

RESEARCH ARTICLE

Voluntary and non-voluntary blood donations among doctors

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Abstract

Background: Physicians may be an important source of blood donations as they are more likely to be familiar with the importance of donating and the donation process. The aim of this study is to report physicians' knowledge, attitudes, and practices towards voluntary and non-voluntary blood donations.

Study Design and Methods: This was a cross-sectional study conducted at King Faisal Specialist Hospital and Research Centre (KFSH&RC), Saudi Arabia. One-hundred-and-sixteen physicians and dentists responded to an online structured questionnaire sent to their institutional emails.

Results: Sixty-eight percent of participants (79% of males and 43% of females) reported previously having donated blood. Eighty-six percent of donors had previously donated on a voluntary basis, whereas 31% of donors had previously donated for a specific person. A recent donation within 5 years was associated with the younger age group and knowledge of the minimum interval between donations. Fifty-six percent of participants agreed with using replacement donations. Compared to participants in the youngest age group (25-35 years), older participants in the age groups (46-55 years) and (>55 years) were less likely to express intention to donate in the next 6 months (OR 0.289, $P = .022$ and OR 0.083, $P = .004$, respectively). Participants reporting poor nutritional status or other medical reasons as a barrier to donating blood were less likely to intend to donate (OR 0.146, $P < .001$). Among previous donors, intention to donate was associated with a recent donation within 1 year (OR 27.13, $P = .002$) and having had a pleasant donation experience (OR 14.98, $P < .001$).

Conclusion: Blood donation practices are strongly tied to physicians' gender and age and their knowledge of the donation process. The most significant barrier to blood donation was found to be nutritional and medical status.

KEYWORDS

blood donation, dentists, non-voluntary, physicians

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1 | INTRODUCTION

Blood transfusions are life-saving interventions in the settings of acute blood loss, major surgeries, and hematological diseases. Increasing donor recruitment and securing a sustainable supply of safe blood products is an important public health issue in transfusion medicine.

While voluntary, non-remunerated donors are usually motivated by altruistic intentions,¹ blood donations may also be obtained from non-voluntary sources—such as in the case of replacement donors (individuals who donate on behalf of a family member or friend as a prerequisite before an elective procedure) and statutory donors (those who donate for legislative purposes such as obtaining a driving license). There are also paid donors who provide blood commercially.

In Saudi Arabia, hospitals under the Ministry of Health (MOH) share centralized blood banks run by the respective regional MOH, whereas other independent hospitals run their own blood transfusion service.² The majority of blood donations in Saudi Arabia are non-voluntary similar to the trend in developing countries.³ Studies in AlKhobar, for example, reported that non-voluntary blood donations made up 85.2% of the donor pool between 1992 and 1998 and 81% of the pool between 1996 and 2000.^{4,5} Most hospitals employ a “No Blood - No Operation” policy, whereby patients are required to arrange a replacement donation before elective surgeries, and this is typically sourced from the patient's family member or acquaintance.² Various surveys have reported the rate of non-voluntary donations among Saudi donors to range from 15% to 64%.⁶⁻⁸ Replacement donations are less than ideal, since donors tend to have short-lived motives and are less likely to be retained.⁹ Furthermore, there may be ethical implications in insisting for replacement donations. Family members or friends of patients may be burdened with expectations to donate, and they might omit disclosing risk factors during blood donation in order to avoid social stigma. This in turn could increase the risk of infected blood products. Studies have shown that voluntary sources are associated with the lowest risks of infected products¹⁰ and as such, the World Health Organization (WHO) and Saudi Arabian Ministry of Health aim towards achieving an entirely voluntary blood pool.⁴

Few studies in Saudi Arabia have explored factors associated with blood donations, the results of which have mainly been consistent with those reported in other countries.¹¹⁻¹⁴ In terms of demographic characteristics, donors are more likely to be male, to belong to the middle-age group (30-50 years), to be married, and to have higher educational levels.^{8,15} The most common reason for non-donors not to donate is not being asked.⁷ In one survey, half of 316 non-donors reported they had been asked to donate blood; reasons cited by this group for not donating included fear, medical reasons, and lack of time.⁶ Other reported barriers to donating blood are site inaccessibility, perceived possibility of acquiring infection, and anticipation of possible need to donate to a family member in the future.⁸

Retaining previous donors is a further area of research when strategizing blood procurement, especially for donor groups with a rare blood type or low-risk status for infection.⁹ Returning donors are more likely to

be older and to have higher educational levels. Blood donation experience and perceived well-being after donating also affect future intention to donate.^{9,16} Studies have investigated the perceived effects of interventions such as gifts, free health checkups, blood credits, time-off work, and monetary compensation on donors' intentions to donate again. The effects of these motivators appear to vary according to donor characteristics. Older donors and long-time donors are less likely to report being influenced by compensatory interventions compared to their younger counterparts.¹⁰

Physicians, by virtue of their profession, should be especially aware of the importance of blood donations and should also be familiar of the donation process and its negligible risks. They may therefore be expected to be a promising source of blood donations; however, observational data suggest that this is not the case. A study that recruited potential donors from a university hospital, for example, found that only 3.1% of respondents were physicians.¹⁷ In a local college survey, medical and science students were no more likely to donate blood than students from other disciplines, suggesting that donation practices may ultimately be a social attribute.⁶ Among healthcare professionals, however, physicians do appear to be the most likely to donate.¹⁸⁻²⁰ Barriers to donating blood in the physician population have mainly been investigated in developing countries. These have found that the primary reasons for not donating include not being asked, fear of needles or discomfort during the procedure, not being fit to donate, and fear of knowing their medical status.^{18,20-23}

During the peak of the COVID-19 pandemic, hospitals in Saudi Arabia witnessed sharply decreasing donor rates and a shortage of blood products. In response, the Ministry of Health had implemented campaigns to facilitate blood donations such as providing mobile donation services to visit neighborhoods and individual homes and exempting donors from the national curfew for purposes of donation. In this most recent crisis, healthcare workers would have been a vital source of blood donations.

