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Original Article

Assessment of knowledge and attitude on stem cell research and therapy among faculty members and students in the medical field at Shaqua University

Alhomidi Almotiri

Department of Clinical Laboratory Sciences, College of Applied Medical Sciences, Shaqua University, Saudi Arabia.

CORRESPONDING AUTHOR

Alhomidi Almotiri

Department of Clinical
Laboratory Sciences,
College of Applied
Medical Sciences, Shaqua
University, Saudi Arabia
Email:

hsalmutiri@su.edu.sa



<https://orcid.org/0000-0002-5906-6544>

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ABSTRACT

Objective: This study was carried out to assess the knowledge and attitude on stem cell research and therapy among faculty members and students in the medical field at Shaqua University.

Methods: A questionnaire-based cross-sectional study was conducted from November 2023 to February 2024 with 217 participants.

Results: A gender-balanced cohort of 50.23% males and 49.77% females, along with 34% faculty members, participated in the survey. The primary source of stem cell information was educational institutions (70.5%), followed by social media (37.7%). The majority of participants (96.7%) have heard about stem cells, yet only 53% exhibited familiarity with distinct stem cell types. Alarming, the responses to the use of stem cells in the clinic were blood-related disorders (64.5%), skin care (43.3%), solid cancers (28.5%), etc. Worryingly, 162 (74%) respondents favor the patient's visit to try stem cell therapy for diabetes, rejuvenation, and anti-aging. Although the majority of participants (94%) expressed a keen interest in developing their knowledge about stem cells, approximately 45% were willing to donate stem cells. Furthermore, approximately 36% of participants were aware of the Saudi Stem Cell Donor Registry (SCDR), with a modest response to register 38.2%, while 41.9% were not sure. The participants have shown a positive attitude toward supporting stem cell research and increasing public awareness.

Conclusion: The data shows a low to moderate level of knowledge about stem cells and their clinical application while showing a positive attitude toward supporting stem cell-related initiatives. Thus, it emphasizes the importance of increasing awareness about stem cells and their uses in research and therapy.

Keywords: Awareness, knowledge, stem cells, Saudi stem cell donor registry, stem cell industry

INTRODUCTION

Stem cell research, leveraging embryonic, adult, and induced pluripotent stem cells, holds increasing importance for regenerative medicine and disease treatment.^[1,2] Currently, the only successful and approved clinical application of stem cells is hematopoietic stem cell transplantation (HSCT) for blood-related disorders and immune deficiencies.^[3] Despite successful therapeutic outcomes, stem cell transplantation procedures and results are subject to ongoing evolution.^[4] Regarding stem cell research, there might be some psychological, biological, religious, and moral issues related to the procedures of stem cell retrieval and transplantation.^[5] Furthermore, the field faces challenges characterized by an

escalating inclination to advance stem cell-based interventions for clinical application lacking adequate scientific substantiation, thereby contributing to heightened ambiguity. Concerns also emerge regarding potential health risks associated with the use of unapproved stem cells in clinical settings, including the increase of direct-to-consumer, inadequately tested, or untested so-called 'cell therapies' often presented as "trials", entailing complex ethical, social, and economic implications.^[6,7]

It is anticipated that medical and allied health students and workers possess adequate knowledge and a positive attitude toward stem cell use in research and therapy. In Saudi Arabia, however, a study demonstrated inadequate knowledge, attitude, and practice among final-year medical students and physicians concerning the use of stem cells in managing diabetes.^[8] Furthermore, there is a notable lack of precise understanding regarding stem cell transplantation and therapeutics, both among the general population and healthcare service providers.^[9-14] This lack of understanding has resulted in misconceptions and impractical expectations concerning the efficacy of stem-cell therapy for particular diseases.^[15] Globally, an investigation was conducted in Italy, and a significant majority of participating physicians demonstrated a lack of comprehensive understanding regarding stem cells and their approved applications.^[16] Therefore, it is crucial to measure the knowledge and attitudes on stem cell research and therapy amongst healthcare professionals as well as the general population to ensure patient safety and overall healthcare quality improvement.

Given the importance of stem cells in research and therapy, assessment of knowledge and attitude toward stem cell research and therapy among university students and faculty members especially those in the medical field may help identify the gaps in knowledge and whether attitudes may need to be addressed and modified which may require developing educational programs or curricular change.^[17-19] Also, it may help faculty members and students as future clinicians or allied healthcare workers to find areas where they need to improve to positively reflect on the overall quality of healthcare. Furthermore, it may contribute to the advancement of stem cell research and therapy by ensuring that medical field faculty members and students are well-prepared and have the right attitudes to engage in stem cell activities.^[18] It will also increase the awareness of the community about the use of stem cells in research and therapy so they can support the research initiatives and make the right decision when they are tempted by the unproven stem cell industry. Thus, this study aims to evaluate the knowledge and attitude toward stem cell research and therapy among faculty members and students in the medical field at Shaqra University. It also intends to compare medical and non-medical students and faculty members, including their perspectives on the use of unproven stem cells.

METHODS

Study design

A cross-sectional study was carried out using a self-administrated electronic survey questionnaire, distributed among faculty members and students at Shaqra University. A part of the questionnaire was adapted from previous work.^[20] Data collection was done between 27 November 2023 and 7 Feb 2024.

Target population

The target population for this study was students and faculty members from the College of Medicine, College of Pharmacy, Department of Clinical Laboratory Sciences (CLS), Department of Nursing, Department of Health Rehabilitation Sciences (HRS), College of Science and Humanities (CSH) at Shaqra University. CSH was used as a representative sample of common people.

Ethical considerations

Informed consent was obtained from those who chose to participate, and the study guaranteed the confidentiality of all collected data, emphasizing its exclusive use for research purposes. The research was approved by the Local Committee of Research Ethics at Shaqra University (ERC_SU_S_202300037).

Sample Size Estimation

The sample size was determined using a population proportion of 50%, a confidence level of 95%, and a margin of error of 5%. The sample size estimation was completed by using Raosoft software (<http://www.raosoft.com/samplesize.html>).

