ORIGINAL ARTICLE

Knowledge of Renal Transplantation, its Sources, and Correlates among First-Degree Relatives of End-Stage Kidney Disease Patients: A Study on the Primary Donor Pool in Pakistan

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Abstract

Background: Renal transplantation in Pakistan, the fifth most populous country, relies almost entirely on the willingness of first-degree relatives (FDR) of end-stage kidney disease (ESKD) patients to donate organs. Studies suggest that the willingness to donate is closely tied to knowledge about transplantation. This study is the first of its kind in Pakistan, aiming to fill this knowledge gap.

Objective: To assess renal transplantation knowledge among FDR of ESKD patients, investigate its sources, and explore associations with demographic factors and reasons for inadequate knowledge.

Methods: A cross-sectional descriptive study was conducted at the dialysis Unit, National Institute of Kidney and Urological Diseases (NIKUD) Research Hospital, The Kidney Foundation, Karachi, Pakistan Ethical approval and consent were obtained. First-degree blood relatives of ESKD patients were included. A structured questionnaire assessed knowledge about kidney transplantation.

Results: Among 200 FDRs, 27.5% were parents, 28.5% were siblings, and 44% were offspring. Adequate knowledge was observed in 153 participants (76.5%), while 47 (23.5%) had inadequate knowledge. Younger participants (18-40 years), females, offspring of ESKD patients, and postgraduates demonstrated better knowledge. Notably, 69.5% incorrectly believed that kidneys could be sold for financial gain. Media was the primary information source for 58.5%, while only 23.5% received information from healthcare professionals.

Conclusion: This study reveals significant knowledge gaps among FDR of ESKD patients in Pakistan, underscoring the need for targeted education to improve organ donation rates in a country burdened by kidney disease.

Keywords: *First-degree relatives, end-stage renal disease, kidney donation, renal transplant.*

INTRODUCTION

The rising number of patients with end-stage kidney disease (ESKD) and the associated financial strain have emerged as major global challenges. This problem persists even in the most developed nations, and projections suggest that it will likely escalate further [1, 2]. Pakistan, as the fifth most populous country globally, encounters significant challenges in healthcare. The prevalence of chronic kidney disease (CKD) in the country is around 21%, which is substantially higher than the global average. Additionally, the incidence of end-stage kidney disease in Pakistan is approximately 100 per million people [3]. The country lacks a National Kidney Registry, making accurate data collection difficult. This concerning statistic highlights the critical need to address renal health challenges in the country. Patients with end-stage kidney disease are dependent on kidney replacement therapy, which includes options such as ongoing dialysis or kidney transplantation [4]. Hemodialysis is unfortunately unaffordable for a significant portion of the poor population in Pakistan, and there are limited free or non-profit dialysis services available in the country [5].

The alternative to dialysis is a renal transplant and it has been proven in many studies that transplant is the most cost-effective procedure with greater long-term survival as compared to other methods of renal replacement [6] but unfortunately, Pakistan is suffering from the scarcity of voluntary kidney donation and the growing curse of commercial kidney donation black market, sadly the rate of commercial kidney donation in Pakistan is one of the highest in the world [7].

Studies show that health-related quality of life improves significantly after a successful renal transplant compared to dialysis, with no evidence suggesting kidney donors experience a long-term decline in kidney function. The National Kidney Foundation recommends renal transplantation as the most effective treatment for ESKD.

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Interestingly many studies suggest that motivation to donate organs has been strongly associated with the knowledge of the process of organ donation and transplantation. The most common source for organ donation is considered to be the relatives of the patients and the study done in Karachi and China has provided similar results [8, 9].

