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Research article

# Predictors of self-care in kidney transplant patients according to preoperative dialysis: A comparative study

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ABSTRACT

*Background:* Preemptive kidney transplantation (PKT) is associated with reduced dialysis-related morbidity and improved graft survival, which has led to an increase in the prevalence of PKT. The distinct clinical pathways of PKT and non-preemptive kidney transplantation (NPKT) patients may affect their ability to perform self-care, a key factor in post-transplant recovery. However, there is ongoing controversy regarding which group demonstrates better self-care abilities, highlighting the need to explore the factors influencing self-care in each group.
*Objectives:* This study aims to identify and compare predictors of self-care in PKT and NPKT groups.
*Methods:* We collected data from 209 KT recipients, consisting of 101 PKT and 108 NPKT patients, using self-administered questionnaires. These questionnaires assessed general and disease-specific characteristics, stress, social support, and self-care behaviors. Data were analyzed using descriptive statistics, t-tests, ANOVA, and multiple regression analysis.
*Results:* The study identified significant predictors of self-care among both PKT and NPKT patients. For PKT patients, marital status ($\beta = .19$, $p = .033$) and family support ($\beta = .28$, $p = .006$) are key predictors of self-care, with those having spousal support and strong family networks reporting better self-care levels. Conversely, in NPKT patients, significant predictors of self-care included marital status ($\beta = .31$, $p = .001$), employment status ($\beta = .29$, $p = .007$), post-transplantation duration (less than 36 month) ($\beta = -.22$, $p = .015$), post-transplantation duration (36–72 month) ($\beta = -.33$, $p = .001$), and stress levels ($\beta = -.20$, $p = .028$).
*Conclusions:* The study provides valuable insights into the predictors of self-care based on preoperative dialysis status, illustrating distinct predictors between the growing population of PKT and NPKT patients. These findings emphasize the need for personalized nursing strategies to enhance post-transplant self-care, tailored to individual patient characteristics.

## 1. Introduction

The global incidence of end-stage renal disease (ESRD) is rising due to an aging population, the growing prevalence of chronic illnesses (e.g., diabetes mellitus [DM] and hypertension), increased consumption of processed foods, and various environmental factors (e.g., air pollution) [1–3]. In 2020, Taiwan, China had the world's highest ESRD incidence, affecting 525 individuals per million, while South Korea ranked fourth with a rate of 355 individuals per million [4].

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**Abbreviations**

| | |
|---|---|
| Cr | Creatinine |
| ESRD | End-stage renal disease |
| DM | Diabetes mellitus |
| KT | Kidney transplantation |
| NPKT | Non-preemptive kidney transplantation |
| PKT | Preemptive kidney transplantation |
| QOL | Quality of life |

ESRD, a condition characterized by diminished renal function, necessitates one of three treatments: hemodialysis, peritoneal dialysis, or kidney transplantation (KT). KT is identified as the most efficacious treatment for ESRD, enhancing both lifespan and quality of life (QOL) [5–9]. Preemptive kidney transplantation (PKT), where the transplant occurs before the initiation of dialysis, is considered advantageous in several aspects [10]. By avoiding the onset of dialysis, PKT not only eliminates the complications and costs associated with dialysis but also has been shown to contribute to improved clinical outcomes, including lower rates of graft rejection and enhanced long-term patient survival [11–13]. This approach accounts for 30 % of KT surgeries worldwide [14].

Although PKT is widely considered advantageous, the clinical and psychological experiences of PKT and non-preemptive kidney transplantation (NPKT) patients differ substantially, warranting further investigation into how these differences may impact patient outcomes.

KT necessitates complex self-care requirements to minimize the risk of transplant rejection and other post-transplantation complications [15,16]. Essential self-care practices for KT recipients include accurate administration of immunosuppressants, infection prevention, and early detection, transplant rejection identification, dietary management, balancing activity with rest, and regulating body weight and blood pressure [14]. Noncompliance with these practices leads to a 1.5-fold and 65 % higher risk of transplant rejection and KT failure, respectively [17]. Patient outcomes underscore the significance of self-care, leading to concerted efforts to raise awareness and promote self-care compliance among KT recipients [18–22]. However, roughly 30–50 % of these patients do not strictly adhere to their immunosuppressant regimens, largely due to a knowledge gap regarding their benefits [23–26]. This suggests that KT patients may find self-care daunting, highlighting the continued need for initiatives to boost self-care practices.