Data collection Instrument

An electronic survey using Google Forms was sent to the participants, commencing with an expression of informed consent. Subsequently, participants were prompted to give socio-demographic details such as age and gender, whether faculty or student, University/College, and year of study (in the case of students). The middle section of the survey consists of nine inquiries aimed at evaluating fundamental knowledge and awareness about stem cells. This encompasses questions related to the participants' sources of information on stem cells, their awareness of various types of stem cells, their understanding of the use of stem cells in medical treatments, and the potential health issues arising from unapproved stem cell treatments. The third part aimed at investigating the attitude of participants toward stem cell research and therapy was divided into parts, with six questions each. All questions in the first segment offered response options of "strongly agree", "agree", "neutral", "disagree", and "strongly disagree". Some selected queries in this segment had the responses of "Yes", "No", or "I don't know". The last six questions explored participants' willingness to undergo stem cell therapy in clinics, donate stem cells, and register in the Saudi Stem Cell Donor Registry (SCDR). To guarantee a comprehensive understanding of the questions, an Arabic translation was created.

Data analysis

Microsoft Excel software (Microsoft Corporation) was used to analyze data in the tables. Descriptive data were presented as frequency (n) and percentage (%). Quantitative data were presented as mean and standard deviation (SD). The mean of attitude-related responses between colleges and departments was analyzed by Dunnett's multiple comparisons test using Prism (GraphPad Software, Inc.) where data is significant if the p-value is below 0.05.

RESULTS**Sociodemographic characteristics of the participants**

In this survey, the total number of participants was 217, with an equal proportion of males and females (50.23 and 49.77%, respectively) (Table 1). Students constituted the majority of participants 146 (67.27%) exhibiting 39.72% male and 60.27% female. Faculty members constituted one-third of the total participants 71 (32.71%). In contrast to students, the representation of males (70.42%) in faculty members is higher than females (29.75%). The majority of participants (65.9%) were aged between 18 and 26, primarily students. Most students were in the third (21.65%) and fourth year (19.81%) of their study. Over one-third of the total participants were from the Department of Clinical Laboratory Sciences (CLS) (36.86%). The Department of Nursing exhibited the second-highest percentage of participants (18.43%) with the College of Medicine following closely at 16.59%. The College of Pharmacy, the Department of Health Rehabilitation Sciences (HRS), and the College of Sciences and Humanities (CSH) had a participation rate of 9.67%, 6.45 %, and 11.98% respectively (Table 1).

Assessment of participants' knowledge about stem cells and their uses

Before testing the participants' knowledge of stem cells in detail, a preliminary inquiry was made regarding their familiarity with the term "stem cells".

Table 1: Demographic data of the total participants (n: 217)

Characteristics			Freque	Percent
Gender	Males		109	50.23
	Females		108	49.77
Age	18-26		143	65.90
	27-39		28	12.90
	40-49		28	12.90
	>50		18	8.29
Status	Students	Male	58	39.72
		Female	88	60.27
	Faculty	Male	50	70.42
		Female	21	29.57
College or Department	College of Medicine		36	16.59
	College of Applied Medical Sciences	Department of Nursing	40	18.43
		Department of Clinical Laboratory Sciences	80	36.86
	College of Sciences and Humanities		26	11.98
	College of Pharmacy		21	9.67
Department of Health Rehabilitation Sciences		14	6.45	
Awareness of stem cell	Yes		210	96.77
	No		7	3.23
Year of study	First Year		5	2.3
	Second Year		31	14.28
	Third Year		47	21.65
	Fourth Year		43	19.81
	Fifth Year		10	4.6
	Sixth Year		9	4.14
	Internship Year		1	0.46
	Other*		71	34.1

*Faculty members, n: number of participants

Table 2: Level of knowledge about stem cells among participants on a 5-point Likert scale [n (%)]

Have you heard about stem cells?		How would you rate your knowledge on stem cells?				
		Response	Gender	Faculty	Students	Total
Yes	209 (96.75)	Very Low (1)	Male	2 (0.92)	2 (0.92)	4 (1.84)
			Female	0 (0.00)	7 (3.22)	7 (3.22)
		Low (2)	Male	3 (1.38)	11 (5.06)	14 (6.45)
			Female	1 (0.46)	27	28 (12.90)
		Moderate (3)	Male	18 (8.29)	23 (10.5)	41 (18.89)
			Female	8 (3.68)	30	38 (17.51)
		High (4)	Male	20 (9.21)	12 (5.52)	32 (14.74)
			Female	10 (4.60)	13 (5.99)	23 (10.5)
		Very High (5)	Male	6 (2.76)	5 (2.30)	11 (5.06)
Female	2 (0.92)		9 (4.14)	11 (5.06)		
		Average		3.54	2.97	3.25
No	7 (3.24)	Very Low (1)	Male	0 (0.00)	4 (1.84)	1 (0.46)
			Female	0 (0.00)	1 (0.46)	4 (1.84)
		Low (2)	Male	0 (0.00)	1 (0.46)	1 (0.46)
			Female	0 (0.00)	1 (0.46)	1 (0.46)
		Moderate (3)	Male	0 (0.00)	0 (0.00)	0 (0.00)
			Female	0 (0.00)	0 (0.00)	0 (0.00)
		High (4)	Male	0 (0.00)	0 (0.00)	0 (0.00)
			Female	0 (0.00)	0 (0.00)	0 (0.00)
		Very High (5)	Male	0 (0.00)	0 (0.00)	0 (0.00)
Female	0 (0.00)		0 (0.00)	0 (0.00)		

Although 96.75% of participants have heard about stem cells, they claimed an average knowledge of stem cells at a moderate level (3.25/5) though the faculty members had a higher average knowledge (3.54/5) than students (2.97/5) (Table 2). Furthermore, 53% of the participants showed knowledge of various types of stem cells (e.g., embryonic, adult, induced pluripotent stem cells) (figure 1). The survey revealed that the majority (76%) of the participants asserted that stem cells are utilized in both research and clinics, while 11% and 10% maintained the perspective that stem cells are employed in medical research and clinics, respectively (figure 2).

