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# Acceptance, Awareness, Attitude, and Practices Toward Heart Transplantation: A Saudi Based Survey

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## Abstract

**Introductions:** The awareness of brain death and heart donation (HD) among the Saudi population remains limited, coupled with negative attitudes toward heart donation, resulting in a significant gap between the demand for donor hearts and the available supply. This study aimed to comprehensively understand the current perceptions, attitudes, and practices of the Saudi population regarding HD, as well as identify the obstacles. The ultimate goal was to strengthen the local donor pool.

**Methods:** A cross-sectional study was conducted from March to May 2023, employing a self-administered internet survey. The survey collected demographic information, assessed awareness, attitudes, and practices related to HD, and was completed by 1820 participants from various regions in Saudi Arabia. Data was analyzed using SPSS version 25 (SPSS Inc., Chicago, Illinois, USA). Chi-square test, Independent-samples t-test, one way analysis of variance test (ANOVA) and Spearman correlation coefficient was performed with the significance level set at  $p < 0.05$ .

**Results:** A significant portion of the population (out of 1820 participants) lacked organ donation cards and were uncertain about the registration process. Participants displayed a moderate level of knowledge about HD, with roughly half holding unfavorable attitudes toward HD. A considerable percentage of participants 62.0% were unwilling to register as heart donors, but a majority (79.9%) were willing to contribute by disseminating information about HD.

The study identified significant associations between knowledge scores and several factors, including age ( $p = 0.002$ ), career ( $p = 0.000$ ), possession of an organ donation card ( $p = 0.000$ ), and a history of transplantation or organ donation among relatives ( $p = 0.000$ ). A significant relationship was observed between attitude scores and several factors, including career ( $p = 0.001$ ), Saudi region ( $p = 0.025$ ), possession of an organ donation card ( $p = 0.000$ ), and a history of transplantation or organ donation among relatives ( $p = 0.000$ ).

**Conclusion:** The study highlights the urgent need for increased awareness to bolster the number of local heart donors. The involvement of healthcare professionals and social campaigns is essential to enhance public knowledge and potentially boost the willingness of individuals to become donors.

**Keywords:** Heart donation, Heart transplant, Organ donation

## 1. Introductions

Organ transplantation preserves thousands of lives, affording recipients a second chance at life. Vital organs, such as the heart, pancreas, liver, kidneys, and lungs, can be transplanted to individuals experiencing organ failure. The process of organ donation presents a multifaceted challenge,

encompassing medical, legal, ethical, organizational, and societal aspects [1].

Cardiac transplantation is the most effective treatment strategy for patients with end-stage heart disease who do not respond to medication or device therapy. It is used as a last-resort, efficient technique to enhance patients' quality of life and extend their life expectancy. The first human-to-human

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heart transplant (HT) was performed in 1967 by surgeon Christian Barnard and his colleagues [2–4].

In 1985, in Jordan, Dr. Hanania made history by performing the Middle East region's first HT [5]. Following this breakthrough, Riyadh Military Hospital achieved the Gulf region's first HT in 1986 [6]. Expanding on these advancements, King Faisal Specialist Hospital conducted its first HT procedure in 1989 [7].

Over the past two decades, there has been a notable increase in HT volumes and organ donation rates, both in the region and worldwide [8,9]. However, this positive trend coincides with a rising burden of heart failure (HF) in the Eastern Mediterranean Region, in contrast to decreasing global trends [10]. Consequently, there is a growing number of patients recommended for transplantation, leading to a significant imbalance between supply and demand [11,12].

The primary rate-limiting step for heart transplantation remains the availability of donors [13]. Waiting for a suitable donor heart can extend for months or even years. This process involves obtaining consent for donation and confirming brain death, along with matching the right blood type and meeting other criteria [2,14]. The worldwide shortage of suitable donor hearts leads to tragic outcomes, with adult waiting list mortality rates at 15% and paediatric rates ranging from 5% to 32% [15,16].

The number of brain-dead donors in the Asian continent is relatively low compared to the Americas and Europe. In 2019, the estimated number of brain-dead donors in Asia was 6 donors per million population, in contrast to 12 and 15 in Europe and the Americas, respectively [9].

Like the rest of the world, organ shortage presents one of the primary challenges in the Electronic Medical Record [17]. Data from Saudi Arabia estimates that there are 15–20 patients per million population waiting for HT, compared to only 1.5 available organs from deceased donors, reflecting the current imbalance between supply and demand in Saudi Arabia [18].