Studies on self-care predictors in KT patients have identified several key factors: post-transplantation durations, comprehension of health-related information, support from healthcare professionals and family, as well as stress and depression [27–31]. Notably, the psychological impact of stress and the social dynamics of support play pivotal roles in the self-care behaviors of transplant recipients. Stress manifests as a multifactorial symptom in these patients, stemming from a complex interplay of physical problems—such as cardiovascular disease, cancer, DM, osteoporosis, infections, and weight gain due to long-term immunosuppressant use—and psychological factors, including fear of rejection, resumption of dialysis, and uncertainties about the future [8,32–35]. The degree of perceived stress is significantly correlated with adopting health-promoting behaviors. A heightened level of stress negatively impacts self-care [29,36]; however, a moderate stress level can catalyze patients [37], fostering self-regulation and resilience in self-care, thereby aiding their treatment [38]. It is necessary to closely scrutinize the stress levels in KT patients and further investigate the potential impact of stress on their self-care behaviors.

Moreover, social support from family and healthcare providers is vital components in fostering effective self-care among KT recipients. Recent advancements in community healthcare and the continuation of nursing care have highlighted the crucial role of social support in this patient group [39]. It is widely accepted that health outcomes strongly correlate with the extent of social support; enhanced support generally leads to improved health [40,41]. In the context of KT recipients, the emphasis on self-care is critical to ensuring the transplanted organ's functionality and preventing rejection [17]. Accordingly, social support is pivotal in bolstering these self-care routines [41]. Key sources of this support are family members and healthcare professionals, who encourage patient adherence to self-care practices and create an optimal environment for such care [31,42]. Therefore, it is essential to examine the degree of social support KT patients receive and determine its potential impact on their adherence to self-care regimens.

Patients receiving PKT who do not require pre-transplant dialysis may have a different perception of KT than those receiving non-preemptive kidney transplantation (NPKT). PKT recipients often perceive kidney failure as an acute rather than a chronic condition, with their disease trajectory shortened by the absence of dialysis [43,44]. In contrast, NPKT patients endure a longer and more complex pre-transplant pathway, marked by the physical and emotional challenges of dialysis [45,46]. These differing experiences may influence not only the patients' perceptions of their illness but also their approach to post-transplant care, including adherence to medical regimens and lifestyle modifications.

Furthermore, the literature presents a degree of controversy regarding which group demonstrates better post-transplant outcomes [47–49]. Some studies suggest that PKT patients exhibit better clinical outcomes and higher adherence to post-transplant care, likely due to the greater prevalence of factors commonly associated with better adherence, such as higher socioeconomic status and educational attainment, among those who receive preemptive transplantation [50–52]. However, other research posits that the experience of dialysis may prompt NPKT patients to be more diligent in their self-care, as they are more acutely aware of the consequences of non-adherence [53]. Given this controversy, it is critical to examine the predictors that may influence self-care and other patient outcomes in PKT and NPKT recipients. Therefore, this study aimed to identify predictors of self-care with a focus on preoperative dialysis to establish a foundation for developing improved nursing interventions and educational programs for transplant

patients.

## 2. Methods

### 2.1. Study design and participant selection

We conducted a descriptive study to identify and compare the factors influencing self-care post-KT in both PKT and NPKT patients. A convenience sampling method was used to recruit participants from a tertiary hospital in Seoul, where patients received regular outpatient follow-ups at the organ transplantation center. Eligible participants met the following criteria: (a) underwent KT at 18 years of age or older; (b) could communicate and complete the questionnaire independently; (c) consented to participate in the study; (d) had a minimum of 1 year elapsed since their KT surgery; (e) for NPKT patients, had undergone regular dialysis for at least 6 months preoperatively.