Table 3: Level of knowledge about stem cells among participants according to the department/college on a 5-point Likert scale

Department	Frequency (%)	Response [n(%)]					Mean
		Very low	Low	Moderate	High	Very High	
Department of Nursing	40 (18.43)	5 (12.50)	7 (17.50)	16 (40.00)	7 (17.50)	5 (12.50)	3
Department of Clinical Laboratory Sciences	80 (36.86)	4 (5.00)	19 (23.75)	21 (26.25)	27 (33.75)	9 (11.25)	3.22
Department of Health Rehabilitation Sciences	14 (6.45)	1 (7.14)	5 (35.71)	8 (57.14)	0 (0.00)	0 (0.00)	2.5
College of Pharmacy	20 (9.21)	0 (0.00)	3 (14.28)	12 (57.14)	4 (19.04)	1 (9.52)	3.15
College of Medicine	36 (16.58)	1 (2.77)	5 (13.88)	13 (36.11)	15 (41.66)	2 (5.55)	3.33
College of Sciences and Humanities	26 (11.98)	5 (19.23)	5 (19.23)	9 (34.61)	2 (7.69)	5 (19.23)	2.88

Table 4: Awareness of stem cells, their usage, and the source of their information [n (%)]

Response for a query	Male faculty	Female faculty	Male students	Female students	Total
What is your source of information about stem cells?					
Education (Univ/School)	37 (48.05)	16 (59.25)	45 (43.68)	55 (34.37)	153 (70.50)
Social media	9 (11.68)	1 (3.70)	22 (21.35)	50 (31.25)	82 (37.7)
Hospital	12 (15.58)	4 (14.81)	13 (12.62)	14 (8.75)	43 (19.8)
Media (TV, Radio)	11 (14.28)	5 (18.51)	8 (7.76)	17 (10.62)	41 (18.8)
Other	4 (5.19)	1 (3.70)	7 (6.79)	11 (6.87)	23 (10.5)
Family/Friend	3 (3.89)	0 (0.00)	7 (6.79)	12 (7.50)	22 (10.1)
Commercial companies	1 (1.29)	0 (0.00)	1 (0.97)	1 (0.62)	3 (1.3)
Based on your knowledge, stem cells are approved and used as a treatment in the clinic for:					
Blood-related disorders	31 (28.97)	16 (19.51)	33 (40.24)	60 (28.03)	140 (64.5)
Skin care/Cosmetics	14 (13.08)	12 (14.63)	23 (10.59)	45 (21.02)	94 (43.3)
Solid Cancers	10 (9.34)	12 (14.63)	19 (18.44)	21 (9.81)	62 (28.5)
Spinal cord injuries	15 (14.01)	6 (7.31)	9 (8.73)	27 (12.61)	57 (26.26)
Hair loss/Baldness	7 (6.54)	9 (10.97)	11 (10.67)	25 (11.68)	52 (23.9)
Brain-related diseases	11 (10.28)	6 (7.31)	11 (10.67)	12 (5.60)	40 (18.4)
Diabetes	11 (10.28)	8 (9.75)	10 (9.70)	8 (3.73)	37 (17)
I don't know	4 (3.73)	0 (0.00)	14 (13.59)	11 (5.14)	29 (13.3)
Other	4 (3.73)	13 (15.85)	0 (0.00)	5 (2.33)	22 (10.13)
What are the medical conditions that are cured using stem cells in Saudi Arabia?					
I don't know	6 (11.53)	25 (32.89)	31 (36.47)	35 (23.80)	97 (44.7)
Blood-related disorders	12 (23.07)	18 (23.68)	20 (23.52)	40 (27.21)	90 (41.4)
Skin care/Cosmetics	10 (19.23)	6 (7.89)	9 (10.58)	25 (17.00)	50 (23)
Brain-related diseases	6 (11.53)	4 (5.26)	8 (9.41)	14 (9.52)	32 (14.7)
Solid Cancers	6 (11.53)	3 (3.94)	6 (7.05)	11 (7.48)	26 (11.9)
Spinal cord injuries	4 (7.69)	3 (3.94)	2 (2.35)	15 (10.20)	24 (11)
Diabetes	4 (7.69)	7 (9.21)	5 (5.88)	1 (0.68)	17 (7.83)
Hair loss/Baldness	3 (5.76)	6 (7.89)	4 (4.70)	3 (2.04)	16 (7.3)
Other	1 (1.92)	4 (5.26)	0 (0.00)	3 (2.04)	8 (3.6)

Next, different responses among departments and colleges regarding knowledge of stem cells were presented. This is to get a clear idea of which department/college has the highest level of knowledge. The data showed that the College of Medicine had an average level of knowledge of 3.33/5, followed by the Department of CLS and the College of Pharmacy at 3.22/5 and 3.15/5, respectively. The Department of Nursing showed 3/5, and the CSH had 2.88/5. The lowest average knowledge of stem cells was the Department of HRS 2.5/5 (Table 3).

Table 5: The 5-point Likert scale for attitude-based queries [n (%)]