The issue of commercial organ donation, particularly in the black market, remains a serious concern in Pakistan. A few years ago, the number of illegal kidney transplants in the country surged to troubling levels, with up to 2,000 illegal transplants being performed annually. Although the numbers decreased following the implementation of a 2007 ordinance aimed at curbing this illegal activity, the underground market for renal transplants continues to operate in the country [10]. Although the number of patients with end-stage kidney disease (ESKD) is rapidly increasing, the annual number of voluntary renal transplants in the country remains limited, with deceased donor transplants accounting for only a minuscule portion. Pakistan lacks a formal deceased donor program, which forces the country to rely predominantly on living kidney donors. Previous data indicated that only seven cadaveric kidneys have been utilized for transplantation, with only one originating from Pakistan, while the others were sourced from international donors [11]. However Recent data indicate that Bahria Hospital in Rawalpindi performed two deceased donor transplants in the last two years [12].

A strong rationale for this study is based on the crucial role that knowledge, attitudes, and beliefs play in influencing the willingness of potential kidney donors [13]. First-degree relatives are the most likely source of kidney donation, and their level of awareness significantly impacts donation rates. By identifying specific knowledge gaps in this group, this study aims to provide insight into the barriers hindering voluntary organ donation.

There are some studies done in Pakistan related to knowledge regarding organ donation including a study conducted in Karachi among undergraduate students found that while 88.7% were aware of kidney donation, only 34.6% were willing to donate, citing religious beliefs and lack of knowledge as primary barriers [14]. Similarly, a study at Lady Reading Hospital, Peshawar, found that 82.18% of participants were unaware of Pakistan's Organ Donation Registry, despite 58.09% supporting organ donation [15].

These findings suggest a widespread need for improved awareness initiatives. But it is important to note that despite these studies regarding knowledge about organ donation, there is very limited, if any research done on the knowledge and awareness of kidney donation specifically among first-degree relatives of ESKD patients in Pakistan, that is the primary donor pool in the country. Particularly, our study is unique in Pakistan, as no similar study has been conducted previously in Pakistan. Therefore, the purpose of this study is to assess the level of knowledge among first-degree relatives of ESKD patients regarding kidney donation and to identify any factors that may be associated with a lack of knowledge.

A similar study was done in Nigeria and it gave very disturbing results regarding the current state of knowledge of relatives of the patients regarding renal transplant and pointed towards some significant lacking on the part of healthcare professionals, it also gave very concerning evidence of ignorance in the majority of the participants regarding the illegality of commercial organ donation and it also pointed out that majority of the participants had a wrong belief that kidney donation can harm their health [16]. These results were considered the basis on which planning could be done for the improvement of the status of organ donation in the country, a similar impact can be achieved with this study in Pakistan.

The primary objective of this study is to assess the level of knowledge regarding renal transplantation among first-degree relatives of end-stage kidney disease (ESKD) patients in Pakistan, based on predefined criteria. The secondary objectives include determining the demographic characteristics associated with knowledge about renal transplantation among first-degree relatives of ESKD patients. These characteristics include age, gender, relationship with the patient, education level, income, and religion, and the study will explore the associations between these factors and the level of knowledge. Additionally, the study seeks to identify the sources of information utilized by first-degree relatives regarding renal transplantation.

MATERIALS AND METHODS

In this study, a cross-sectional descriptive design was used. The research was conducted at the Dialysis Unit of the National Institute of Kidney and Urological Diseases (NIKUD) Research Hospital, The Kidney Foundation, Karachi, Pakistan, over six months from 1st February 2024 to 2nd August 2024. The sample size was estimated at approximately 200 first-degree relatives of end-stage renal disease (ESKD) patients, calculated using previous studies that reported an ESKD prevalence of 100 per million in Pakistan,

with a population of approximately 231 million. Non-probability consecutive sampling was employed. The study included first-degree blood relatives of ESKD patients aged 18-60 years who consented to participate, while those with kidney disease contraindicating renal transplant or those unwilling to give consent were excluded. Ethical approval and informed consent were obtained.