Participants were excluded if they had a history of multiple organ transplants, had undergone KT more than once, were unable to communicate due to visuospatial or mental disorders, were undergoing renal replacement therapy post-transplantation, were diagnosed with transplant failure or had their transplanted kidney removed.

### 2.2. Data collection

Data collection occurred between March 22 and August 29, 2022, from patients who had undergone KT and were undergoing regular follow-up visits at the organ transplantation center. Using the G*Power 3.1 software for F tests, linear multiple regression analysis, with an effect size of 0.15, a power of 0.80, and a significance level of 0.05, the calculated sample size was determined to be 98 for both PKT and NPKT patients. Considering a dropout rate, a total of 108 participants were selected for each group. Participants were provided with a self-reported written questionnaire. The researchers directly collected the completed questionnaires and reviewed them to ensure all responses were provided. Out of the 228 questionnaires, 19 were excluded either because the respondents did not meet the inclusion criteria or left sections unanswered. This resulted in a final tally of 209 valid questionnaires for analysis, consisting of 101 PKT and 108 NPKT patients.

### 2.3. Ethical considerations

This study was approved by the Institutional Review Board of Samsung Medical Center in Seoul (IRB No.: 2022-01-192-001). Informed consent was obtained from patients who agreed to participate in the study, and each participant signed the informed consent form after being fully informed of the study's purpose and procedures. Participants were also informed of their rights to withdraw from the survey at any time and request the deletion of their data. All collected information was strictly managed in accordance with the Personal Information Protection Act, and it was used solely for the purposes of this study.

### 2.4. Measurement

#### 2.4.1. Stress

Stress was evaluated utilizing a modified 37-item stress scale adapted from the 44-item Kidney Transplant Recipient Stress Scale developed by Hayward et al. [54] and modified by Cho [55]. The items encompass stress related to medication, infection, rejection, lifestyle adjustments, social interaction, and finances. The items scored on a 5-point Likert scale (1 = "strongly disagree" to 5 = "strongly agree"), span a cumulative range from 37 to 185, with higher scores signifying heightened stress. The Cronbach's α was 0.88 in the study by Cho [55] and 0.94 in this study.

#### 2.4.2. Social support

The level of social support was gauged using a 24-item scale developed by Kim et al. [56] specifically for KT patients. This scale comprises 12 items each for family support and healthcare provider support and utilizes the same 5-point Likert scale. Total scores fall within 24–120, with higher scores indicating greater perceived social support. Cronbach's α coefficients were 0.94 and 0.92 for family support and healthcare provider support, respectively, during development, and 0.95 and 0.93 in this study.

#### 2.4.3. Self-care

Self-care was measured using a 20-item scale created by Kim [57] and designed for KT patients. The scale encompasses two items for medication administration, five for diet, three for infection prevention, eight for daily activities, and two for rejection; each is scored on the same 5-point Likert scale. The total score varies from 20 to 100, with higher scores representing superior self-care compliance. The Cronbach's α was 0.84 upon the scale's creation and 0.86 in this study.

#### 2.4.4. Demographic and disease-specific characteristics

Demographic characteristics included gender, age, educational level, marital status, religious affiliation, employment status, average monthly income, and the number of cohabitating family members. Disease-specific characteristics included the post-transplantation duration, type of donor, ABO compatibility, type of dialysis, duration of dialysis, incidences of readmission, motivation for surgery, source of transplantation information, underlying diseases, and most recent creatinine (Cr) level.

### 2.5. Data analysis

The collected data were analyzed using SPSS version 28.0 (SPSS, Chicago, IL, USA). Each of the four measures–stress, social support, self-care, and demographics characteristics–was analyzed independently to understand their distinct contributions and relationships to self-care outcomes. Descriptive statistics were used to summarize the baseline characteristics of the participants, including means, standard deviations, frequencies, and percentages for each of four measures. The independent *t*-test and chi-square test were employed to evaluate group differences. Indices of stress, social support, and self-care for both cohorts were quantitatively described using means and standard deviations, with intergroup variances evaluated through independent t-tests and ANOVA. Scheffe's post hoc test was applied following the ANOVA for further comparisons. Data not adhering to the normal distribution were evaluated using the Mann–Whitney U and Kruskal–Wallis tests. Multiple regression analysis was utilized to ascertain predictors of self-care within both groups.