Department/College	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean±S
Stem cell therapy has the potential to revolutionize medical treatments (A1)						
Department of Nursing	15 (37.5)	13 (32.5)	8 (20)	3 (7.5)	1 (2.5)	4.07± 1.03
Department of Health Rehabilitation	6 (42.8)	3 (21.4)	3 (21.4)	2 (14.2)	0 (0)	
Department of Clinical Laboratory Sciences	43 (53.7)	15 (18.7)	15 (18.7)	6 (7.5)	1 (1.2)	
College of Pharmacy	13 (61.9)	3 (14.2)	5 (23.8)	0 (0)	0 (0)	
College of Medicine	18 (50)	13 (36.1)	5 (13.8)	0 (0)	0 (0)	
College of Sciences and Humanities	6 (23.0)	6 (23.0)	8 (30.7)	6 (23.0)	0 (0)	
Total N (%) / 217	101 (46.5%)	53	44 (20.2%)	17 (7.8%)	2 (0.9%)	
I believe that stem cell research and therapy should be further encouraged and funded (A2)						
Department of Nursing	21 (52.5)	8 (20)	8 (20)	3 (7.5)	0 (0)	4.28± 0.98
Department of Health Rehabilitation	10 (71.4)	1 (7.1)	2 (14.2)	1 (7.1)	0 (0)	
Department of Clinical Laboratory Sciences	54 (67.5)	12 (15)	9 (11.2)	3 (3.7)	2 (2.5)	
College of Pharmacy	12 (57.1)	5 (23.8)	4 (19.0)	0 (0)	0 (0)	
College of Medicine	20 (55.5)	12 (33.3)	4 (11.1)	0 (0)	0 (0)	
College of Sciences and Humanities	8 (30.7)	7 (26.9)	7 (26.9)	3 (11.5)	1 (3.8)	
Total N (%) / 217	125 (57.6%)	45	34 (15.6%)	10 (4.6%)	3 (1.38%)	
I believe that stem cell related topics should be implemented in the curriculum (A3)						
Department of Nursing	21 (52.5)	9 (22.5)	6 (15)	3 (7.5)	1 (2.5)	4.13± 1.07
Department of Health Rehabilitation	6 (42.8)	1 (7.1)	6 (42.8)	1 (7.1)	0 (0)	
Department of Clinical Laboratory Sciences	50 (62.5)	11 (13.7)	15 (18.7)	1 (1.2)	3 (3.7)	
College of Pharmacy	10 (47.6)	6 (28.5)	5 (23.8)	0 (0)	0 (0)	
College of Medicine	19 (52.7)	7 (19.4)	8 (22.2)	1 (2.7)	1 (2.7)	
College of Sciences and Humanities	8 (30.7)	7 (26.9)	7 (26.9)	2 (7.6)	2 (7.6)	
Total N (%) / 217	114 (52.5%)	41	47 (21.6%)	8 (3.6%)	7 (3.2%)	
There should be more public awareness programs about stem cells and their uses (A4)						
Department of Nursing	24 (60)	8 (20)	8 (20)	0 (0)	0 (0)	4.39± 0.92
Department of Health Rehabilitation	10 (71.4)	2 (14.2)	2 (14.2)	0 (0)	0 (0)	
Department of Clinical Laboratory Sciences	61 (76.2)	10 (12.5)	6 (7.5)	1 (1.25)	2 (2.5)	
College of Pharmacy	14 (66.6)	4 (19.0)	3 (14.2)	0 (0)	0 (0)	
College of Medicine	19 (52.7)	8 (22.2)	8 (22.2)	1 (2.7)	0 (0)	
College of Sciences and Humanities	10 (38.4)	4 (15.3)	9 (34.6)	2 (7.6)	1 (3.8)	
Total N (%) / 217	138 (63.59)	36 (16.58)	36 (16.58)	4 (1.84)	3 (1.38)	
Using unapproved stem cell treatment may cause health problems (A5)						
Department of Nursing	18 (45)	9 (22.5)	10 (25)	2 (5)	1 (2.5)	3.97± 1.13
Department of Health Rehabilitation	5 (35.7)	2 (14.2)	6 (42.8)	0 (0.00)	1 (7.1)	
Department of Clinical Laboratory Sciences	40 (50)	10 (12.5)	21 (26.2)	6 (7.5)	3 (3.7)	
College of Pharmacy	9 (42.8)	3 (14.2)	8 (38.0)	0 (0)	1 (4.7)	
College of Medicine	18 (50)	10 (27.7)	8 (22.2)	0 (0)	0 (0)	
College of Sciences and Humanities	11 (42.3)	3 (11.5)	7 (26.9)	3 (11.5)	2 (7.6)	
Total N (%) / 217	101 (46.5%)	37 (17%)	60 (27.6%)	11 (5%)	8 (3.68%)	
There are some stem cell clinics in the world say that they treat a wide range of diseases using stem cells such as diabetes, rejuvenation,						
Department of Nursing	5 (12.5)	10 (25)	14 (35)	7 (17.5)	4 (10)	3.13± 1.11
Department of Health Rehabilitation	0 (0)	4 (28.5)	6 (42.8)	3 (21.4)	1 (7.1)	
Department of Clinical Laboratory Sciences	10 (12.5)	16 (20)	30 (37.5)	16 (20)	8 (10)	
College of Pharmacy	7 (33.3)	5 (23.8)	8 (38.0)	1 (4.7)	0 (0)	
College of Medicine	3 (8.3)	9 (25)	13 (36.1)	5 (13.8)	6 (16.6)	
College of Sciences and Humanities	3 (11.5)	3 (11.5)	17 (65.3)	2 (7.6)	1 (3.8)	
Total N (%) / 217	28 (12.9%)	47	88 (40.5%)	34 (15.6%)	20 (9.2%)	

Given that the majority of participants have heard about the term "stem cell" and showed a moderate knowledge level about it, the source of information that the participants rely on about stem cells was investigated. University or school education emerged as the top source (70.5%). Followed by social media platforms with 37.7%, approximately 20% gained knowledge during hospital visits, while the remaining participants obtained information through traditional media (18.8%), family/friends (10%), others (10.5%), and commercial companies (1.3%) (Table 4).

To get a deep insight into the knowledge of participants on the use of stem cells in therapy, they were asked about several health conditions and the potential use of stem cells to cure them. The majority believed that stem cells are approved for treating blood-related disorders including blood cancers and genetic diseases like sickle cell disease and thalassemia (64.5%). Interestingly, this was followed by their use in skincare/cosmetics (43%), solid cancers (28.5%), spinal cord injuries (26.26%), hair loss/baldness (23.9%), brain-related diseases (18.4%), diabetes (17%), and others (10.13%), while 13.3% did not know any approved use of stem cells in therapy (Table 4). This emphasizes the importance of increasing awareness about the approved use of stem cells in therapy.

Next, the participants were asked whether stem cells are used and approved in Saudi Arabia. The data showed that 47% indicated that stem cells are approved in Saudi Arabia, while 48% were not sure (figure 1). Regarding the health conditions treated by stem cells in Saudi Arabia, 44.7% did not know about them, while the rest answered with a similar pattern as emerged in responses to the query about the use of stem cell therapy for curing medical conditions (Table 4). This suggests that there is a lack of knowledge about the use of stem cells in therapy in Saudi Arabia.

Afterward, the participants were asked about the potential health problems caused by using unapproved stem cells. The data showed that 59% of the participants expressed concerns about health hazards associated with unapproved stem cells. Approximately 7% replied that there were no health problems associated with the use of unapproved stem cells. A notable percentage (34%) of participants admitted to not knowing the potential health problems (figure 3). This shows that there is a lack of knowledge about the health consequences of using unapproved stem cells in therapy.

Table 6: Responses of participants regarding attitude queries [n (%)]

Question*		Would you be interested in developing your knowledge about stem cell therapy							
		Response	Frequency (%)	Department of Nursing	Department of Clinical Laboratory Sciences	Department of Health Rehabilitation Sciences	College of Pharmacy	College of Medicine	College of Sciences and Humanities
Yes	162 (74.65)	Yes	154 (95)	27 (67.5)	57 (71.25)	9 (64.28)	19 (90.47)	23 (63.88)	19 (73)
		No	8 (5)	2 (5)	2 (2.5)	0 (0)	0 (0)	2 (5.55)	2 (7.70)
No	55 (25.34)	Yes	50 (91)	9 (22.5)	19 (23.75)	5 (35.71)	2 (9.53)	10 (27.77)	4 (15.40)
		No	5 (9)	2 (5)	2 (2.5)	0 (0)	0 (0)	1 (2.77)	0 (0)