In areas with significant cultural and religious concerns, organ transplantation faces ethical and legal dilemmas regarding ongoing life support and organ procurement. In the Middle East, where the concept of brain death is less widely accepted, families often pursue additional life-extending treatments for seriously ill patients who have received a terminal prognosis [19].

Several studies have been conducted on organ donation and transplantation in Saudi Arabia, with some focusing on the general population [20,21].

#### Abbreviations list

HD	Heart Donation
HF	heart failure
HT	Heart Transplant

Regionally, Alessa et al. (2023) examined the Eastern region [22], Somaili et al. (2022) studied Jazan [23], Gismalla et al. (2020) conducted research in the Albaha region [24], and Agrawal et al. (2017) focused on Al-Kharj [25], all exploring the knowledge and attitudes toward organ donation in their respective regions. The common theme among these studies is their conclusion that the primary influencing factor on the organ donation rate in Saudi Arabia is a lack of knowledge.

Just one study by Al Habeeb et al. (2017) [26] has explored the Saudi community's perspective on HD, transplantation, and artificial hearts. To our knowledge, our research will be the second survey conducted in Saudi Arabia that specifically addresses heart transplantation among the general population.

The primary goal of this study is to explore current opinions related to HD among the largest possible sample in the Saudi community, spanning various regions of the Kingdom. Our research is dedicated to not only investigating knowledge but also a thorough investigation of the attitudes and actual practices of our population in relation to HD.

## 2. Subjects and methods

**Study design:** This cross-sectional research was conducted from March to July 2023 to assess the awareness, attitudes and practice of Saudi population towards HD and transplantation.

**Sampling and population:** The study population consisted of random sample of Saudi population from different regions in Saudi Arabia. Inclusion criteria included being a resident of Saudi Arabia, being over the age of 18 and capable of participating voluntarily. Exclusion criteria included younger individual and any incomplete responses.

We calculated the minimum required responses using the website Raosoft software that incorporates population size (approximately 32 million in Saudi Arabia) to be 385 responses based on an estimate of 50% response rate and 95% confidence interval with a 5% margin of error. The decision to collect a larger sample of responses is driven by the need for more robust and reliable survey results, which can lead to better insights and a higher degree of confidence in the conclusions.

**Tools and data collection procedure:** The data was gathered at random via a self-administered internet survey, which published through Emails and social media.

The questionnaire was developed following a thorough analysis of various questionnaires addressing the organ donation knowledge, attitude and practice (Appendix A) [27,28]. with some modifications were made to match the requirement of our research. To ensure the questionnaire's effectiveness, a pilot study involving a sample of 25 individuals from diverse age groups was conducted to assess the clarity of language and the perception of the questions.

The questionnaire's first section contained demographic data (age, sex, educational level, Career, Saudi Region of residency, if having organ donation card, relatives' transplant or organ donation histories, as well as whether they are aware of the location and steps necessary to register for heart donation.

The second section included 11 tri-variable questions on awareness of heart donation. According to the "Correct, Incorrect, and Do Not Know" Likert scale, so that "correct" receives a score of two, "do not know," a score of one, and "incorrect," a score of zero, where 22 is the highest possible score and 0 is the lowest. A person's level of awareness would be higher the higher the score they receive.

The third section of the survey was an evaluation of attitude, which asked respondents if they approved or disapproved of HD and the reasons behind their decisions, willingness to donate a heart in circumstances of brain death and propensity to receive donated hearts when needed which was created as a Likert questionnaire and contained the following option: agree (score one), neutral (score two), disagree (score three) with the maximum score of 33 and a minimum score of 11. The higher the obtained score is, the more negative attitudes toward brain death and HD would be. The final part of the questionnaire was the practice evaluation that asks participants if they would register for heart donation, assisting in the distribution of information regarding HD to others and where they were to search for additional information on heart transplantation and organ donation.

2.1. Statistical design

Data was analyzed using SPSS version 25 (SPSS Inc., Chicago, Illinois, USA). The categorical variables were presented as frequencies (%) and numerical variables as mean ± SD. Chi-square test, Independent-samples t-test, one way analysis of

variance test (ANOVA) and Spearman correlation coefficient was performed with the significance level set at  $p < 0.05$ .

**Ethical consideration:** After receiving approval from Taif University's Scientific Research Ethics Committee (number: 44–266) and after explaining the study's goal and providing assurances on compliance with protecting information integrity, we seek electronic consents from people who agreed to participate in the study. We let everyone know that the necessary data will only be used for research purposes.

3. Results

1820 people from different regions completed the survey. Ages 18 to 30 made up the majority of the population (53.1%), female respondents made up the greatest percentage of the sample (78.3%) and 69.9% non-medical professional career.