## 3. Results

### 3.1. Comparison of demographic and disease-specific characteristics between PKT and NPKT groups

In this study, 59.8 % of the participants were male, with an average age of 51.22 ± 11.59 years. The majority of the participants (82.8 %) were with spouse, more than half had an undergraduate degree (53.6 %), and two-thirds were employed (66.5 %). The average number of cohabiting family members was 2.89 ± 1.13.

In the PKT group ($N = 101$), 57.4 % were male, averaging 49.52 ± 11.03 years. Among these participants, 80.2 % were married, and 59.4 % held at least a bachelor's degree. Unemployment was reported by 30.7 % of these patients, and 50.5 % identified as non-religious. Roughly half (49.5 %) reported an average monthly income of 5.01 million KRW or higher, and the mean number of family members living in the same household was 3.14 ± 1.12. The average time since the KT was 45.44 ± 38.57 months, with spouses being the most common donors (41.6 %). The most frequent motivation for surgery was recommendations from healthcare providers and family, each cited by 39.6 % of PKT patients, and 73.3 % of patients were ABO compatible.

The NPKT group ($N = 108$) consisted of 62.0 % males, with an average age of 52.80 ± 11.92 years. Within this group, 36.1 % of participants reported being unemployed, while 48.1 % fell within the monthly income bracket of 2.01–4.99 million KRW. The average household size was slightly smaller, with a mean of 2.65 ± 1.20 cohabiting family members. In this group, the mean duration post-KT was 47.43 ± 38.22 months, and a majority of these patients (54.6 %) received their organs from a deceased donor. A substantial majority (88.0 %) had previously undergone hemodialysis, with the mean dialysis duration being 62.41 ± 42.86 months. ABO compatibility was predominantly yes (95.4 %), and the most common motivation for surgery was self-decision, reported by 49.1 % of NPKT patients.

There were differences in monthly income ($p = .013$), cohabiting family members ($p = .004$), type of donor ($p < .001$), ABO

**Table 1**
Comparison of demographic characteristics between PKT and NPKT groups ($N = 209$).

| | | Total | PKT ($N = 101$) | NPKT ($N = 108$) | $\chi^2$ | *p* |
|---|---|---|---|---|---|---|
| | | *n* (%) | *n* (%) | *n* (%) | | |
| Gender | Male | 125 (59.8) | 58 (57.4) | 67 (62.0) | 0.46 | .497 |
| | Female | 84 (40.2) | 43 (42.6) | 41 (38.0) | | |
| Age (years) | <40 | 34 (16.3) | 20 (19.8) | 14 (13.0) | 5.66 | .129 |
| | 41–50 | 50 (23.9) | 28 (27.7) | 22 (20.4) | | |
| | 51–60 | 72 (34.9) | 34 (33.7) | 39 (36.1) | | |
| | ≥60 | 52 (24.9) | 19 (18.8) | 33 (30.6) | | |
| | Mean (±*SD*) | 51.22 (±11.59) | 49.52 (±11.03) | 52.80 (±11.92) | | |
| Marital status | With spouse | 173 (82.8) | 81 (80.2) | 92 (85.2) | 0.91 | .340 |
| | Without spouse | 36 (17.2) | 20 (19.8) | 16 (14.8) | | |
| Educational level | ≤High school | 59 (28.2) | 21 (20.8) | 38 (35.2) | 5.35 | .069 |
| | Undergraduate | 112 (53.6) | 60 (59.4) | 52 (48.1) | | |
| | ≥Graduate | 28 (18.2) | 20 (19.8) | 18 (16.7) | | |
| Employment status | Yes | 139 (66.5) | 70 (69.3) | 69 (63.9) | 0.69 | .407 |
| | No | 70 (33.5) | 31 (30.7) | 39 (36.1) | | |
| Religion | Yes | 110 (52.6) | 50 (49.5) | 60 (55.6) | 0.77 | .381 |
| | No | 99 (47.4) | 51 (50.5) | 48 (44.4) | | |
| Monthly income (10,000 KRW) | ≤200 | 32 (15.3) | 10 (9.9) | 22 (20.4) | 8.62 | .013 |
| | 201–500 | 93 (44.5) | 41 (40.6) | 52 (48.1) | | |
| | ≥501 | 84 (40.2) | 50 (49.5) | 34 (31.5) | | |
| Cohabiting family members | ≤1 | 20 (9.6) | 6 (5.9) | 14 (13.0) | 10.82 | .004 |
| | 2 | 66 (31.6) | 24 (23.8) | 42 (38.9) | | |
| | ≥3 | 123 (58.9) | 71 (70.3) | 52 (48.1) | | |
| | Mean (±*SD*) | 2.89 (±1.13) | 3.14 (±1.12) | 2.65 (±1.20) | | |