* Do you think the patient's visit to the clinics that claim treating diseases such as diabetes, rejuvenation, anti-aging, and having stem cell therapy deserves a try

Assessment of participants' attitudes toward stem cells and their uses

The initial set of attitude-based queries (n=6) encompasses investigations regarding the transformative potential of stem cells in medical treatment (A1), increased funding for stem cell research and therapy (A2), integration of stem cell-related topics into the school curriculum (A3), organization of public

awareness programs about stem cells and their applications (A4), health issues arising from using unapproved stem cell treatments (A5), and claims made by certain clinics about treating a broad spectrum of diseases (A6). The 5-point Likert scale responses to these questions revealed that most of the participants agreed with statements A1 (4.07/5), A2 (4.28/5), A3 (4.13/5), A4 (4.39/5), and A5 (3.97/5) (Table 5). This trend was consistent across all departments and colleges, including the CSH though it showed the lowest score compared to the medical field participants (figure 4 & table 5). However, for query A6 which is about agreeing with the claims made by certain clinics in the world about treating a broad spectrum of diseases using stem cells such as diabetes, rejuvenation, anti-aging, and others, a neutral response was most recorded, particularly in the CSH (figure 4 & table 5). Alarming, the College of Pharmacy agreed with this claim 3.86/5 (figure 4). A total of 162 out of 217 participants (74.65%) believed that going to these clinics deserved a try (Table 6). This suggests that the medical field participants and the CSHs participants as representatives of ordinary people are less informed about the ramifications of using unapproved stem cells.

Subsequently, the participants were asked about their willingness to donate stem cells. Approximately 45% of the participants expressed willingness to donate stem cells, while 17.97% did not wish to donate and 36.86% were not sure (Table 7). Those who were not willing to donate stem cells (n=39) cited several reasons for their reluctance. The reasons included health-related apprehensions (46%), a need for more knowledge regarding the donation process (38.46%), concerns about the donation process (33.33%), and not feeling comfortable about donation (30.7%) (Table 7). This poor response suggests the importance of promoting awareness among healthcare professionals regarding stem cell donation.

Table 7: Response of volunteers regarding the donation of stem cells

Are you willing to donate stem cells?			
Response	n (%)	Reasons for not donating n (%)	
Yes	98 (45.16)	Not applicable.	
No	39 (17.97)	It may cause health problems to me	18 (46.15)
		Need further clarification about the donation process before I decide	15 (38.46)
		I am afraid of the donation process	13 (33.33)
		I feel I do not want to donate stem cells	12 (30.7)
		Other reasons	2 (5.12)
		I wish to donate stem cells	1 (2.56)
I don't know	80 (36.86)	Other reasons	38 (47.5)
		Need further clarification about the donation process before I decide	29 (36.25)
		I am afraid of the donation process	16 (20)
		It may cause health problems to me	9 (11.25)
		I wish to donate stem cells	6 (7.5)
		I feel I do not want to donate stem cells	4 (5)

Next, participants' awareness of the Saudi Stem Cell Donor Registry (SCDR) was evaluated. A modest proportion of participants (n= 79, 36.4%) have heard about the SCDR (Table 8). They had a balanced gender representation (1:1 ratio). Male representation accounted for approximately 50.6%, while females comprised 49.3%. Response analysis between departments and colleges has shown that the participants from the Department of CLS have the most knowledge about the SCDR (48.75%), while the other groups have a range between 24%-32.50% (figure 5). Regarding the willingness to register in SCDR, there were 38.2% affirmative responses ("yes"), 19.8% negative responses ("no"), and 41.9% ambivalent responses ("not sure"). Subsequently, a nearly equivalent proportion of males and females expressed eagerness to enroll in the SCDR and participate in the donation process. Intriguingly, there was a twofold increase in the number of individuals willing to register compared to those uncertain, despite having no prior

knowledge of the SCDR (Table 8). Among participants aware of the existence of SCDR, nearly all faculty and students from the Department of CLS showed willingness to register, with only a small percentage (7.52%) of female students unwilling to do so. In the College of Medicine, most male students were unwilling to register, while male faculty members were eager to do so. A similar trend was observed in the CSH. However, many participants from the CSH were unsure about registering, as they lacked knowledge about SCDR. This uncertainty was also seen in male students of Medicine and CLS, as well as all students from Nursing and Pharmacy. Interestingly, male faculty members from Medicine, all faculty members from Pharmacy, and male students from HRS were eager to register, despite having no prior knowledge of SCDR. Female faculty members from Nursing who were unaware of SCDR expressed no interest in registering, while those who were aware were willing to donate (Table 8). This emphasizes the need to promote awareness about SCDR.

Table 8: Knowledge and attitude towards Stem cell donor registry (SCDR) in participants belonging to various Departments/Colleges [n (%)]

Have you heard about the Saudi Stem Cell Donor Registry?						Willing to register in the Saudi Stem Cell	
Response	Frequency	Department/College	Frequency	Participants	Frequency	Yes	No
Yes	79 (36.4%)	Department of Nursing	13 (32.5)	Male Faculty	1 (1.26)	Yes	0 (0.00)
						No	0 (0.00)
						Not sure	1 (1.26)
				Female Faculty	3 (3.79)	Yes	3 (3.79)
						No	0 (0.00)
						Not sure	0 (0.00)
				Male students	4 (5.06)	Yes	0 (0.00)
						No	1 (1.26)
						Not sure	3 (3.79)
				Female students	5 (6.32)	Yes	2 (2.53)
						No	2 (2.53)
						Not sure	1 (1.26)
		Department of Health Rehabilitation Sciences	4 (28.5)	Male Faculty	2 (2.53)	Yes	1 (1.26)
						No	0 (0.00)
						Not sure	1 (1.26)
				Female Faculty	0 (0.00)	Yes	0 (0.00)
						No	0 (0.00)
						Not sure	0 (0.00)
				Male students	2 (2.53)	Yes	1 (1.26)
						No	0 (0.00)
						Not sure	1 (1.26)
				Female students	0 (0.00)	Yes	0 (0.00)
						No	0 (0.00)
						Not sure	0 (0.00)
Department of Clinical Laboratory Sciences	39 (48.75)	Male Faculty	10 (12.65)	Yes	9 (11.39)		
				No	0 (0.00)		
				Not sure	1 (1.26)		
		Female Faculty	4 (5.06)	Yes	3 (3.79)		
				No	0 (0.00)		
				Not sure	1 (1.26)		
		Male students	3 (3.79)	Yes	3 (0.00)		
				No	0 (0.00)		
				Not sure	0 (0.00)		
		Female students	22 (27.84)	Yes	13 (16.45)		
				No	3 (3.79)		
				Not sure	6 (7.59)		
College of Pharmacy	5 (23.80)	Male Faculty	1 (1.26)	Yes	0 (0.00)		
				No	1 (1.26)		
				Not sure	0 (0.00)		