In (Table 1), the distribution of participants throughout the five Saudi Arabian areas is depicted, together with specific socioeconomic demographic data.

Eighty-nine percent of the individuals (89.4%) did not have an organ donation card, The majority of participants (73.7%) had no family history of organ donation or transplantation and 68% were unsure of where or how to register to be a cardiac donor (Fig. 1).

The capacity to accurately respond to the majority of knowledge questions is what is meant by "good knowledge." Poor knowledge is described as providing erroneous responses to the majority of

Table 1. Demographic characteristics.

		N (%)
Sex	Male	395 (21.7 %)
	Female	1425 (78.3 %)
Age	18–30	967 (53.1 %)
	31–40	323 (17.7 %)
	41–50	341 (18.7 %)
	>50	189 (10.4 %)
Career	Medical Professional (Doctor, Paramedic, Medical student, Nurse)	547 (30.1 %)
	Non-medical professional	1273 (69.9 %)
Educational Level	Elementary to Middle	51 (2.8 %)
	High School Level	430 (23.6 %)
	University Degree	1219 (67.0 %)
	Higher Studies	120 (6.6 %)
Saudi Region	Central	412 (22.6 %)
	Western	497 (27.3 %)
	Eastern	370 (20.3 %)
	Northern	396 (21.8 %)
	Southern	145 (8.0 %)

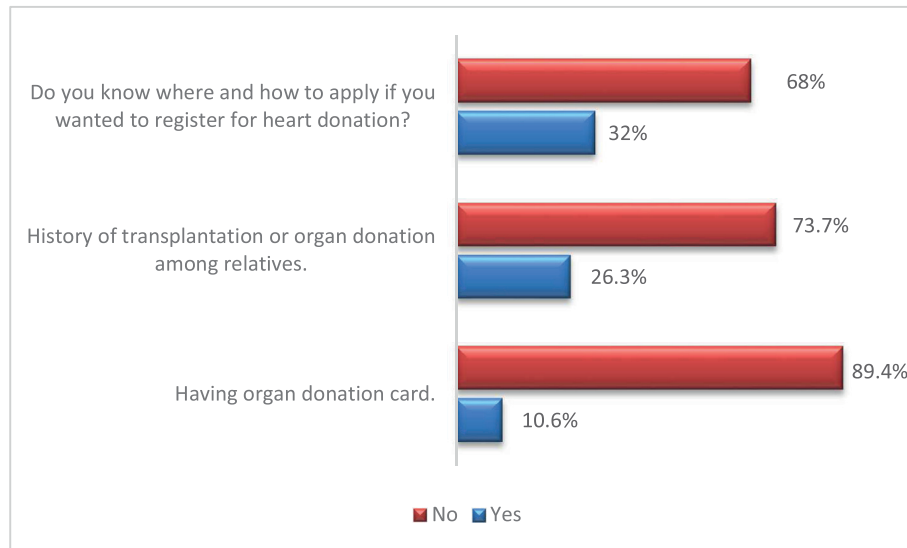


Fig. 1. Knowledge of cardiac donation registration.

knowledge questions. In order to assess the participants' awareness and knowledge about cardiac donation, a number of questions were presented to them. The results from the analysis are shown in Table 2.

The mean and the standard deviation of knowledge score were  $13.41 \pm 2.61$  (with a minimum score 0 and maximum score 22). With participants' general level of knowledge about organ and HD being moderate.

Attitude is defined as the fixed feeling or way of thinking about donation. The respondents were asked to select all the acceptance or rejection reasons they believed toward donating their heart, their tendency to receive a donated heart if needed and their willingness to HD in cases of brain death using

a several question, the results from the analysis are shown in Table 3.

The mean and standard deviation of attitude score were  $18.74 \pm 3.69$  (with a minimum score 11 and maximum score 33, A high score on the questionnaire represents a weaker attitude). The attitude of approximately half of participants (52.1%) to HD was unfavorable.

It was observed that 62.0% of participants were unwilling to register to donate a heart, while the majority (79.9%) were willing to help others learn about HD by sharing information about it (Table 4).

Participants were asked to choose which resources they liked to use to learn more about heart transplants. Figure 2 displays the results that were obtained. Notably, doctors and healthcare professionals

Table 2. Knowledge of heart transplantation.