PKT = Preemptive kidney transplant; NPKT = Non-preemptive kidney transplant.

compatibility ($p < .001$), and motivation for surgery ($p < .001$) between PKT and NPKT groups (Table 1, Table 2).

### 3.2. Stress

The stress levels were similar between PKT and NPKT groups. The mean stress score for PKT group was 97.23 ± 24.16, while for NPKT group it was 96.13 ± 24.02, with no significant difference between the two groups ($p = .742$) (Table 3).

### 3.3. Social support

Both family support and healthcare provider support were significantly higher in the PKT group compared to the NPKT group. The mean family support score was 53.77 ± 6.09 in PKT group, which was significantly higher than 49.06 ± 10.65 in the NPKT group ($p < .001$). Healthcare provider support was higher in the PKT group with a mean score of 49.45 ± 7.70, compared to 46.74 ± 8.72 in the NPKT group ($p = .009$) (Table 3).

### 3.4. Self-care

There was no significant difference in self-care ability between the PKT and NPKT groups ($p = .319$). The mean self-care scores for PKT group were 84.20 ± 9.49, while for NPKT group, they were 83.56 ± 9.92 (Table 3).

However, in the PKT group, there were significant differences in self-care according to gender, marital status, and employment status. On the other hand, in the NPKT group, there were significant differences in self-care according to gender, marital status, employment status, religion, and the duration post-KT. A subsequent Scheffe's post hoc analysis disclosed that patients who had undergone transplantation surgery less than 36 months ago demonstrated significantly better self-care than those whose transplantation occurred more than 72 months ago (Table 4, Table 5)