				Female Faculty	1 (1.26)	Yes	0 (0.00)
						No	0 (0.00)
						Not sure	1 (1.26)
				Male students	2 (2.53)	Yes	0 (0.00)
						No	0 (0.00)
						Not sure	2 (2.53)
				Female students	1 (1.26)	Yes	0 (0.00)
						No	1 (1.26)
						Not sure	0 (0.00)
		College of Medicine	11 (30.5)	Male Faculty	6 (7.59)	Yes	4 (5.06)
						No	1 (1.26)
						Not sure	1 (1.26)
				Female Faculty	0 (0.00)	Yes	0 (0.00)
						No	0 (0.00)
						Not sure	0 (0.00)
				Male students	4 (5.06)	Yes	1 (1.26)
						No	0 (0.00)
						Not sure	3 (3.79)
				Female students	0 (0.00)	Yes	0 (0.00)
						No	0 (0.00)
						Not sure	0 (0.00)
College of Sciences and Humanities	7 (27)	Male Faculty	1 (1.26)	Yes	1 (1.26)		
				No	0 (0.00)		
				Not sure	0 (0.00)		
		Female Faculty	0 (0.00)	Yes	0 (0.00)		
				No	0 (0.00)		
				Not sure	0 (0.00)		
		Male students	4 (5.06)	Yes	1 (1.26)		
				No	00 (0.00)		
				Not sure	3 (3.79)		
		Female students	2 (2.53)	Yes	1 (1.26)		
				No	0 (0.00)		
				Not sure	1 (1.26)		
No	138 (63.5%)	Department of Nursing	27 (67.5)	Male Faculty	2 (1.44)	Yes	1 (0.72)
						No	1 (0.72)
						Not sure	0 (0.00)
				Female Faculty	4 (2.89)	Yes	1 (0.72)
						No	3 (2.17)
						Not sure	0 (0.00)
				Male students	5 (3.62)	Yes	2 (1.44)
						No	0 (0.00)
						Not sure	3 (2.17)
				Female students	16 (11.59)	Yes	2 (1.44)
						No	3 (2.17)
						Not sure	11 (7.97)
		Department of Health Rehabilitation Sciences	10 (71.5)	Male Faculty	2 (1.44)	Yes	0 (0.00)
						No	1 (0.72)
						Not sure	1 (0.72)
				Female Faculty	0 (0.00)	Yes	0 (0.00)
						No	0 (0.00)
						Not sure	0 (0.00)
				Male students	8 (5.79)	Yes	6 (4.34)
						No	2 (1.44)
						Not sure	0 (0.00)
Female students	0 (0.00)			Yes	0 (0.00)		
				No	0 (0.00)		
				Not sure	0 (0.00)		
Department of Clinical Laboratory	41 (51.25)	Male Faculty	5 (3.62)	Yes	1 (0.72)		
				No	1 (0.72)		

		Sciences		Female Faculty	4 (2.89)	Not sure	3 (2.17)
						Yes	1 (0.72)
						No	0 (0.00)
				Male students	8 (5.79)	Not sure	3 (2.17)
						Yes	1 (0.72)
						No	1 (0.72)
				Female students	24 (17.39)	Not sure	6 (4.34)
						Yes	8 (5.79)
						No	5 (3.62)
		College of Pharmacy	16 (76.20)	Male Faculty	3 (2.17)	Not sure	11 (7.97)
						Yes	2 (1.44)
						No	0 (0.00)
				Female Faculty	2 (1.44)	Not sure	1 (0.72)
						Yes	2 (1.44)
						No	0 (0.00)
				Male students	4 (2.89)	Not sure	0 (0.00)
						Yes	1 (0.72)
						No	1 (0.72)
		Female students	7 (5.07)	Not sure	2 (1.44)		
				Yes	1 (0.72)		
				No	0 (0.00)		
		College of Medicine	25 (69.5)	Male Faculty	11 (7.97)	Not sure	6 (4.34)
						Yes	5 (3.62)
						No	3 (2.17)
				Female Faculty	2 (1.44)	Not sure	3 (2.17)
						Yes	1 (0.72)
						No	1 (0.72)
				Male students	12 (8.69)	Not sure	0 (0.00)
						Yes	2 (1.44)
						No	5 (3.62)
Female students	0 (0.00)	Not sure	5 (3.62)				
		Yes	0 (0.00)				
		No	0 (0.00)				
College of Sciences and Humanities	19 (73)	Male Faculty	6 (4.34)	Not sure	0 (0.00)		
				Yes	1 (0.72)		
				No	2 (1.44)		
		Female Faculty	1 (0.72)	Not sure	3 (2.17)		
				Yes	0 (0.00)		
				No	1 (0.72)		
		Male students	2 (1.44)	Not sure	0 (0.00)		
				Yes	1 (0.72)		
				No	1 (0.72)		
Female students	10 (7.24)	Not sure	0 (0.00)				
		Yes	2 (1.44)				
		No	1 (0.72)				
				Not sure	7 (5.07)		

Figures:

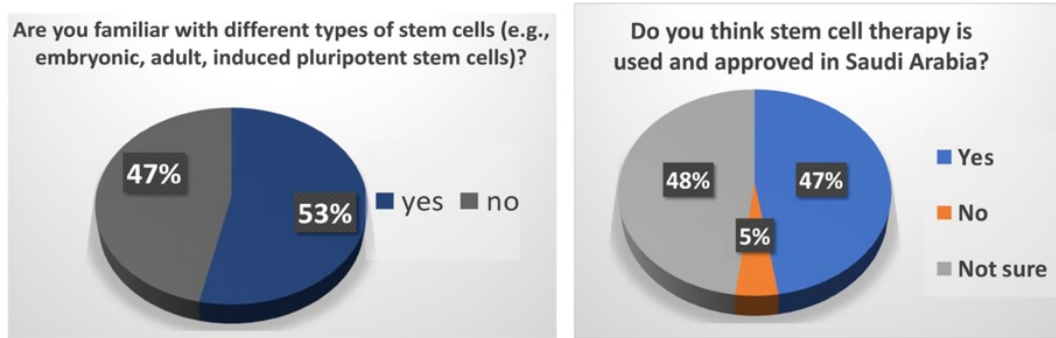


Figure 1: Response of participants to selected knowledge-based queries (number of participants: 217)