	Correct N (%)	Incorrect N (%)	Do not Know N (%)
Brain death is different from coma.	1424 (78.2 %)	132 (7.3 %)	264 (14.5 %)
All organs can be donated In the event of brain death.	1244 (68.4 %)	166 (9.1 %)	410 (22.5 %)
There is the possibility of returning to life in people with brain death.	361 (19.8 %)	964 (53.0 %)	495 (27.2 %)
Do you know the hospital/centers in Saudi Arabia, where heart transplantation facility available?	540 (29.7 %)	804 (44.2 %)	476 (26.2 %)
The age group/sex predilection of donor/recipient for heart transplantation should be of same.	157 (8.6 %)	1092 (60.0 %)	571 (31.4 %)
Do you know for what conditions or diseases, heart Transplant is required?	640 (35.2 %)	597 (32.8 %)	583 (32.0 %)
Are there contraindications for the donor donating the heart?	1201 (66.0 %)	98 (5.4 %)	521 (28.6 %)
Is there a time limit during which the heart must be transferred and transplanted from the donor to the recipient?	1149 (63.1 %)	95 (5.2 %)	576 (31.6 %)
Is it possible to transfer the donated heart for transplantation to a patient located in another remote location?	888 (48.8 %)	252 (13.8 %)	680 (37.4 %)
What is the duration of the patient's medical follow-up after a heart transplant?	609 (33.5 %)	309 (17.0 %)	902 (49.6 %)
What are the most common complications after a heart transplant?	918 (50.4 %)	234 (12.9 %)	668 (36.7 %)

Table 3. Attitude toward heart donation.

	Agree N (%)	Disagree N (%)	Neutral N (%)
<b>The acceptance or rejection of heart donation.</b>			
The concept of heart donation and transplantation is acceptable	1045 (57.4 %)	128 (7 %)	647 (35.5 %)
<b>The acceptance or rejection reasons of heart donation.</b>			
The survival and vitality in others, is an important impetus to donation.	1451 (79.7 %)	45 (2.5 %)	324 (17.8 %)
Obtaining heavenly rewards is an important impetus to donation.	1450 (79.7 %)	57 (3.1 %)	313 (17.2 %)
Disfiguration of a dead body is a factor to avoid donation.	431 (23.7 %)	677 (37.2 %)	712 (39.1 %)
Donation is incompatible with the natural course of life and death	277 (15.2 %)	821 (45.1 %)	722 (39.7 %)
The health care professionals would try less to save patient life if they are aware that he is a registered organ donor?	516 (28.4 %)	721 (39.6 %)	583 (32.0 %)
The body is treated respectfully by health care professionals after donation?	1246 (68.5 %)	80 (4.4 %)	494 (27.1 %)
<b>Tendency to receive a donated heart if needed</b>			
If I need, I'll get it.	1096 (60.2 %)	141 (7.7 %)	583 (32.0 %)
<b>Willingness to Heart donation in cases of brain death</b>			
In the event of brain death I donate all my organs including Heart to relative.	710 (39.0 %)	333 (18.3 %)	777 (42.7 %)
In the event of brain death I donate all my organs including Heart to non-relative.	659 (36.2 %)	368 (20.2 %)	793 (43.6 %)
Even if organ donation is not accepted by the general public, still do it.	726 (39.9 %)	296 (16.3 %)	798 (43.8 %)

Table 4. Practice toward heart donation.

	Yes N (%)	No N (%)
Would you like to register to donate a heart?	692 (38.0 %)	1128 (62.0 %)
Would you contribute to spreading the information about heart donation to others?	1455 (79.9 %)	365 (20.1 %)

were identified as their top preferred source of knowledge on heart transplantation (55%), followed by 23.7% from websites while only 9.8% of participants depend on social media for getting their information.

Results of the knowledge and attitude correlation assessment revealed a negative correlation between the two factors. However its weak correlation coefficient, it indicates that if the Knowledge level is lower the Attitude score is greater (A high score on

the survey indicates a negative attitude) and this association was statistically significant ( $p = 0.000$ ) (Fig. 3).

There was a significant relationship between knowledge score and the participants age ( $p = 0.002$ ), Career ( $p = 0.000$ ), having organ donation card ( $p = 0.000$ ), and history of transplantation or organ donation among relatives ( $p = 0.000$ ). While, there was no significant relationship between knowledge score and sex, Educational Level, and different Saudi Region (Table 5).

There was a significant relationship between attitude score and the participants Career ( $p = 0.001$ ), Saudi Region ( $p = 0.025$ ), having organ donation card ( $p = 0.000$ ), and history of transplantation or organ donation among relatives ( $p = 0.000$ ). While, there was no significant relationship between attitude score and age, sex, and Educational Level (Table 6).