There have been no reported studies from Saudi Arabia on physicians' knowledge, attitudes, and practices of voluntary and non-voluntary blood donations. This study aimed at investigating these factors and identify the predictors of donor status among physicians, with view to encourage voluntary, non-remunerated blood donations within the physician population and eventually the wider medical community.

2 | METHODS

2.1 | Study design

The study data were collected and managed using REDCap electronic data capture tools hosted at King Faisal Specialist Hospital and Research Centre (KFSH&RC).²⁴ A link to the study questionnaire was sent to the institutional emails of all physicians and dentists at two branches of KFHS&RC in Riyadh and Jeddah. Three emails were sent on April 21, April 25, and May 7, 2019. Recipients were randomized to receive the email invitation with an incentive mentioned in the subject (draw for 100 SR bookstore voucher) or without mention. At the end of completing the survey, all participants were given the option to enter the draw regardless of the email version they received.

Responses were collected until the end of June 2019. A total of 1646 doctors and dentists were invited to complete the questionnaire.

2.2 | Questionnaire

A structured questionnaire was initially piloted on 19 doctors who were randomly selected from five departments at KFSH&RC-Riyadh between December 2018 and January 2019. Feedback was collected on the questionnaire items, and appropriate modifications were made to the phrasing and arrangement of questions.

The first part of the survey collected information on the respondents' demographics including age, gender, marital status, nationality, hospital branch, specialty department, and current position in the hospital. The second part of the survey recorded respondents and their families' previous need for blood transfusions and replacement donations, sources of replacement donations, and the respondents' level of agreement that patients should arrange for replacement donations. The survey then asked respondents whether they had previously donated blood, reasons for previously donating, whether previous donations were prompted by campaigns or online appeals, the time since their last blood donation, and a 5-point Likert scale rating of their last donation experience. All respondents were asked to select barriers to donating blood from a preset list and to estimate their likelihood of donating blood in the next 6 months. The final part of the survey assessed the knowledge of participants (in a multiple-choice question [MCQ] format) on blood transfusion need, the national donation rate in Saudi Arabia, aspects related to the donation process, and the shelf life of blood products.

2.3 | Statistical analysis

Statistical analysis was performed using SPSS version 26.0. The results of descriptive analyses of all variables are presented as frequencies and proportions. Pearson's chi-square test was used to examine the associations between participant characteristics and donor status (non-donor and previous donor), barriers to donating blood, and answers to knowledge-related questions. Logistic regression was used to assess predictors of intention to donate in the next 6 months and agreement that patients should arrange replacement donations before elective procedures.

2.4 | ETHICS STATEMENT

Ethical approval was granted by the ethics committee at the Office of Research Affairs at King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia. The participants' consent was implied by the completion and submission of the questionnaire.

3 | RESULTS

3.1 | Participant characteristics, donor status, and previous need for blood donations

One-hundred and sixteen participants completed the survey. Donor status was provided by 113 respondents.

Sixty-eight percent of participants reported having had previously donated blood. Table 1 shows the participants' characteristics and their association with donor status. The minimum age of the sample participants was 25 years. Male gender, being married, and being a non-Saudi were associated with being a previous donor. However, after adjusting for gender by Mantel-Haenszel stratification, marital status and nationality no longer predicted donor status (adjusted $\chi^2 = 3.415$, $P = .065$ and $\chi^2 = 2.654$, $P = .103$, respectively). There was no significant association between donor status and respondents' current position, institution (not shown), or number of years affiliated in the institution.

Table 2 describes the proportion of participants who had required blood donations for themselves or their family members. Only two participants reported having had a personal need for a blood transfusion. Family members of at least one-third of participants had previously needed a transfusion. The most common reasons for requiring a transfusion were surgeries (41%) and medical diseases (30%). One-quarter of participants reported they had needed a replacement donation for themselves or their families. Donor status was not associated with previous need for blood transfusions for self and family members, including and excluding need for replacement donations (data not shown).

3.2 | Barriers to donating blood

Table 3 includes barriers to donating blood that were reported by non-donors and previous donors. Around three-quarters of participants knew whom to contact to donate blood. The most commonly reported barriers among non-donors were poor nutritional status (such as anemia or low weight) or other medical reasons (56%, $n = 20$), followed by time constraints (28%), fear related to the procedure (19%), and not being asked (17%). The most common barrier among previous donors was time constraints (25%), followed by poor nutritional status or other medical reasons (14%, $n = 11$), and not being asked to donate (14%).

Female participants were more likely to report poor nutritional status or other medical reasons as barriers compared to males (48.6% vs 15.4%, $\chi^2 = 13.947$, $P < .001$), but not time constraints ($\chi^2 = 0.853$, $P = .356$) or fear related to the procedure ($\chi^2 = 0.224$, $P = .636$). Participants who self-rated their health as good were more likely to report poor nutritional status or other medical reasons as barriers compared to those who rated their health as excellent/very good (58.3% vs 23.8%, $\chi^2 = 6.439$, $P = .011$). Time constraints as a barrier was not significantly associated with current position ($\chi^2 = 0.034$, $P = .983$) or age group ($\chi^2 = 3.431$, $P = .330$).

Forty-four percent of previous donors did not select any barrier to donating blood. None of the 22 donors who donated blood within the last 1 year selected any barrier to donation.

3.3 | Previous reasons for donating blood

Eighty-six percent of donors previously donated on a voluntary basis, whereas 31% of donors ($n = 24$) reported having previously donated for a specific person as a replacement donation (19% of donors,

$n = 16$) or for direct transfusion (17% of donors, $n = 13$) (see Table 4). Hospital-based campaigns and messages had prompted blood donations for at least 20% of donors.