For the operational definitions, first-degree relatives were defined as close-blood relatives, including parents, siblings, and children. End-stage kidney disease (ESKD) was defined as a glomerular filtration rate below 15 ml/min/1.73m², requiring dialysis or a kidney transplant. Renal transplantation refers to surgically placing a functioning kidney from a living or deceased donor into an ESKD patient. Legally acceptable organ donors in Pakistan, according to the Transplantation of Human Organs and Tissues Ordinance 2007, must be over 18 years of age and donate voluntarily.

A bilingual (English/Urdu) structured questionnaire consisting of 21 items was used for data collection, with three sections covering demographic details, knowledge of kidney donation, and sources of information. The second section's responses were recorded on a dichotomous scale (Yes/No), with "Yes" scored as 1 and "No" as 0. Reverse scoring was used for certain questions. Scores of ≥ 50% indicated adequate knowledge, while scores below this threshold were considered inadequate. Participants unfamiliar with kidney transplantation were considered to have inadequate knowledge. Interviews were conducted separately for each participant, taking 20-25 minutes per interview.

Data was entered and analysed using SPSS version 21. Continuous variables like age were presented as means and standard deviations, while categorical variables such as gender, education level, and adequacy of knowledge were presented as percentages. Effect modifiers like age, gender, education, socioeconomic status, and relation to the patient were analysed using stratification and chi-square tests, with a p-value of ≤0.05 considered significant.

We applied a logistic regression analysis to examine the impact of demographic factors (age, gender, education level, and income) on the adequacy of knowledge regarding kidney transplantation.

RESULTS

For this study, a total of 200 first-degree blood relatives of ESKD patients aged 18-60 years were selected. Each patient had one relative interviewed. The mean age of the participants was 42.89±9.4 years, and the distribution of age is illustrated in **Fig. (1)**. Among the participants, 88 (44%) were male, and 112 (56%) were female. The age distribution for the 20-24, 30-34, and 35-39 age groups was 3%, 12.5%, and 15.5%, respectively. The smallest group was 55-59 years (3.5%), and the largest group was 50-54 years (36%), as shown in **Fig. (1)**. The participants' relationships with the patient were as follows: 55 participants (27.5%) were the parents of ESKD patient, 57 (28.5%) were sibling, and 88 (44%) were offspring of the patients, according to Table **1**. In terms of education level, 35 participants (17.5%) had a primary education, 38 (19%) had a secondary education, 46 (23%) had tertiary education, 56 (28%) had postgraduate education, and 25 (12.5%) had no formal education, as shown in Table **1**. Additionally, the

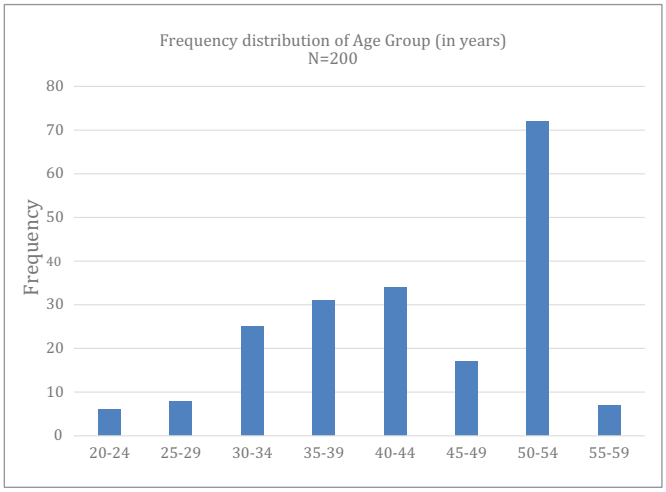

Fig. (1): Frequency distribution of Age Group (in years).

Table 1: Demographic characteristics of participants (n=200): frequency distribution of gender, age, and relationship with the patient, level of education, cumulative monthly household income and religion.