**Table 2**
Comparison of disease-specific characteristics between PKT and NPKT groups ($N = 209$).

| | | Total | PKT ($N = 101$) | NPKT (**N** = 108) | $\chi^2$ | $p$ |
|---|---|---|---|---|---|---|
| | | *n* (%) | *n* (%) | *n* (%) | | |
| Post-transplantation duration (months) | <36 | 110 (52.6) | 52 (51.5) | 58 (53.7) | 0.44 | .802 |
| | 36–71 | 68 (32.5) | 35 (34.7) | 33 (30.6) | | |
| | ≥72 | 31 (14.8) | 14 (13.9) | 17 (15.7) | | |
| | Mean (±*SD*) | 46.46 (±38.31) | 45.44 (±38.57) | 47.43 (±38.22) | | |
| Type of donor | Spouse | 59 (28.2) | 42 (41.6) | 17 (15.7) | 75.52 | <.001 |
| | Offspring | 19 (9.1) | 10 (9.9) | 9 (8.3) | | |
| | Parents | 24 (11.5) | 17 (16.8) | 7 (6.5) | | |
| | Other | 47 (22.5) | 31 (30.7) | 16 (14.8) | | |
| | Deceased | 60 (28.7) | 1 (1.0) | 59 (54.6) | | |
| ABO compatibility | Yes | 177 (67.3) | 74 (73.3) | 103 (95.4) | 19.66 | <.001 |
| | No | 86 (32.7) | 27 (26.7) | 5 (4.6) | | |
| Type of dialysis | Hemodialysis | N/A | N/A | 95 (88.0) | | |
| | Peritoneal dialysis | | | 11 (10.2) | | |
| | Both | | | 2 (1.9) | | |
| Duration of dialysis (month) | <36 | N/A | N/A | 34 (31.5) | | |
| | 36–71 | | | 28 (25.9) | | |
| | ≥72 | | | 46 (42.6) | | |
| | Mean (±*SD*) | | | 62.41 (±42.86) | | |
| Readmission | Yes | 123 (51.7) | 55 (54.5) | 68 (63.0) | 1.56 | .212 |
| | No | 101 (48.3) | 46 (45.5) | 40 (37.0) | | |
| Motivation for surgery | Self | 73 (34.9) | 20 (19.8) | 53 (49.1) | 21.41 | <.001 |
| | Healthcare provider | 62 (29.7) | 40 (39.6) | 22 (20.4) | | |
| | Family | 71 (34.0) | 40 (39.6) | 31 (28.7) | | |
| | Other | 3 (1.4) | 1 (1.0) | 2 (1.9) | | |
| Source of transplantation information† | Internet | 101 (48.3) | 55 (54.5) | 46 (42.6) | | |
| | Healthcare provider | 126 (60.3) | 55 (54.5) | 71 (65.7) | | |
| | Other | 39 (18.7) | 15 (14.9) | 24 (22.2) | | |
| Underlying disease | Yes | 149 (71.3) | 67 (66.3) | 82 (75.9) | 2.35 | .126 |
| | No | 60 (28.7) | 34 (33.7) | 26 (24.1) | | |
| Cr level†† | Normal (0.5–0.9 mg/dℓ) | 103 (49.3) | 51 (50.5) | 52 (48.1) | 4.93 | .085 |
| | Abnormal | 81 (38.8) | 43 (42.6) | 38 (35.2) | | |
| | Unknown | 25 (12.0) | 7 (6.9) | 18 (16.7) | | |

†Multiple choice. ††Most recent creatinine level. PKT = Preemptive kidney transplant; NPKT = Non-preemptive kidney transplant; KT = Kidney transplant; Cr = Creatinine.

**Table 3**
Comparison of stress, social support, and self-care between PKT and NPKT groups ($N = 209$).

| | Total | PKT ($N = 101$) | NPKT ($N = 108$) | t | $p$ |
|---|---|---|---|---|---|
| | Mean (±*SD*) | Mean (±*SD*) | Mean (±*SD*) | | |
| Stress | 96.66 (±24.03) | 97.23 (±24.16) | 96.13 (±24.02) | 0.33 | .742 |
| Social support Healthcare provider support | 99.38 (±14.95) | 103.22 (±11.71) | 95.80 (±16.72) | 3.74 | <.001 |
| Family support | 51.33 (±9.04) | 53.77 (±6.09) | 49.06 (±10.65) | 3.96 | <.001 |
| Healthcare provider support | 48.05 (±8.33) | 49.45 (±7.70) | 46.74 (±8.72) | 2.38 | .009 |
| Self-care | 83.87 (±9.70) | 84.20 (±9.49) | 83.56 (±9.92) | 0.47 | .319 |

PKT = Preemptive kidney transplant; NPKT = Non-preemptive kidney transplant.

### 3.5. Predictors of self-care

To elucidate the predictors of self-care, variables that exhibited significant disparity in association with self-care and key study parameters (stress, social support) were incorporated into a regression analysis. The normality of these variables was verified prior to the analysis.

In the PKT cohort, the correlations among the independent variables did not exceed 0.9, with the tolerance index ranging from 0.791 to 0.991, comfortably above the threshold of 0.1, and a variance inflation factor between 1.009 and 1.265, well below the critical limit of 10. This confirmed the absence of multicollinearity. Additionally, a Durbin–Watson statistic of 1.771, proximal to 2, confirmed the absence of residual correlations, thus substantiating the regression model's acceptability.

Likewise, in the NPKT cohort, the correlation among the independent variables remained below 0.9. The tolerance values varied between 0.628 and 0.917, and the variance inflation factor ranged from 1.091 to 1.593, again confirming the absence of multicollinearity. The Durbin–Watson statistic, at 2.054, confirmed the absence of autocorrelation among residuals, rendering the regression model acceptable.

