparisons of Means of Level of Education Variable.**

Domain	Level of education levels		Mean difference	Sig.
Knowledge	Higher education	Secondary	0.20415*	0.032
Information about sickle cell disease	Intermediate	Secondary	0.11534*	0.013
	Elementary	Secondary	0.23202*	0.004
Perceptions and personal opinions	Higher education	Secondary	0.14482*	0.001

\* Significant at (0.05)

### Overall Sample Analysis (ANOVA Test)

Concerning source of information variable, results obtained from the One-Way ANOVA test shown in (table 11) showed statistically significant differences at the level of significance ( $\alpha \leq 0.05$ ) in the arithmetic average assessment

of knowledge and awareness towards SCD on all domains, where the significance value associated with the F test is less than the level of statistical significance ( $\alpha \leq 0.05$ ) i.e. The average assessment of knowledge and awareness of SCD varies according to the source of the information.

**Table 11: The Results of the Single-analysis Variance to Reveal the Presence of Statistically Significant Differences to Measure the Level of Knowledge Assessment and Awareness of SCD According to the Source of Information Variable.**

Domain	Source of Variation	Sum of Squares	Degrees of Freedom	Mean of Squares	F	Sig.
Knowledge	Between groups	8.799	4	2.200	10.013	0.000
	Within groups	286.687	1305	0.220		
Information about sickle cell disease	Between groups	27.155	4	6.789	20.490	0.000
	Within groups	432.386	1305	0.331		
perceptions and personal opinions	Between groups	37.613	4	9.403	34.538	0.000
	Within groups	355.297	1305	0.272		

### Overall Sample (Scheffé test)

Furthermore, in order to identify any levels of the source of information, including statistically significant differences in the average assessment of knowledge and awareness of SCD, a Scheffé test was performed as shown in (table 12). There is statistically significant differences at the

level of significance ( $\alpha \leq 0.05$ ) between the averages on the knowledge, information about SCD and perceptions and personal opinions domains, and in favor of the Family doctor, scientific lectures and TV/Newspaper/Radio. The above results are predicted in Table.12.

**Table 12: Scheffé Test Results for Dimensional Comparisons of Means of the Source of Information Variable.**

Domain	Source of Information Levels	Mean Difference	Sig.	
Knowledge	Family doctor	Official governmental websites	0.24671*	0.000
	Social media	Official governmental websites	0.16136*	0.026
	Scientific lectures	Social media	0.26527*	0.003
		Official governmental websites	0.42663*	0.000
	TV/Newspaper/Radio	Family doctor	0.19737*	0.003
		Social media	0.28272*	0.000
Official governmental websites		0.44408*	0.000	
Information about sickle cell disease	Family doctor	Social media	0.10532*	0.046
		Official governmental websites	0.15588*	0.007
	Scientific lectures	Social media	0.23992*	0.001
		Official governmental websites	0.29049*	0.000
	TV/Newspaper/Radio	Social media	0.12608*	0.029
		Official governmental websites	0.17664*	0.004
Perceptions and personal opinions	Family doctor	Official governmental websites	0.32368*	0.000
		Official governmental websites	0.22800*	0.000
	Scientific lectures	Social media	0.20885*	0.016
		Official governmental websites	0.43685*	0.000
	TV/Newspaper/Radio	Family doctor	0.23173*	0.000
		Social media	0.32741*	0.000
	Official governmental websites	0.55541*	0.000	

\* Significant at (0.05)

## DISCUSSION

The assessment of knowledge and perceptions regarding Sickle Cell Disease (SCD) shows the different levels of awareness across different sociodemographic groups. SCD is one of the most common genetic disorders in various countries. Therefore, understanding these differences becomes crucial for improving health education and public health interventions. Therefore, the study objective was the assessment of knowledge and perceptions of sickle cell disease in the eastern province of Saudi Arabia. For this purpose, data was collected through a survey instrument. Pre-test and pilot test were conducted to ensure the reliability and validity of the questionnaire by using appropriate stoical methods such as the Cronbach Alpha equation and Pearson correlation coefficient with positive results it was deemed valid. The questionnaire was used to assess the level of awareness and knowledge in the eastern province in Saudi Arabia. The results showed a moderate level of satisfaction when asked about the cause of the disease while in a study done in in Lubaga division, Kampala Uganda a large proportion did not know the cause of SCD, more than 44% of the participants did not know the cause of the disease.<sup>[43]</sup>

Further, empirical analysis has been conducted. The findings of this analysis were based on gender, age, education, and information sources, providing a foundation for developing targeted awareness campaigns to address the public's understanding of the disease. The key findings shown that as per the gender perspective, there was no statistical difference in the knowledge of gender for the SCD. There was a statistical difference in the awareness of information and personal perception about the disease. These findings show the there is a significant role in societal factors through healthcare resources. The results are in line with the study of Shahin *et al.*<sup>[37]</sup> and Reich *et al.*<sup>[44]</sup> {Alturaifi, 2018 #1} where they found that men tend

to have more direct engagement with healthcare systems, potentially due to cultural and occupational factors. These studies highlight the importance of ensuring that both genders have equal access to reliable information, as both men and women play critical roles in managing family health in Saudi society. Reducing this gap may require extending efforts to involve women in communication in an even more elaborate and appropriate course, for instance, exploring the health forum that targets women or developing wider efforts through maternal.