Variable	Frequency (n = 200)	Percentage
Gender		
Male	88	44
Female	112	56
Age Group (Year)		
20-24	6	3
25-29	8	4
30-34	25	12.5
35-39	31	15.5
40-44	34	17
45-49	17	8.5
50-54	72	36
55-59	7	3.5
Relationship with the patient		
Parent	55	27.5
Sibling	57	28.5

Variable	Frequency (n = 200)	Percentage
Offspring	88	44
Level of education		
No normal education	25	12.5
Primary education	35	17.5
Secondary education	38	19
Tertiary education	46	23
Postgraduate education	56	28
Cumulative monthly household income (PKR)		
<5000	0	0
5000-20000	7	3.5
21000-50000	111	55.5
51000-80000	55	27.5
81000-100000	7	3.5
>100000	20	10
Religion		
Islam	134	67
Christianity	28	14
Hinduism	34	17
Others	4	2

Table 2: Frequency distribution of awareness/experience related to kidney donation and transplantation (n=200).

Variable	Frequency (n=200)	
	Yes n(%)	No n(%)
Have you heard of the term "kidney donation"?	184(92)	16(8)
Have you heard of the term "kidney transplantation?"	174(87)	26(13)
Do you know anyone who has received a kidney transplant?	16(8)	184(92)
Do you know anyone who has donated a kidney?	11(5.5)	189(94.5)

majority of participants in the study were Muslim, with 134 participants (67%), followed by Christianity with 28 participants (14%), Hinduism with 34 participants (17%), and other religions with 4 participants (2%),

The study found that the mean cumulative monthly household income was 61625.00±46454.5 PKR, and the distribution of cumulative monthly household income is presented in Table **1**. Table **2** shows that 184 participants (92%) were familiar with the term "kidney donation", and 174 participants (87%) knew the term "kidney transplantation". However, only 16 participants (8%) reported knowing someone who received a kidney transplantation, and 11 participants (5.5%) knew someone who had donated a kidney.

In Table **3**, it is shown that out of the 200 participants surveyed, a majority of them had certain levels of awareness regarding kidney transplants. Significant findings revealed that 78% of participants were knowledgeable about the kidney transplant process involving receiving a kidney from another person. A majority, 72%, were familiar with the "Transplantation of Human Organs and Tissues Ordinance 2007." Notably, 69.5% of participants believed that individuals could sell their kidneys for money, reflecting a misconception that underscores the need for targeted education. Furthermore, 65.5% recognized that kidney transplants improve the quality of life for recipients. Awareness regarding kidney transplantation being a cure for kidney failure was also significant, with 67% of the participants demonstrating adequate knowledge. However, 69.5% of participants demonstrated inadequate knowledge regarding the risk of kidney disease for donors. Table **4** displays that the source

Table 3: Frequency distribution of awareness about kidney transplantation involving donor kidneys (n=200).

Scoring scale	Yes n(%)	No n(%)
Does the process of kidney transplant involve giving the patient a kidney taken from someone else?	156(78)	44(22)
Are you aware of "Transplantation of Human Organs and Tissues Ordinance 2007?	144(72)	56(28)
Relatives of a patient can be the donor for the transplanted kidney?	134(67)	66(33)
A deceased person can be the source of a transplanted kidney if he/she had signed up for organ donation in his / her life.	132(66)	68(34)
Any person can sell his/her kidney in exchange for money taken from the patient?	139(69.5)	61(30.5)
Does a kidney transplant improve the patient's quality of life?	131(65.5)	69(34.5)
Is a kidney transplant cure for kidney failure?	134(67)	66(33)
Are kidney donors at an increased risk of developing kidney disease?	139(69.5)	61(30.5)
Is a kidney transplant being carried out in Pakistan?	143(71.5)	57(28.5)

Table 4: Frequency distribution of sources of knowledge on kidney transplantation and scoring scale among first-degree relatives of patients with ESKD (n=200).