Within the PKT group, marital status ($\beta = .19$, $p = .033$) and family support ($\beta = .28$, $p = .006$) identified as significant predictors of self-care. Specifically, participants who were married and received higher levels of family support exhibited better self-care behaviors, with these two factors explaining 20.7 % of the variance in self-care outcomes.

In contrast, the NPKT group identified marital status ($\beta = .31$, $p = .001$), employment status ($\beta = .29$, $p = .007$), post-transplantation duration (less than 36 month) ($\beta = -.22$, $p = .015$), post-transplantation duration (36–72 month) ($\beta = -.33$, $p = .001$), and stress levels ($\beta = -.20$, $p = .028$) as significant self-care predictors. Participants who were married, employed, had a shorter time since transplantation and reported lower stress levels demonstrated higher self-care. These parameters explained 24.6 % of the observed variance (Table 6, Table 7).

**Table 4**
Self-care differences by demographic characteristics within PKT and NPKT groups.

| | | PKT ($N = 101$) | | | NPKT ($N = 108$) | | |
|---|---|---|---|---|---|---|---|
| | | Mean (±*SD*) | t or F or $\chi^2$ or Z | $p$ | Mean (±*SD*) | t or F or $\chi^2$ or Z | $p$ |
| Gender | Male | 82.33 (10.31) | −2.46 | .021 | 82.09 (±10.66) | −2.00 | .048 |
| | Female | 86.72 (±7.66) | | | 85.98 (±8.16) | | |
| Age (year) | <40 | 81.40 (±10.08) | 1.39 | .250 | 80.79 (±6.84) | 5.05 | .168† |
| | 40–49 | 83.18 (±10.15) | | | 82.50 (±10.08) | | |
| | 50–59 | 85.06 (±7.55) | | | 82.85 (±11.84) | | |
| | ≥60 | 87.11 (±10.62) | | | 86.30 (±8.03) | | |
| Marital status | With spouse | 85.22 (±8.93) | −2.23 | .028 | 84.74 (±9.43) | −2.90 | .004†† |
| | Without spouse | 80.05 (±10.73) | | | 76.81 (±10.28) | | |
| Educational level | ≤High school | 85.57 (±10.25) | 0.37 | .691 | 84.87 (±11.44) | 2.82 | .245† |
| | Undergraduate | 83.57 (±9.61) | | | 82.77 (±8.94) | | |
| | ≥Graduate | 84.65 (±8.52) | | | 83.11 (±9.46) | | |
| Employment status | Yes | 82.97 (±8.85) | −2.33 | .020†† | 81.64 (±9.82) | −2.96 | .003†† |
| | No | 86.97 (±10.41) | | | 86.97 (±9.28) | | |
| Religion | Yes | 85.60 (±9.34) | −1.48 | .142 | 85.27 (±9.77) | −2.33 | .020†† |
| | No | 82.82 (±9.51) | | | 81.44 (±9.81) | | |
| Monthly income (10,000KRW) | ≤200 | 88.40 (±10.00) | 1.25 | .292 | 83.91 (±10.28) | 0.68 | .511 |
| | 201–500 | 84.34(±10.14) | | | 82.48(±10.07) | | |
| | ≥501 | 83.24(±8.76) | | | 85.00(±9.56) | | |
| Cohabiting family members | ≤1 | 91.50 (±8.87) | 4.75 | .093† | 81.64 (±13.66) | 1.33 | .515† |
| | 2 | 83.42 (±11.20) | | | 85.26 (±7.22) | | |
| | ≥3 | 83.85 (±8.76) | | | 82.71 (±10.63) | | |

†Kruskal-Wallis test; ††Mann-Whitney test. PKT = Preemptive kidney transplant; NPKT = Non-preemptive kidney transplant.