Figure 1 illustrates the proportion of donors who donated within 1 and 5 years by the age group. Less than one-third of donors (22 of 77 donors) reported last donating blood within 1 year, and 65% (50 donors) had donated within 5 years. Across increasing age groups, the proportion of donors who donated within the last 5 years decreased; all donors in the age group (25-30 years) had donated blood within 5 years compared to 25% of donors in the age group

TABLE 1 Characteristics of participants with a known donor status ($n = 113$)

	Total n (%)	Non-donor (n = 36)	Previous donor (n = 77)	P-value ^a
Age				
25-35 years	30 (26.5)	12 (33.3)	18 (23.4)	.372
36-45 years	39 (34.5)	9 (25.0)	30 (39.0)	
46-55 years	30 (26.5)	9 (25.0)	21 (27.3)	
Older than 55 years	14 (12.4)	6 (16.7)	8 (10.4)	
Female gender	35 (31.0)	20 (55.6)	15 (19.5)	<.001
Saudi Arabian nationality	68 (60.7)	28 (77.8)	40 (52.6)	.011
Marital status				
Single/divorced/widowed	23 (20.4)	15 (41.7)	8 (10.4)	<.001
Married	90 (79.6)	21 (58.3)	69 (89.6)	
Current position				
Consultant/associate consultant	68 (60.7)	24 (68.6)	44 (57.1)	.358
Assistant consultant/fellow	29 (25.9)	6 (17.1)	23 (29.9)	
Resident/specialist physician	15 (13.4)	5 (14.3)	10 (13.0)	
Number of years in the institution				
Less than 5 years	51 (45.1)	14 (38.9)	37 (48.1)	.182
6-10 years	21 (18.6)	5 (13.9)	16 (20.8)	
11-20 years	22 (19.5)	7 (19.4)	15 (19.5)	
More than 20 years	19 (16.8)	10 (27.8)	9 (11.7)	
Self-rated health				
Excellent	48 (42.5)	17 (47.2)	31 (40.3)	.459
Very good	53 (46.9)	17 (47.2)	36 (46.8)	
Good	12 (10.6)	2 (5.6)	10 (13.0)	
Blood type				
A	25 (22.3)	8 (22.2)	17 (22.4)	.999
B	29 (25.9)	9 (25.0)	20 (26.3)	
AB	6 (5.4)	2 (5.6)	4 (5.3)	
O	52 (46.4)	17 (47.2)	35 (46.1)	
Self or family member needed donation ^b	72 (63.7)	24 (66.7)	48 (62.3)	.656
Agree that patients should arrange for replacement donations				
Strongly agree/agree	63 (55.8)	16 (44.4)	47 (61.0)	.09
Neutral	23 (20.4)	11 (30.6)	12 (15.6)	
Disagree/strongly disagree	27 (23.9)	9 (25.0)	18 (23.4)	

^aPearson's chi-square test.

^bIncluding both blood transfusions and replacement donations.

TABLE 2 Previous need for blood transfusions and replacement donations among participants and their families (n = 116)

	n (%)
Previously needed transfusion	2 (1.7)
First-degree relative previously needed transfusion	40 (34.5)
Other relative previously needed transfusion	50 (43.1)
Reasons for blood transfusion among participants and their families	
Surgery	47 (40.5)
Car or other motor vehicle accident	5 (4.3)
Other trauma	2 (1.7)
Medical disease	35 (30.2)
Self or family member needed replacement donation	29 (25.0)
Supplier of replacement donation	
Self	10 (8.6)
Family member	22 (19.0)
Friend	10 (8.6)
Stranger or unknown person	9 (7.8)

TABLE 3 Reported barriers to donating blood and participants' intentions to donate in the next 6 months (n = 113)

	Non-donors (n = 36)	Previous donors (n = 77)
Do you know where to go to/whom to contact to donate blood? (Answered yes)	26 (76.5%)	60 (78.9%)
Reported barriers to donating blood		
Poor nutritional status	14 (38.9%)	3 (3.9%)
Other medical reasons	8 (22.2%)	8 (10.4%)
Time constraints	10 (27.8%)	19 (24.7%)
Fear related to procedure ^a	7 (19.4%)	6 (7.8%)
Fear of bad news while screening	2 (5.6%)	0 (0%)
Previous bad experience	na	1 (1.3%)
No one asked me to donate	6 (16.7%)	11 (14.3%)
I do not know whom to contact	0 (0%)	1 (1.3%)
I believe there is no need to donate	1 (2.8%)	1 (1.3%)
Others	0 (0%)	7 (9.1%)
None of the above barriers selected	0 (0%)	34 (44.2%)
Intention to donate in the next 6 months		
Very likely/likely	12 (33.3%)	45 (58.4%)
Neither likely nor unlikely	8 (22.2%)	14 (18.2%)
Unlikely/very unlikely	16 (44.4%)	18 (23.4%)

Abbreviation: na, not applicable.

^aFear of needles or blood, fear of pain or discomfort during the procedure, or fear of complications during the procedure.

TABLE 4 Experiences with donating blood among previous donors (n = 77)

	n (%)
When was the last time you donated blood	
Less than 1 months ago	3 (3.9%)
1 month to 6 months ago	10 (13.0%)
6 months to 1 year ago	9 (11.7%)
1 year to 5 years ago	28 (36.4%)
More than 5 years ago	27 (35.1%)
Why have you donated in the past?	
No specific reason/voluntary	66 (85.7%)
Family member needed a replacement donation	11 (14.2%)
A friend needed a replacement donation	2 (2.6%)
Stranger/unknown person needed a replacement donation	5 (6.5%)
Family member needed a blood transfusion	4 (5.2%)
A friend needed a blood transfusion	2 (2.6%)
Stranger/unknown person needed a blood transfusion	9 (11.7%)
Did you ever donate after the following	
Request from WhatsApp, Facebook, or other online media to donate	7 (9.1%)
Campaign in the hospital	34 (44.2%)
Campaign at a conference or event	3 (3.9%)
Message from hospital or blood bank	24 (31.2%)
Last blood donation experience	
Very pleasant/pleasant	54 (70.1%)
Neither pleasant nor unpleasant	20 (26.0%)
Unpleasant/very unpleasant	3 (3.9%)

(>55 years). We did not find any significant difference in donation rates within 1 or 5 years between male and female donors (data not shown).