Variable	Frequency n=(200)	Percentage
Where did you acquire the knowledge regarding kidney transplants?		
Healthcare professional	47	23.5
Newspaper/TV/Internet	117	58.5
Other patients	36	18
Knowledge of FDR regarding kidney donation		
Adequate Knowledge	153	76.5
Inadequate Knowledge	47	23.5

Table 5: Relationship between knowledge and demographic factors (age, gender, relationship with the patient, and level of education) and knowledge related to awareness of kidney donation and transplantation and knowledge related to personal experience with kidney transplantation or donation (n=200).

Variable	Knowledge of FDR of ESKD patients regarding kidney donation		Total n(%)	p-value
	Adequate Knowledge n(%)	Inadequate Knowledge n(%)		
Age (Years)				
18-40	83(41.5)	12(6)	95(47.5)	0.089
41-59	70(35)	35(17.5)	105(52.5)	
Gender				
Male	73(36.5)	15(7.5)	88(44)	0.056
Female	80(40)	32(16)	112(56)	
Relationship with the patient				
Parent	51(25.5)	4(2)	55(27.5)	0.002
Sibling	43(21.5)	14(7)	57(28.5)	
Offspring	59(29.5)	29(14.5)	88(44)	
Level of education				
No normal education	21(0)	4(2)	25(12.5)	0.135
Primary education	24(12)	11(5.5)	35(17.5)	
Secondary education	27(13.5)	11(5.5)	38(19)	
Tertiary education	35(17.5)	11(5.5)	46(23)	
Postgraduate education	46(23)	10(5)	56(28)	
Cumulative monthly household income				
<5000	0(0)	0(0)	0(0)	0.300
5000-20000	4(2)	3(1.5)	7(3.5)	
21000-50000	90(45)	21(10.5)	111(55.5)	
51000-80000	40(20)	15(7.5)	55(27.5)	
Religion				
Islam	101(50.5)	33(16.5)	134(67)	0.153
Christianity	25(12.5)	3(1.5)	28(14)	
Hinduism	25(12.5)	9(4.5)	34(17)	
Others	2(1)	2(1)	4(2)	
Have you heard of the term "kidney donation?				
Yes	152(76)	32(16)	184(92)	<0.001
No	1(0.5)	15(7.5)	16(8)	
Have you heard of the term "kidney transplantation?				
Yes	152(76)	22(11)	174(87)	<0.001
No	1(0.5)	25(12.5)	26(23)	
Do you know anyone who has received a kidney transplant				
Yes	9(4.5)	7(3.5)	16(8)	0.046
No	144(72)	40(20)	184(92)	
Do you know anyone who has donated a kidney?				
Yes	8(4)	3(1.5)	11(5.5)	0.021
No	145(72.5)	44(22)	189(94.5)	

of information regarding kidney transplantation was healthcare professionals for 47 participants (23.5%), while 117 participants (58.5%) acquired knowledge through newspapers, television, or the Internet. 36 (18%) obtained information from other patients. Table **5** also shows that based on a scoring scale where adequate knowledge was defined as ≥50% correct responses, 153 participants (76.5%) had adequate knowledge, while 47 participants (23.5%) had inadequate knowledge about kidney transplantation.

Table **5** displays the frequencies of various demographic factors, such as age groups, gender, relationship with the patient, level of education, cumulative monthly household income, religion, familiarity with the terms

Table 6: Logistic regression analysis of the relationship between knowledge and demographic factors (age, gender, relationship with the patient, and level of education) with odds ratios and 95% confidence intervals for knowledge related to awareness of kidney donation and transplantation among first-degree relatives of ESKD patients (n=200).