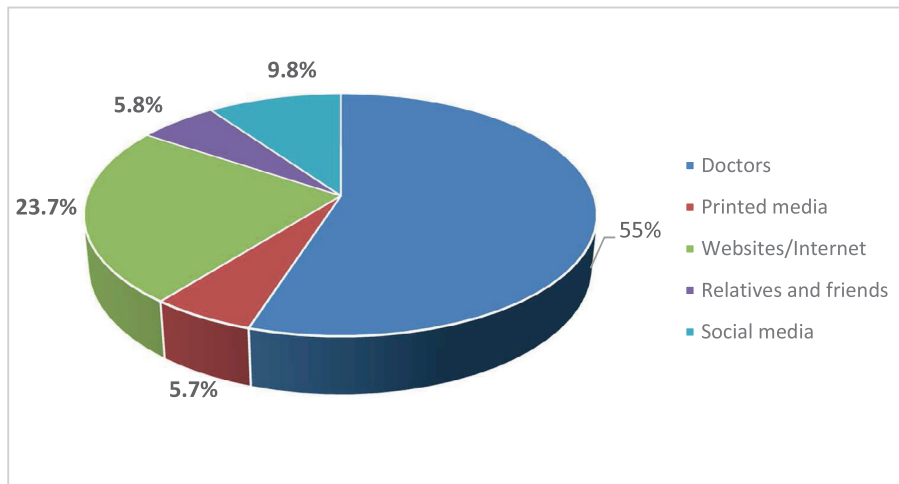


Fig. 2. Source of information about heart donation.

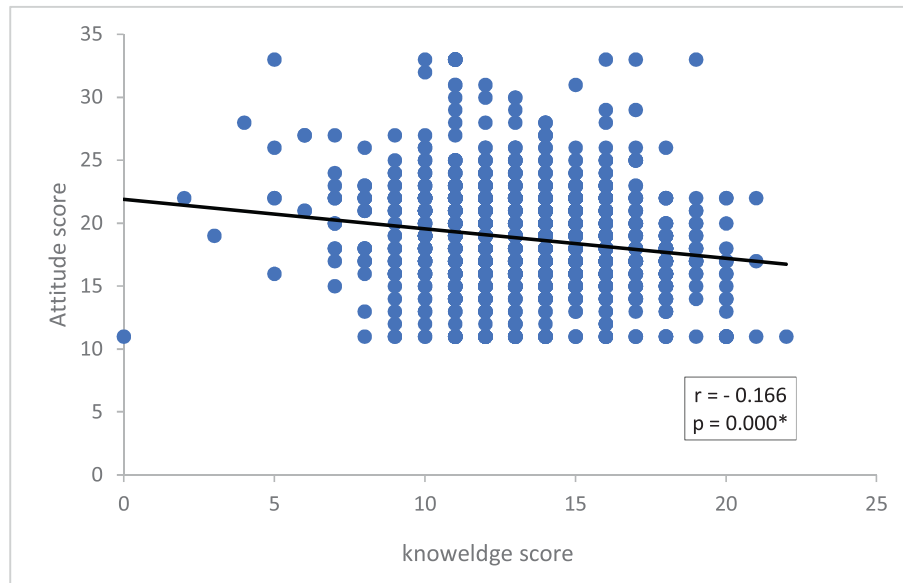


Fig. 3. Correlation between Knowledge score and attitude score.

Table 5. Association between demographic data and willing to donate heart with knowledge score.

		Mean $\pm$ SD K score	p
Age	18–30	13.61 $\pm$ 2.6	0.002*
	31–40	13.00 $\pm$ 2.5	
	41–50	13.33 $\pm$ 2.5	
	>50	13.23 $\pm$ 2.4	
sex	Female	13.36 $\pm$ 2.5	0.091
	Male	13.61 $\pm$ 2.7	
Career	Medical Professional (Doctor, Paramedic, Medical student, Nurse)	14.12 $\pm$ 2.6	0.000*
	Non-medical professional	13.11 $\pm$ 2.5	
	Elementary to Middle	12.80 $\pm$ 3.0	
Educational Level	High School Level	13.24 $\pm$ 2.6	0.117
	University Degree	13.49 $\pm$ 2.5	
	Higher Studies	13.49 $\pm$ 3.0	
Saudi Region	Central	13.29 $\pm$ 2.451	0.747
	Western	13.38 $\pm$ 2.674	
	Eastern	13.52 $\pm$ 2.521	
	Northern	13.42 $\pm$ 2.796	
	Southern	13.55 $\pm$ 2.560	
Having organ donation card.	yes	14.66 $\pm$ 2.913	0.000*
	no	13.26 $\pm$ 2.534	
History of transplantation or organ donation among relatives.	yes	14.07 $\pm$ 2.832	0.000*
	No	13.17 $\pm$ 2.487	
Do you know where and how to apply if you wanted to register for heart donation?	Yes	14.41 $\pm$ 2.674	0.000*
	No	12.94 $\pm$ 2.444	
Would you like to register to donate a heart?	Yes	13.91 $\pm$ 2.632	0.000*
	no	13.10 $\pm$ 2.552	
Would you contribute to spreading the information about heart donation to others?	yes	13.57 $\pm$ 2.589	0.000*
	no	12.76 $\pm$ 2.605	