3.4 | Intention to donate in the next 6 months

Fifty-eight percent of previous donors expressed intention to donate blood in the next 6 months compared to 33% of non-donors. Logistic regression was performed to identify predictors of intention to donate among participants (Table 5). Compared to participants in the youngest age group (25-35 years), older participants in the age groups (46-55 years) and (>55 years) were less likely to express intention to donate in the next 6 months (OR 0.289, 95% CI:0.100-0.837, $P = .022$ and OR 0.083, 95% CI:0.016-0.446, $P = .004$, respectively). Reporting poor nutritional status or other medical reasons as a barrier was a negative predictor of intention to donate (OR 0.146, 95% CI:0.054-0.395, $P < .001$).

Among previous donors, intention to donate was associated with having donated within the last 1 year (OR 27.13, 95% CI:3.4-216.2, $P = .002$) and 5 years (OR 12.41, 95% CI:4.02-38.3, $P < .001$), and

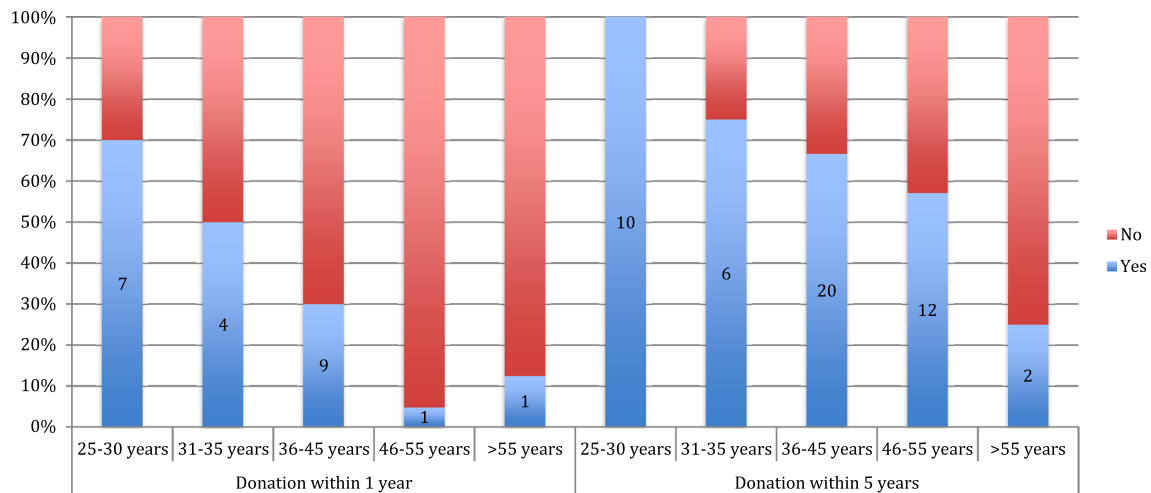


FIGURE 1 Proportion of donors who donated within 1 and 5 years by the age group (n = 77)

TABLE 5 Simple logistic regression testing factors associated with intention to donate (very likely or likely to donate in the next 6 months) and agreement that patients should arrange for replacement donations (strongly agree or agree) among participants (n = 116)

	Participants who are very likely or likely to donate in the next 6 months		Participants who strongly agree or agree that patients should arrange replacement donations	
	OR (95%CI)	P-value	OR (95%CI)	P-value
Age				
25-35 years (reference group)	-	-	-	-
36-45 years	0.800 (0.295-2.166)	.661	0.919 (0.358-2.359)	.860
46-55 years	0.289 (0.100-0.837)	.022	1.313 (0.472-3.653)	.603
Older than 55 years	0.083 (0.016-0.446)	.004	1.750 (0.481-6.364)	.396
Female gender	0.643 (0.288-1.436)	.281	0.506 (0.228-1.123)	.094
Self or family member needed donation ^a	1.110 (0.515-2.391)	.790	1.575 (0.731-3.392)	.246
Donated previously voluntarily ^b	1.204 (0.333-4.348)	.777	2.100 (0.579-7.617)	.259
Donated previously to family or friend ^{a,b}	0.772 (0.248-2.401)	.655	1.351 (0.412-4.430)	.619
Donated previously as a replacement donor ^b	0.893 (0.294-2.714)	.842	1.528 (0.472-4.941)	.479
Agree that patient should arrange replacement donations	1.376 (0.654-2.899)	.401	na	na
Last time donated < 1 year ago ^b	27.125 (3.403-216.181)	.002	0.528 (0.193-1.440)	.212
Last time donated < 5 years ago ^b	12.409 (4.019-38.312)	<.001	0.882 (0.336-2.315)	.799
Nutritional or other medical reason as a barrier	0.146 (0.054-0.395)	<.001	1.342 (0.580-3.107)	.492
Time constraints as a barrier	1.071 (0.460-2.493)	.873	0.659 (0.283-1.532)	.333
Fear related to procedure ^c as a barrier	0.256 (0.066-0.985)	.047	1.888 (0.546-6.525)	.315
Previous donation experience very pleasant/pleasant ^b	14.981 (4.311-52.063)	<.001	0.776 (0.281-2.141)	.624

Abbreviation: na, not applicable.