Variable	Odds Ratio	95% CI
Age		
18-40 years	3.46	1.67 - 7.17
41-59 years	Reference category	-
Gender		
Male	Reference category	-
Female	0.51	0.26 - 1.02
Relationship		
Parent	Reference category	-
Sibling	0.24	0.07 - 0.79
Offspring	0.16	0.05 - 0.48
Education		
No education	Reference category	-
Primary education	0.42	0.11 - 1.50
Secondary education	0.47	0.13 - 1.68
Tertiary education	0.61	0.17 - 2.15
Postgraduate education	0.88	0.25 - 3.12

"kidney donation" and "kidney transplantation", personal experience with kidney transplantation or donation, and sources of knowledge about kidney transplantation. These tables were calculated based on the level of knowledge of first-degree relatives of patients with end-stage kidney disease regarding kidney donation. The results show that adequate knowledge was more prevalent in participants aged 18 to 40 years, with a higher proportion of females, offspring, and postgraduates. Additionally, adequate knowledge was predominant in participants with a cumulative monthly household income of 51,000 to 80,000 Pakistani rupees and in those who followed the Islamic religion.

The regression analysis indicated that while the overall model was statistically significant (p-value = 0.03), individual predictors such as age group, gender, education level, and income level did not show statistical significance (p-values < 0.05) when analyzed independently.

Table **6** displays logical regression; this analysis was conducted to examine the relationship between demographic factors and knowledge adequacy regarding kidney donation and transplantation among first-degree relatives (FDRs) of ESKD patients. The odds of having adequate knowledge were significantly higher among younger participants (18-40 years) compared to those aged 41-59, with an odds ratio (OR) of 3.46 (95% CI: 1.67-7.17). Gender analysis showed that females had approximately half the odds of adequate knowledge compared to males (OR: 0.51, 95% CI: 0.26-1.02), though this result was not statistically significant. Additionally, relationship to the patient influenced knowledge levels; siblings and offspring had lower odds of adequate knowledge compared to parents, though the results varied by subgroup. These findings suggest that age, gender, and family role may influence knowledge adequacy about kidney donation and transplantation, highlighting the need for targeted educational interventions for different demographic groups.

DISCUSSION

A significant challenge in kidney transplantation is the limited availability of donors. Although first-degree relatives are often considered potential donors, many are hesitant due to insufficient understanding of the donation process. The results of this study indicate that there is a gap in knowledge among the first-degree relatives of patients with end-stage kidney disease in Pakistan. Even with the widespread prevalence of kidney disease in the region, there remains a need for increased public education and awareness about kidney donation.

Our study reveals that participants' ages ranged from 18 to 60 years, with the highest representation in the 50-54 age group (36%). A similar study in Pakistan by Raza *et al.* found that the majority of respondents were aged 30-45 years, which aligns with our study's demographic distribution, although our population had a higher representation of older participants (50-54 years) [17]. In our study, the mean age of participants was 42.89 ± 9.4 years. In comparison, a similar study by Bello *et al.* [16] reported that the FDRs (First-Degree Relatives) of patients with CKD were younger, with a mean age of 34.8 years.

Additionally, in Raza *et al.*'s study [17], knowledge about organ donation was significantly associated with education and socioeconomic status. Similar results were observed in our study, where participants with higher education and better income demonstrated greater knowledge about kidney donation.

Compared to studies from Pakistan, a majority of our participants (92%) had heard of kidney donation, and 87% knew about kidney transplantation. These results indicate a relatively high baseline awareness compared to other studies in Pakistan. Zafar *et al.* [18] found that only 65% of respondents were aware of kidney transplantation, suggesting that our sample might have been more informed. However, this higher level of awareness might also be because we surveyed first-

degree relatives of end-stage kidney disease (ESKD) patients—a group likely more exposed to the concept of kidney transplants than the general population.

While our study showed that 76.5% of participants had adequate knowledge (≥50% correct responses), a significant proportion (23.5%) had inadequate knowledge. This finding aligns with another study from Pakistan by Siddiqui *et al.* [19], which highlighted that despite hearing about kidney transplantation, many relatives lacked a deep understanding of the process and risks involved. Moreover, our study found that many participants (69.5%) believed kidney donors could sell their kidneys for money, echoing a common misconception observed in similar studies in Pakistan. Ali *et al.* [20] noted that this myth was widespread and contributed to a negative perception of kidney donation, stressing the importance of targeted public education.