In addition to the above, further results also show that in different ages respondents have statistical differences in the information, knowledge, and personal opinion in the province of Saudi Arabia. These results indicated that youngsters are considered to be more knowledgeable as compared to others who are elders in the SCD disease. The findings are supported with the following empirical studies,<sup>[11,12,37]</sup> where they also found that younger population has more access to health information using social media, etc. On the other hand, older individuals might rely on traditional media or healthcare visits for health-related information. These studies emphasized that Saudi Arabia should provide proper awareness of SCD through social media or others to create awareness across all age groups. Further results show that the education of respondents also showed statistically significant awareness of SCD in the context of knowledge, information about SCD, and perception and awareness. This shows that individuals with higher levels of education showed significantly better understanding and more informed perceptions of the disease compared to those with lower education levels. The findings are in line with the study of Alzahrani *et al.*<sup>[6]</sup>, Shahin *et al.*<sup>[37]</sup> and Alsalman *et al.*<sup>[43]</sup> who also emphasized that individuals with higher education levels have greater access to health information and are more capable of understanding complex medical topics like

genetic disorders. These findings show that Saudi Arabia's educational institutions should focus on the improvement of education level towards SCD through workshops that could increase awareness of individuals and also this could create an effective bridge for fulfilling the knowledge among the population which is less educated.

On the other hand, ANOVA results on the overall sample show the statistical difference in the knowledge, information, and personal opinion assessment for the SCD. These results show that people's attitudes in Saudi Arabia about SCD depend on their information source. These results show that when individuals are provided information from various resources like family doctors, government websites or seminars, and social media then awareness about the disease SCD increases. These findings emphasized the significance promotion of information about health communication in the improvement of SCD awareness among the population members. This approach could enhance the communities that are more knowledgeable which could increase the effective health outcomes related to SCD. The results are in line with the findings of Alzahrani *et al.*<sup>[6]</sup> and Ekwem<sup>[18]</sup>. Further results show that information sources influence also has a statistical differences. Traditional media, including television, newspapers, and radio, along with healthcare professionals like family doctors, were identified as the most trusted and effective sources of information. In contrast, social media and governmental websites were less impactful. The findings are similar to the study of Das *et al.*<sup>[5]</sup> and Agbozo *et al.*<sup>[19]</sup>, where they also highlighted that citizens often trust healthcare professionals more than online sources when information seeking about health. This highlights the need that Saudi Arabia should use credible communication media in the promotion of health promotion programs. Furthermore, Saudi Arabia should also increase media literacy and public health campaigns among healthcare professionals which could minimize the risks of damaging health that could improve the well-being level of individuals.

### Implications

The knowledge and perception-related assessment regarding Sickle Cell Disease (SCD) in the Eastern Province of Saudi Arabia provides important theoretical insights into the role of socio-demographic factors in health literacy. The differences in the level of awareness according to gender, age, or education level contributed to why health communication theories need to integrate demographic variables in a wider sense. This study demonstrates the role of the various sources of information in the public comprehension of a genetic disease such as SCD indicating that health education models need to incorporate the concept of various populations with varying access to information. Understanding this gap and the need for specific communication strategies to resolve these differences brings the findings to the body of knowledge on health literacy and disease perception in ethnically diverse contexts. Moreover, the study supports how individual beliefs and social contexts contribute to influencing health behaviors and perceptions, thereby

reinforcing the idea that knowledge is socially constructed. Practically, the study emphasized that there is a critical need for targeted public health interventions which aimed should be to improve the awareness of SCD in Saudi Arabia. The emphasis on utilizing trusted communication channels like healthcare professionals and traditional media could contribute to the practical application of health communication theories. By focusing on culturally sensitive messaging and engaging specific demographics, public health campaigns can contribute to enhancing community understanding and ultimately improving health outcomes related to SCD. Furthermore, findings also contributed to creating a community-based participatory approach that could help to develop health education initiatives which is ensuring that interventions are not only scientifically sound but also culturally relevant and context-specific. Furthermore, the methodological contribution of this study employing ANOVA and Scheffé's test, this research provides a robust analytical framework that could contribute to informing future research in the field. This model could serve as a reference for other health-related studies seeking to assess knowledge and perceptions across various demographic groups.

### Limitations and future Directions

Along with significant contributions, the study still has various limitations that could addressed in future research. Firstly, the study employed the Cross-sectional which limited the scope of the study, further research could be explored on longitudinal research design to increase research generalizability. Secondly, the study was limited to one city in Saudi Arabia, and which findings could not be generalized to other cities or other countries. Therefore, further research could be explored on other countries to increase the generalizability of the findings. Lastly, the study was not conducted on regression-based. Therefore, future research could explore regression based on knowing the variations in the results.

### CONCLUSION

The research aimed to empirically test the assessment of knowledge and perceptions of sickle cell disease in the Eastern Province of Saudi Arabia. For this purpose, the cross-sectional research design was employed where data was collected through self-administered questionnaires from 1310 citizens of Eastern Province in Saudi Arabia. Descriptive, independent sample T-test, ANOVA, and Post Hoc (Scheffé) tests were conducted using SPSS software. The results show moderate awareness across the information, knowledge, and perception domains. Findings also show significant differences based on gender, age, education level, and sources of information. Younger participants and those with higher education demonstrated better awareness, while females reported higher concern about Sickle cell disease. Based on the study findings targeted educational interventions and broader public health campaigns are recommended to enhance community understanding and improve Sickle cell disease prevention efforts. The study with findings highlighted a need for

targeted educational programs that should be focused on the younger and less educated populations to increase the awareness for Sickle cell disease. Research limitations and future directions also discussed.

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