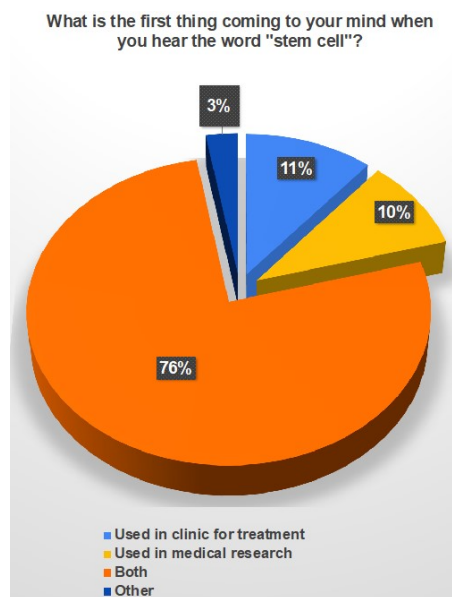


Figure 2: 3-D pie diagram summarizes the responses about regarding the question what the first thing is coming to your mind when you hear the term "stem cell". (number of participants: 217)

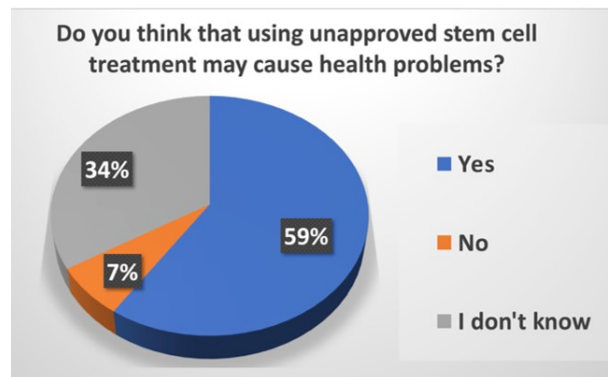


Figure 3: Response of participants regarding knowledge-based query about health problems caused by unapproved stem cell therapy. (number of participants: 217)

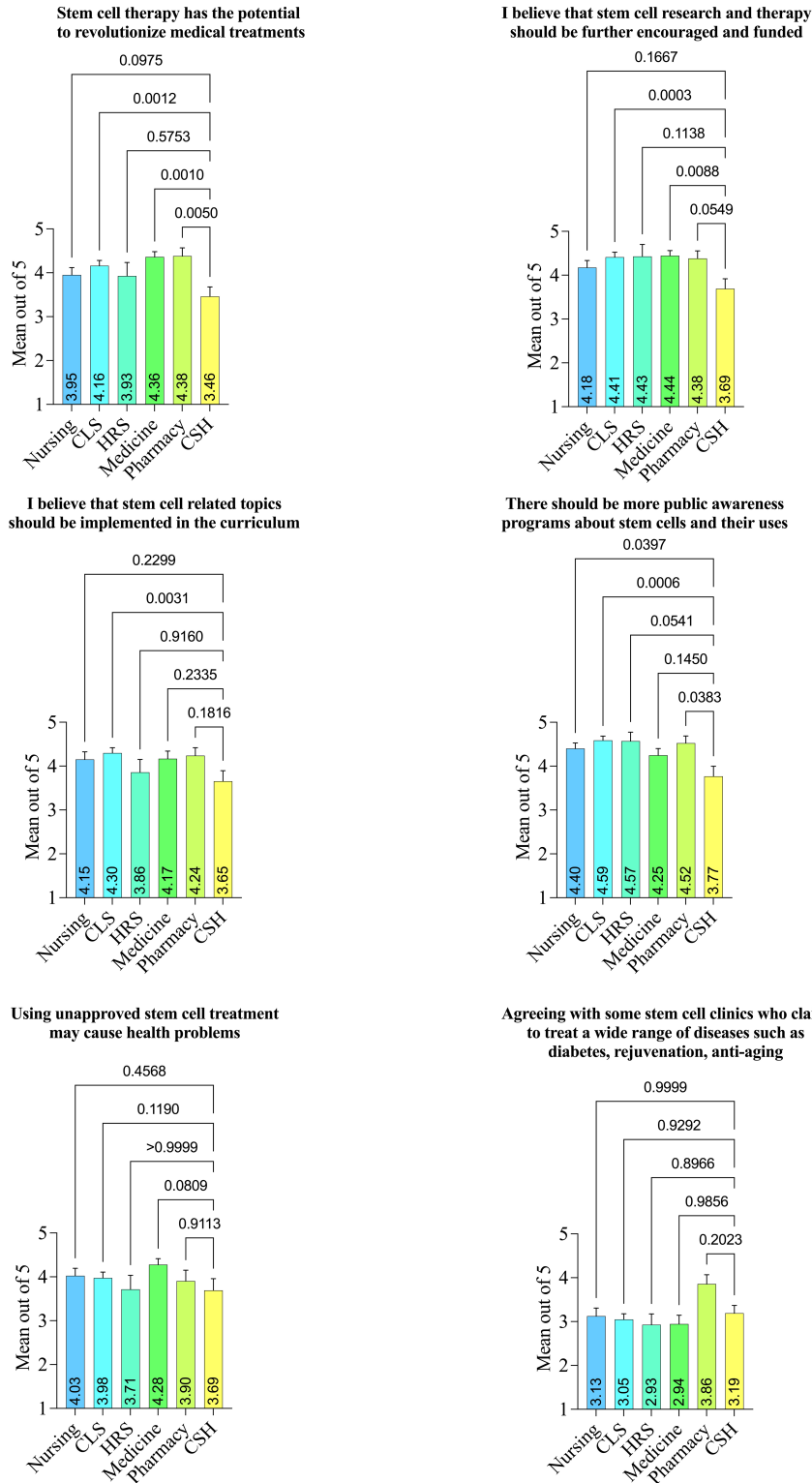


Figure 4. The comparative analysis of attitude-based queries across departments and colleges on a 5-point Likert Scale, ranging from 1 to 5. CLS (Clinical Laboratory Sciences), HRS (Department of Rehabilitation Sciences), CSH (College of Sciences and Humanities). Dunnett's Multiple Comparisons Test was used. The adjusted p-value is shown where it becomes significant if it is below 0.05. Figures were prepared using GraphPad Prism software.