In our study, adequate knowledge (≥50% correct responses) was observed in 153 participants (76.5%), and 16 participants (8%) knew someone who had received a kidney transplant. In contrast, the study by Bello *et al.* [16] found that the majority (85.1%) of their participants had some knowledge of kidney transplantation. However, only 11.8% knew someone who had received a kidney transplant. Similar to our study majority of participants in Bello *et al.*'s study believed that kidney transplantation improved the quality of life for patients with kidney failure, however only 40% considered it a cure for the condition, in contrast to this 67% of respondents in our study considered renal transplant as a cure to kidney failure.

Despite having at least one first-degree relative (FDR) with chronic kidney disease (CKD) who was attending a nephrology clinic, more than half of the respondents in this study reported that their primary source of information about kidney transplantation was mass media outlets. Only about one-third of respondents had received information about kidney transplantation from a healthcare provider. This observation contrasts with the findings of Lennerling *et al.* [21], who surveyed 207 potential kidney donors undergoing evaluation in Norway and Sweden. In their study, physicians were the predominant source of information for prospective donors.

The lack of information provided by healthcare professionals in our study may be due to the overwhelming patient load in specialist clinics, which limits the time available for communication between healthcare providers, patients, and their families. [22] This situation is compounded by the growing population and the shortage of medical specialists in the country [23]. Moreover, the study population consisted of young, well-educated adults who likely have access to the Internet and social media, which provide readily available information on various topics. A significant proportion of our participants (58.5%) reported gaining knowledge from media sources such as TV, newspapers, and the internet. This trend is consistent with studies by Aslam *et al.* [24], where mass media was identified as a primary source of health-related information in Pakistan.

In our study, 143 participants (71.5%) were aware that kidney transplants were being performed in Pakistan. This contrasts with a previous study conducted in Nigeria [16], where surprisingly, less than half of the respondents knew that kidney transplants were available in their country, even though such surgeries had been performed there for over 13 years. This lack of awareness in Nigeria may partly explain the high rates of transplant tourism among Nigerian patients [16]. Pakistan could take this as a learning opportunity, leveraging mass media to better disseminate information about kidney transplantation and improve awareness nationwide.

Our research found that approximately 69% of respondents wrongly believed that donating a kidney would increase their risk of developing kidney failure in the future. This result aligns with the findings of Cunningham *et al.* [25], who reported in a survey of Australian nephrologists and trainees that 25% of respondents similarly felt that kidney donors were at higher risk of developing end-stage renal disease (ESKD). These findings highlight the necessity of enhancing public awareness regarding the overall safety of kidney donation, as extensively supported by medical literature.

In our study, 153 participants (76.5%) demonstrated adequate knowledge about kidney donation, a notably higher proportion compared to Adejumo *et al.*'s study [26], where only 63.4% of respondents exhibited similar awareness. Nearly all participants understood that kidneys used for transplantation in patients with kidney failure were obtained from other individuals. A majority were aware that kidneys could be sourced from first-degree relatives (FDRs) of patients with kidney failure. However, approximately half of the respondents believed that kidneys for transplantation could be acquired from commercial donors.

Emphasizing the distinction between living and deceased donor transplants, our study found that 66% of participants were aware of the option of deceased donor kidney transplants, whereas 34% believed that

deceased donor kidney transplantation was not possible. In contrast, Adejumo *et al.*'s study [26] found that only about 11% of respondents recognized deceased donation as an option.

In our research, 139 participants (69.5%) mistakenly believed that individuals could sell their kidneys for financial compensation from recipients. This observation differs from an earlier study, which indicated a possible willingness among first-degree relatives (FDRs) of chronic kidney disease (CKD) patients to consider donor kidney procurement. However, it aligns with findings by Al-Saeid *et al.* [27], who reported that over half of the physicians and emergency room technicians surveyed in their study thought that kidneys could be bought and sold in Qatar. This widely held belief regarding the commercialization of kidney donation is attributed to two major factors: the significant shortage of donor kidneys and the unchecked expansion of transplant tourism globally [28-30]. Chugh and Jha [29] have observed that, in many developing countries, a commercial component is often present in living unrelated renal transplants.