\*p < 0.05.

#### 4. Discussion

Saudi Arabia retains a prominent regional position in the field of organ donation and transplantation. Numerous obstacles to deceased donation have

been recognized, including the absence of authoritative figures within extended Arab families, limited awareness regarding brain death, inadequate communication of diagnoses to families while in the

Table 6. Association between demographic data and willing to donate heart with Attitude score.

		Mean ± SD A score	p
Age	18–30	18.69 ± 3.681	0.858
	31–40	18.78 ± 3.946	
	41–50	18.72 ± 3.676	
	>50	18.94 ± 3.381	
sex	Female	18.72 ± 3.684	0.710
	Male	18.80 ± 3.746	
Career	Medical Professional	18.31 ± 3.592	0.001*
	Non-medical professional	18.92 ± 3.728	
Educational Level	Elementary to Middle	18.98 ± 4.398	0.606
	High School Level	18.55 ± 3.506	
	University Degree	18.77 ± 3.761	
	Higher Studies	18.94 ± 3.389	
Saudi Region	Central	18.87 ± 3.612	0.025*
	Western	18.94 ± 3.849	
	Eastern	18.92 ± 3.535	
	Northern	18.42 ± 3.679	
	Southern	18.04 ± 3.765	
Having organ donation card.	Yes	16.87 ± 3.033	0.000*
	No	18.96 ± 3.706	
History of transplantation or organ donation among relatives.	Yes	17.75 ± 3.520	0.000*
	No	19.09 ± 3.696	
Do you know where and how to apply if you wanted to register for heart donation?	Yes	17.99	0.000*
	No	19.09	
Would you like to register to donate a heart?	Yes	16.85	0.000*
	No	19.89	
Would you contribute to spreading the information about heart donation to others?	Yes	18.16	0.000*
	No	21.04	

\*p < 0.05.

Intensive Care Unit, organizational deficiencies resulting in a protracted decision-making process, along with the presence of conflicting cultural and religious beliefs [29].

Moreover, A Saudi national survey revealed that the average age of individuals with HF is 57–60 years, notably 10 years younger than in developed nations [30]. This trend is attributed to several risk factors, including a high incidence of diabetes, hypertension, obesity and high prevalence of smoking [31]. Accordingly, the high prevalence in the region, indicating the need for more human hearts for transplantation.

It is noteworthy that 525 hearts have been transplanted overall between 1986 and 2020. And in 2021; 63 hearts were retrieved, of which 48 hearts were transplanted (of which 31 were given to adults and 17 to children under the age of 14) and 15 hearts were recovered as sources of valves. However, the donation rate failing to satisfy the need [32].

Addressing these recognized obstacles is anticipated to enhance the rates of deceased organ donation in Saudi Arabia. Therefore, in our study, we not only investigated awareness but also explored the attitudes and practice of the Saudi population regarding heart donation.

In our study, we directed our attention towards assessing the population's knowledge about Brain death, with a particular emphasis on questions related to heart donation; if they know the centers in Saudi Arabia, where heart transplantation facility available, what conditions or diseases HT is required, if any age group/sex predilection of donor/recipient for heart transplantation and are there contraindications for the donor donating the heart.

The first barriers cited by the participants in our study was not knowing where to donate or register as a donor (68%). In our study only 10.6 % reported having an organ donation card, which is considered a very low percentage. A lower percentage was found in a prior study by Alnasyan et al., where only 2.3% of respondents reported having an organ donation card [33].

The registered HD center included; Prince Sultan Cardiac Center, Riyadh, Saudi Arabia, King Faisal Specialist Hospital & Research Centre, Riyadh and King Abdul-Aziz Cardiac Center, National Guard, Riyadh.

However, with the overall improvement of the healthcare infrastructure in Saudi Arabia, 70% of the study respondents did not know the centers where heart transplantation facility available.