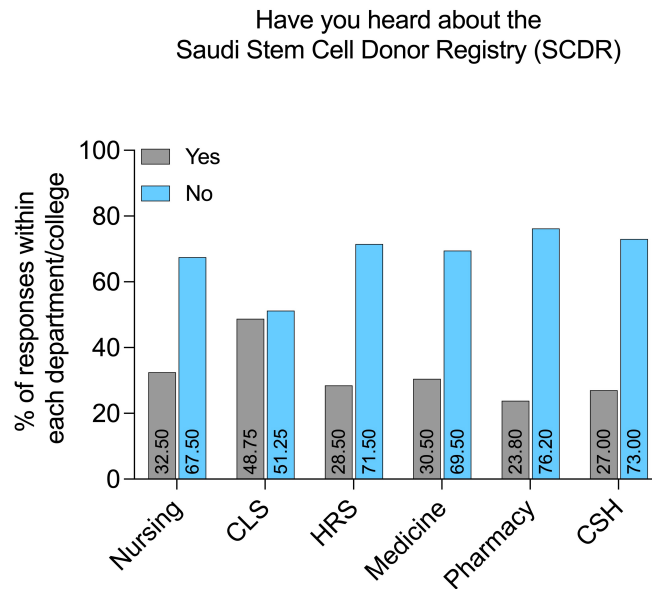


Figure 5: Responses of participants about familiarity with the SCDR.

DISCUSSION

Understanding attitudes toward stem cell research and therapy is essential for addressing societal, ethical, and cultural considerations in this field. Further, healthcare workers serve as vital sources of information for patients, shaping their understanding and perspectives on stem cells. This knowledge is crucial for informed decision-making regarding stem cell therapies. Thus, this study at Shaqra University aimed to assess the knowledge and attitudes of students and faculty members, particularly in the medical field towards stem cell research and therapy. Although the data has shown participants' familiarity with stem cells, a low to moderate level of knowledge about the use of stem cells in therapy was found. In contrast, the participants have shown a positive attitude towards supporting stem cell research and therapy and developing their knowledge about it.

Consistent with the data in this report, globally, research indicates that healthcare professionals exhibit diverse levels of understanding and perspectives regarding stem cells and their therapeutic applications. For instance, cross-disciplinary investigations, such as one involving nursing students in Malaysia, revealed a preference for utilizing stem cells in medical contexts, coupled with a moderate level of knowledge.^[21] Similarly, a study among physicians in Italy revealed that the majority lacked substantial knowledge regarding stem cells.^[16] In KSA alone, several studies have investigated the understanding of stem cells and their application amongst nurses, dental students, and medical students showing low to moderate knowledge and a positive attitude.^[10,12,22,23]

Prior research indicates that the majority of participants were aware of stem cell research.^[10,24] In this report, the observations revealed a high level of familiarity (96.7%) regarding stem cells. However, only 53% of participants demonstrated familiarity with distinct types of stem cells. A study conducted in Qassim province demonstrated an intermediate degree of awareness and a favorable mindset regarding transplants of stem cells among medical professionals, recommending informational campaigns to enhance understanding and acceptance ^[14]. A study revealed that approximately 71.3% of participants were familiar with stem cells, recognizing them as unspecialized cells capable of forming any cell type.^[10] In 2020, a study at King Abdulaziz University explored knowledge and attitudes toward stem-cell transplantation and treatments, revealing generally positive attitudes but emphasizing the need for measures to protect society from potential repercussions.^[11]

In this survey, educational institutions were identified as the primary source of stem cell information (70.5%) followed by social media (37.7%). Interestingly, recent trends indicate that social media and online sources have emerged as the major channels for obtaining information on stem cells.^[25,26]

In this report, there is a higher acceptance attitude toward supporting stem cell research, funding, and public awareness, indicating progress in stem cell donation, treatment, and research in Saudi Arabia. This is consistent with previous findings which primarily surveyed healthcare providers, and similarly, found that most participants held a positive attitude towards stem cell donation and research.^[14] Additionally, the majority (94%) expressed a strong interest in expanding their knowledge on the subject, advocating for additional public awareness programs about stem cells. This correlates with previous findings where the majority of participants (81.9%) supported the implementation of additional awareness demonstrations focusing on stem cells and their therapeutic implications.^[10] Moreover, they also reported that over half of the respondents (61.3%) expressed a willingness to endorse stem cell therapy should it become accessible.^[10]

Despite the clinical use of stem cells to treat blood-related diseases^[3], the data reveals that only 64% of the participants associate stem cells with blood and immune cell diseases, with the remainder focusing on skincare and cosmetics, solid cancers, spinal cord injuries, hair loss, etc. Alarming, the participant's attitudes toward agreeing with those clinics that claim to treat several diseases and conditions, including diabetes, aging, and rejuvenation using stem cells were neutral. Furthermore, 74% of them think that the patient's visit to these clinics deserves a try. This is shocking because 88% of the participants are students and/or faculty members in the medical field who are supposed to be aware of and have basic information about the clinical application of stem cells. Numerous clinics around the world have advertised unproven stem cell-based interventions, which have spread quickly.^[27] This is worrying because they cause adverse events for the patients^[28] in addition to the high cost. Thus, it is necessary to increase awareness among healthcare providers about the therapeutic use of stem cells because they are often the source of information for patients.

This work highlights the importance of ongoing education and dialogue within the community to ensure a comprehensive understanding of the benefits and challenges associated with stem cell research and therapy. By pinpointing specific areas of misconception or lack of understanding, targeted educational strategies can be devised to enhance awareness, disseminate accurate information, and foster a more informed and supportive community. This approach not only promotes a nuanced understanding of the scientific, ethical, and social aspects of stem cell research but also contributes to building a foundation of trust and acceptance within the academic and broader community. In the rapidly advancing medical field, where information is easily accessible, descriptive studies become essential to pinpoint breaches in understanding and attitudes impacting ethical practices and patient care.^[29] One limitation of this study is that the data collected relied on self-reports from participants through a questionnaire. Self-reported data cannot be independently verified and may be susceptible to biases such as exaggeration or underreporting by individuals.

CONCLUSION

This study found a low to moderate level of knowledge about stem cells and their clinical applications. However, it showed a positive attitude towards supporting stem cell-related initiatives and believing in their potential to revolutionize medicine. This emphasizes the need for targeted educational programs to enhance understanding and promote informed decision-making regarding stem cell-related matters.

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Conflict of Interest

The authors declare no conflict of interest relevant to this article.

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