^aIncluding both blood transfusions and replacement donations.

^bAmong previous donors only (n = 77).

^cFear of needles or blood, fear of pain or discomfort during the procedure, or fear of complications during the procedure.

having a pleasant donation experience (OR 14.98, 95%CI:4.31-52.06, $P < .001$). After adjusting for the age group, donating within the last 1 or 5 years remained significantly positive predictors of intention to donate (OR 24.65, 95%CI:2.28-266.68, $P = .008$ and OR 10.201, 95%CI:2.92-35.69, $P < .001$, respectively).

3.5 | Participants' opinions on replacement donations

Previous donors were more likely to agree that patients should arrange replacement donations (61% vs 44%), whereas a higher

TABLE 6 Knowledge of blood transfusion need and donation process among participants (n = 116)

	I do not know	Correct answer	Incorrect answer
Q.1: What percentage of people will need a blood transfusion in their lifetime?	51.7%	3.4%	44.8%
Correct answer: 50%			
Q.2: In Saudi Arabia, what is the blood donation rate per 1000 people?	65.5%	11.2%	23.3%
Correct answer: 10-20 per 1000 people			
Q.3: In Saudi Arabia, what percentage of blood donations comes from patients' families and friends?	50.4%	10.4%	39.1%
Correct answer: 60%			
Q.4: What blood type is most needed?	17.2%	70.7%	12.1%
Correct answer: type O			
Q.5: What plasma type is most needed?	49.6%	16.5%	33.9%
Correct answer: type AB			
Q.6: How much blood is collected from a donor during each collection?	6.9%	63.8%	29.3%
Correct answer: 450 mL			
Q.7: What minimum time interval is required between each blood donation?	10.3%	34.5%	55.2%
Correct answer: 2 months			
Q.8: How quickly do the following blood products expire?			
RBCs (correct answer: 6 weeks)	36.5%	20.0%	43.1%
Platelets (correct answer: 5 days)	44.7%	36.8%	18.4%
Plasma (correct answer: 12 months)	53.4%	19.0%	27.6%
Cryoprecipitate (correct answer: 12 months)	61.2%	17.2%	21.6%

proportion of non-donors held a neutral stance ($P = .09$). None of the variables tested predicted participants' agreement of replacement donations (Table 5).

3.6 | Knowledge of blood transfusion need and the donation process

Table 6 summarizes the proportion of respondents who correctly answered the questions pertaining to knowledge on blood transfusion need and the donation process. Percentages of correct answers were generally low for all questions.

Participants were asked to select the minimum time interval between blood donations. The majority of non-donors answered this question as "I do not know" (22.2% non-donors compared to 5.2% of previous donors). Most incorrect answers overestimated the minimum interval (55.8% of answered questions). When previous donors were examined separately, those who had donated within 5 years were more likely to correctly answer the minimum interval between donations (number of correct answers $n = 24$ [51.1%], underestimate $n = 3$ [6.4%], overestimate $n = 20$ [42.6%]) compared to donors who had donated longer ago (number of correct answers $n = 6$ [23.1%],

underestimate $n = 2$ [7.7%], and overestimate $n = 18$ [69.2%]) ($\chi^2 = 5.521$, $P = .063$) (data not shown).

4 | DISCUSSION

This is the first study in Saudi Arabia to report physicians' attitudes and practices towards blood donation. The study also explored perceptions of physicians towards replacement donations, a prevalent form of non-voluntary blood donation in Saudi Arabia.

4.1 | Demographic predictors of donation

According to large American and European studies, donors generally tend to be white, married, middle-aged men.^{25,26} Nevertheless, there exist wide geographical variations with respect to donor demographics, especially gender, with some countries reporting equal or greater female contributions to donations.^{25,27} Younger female donors in particular may outnumber males in Western countries.²⁷ In the current study, 79% of males and 43% of females had previously donated blood. Male gender appeared to confound the

association between marital status and nationality and donor status. Because the current sample consisted of doctors and dentists only, there are likely small socioeconomic variations among participants, which could have diluted the effects of these social factors on donor status.

Females were more likely to report poor nutritional status such as anemia and low weight (39%) or other medical reasons (11%) as barriers to donating blood, similar to other reports.²⁸ Other studies have suggested that women are also more likely to report complications of procedures as barriers to donation, whereas men are more likely to report time constraints.²⁸ These differences were not observed in the current study, however, as previously mentioned, our sample was relatively homogenous and this could have resulted in decreased variation of experienced barriers, since male and female respondents would have similar work commitments, time constraints, and tolerances to procedures due to professional exposure. The most commonly cited reasons for deferrals among females are anemia, pregnancy, and lactation.²⁹ Authors have emphasized the need to encourage female donors to continue blood donations after pregnancy (which may be used for the transfusion of plasma and its derivatives) since they may be at risk of lapsing.²⁸

Although there was no significant difference in donor status by the age group, the study found that participants in the age group (25-35 years) were more likely to express intention to donate in the next 6 months compared to the older age groups (46-55 years) and (>55 years), but equally as likely as the age group (36-45 years). This was in spite of a lack of association between age groups and reporting time constraints as a barrier to donating blood. Although it can be argued that intention to donate may not translate into actual donation practice and thus cannot be taken as a proxy to ascertain predictors, studies have shown that intention may indeed predict donation.^{30,31}

The literature suggests that there is a global trend towards increasing donation rates among the younger generation. In one Saudi study that surveyed primary care patients, those in the age group (31-50 years) had the highest donation rates (57%).⁸ A recent hospital-based study also found that the age group (26-35 years) had the greatest contribution to the donor pool (around 47%).³² One European study found that persons in the age group (30-44 years) were more likely to have donated blood compared to their younger and older counterparts in cohorts recruited across 1994 and 2014. As older persons are more likely to have a lifetime prevalence of blood donations, the authors further modeled interactions of age with time period to show that younger birth cohorts indeed appeared more likely to donate.²⁵ This trend of increasing blood donations specifically among the young was also reported in a US study that examined donation trends from 2011 to 2015³³ in which the youngest age group (<18 years) as well as new, first-time donors made up an increasing proportion of the donor pool over the study period.