Brain death criteria have been accepted across the ME region [5], as a part of the region nearly 66 % of this study respondents had a good knowledge about Brain death. But still there is a significant need for public education focusing on the irreversibility of this condition. Moreover, active religious support of the concept is needed [34].

Our results regarding knowledge related to heart transplantation showed a moderate score of  $13.41 \pm 2.61$  (with a minimum score 0 and maximum score 22). Thus, insufficient information is considered as a main reason for indecision about heart donation.

In the current study, the most prevalent reason for donating was the belief of obtaining heavenly rewards and preserving the survival and vitality in others which was reported by 79.7% of respondents, which can be related to the religious belief. Religion was, in fact, a major factor in the willingness or unwillingness to donate in many parts of the world; therefore, these findings highlight the significance of religious leaders' roles in this regard around all over the world [27].

According to 28.4% of respondents in our cohort, the most prevalent worry about organ donation was that hospital staff might not try their best to save lives if the patient is a registered donor. This finding is consistent with the findings of the Al Habeeb et al. study [26].

Our study examined the correlation between knowledge and attitude score of participants, showing that a positive attitude toward donation is connected with more awareness about heart donation; correlation analysis revealed that HD was substantially more likely to occur among people who had sufficient knowledge ( $p = 0.000$ ). These well-established findings underline the need for improved public education to help people understand brain death, and heart donation, to cultivate the right attitude and ultimately encourage choices based on accurate beliefs.

When inquiring with our survey participants regarding their inclination to accept a donated heart when required (if I need, I will get it), 60.2% respondents expressed agreement. However, when we inquired about their willingness to donate their own heart in cases of brain death, only 39.0% respondents indicated agreement. Therefore, to uncover the underlying reasons for this disparity we studied the association between participant's demographic data and willing to donate heart with knowledge score/attitude score.

There was a significant relationship between knowledge score and the participants age (the

younger the age, the higher the knowledge score). Our results are consistent with the results of Somaili et. al. study, who demonstrated that young people are more likely to be knowledgeable as compared to their counterparts [23] This might be explained by the belief that younger generations are more receptive to new concepts.

While in a study by Alnasyan et al., the majority of the younger group ( $\leq 40$  years) were willing to donate under special circumstances. While, their older group of participants was mostly willing to donate irrespective of circumstances [33].

The knowledge score was significantly associated with Career (the medical professions have higher knowledge score), this conclusion can be explained by the fact that those in the medical profession have completed university-level or above, where information is readily available. Similar results was obtained by Alanazi et al. [27], where the medical professionals were significantly more inclined to donate their corneas than those in other professions.

Moreover, Participants having organ donation card, and those having history of transplantation among relatives got higher knowledge score. This could be attributed to their previous experience with organ transplantation.

While, there was no significant relationship between knowledge score and sex, Educational Level, and different Saudi Region. This finding is consistent with a comparable survey carried out in Jazan and Jeddah [23,35]. This in contrast to a Korean study by Kim et al., which revealed a higher education level is connected with organ donation, particularly among health care professionals [36].

The participants' career and attitude score were significantly correlated, with the medical professions having a positive attitude regarding heart donation. Also, Participants having organ donation card and having history of transplantation among relatives got positive attitude toward heart donation. While, Age, sex, and educational level had no significant relationships with attitude score.

The participant's educational level had no effect on their sentiments attitudes, and this in accordance with a study in Greece It implied that the opposition to organ donation in this region may go beyond poor education alone [37].

In our study, willing to register to donate a heart and being ready to share information about HD were strongly correlated with higher knowledge and more positive attitudes scores.

It was observed that the majority (79.9%) of participants were ready to help spread information

about HD to other people. The participants are very motivated and willing to learn more about this interesting topic. Physicians and healthcare professionals were determined to be the respondents' favourite knowledge sources (55%), followed by 23.7% from websites while only 9.8% of participants depend on social media for getting their information. Consistent with our study, a survey done by Marqués-Lespier among general public, was discovered that health professionals face an important challenge in inspiring and educating as many people as possible about patients in need of organ transplantation [38].

As a result, it is sense to expect that social campaigns could raise awareness and encourage willingness to donate heart in areas where people can obtain the information directly from doctors and healthcare professionals. These results show that increased societal awareness may enhance the consent rate for organ donation, and it is important to continue providing families of the deceased with comprehensive information on heart donation.

Study limitations; this study also faces limitations commonly associated with questionnaire-based research, particularly concerning variations in how questions are understood and interpreted. The other limitation of the current study is the gender imbalance, which makes it impossible to know the opinions of the men who declined to participate, and it's probable they're more positive about heart donation. The study group also varied widely in terms of occupation and level of education. These factors could affect the results generalization in Saudi Arabia.