Studying first-degree relatives of end-stage kidney disease (ESKD) patients is the most effective way to assess knowledge and willingness regarding renal transplantation, as they represent the primary donor pool. Research consistently shows that relatives are the most willing donors. Yang *et al.* [31] found that a relative's willingness to donate is strongly influenced by their emotional closeness to the recipient. Similarly, Lennerling *et al.* [21] observed that potential kidney donors prioritized the recipient's well-being over their concerns. Additionally, prior studies have reported that over three-quarters of participants were open to donating a kidney to a family member in need. These findings align with research by Aghanwa *et al.* [32] in Nigeria and Boulware *et al.* [33] in the USA, further supporting the notion that family members are the most likely donors. In this study, respondents frequently cited affection and a sense of duty as key motivations for kidney donation, reinforcing the critical role of relatives in transplantation efforts.

A major outcome of this study is the identification of age, education, and income as crucial factors influencing awareness of kidney donation. Younger individuals, those with advanced educational backgrounds, and participants with higher income levels were found to possess greater knowledge about kidney donation. This underscores the importance of developing public education initiatives that are customized for various demographic segments.

The study also highlights the pivotal role healthcare professionals have in educating the public about kidney donation. Through patient and family education, healthcare workers can help address misconceptions and raise awareness of the benefits of kidney donation. In a country like Pakistan, where kidney disease is prevalent, such efforts could contribute to higher organ donation rates and better patient outcomes.

LIMITATIONS

While this study offers valuable insights, it has some limitations. As a single-centre study focused on first-degree relatives of end-stage kidney disease patients, its findings may not be fully generalizable. Many of the participants were graduates, middle-aged, and had higher incomes, which may not reflect the general population. The religious composition also slightly differed from the national average. Future research with a larger, more diverse sample could offer a broader perspective.

CONCLUSION

In conclusion, this study highlights the need for greater public awareness and education regarding kidney donation in Pakistan, particularly among first-degree relatives of end-stage kidney disease patients. The findings suggest that targeted public education campaigns and increased involvement of healthcare professionals in educating the public about kidney donation could help to improve organ donation rates and ultimately improve health outcomes for patients.

LIST OF ABBREVIATIONS

AKI : Acute Kidney Injury
ARF : Acute Renal Failure
SCr : Serum Creatinine
UO : Urine Output
GFR : Glomerular Filtration Rate
ATN : Acute Tubular Necrosis
CKD : Chronic Kidney Disease
ICU : Intensive Care Unit
KRT : Kidney Replacement Therapy
ADQI : Acute Dialysis Quality Initiative
ESKD : End-Stage Renal Disease
AKIN : Acute Kidney Injury Network

ETHICAL APPROVAL

Ethical approval was obtained from the Interactive Research and Development – Institutional Review Board (IRD-IRB) under protocol number IRD_IRB_2024_01_001 of the National Institute of Kidney and Urological Diseases (NIKUD) Research Hospital, Karachi. All procedures performed in studies involving human participants were in accordance with the ethical

standards of the institutional and/or national research committee and the Helsinki Declaration.

CONSENT FOR PUBLICATION

Informed written consent was obtained from all participants before their inclusion in the study. No personal identifying information has been disclosed.

AVAILABILITY OF DATA

The authors confirm that data supporting the results of this study are available within the article.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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AUTHORS' CONTRIBUTION

SMKK: Study concept, design, result analysis and interpretation, literature review, and manuscript drafting. SY: Study concept, literature review, critical review, and revision of the initial draft. MTK and MLR: Literature review, critical review, and statistical analysis. MF: Data collection. SKB: Manuscript drafting. All authors have critically reviewed, revised, and approved the final version of the manuscript.

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