Possible explanations for these observations include the elimination of cultural barriers and increasing education and awareness among the general public in recent years.³⁴ We believe the same applies to the Saudi population and may explain why younger people are more likely to express intention to donate in the current study.

Voluntary blood donations did not become the norm among the general population until at least 1985, prior to which donations were mostly provided by paid non-Saudi donors or imported from other countries.³⁵

An alternative explanation for increased donations among the young is increasing efforts from blood banks directed at recruiting younger people, with the aim to retain them in the long term.^{26,33} There are no data to confirm whether Saudi transfusion services are currently employing this strategy. The increased use of online platforms to invite potential donors may be particularly effective among the youngest age groups, whether intentional or not. In the current study, four of seven of those who donated after an online media request were 25 to 35 years old, whereas responses to other modalities such as hospital campaigns were equally elicited across the different age groups (data not shown). However, in other studies, the effect of text messages on returning donations did not have a significant interaction with age.³⁶

Retention of donors is crucial for maintaining blood supplies, and almost half of the first-time donors will not return to donate after 5 years. The 2016 National Health Interview Survey showed that the percentage of individuals reporting a past-year history of blood donation was the highest in the youngest age group²⁶; however, lapsed donors were not taken into account. Although our data demonstrated that a greater proportion of the youngest donors had donated within the last 5 years compared to other age groups, the lifetime prevalence of donations did not significantly differ among the groups. The relatively high rate of lapses among older donors has concerning implications for donation sustainability in Saudi Arabia, as they may suggest an overall low rate of repeat donations compared to other populations. Returning donors made up at least 60% of US donations in 2015,³³ and older donors are usually observed to donate more frequently than younger persons.³⁷ In the current study, we did not find any barrier specific to the older age groups that would preclude them from donating in recent years. Studies in other countries suggest that older donors are more likely to report time constraints and lack of center accessibility as reasons for lapsing.^{28,38}

Unfortunately, our study did not capture the number of donations provided by participants; therefore, it is difficult to fully discuss donor retention based on the current results. While all donors in the youngest age group had donated blood in the last 5 years, the study did not differentiate whether these had been one-time donations or if participants had donated multiple times (a positive predictor of long-term retention³⁹); observations from other studies suggest younger donors are less likely to return to donate⁴⁰ Our findings invite future research into determining predictors of donor retention within the Saudi population.

4.2 | Barriers to donating blood

In our study, the most commonly cited barriers to donating blood were time constraints, poor nutritional status, other medical reasons,

and not being asked. Non-donors also frequently reported fear related to the procedure as a barrier. Reporting poor nutritional status or other medical reasons as a barrier was negatively associated with intention to donate in the next 6 months. The study did not investigate whether participants' self-reported health truly excluded them from being potential donors, which would have been of interest to explore. Exclusion factors to donation can be classified as permanent, long-term, or short-term; therefore, a current contraindication may not necessarily be everlasting.⁴¹ Individuals should be encouraged to seek independent advice from their primary physicians and blood donation centers, who in turn can engage in active follow-up of donors with short-term contraindications. Our study only focused on whole-blood donors; however, physicians with poor nutritional status or medical concerns may be candidates for non-whole-blood donations.

A previously unpleasant donation experience also negatively predicted intention to donate among previous donors, which has been observed in other studies.⁹ It can be argued that this observation could be influenced by an individual's sense of morality; persons who are more willing to donate may feel obliged to rate their donation experience positively. However, of the six previous donors who reported procedure-related complications as a barrier to donating blood, only one described their last donation experience as pleasant and expressed intention to donate in the next 6 months. This suggests that these respondents' unpleasant experiences may have created barriers to future donations, although the cross-sectional nature of the data does not exclude the possibility that these individuals fearing complications were already pessimistic about the donation process. Nevertheless, the literature has shown that adverse events related to blood donations can negatively impact donor return rates and decrease donor retention.⁴²

Time constraints as a barrier did not reach significance as a deterrent for intention to donate; however, the lack of association in the current study could be due to the low response rate and small sample size. Other studies on non-physician populations seem to suggest that free time-off work can improve donation rates. Danielson et al. showed that in the United States, discontinuing a time-off incentive (4 hours off work) decreased the units of blood collected by more than half.⁴³ In Italy, a one-day paid leave leads to a 40% increase in annual donations.⁴⁴ An Iranian study found that 33.6% of men and 18.6% of women reported they would donate blood if they received leave from work.⁴⁵

Previous donors were more likely to be aware of details of the blood donation process consistent with previous studies.^{7,8} It has been suggested that decreasing the time interval between blood donations can encourage individuals to become regular donors.¹⁶ In the current study, those with a wide gap since their last donation (>5 years) were more likely to overestimate the minimum interval between donations. It is unknown whether there is a causal link between knowledge of the minimum interval between donations and the frequency of donations. This is a potential intervention target for current donors that could be tested in future studies.

4.3 | Replacement donations

A high proportion of physicians agree that patients should arrange for replacement donations before elective procedures. Previous donors were more likely to agree with replacement donations. This may reflect previous donors' interest in the subject matter, since a greater proportion of non-donors held a neutral stance towards the topic. Participants who had a personal involvement with blood donation may be more aware of the importance of blood supplies and believe that replacement donations are a viable strategy to increase rates. We did not find any other variable associated with the agreement of replacement donations.