### 5. Conclusion

In conclusion, our results regarding knowledge related to heart transplantation showed a moderate score. A positive attitude toward donation is connected with more awareness where people who have good knowledge are more likely to register as donors. The preferred sources of information about HD were doctors and Health Care Workers. Our findings indicate the need for social awareness campaigns to increase public awareness and potentially raise the number of donors who agree to organ donation. It is highly suggested that the future studies with analysis of strategies for promoting

awareness, attitude, and motivation of individuals toward organ donation.

### Author contribution

Conception and design of Study: MAA, FAA, FAA. Literature review: MAA, FAA, FAA. Acquisition of data: MAA, FAA, FAA. Analysis and interpretation of data: RAK, TMA. Research investigation and analysis: RAK, TMA. Data collection: MAA, FAA, FAA. Drafting of manuscript: WA, AZH, MAA, RAK, TMA. Revising and editing the manuscript critically for important intellectual contents: WA, AZH. Data preparation and presentation: WA, AZH, RAK, TMA. Supervision of the research: WA, TMA. Research coordination and management: MAA.

### Conflicts of interest

There are no conflicts of interest.

### Appendix

Questionnaire of Acceptance, Awareness, Attitude, and Practices toward Heart Transplantation: A Saudi Based Survey.

A Questionnaire.

The first part: Demographic Characteristics.

Age	18–30 31–40 41–50 >50
Sex	Male Female
Educational Level	Elementary to Middle High School Level University degree Higher Studies
Career	Medical Professional (Doctor, Pharmacist, Nurse, Student) Non-medical professional
Saudi Region	Central Western Eastern Northern Southern
Are you registered as a donor at the Saudi Center for Organ Transplantation? Yes/No	
Do you have relatives who donated or transplanted any organ? Yes/No	
Do you know where and how to apply if you wanted to register for heart donation? Yes/No	

### The second part: Knowledge of heart transplantation.

1.	Brain death is different from coma.	Yes/No/I don't know
2.	All organs can be donated In the event of brain death.	Yes/No/I don't know
3.	There is the possibility of returning to life in people with brain death.	Yes/No/I don't know
4.	Do you know the hospital/centers in Saudi Arabia, where heart transplantation facility available?	Yes/No/I don't know
5.	The age group/sex predilection of donor/recipient for heart transplantation should be of same.	Yes/No/I don't know
6.	Do you know for what conditions or diseases, heart Transplant is required?	Yes/No/I don't know
7.	Are there contraindications for the donor donating the heart?	Yes/No/I don't know
8.	Is there a time limit during which the heart must be transferred and transplanted from the donor to the recipient?	Yes/No/I don't know
9.	Is it possible to transfer the donated heart for transplantation to a patient located in another remote location?	Yes/No/I don't know
10.	What is the duration of the patient's medical follow-up after a heart transplant?	1 year, 5 year, Lifelong I don't know
11.	What are the most common complications after a heart transplant?	Infection, Rejection, Tumors I don't know

### The third part: Attitude toward Heart Donation.

1.	The concept of heart donation and transplantation is acceptable	Agree/Neutral/disagree
2.	The survival and vitality in others, is an important impetus to donation.	Agree/Neutral/disagree
3.	Obtaining heavenly rewards is an important impetus to donation.	Agree/Neutral/disagree
4.	Disfiguration of a dead body is a factor to avoid donation.	Agree/Neutral/disagree
5.	Donation is incompatible with the natural course of life and death	Agree/Neutral/disagree
6.	The health care professionals would try less to save patient life if they are aware that he is a registered organ donor?	Agree/Neutral/disagree
7.	The body is treated respectfully by health care professionals after donation?	Agree/Neutral/disagree
8.	If I need, I'll get it.	Agree/Neutral/disagree
9.	In the event of brain death I donate all my organs including Heart to relative.	Agree/Neutral/disagree
10.	In the event of brain death I donate all my organs including Heart to non-relative.	Agree/Neutral/disagree
11.	Even if organ donation is not accepted by the general public, still do it.	Agree/Neutral/disagree

### The fourth part of the questionnaire Practice toward Heart Donation.

Would you like to register to donate a heart?	Yes/No/I don't know
Would you contribute to spreading the information about heart donation to others?	Yes/No/I don't know
What are the sources of your information?	-Doctors -Printed media (magazines, newspapers, and books) -Websites/Internet -Relatives and friends -Social media

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