Healthcare workers' support for replacement donations has been reported in other countries that rely on such donations. In one survey, the majority of Nigerian healthcare workers (90%) felt that patients' relatives should be asked to donate,¹⁹ whereas another study showed that 91% of medical students believe that blood should only be donated to family members and friends.⁴⁶

Among the general Saudi population, fear of acquiring infection from blood products of non-related donors may instigate a preference to receive transfusions from family members or acquaintances only.^{6,15} Some non-donors have reported not donating blood in case a family member will need a donation in the future,⁷ so there could also be a cultural perception that family members should provide for each other.

In addition, when a hospital-based replacement donor system has been in existence for many decades and demonstrated sustainability (in Saudi Arabia, accounting for 60% of donations⁴⁷), shifting to a completely voluntary recruitment strategy will be initially challenging and incur great costs.⁴⁸ Nevertheless, this is what will ensure long-term, sustainable donor pools, as well as minimize the risk of infected blood products. Transfusion services need to engage in wider campaigns to promote voluntary, non-remunerated blood donations and eventually aim to eliminate non-voluntary donor sources.

5 | STUDY LIMITATIONS

The study is limited by the low participation rates of invited physicians. The sample is likely to be biased, as individuals who respond are likely to differ from non-responders with regard to donation status.⁹ The rates reported therefore may not represent those of the physician population in Saudi Arabia. Although inferences can be made on the association between different variables with donor status, intention to donate, and agreement of replacement donations, these should be interpreted with caution due to the study's potential selection bias. Of note, receiving an incentive message in the invitation email subject was not associated with any of the study's dependent or independent variables (age, gender, current job position, donor status, and intention to donate) or survey completeness (data not shown). Further studies should be conducted to reproduce the associations observed in our analyses.

6 | CONCLUSION

Blood donation practices are strongly tied to physicians' gender and age and their knowledge of the donation process. The most significant barrier to blood donation was found to be nutritional and medical disease status. Half of the physicians surveyed agreed with mandating replacement donations before elective procedures.

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CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

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All authors have read and approved the final version of the manuscript.

Dr. Hala Khalil had full access to the study data and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

TRANSPARENCY STATEMENT

The manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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REFERENCES

- Kleinman S, King MR, Busch MP, et al. The National Heart, Lung, and Blood Institute retrovirus epidemiology donor studies (retrovirus epidemiology donor study and retrovirus epidemiology donor study-II): twenty years of research to advance blood product safety and availability. *Transfus Med Rev.* 2012;26(4):281-304, 304 e281-282.
- Gader AGMA, Alqahtani FH, Albanayan AA. Blood supply in the Kingdom of Saudi Arabia—self-sufficiency and safety considerations. *J Appl Hematol.* 2011;2(1):7.
- Wake DJ, Cutting WA. Blood transfusion in developing countries: problems, priorities and practicalities. *Trop Dr.* 1998;28(1):4-8.
- Ankra-Badu GA, Ahmad M, Sawayan S, Bashawri L. Demographic characteristics of seropositive donors in Al-Khobar. *Ann Saudi Med.* 2001;21(1-2):113-116.
- Bashawri LA. Pattern of blood procurement, ordering and utilization in a University Hospital in Eastern Saudi Arabia. *Saudi Med J.* 2002;23(5):555-561.
- Abdel Gader AG, Osman AM, Al Gahtani FH, Farghali MN, Ramadan AH, Al-Momen AK. Attitude to blood donation in Saudi Arabia. *Asian J Transfus Sci.* 2011;5(2):121-126.
- Alam M, Masalmeh BD. Knowledge, attitudes and practices regarding blood donation among the Saudi population. *Saudi Med J.* 2004;25(3):318-321.
- Alfouzan N. Knowledge, attitudes, and motivations towards blood donation among King Abdulaziz Medical City population. *Int J Family Med.* 2014;2014:539670-539678.
- Thomson RA, Bethel J, Lo AY, Ownby HE, Nass CC, Williams AE. Retention of “safe” blood donors. The retrovirus epidemiology donor study. *Transfusion.* 1998;38(4):359-367.
- Sanchez AM, Ameti DI, Schreiber GB, et al. The potential impact of incentives on future blood donation behavior. *Transfusion.* 2001;41(2):172-178.
- Gillespie TW, Hillyer CD. Blood donors and factors impacting the blood donation decision. *Transfus Med Rev.* 2002;16(2):115-130.
- Chliaoutakis J, Trakas DJ, Socrataki F, Lemonidou C, Papaioannou D. Blood donor behaviour in Greece: implications for health policy. *Soc Sci Med.* 1994;38(10):1461-1467.
- Misje AH, Bosnes V, Gasdal O, Heier HE. Motivation, recruitment and retention of voluntary non-remunerated blood donors: a survey-based questionnaire study. *Vox Sang.* 2005;89(4):236-244.
- Zucoloto ML, Gonzalez T, Custer B, McFarland W, Martinez EZ. Comparison of the demographic and social profile of blood donors and nondonors in Brazil. *Health Soc Care Community.* 2019;27(2):330-336.
- Al-Drees AM. Attitude, belief and knowledge about blood donation and transfusion in Saudi population. *Pakistan J Med Sci.* 2008;24(1):74.
- Ownby HE, Kong F, Watanabe K, Tu Y, Nass CC. Analysis of donor return behavior. Retrovirus epidemiology donor study. *Transfusion.* 1999;39(10):1128-1135.
- Kanner WA, Jeffus S, Wehrli G. An academic-based hospital donor site: do physicians donate blood? *Ann Clin Lab Sci.* 2009;39(4):339-344.
- Gilani I, Kayani ZA, Atique M. Knowledge, attitude and practices (kap) regarding blood donation prevalent in medical and paramedical personnel. *J Coll Physicians Surg Pak.* 2007;17(8):473-476.
- Nwogoh B, Aigberadion U, Nwannadi AI. Knowledge, attitude, and practice of voluntary blood donation among healthcare workers at the University of Benin Teaching Hospital, Benin City, Nigeria. *J Blood Transfus.* 2013;2013:1-6.
- Raghuwanshi B, Pehlajani NK, Sinha MK. Voluntary blood donation among students - a cross-sectional study on knowledge and practice vs. attitude. *J Clin Diagn Res.* 2016;10(10):EC18-EC22.
- Benedict N, Usimenahon A, Alexander NI, Isi A. Knowledge, attitude and practice of voluntary blood donation among physicians in a tertiary health facility of a developing country. *Int J Blood Transfus Immunohematol.* 2012;2(4):4-10.
- Joshua Daniel M, Muddegowda PH, Dhivya K, et al. Opinions about blood donation amongst medical Personnel's. *J Clin Diagn Res.* 2014;8(1):43.
- Bharatwaj R, Vijaya K, Rajaram P. A descriptive study of knowledge, attitude and practice with regard to voluntary blood donation among medical undergraduate students in Pondicherry, India. *J Clin Diagn Res.* 2012;6(4):602-604.
- Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven

- methodology and workflow process for providing translational research informatics support. *J Biomed Inform.* 2009;42(2):377-381.
25. Wittock N, Hustinx L, Bracke P, Buffel V. Who donates? Cross-country and periodical variation in blood donor demographics in Europe between 1994 and 2014. *Transfusion.* 2017;57(11):2619-2628.
 26. Patel EU, Bloch EM, Grabowski MK, et al. Sociodemographic and behavioral characteristics associated with blood donation in the United States: a population-based study. *Transfusion.* 2019;59(9):2899-2907.
 27. Öhrner C, Kvist M, Blom Wiberg K, Diedrich B. Why do young men lapse from blood donation? 2019;114(6):566-575.
 28. Charbonneau J, Cloutier M-S, Carrier É. Why do blood donors lapse or reduce their donation's frequency? *Transfus Med Rev.* 2016;30(1):1-5.
 29. Misje AH, Bosnes V, Heier HE. Gender differences in presentation rates, deferrals and return behaviour among Norwegian blood donors. 2010;98(3p1):e241-e248.
 30. Charng H-W, Piliavin JA, Callero PL. Role identity and reasoned action in the prediction of repeated behavior. *Soc Psychol Q.* 1988;51(4):303-317.
 31. Godin G, Conner M, Sheeran P, Belanger-Gravel A, Germain M. Determinants of repeated blood donation among new and experienced blood donors. *Transfusion.* 2007;47(9):1607-1615.
 32. Elsafi SH. Demographical pattern of blood donors and pre-donation deferral causes in Dhahran, Saudi Arabia. *J Blood Med.* 2020;11:243-249.
 33. Sapiano MRP, Savinkina AA, Ellingson KD, et al. Supplemental findings from the National Blood Collection and utilization surveys, 2013 and 2015. *Transfusion.* 2017;57(Suppl 2):1599-1624.
 34. Saberton PJ, Paez A, Newbold KB, Heddle NM. Geographical variations in the correlates of blood donor turnout rates: an investigation of Canadian metropolitan areas. *Int J Health Geogr.* 2009;8:56-56.
 35. Abdelgader AM, Al Ghumlas AK. The future of voluntary blood donation in the Kingdom of Saudi Arabia. *Transfusion.* 2020;60(S1):S28-S34.
 36. Pongsananurak C, Norasetthada L, Tantiworawit A, et al. The effects of text messaging for promoting the retention of the first-time blood donors, a randomized controlled study (TEXT study). *Transfusion.* 2020;60(10):2319-2326.
 37. Masser BM, Wright S, Germain M, et al. The impact of age and sex on first-time donor return behavior. *Transfusion.* 2020;60(1):84-93.
 38. Klinkenberg EF, Romeijn B, de Kort WL, Merz EM. Reasons to end the donor career: a quantitative study among stopped blood donors in The Netherlands. *Transfus Med.* 2018;28(3):200-207.
 39. Schreiber GB, Sharma UK, Wright DJ, et al. First year donation patterns predict long-term commitment for first-time donors. *Vox Sang.* 2005;88(2):114-121.
 40. Lattimore S, Wickenden C, Brailsford SR. Blood donors in England and North Wales: demography and patterns of donation. *Transfusion.* 2015;55(1):91-99.
 41. Riley W, Schwei M, McCullough J. The United States' potential blood donor pool: estimating the prevalence of donor-exclusion factors on the pool of potential donors. *Transfusion.* 2007;47(7):1180-1188.
 42. Newman BH. Blood donor complications after whole-blood donation. *Curr Opin Hematol.* 2004;11(5):339-345.
 43. Danielson C, Jones G, McCarthy L, Cuculick E, Waxman D. Is time off work a good incentive to donate blood? *Transfusion.* 2001;41(9S):126S.
 44. Lacetera N, Macis M. Time for blood: the effect of paid leave legislation on altruistic behavior. *J Law Econ Organ.* 2013;29(6):1384-1420.
 45. Mousavi F, Tavabi AA, Golestan B, et al. Knowledge, attitude and practice towards blood donation in Iranian population. *Transfus Med.* 2011;21(5):308-317.
 46. Ugwu NI, WJ OO, Ugwu CN, Uneke CJ. Voluntary non-remunerated blood donation: awareness, perception, and attitude among potential blood donors in Abakaliki, Nigeria. *Niger J Clin Pract.* 2019;22(11):1509-1515.
 47. Regional Status Report on Blood Safety and Availability 2016. WHO Regional Office for the Eastern Mediterranean. WHO; 2017.
 48. Bates I, Hassall O. Should we neglect or nurture replacement blood donors in sub-Saharan Africa? *Biologicals.* 2010;38(1):65-67.

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