**Table 5**
Self-care differences by disease-specific characteristics within PKT and NPKT groups.

| | | PKT ($N = 101$) | | | NPKT ($N = 108$) | | |
|---|---|---|---|---|---|---|---|
| | | Mean (±*SD*) | t or F or $\chi^2$ or Z | *p* | Mean (±*SD*) | t or F or $\chi^2$ or Z | *p* |
| Post-transplantation duration (month) | <36[a] | 85.21 (±8.80) | 1.75 | .179 | 86.83 (±7.38) | 3.86 | .024 (a>c)[†] |
| | 36–71[b] | 84.40 (±9.82) | | | 81.85 (±9.20) | | |
| | ≥72[c] | 79.93 (±10.59) | | | 69.18 (±15.82) | | |
| Type of donor | Spouse | 85.55 (±8.84) | 1.87 | .122 | 87.12 (±9.60) | 8.03 | .090[††] |
| | Offspring | 86.90 (±7.16) | | | 86.11 (±12.23) | | |
| | Parents | 80.82 (±9.27) | | | 80.57 (±4.47) | | |
| | Other | 82.84 (±10.50) | | | 80.25 (±10.20) | | |
| | Deceased | 100.00 | | | 83.41 (±9.92) | | |
| ABO compatibility | Yes | 84.41 (±9.47) | 0.36 | .718 | 83.55 (±9.53) | −0.05 | .957 |
| | No | 83.63 (±9.68) | | | 83.80 (±17.80) | | |
| Type of dialysis | Hemodialysis | N/A | | | 83.78 (±9.52) | 0.31 | .855[††] |
| | Peritoneal dialysis | | | | 82.09 (±13.76) | | |
| | Both | | | | 81.50 (±9.19) | | |
| Duration of dialysis (month) | <36 | N/A | | | 85.09 (±10.35) | 2.03 | .363[††] |
| | 36–71 | | | | 83.64 (±9.95) | | |
| | ≥72 | | | | 82.39 (±9.65) | | |
| Readmission | Yes | 84.27 (±9.60) | −0.25 | .889[§] | 84.10 (±9.17) | −0.41 | .679[§] |
| | No | 84.11 (±9.46) | | | 82.65 (±11.16) | | |
| Motivation for surgery | Self | 84.20 (±8.20) | 0.82 | .845[††] | 83.45 (±9.61) | 1.32 | .724[††] |
| | Healthcare provider | 82.93 (±10.36) | | | 84.09 (±7.62) | | |
| | Family | 84.28 (±9.43) | | | 82.90 (±11.99) | | |
| | Other | 92.00 | | | 91.00 (±8.49) | | |
| Underlying disease | Yes | 83.64 (±9.91) | 0.83 | .411 | 84.00 (±9.83) | −1.01 | .314[§] |
| | No | 85.29 (±8.62) | | | 82.19 (±10.28) | | |
| Cr level[‖] | Normal[¶] | 85.45 (±9.99) | 1.35 | .181[§] | 85.12 (±8.38) | 1.58 | .118[§] |
| | Abnormal | 82.63 (±10.32) | | | 81.18 (±11.84) | | |

[†]Scheffe test; [††]Kruskal-Wallis test; [§]Mann-Whitney test. [‖]Most recent creatinine level. [¶]0.5-0.9mg/dl. PKT = Preemptive kidney transplant; NPKT = Non-preemptive kidney transplant; KT = Kidney transplant; Cr = Creatinine.

## 4. Discussion

This study aimed to explore the general and disease-specific characteristics, stress levels, social support, and self-care among PKT and NPKT groups, as well as identify predictors of self-care, thereby proposing strategies to enhance self-care in KT patients and providing evidence for the development of efficacious nursing interventions to improve QOL.

In our study cohort, the average age was 51.22 ± 11.59 years, with 24.9 % aged 60 or above. This highlights the current trend of an increasing number of older patients undergoing KT. The 2019 Annual Statistics report from the Korea Network for Organ Sharing indicated a significant increase of 179.2 % in organ transplants in patients aged 65 or above, from 250 cases in 2015 to 448 in 2019. Similarly, the 2021 Annual Data Report from the United States Renal Data System demonstrated a consistent rise in KT among older adults aged 65 and over (5,095 in 2019) [4]. KT is no longer seen as contraindicated in older age groups, with survival rates, QOL improvement, and financial benefits comparable to those of younger recipients [58–61]. Considering that older patients frequently present with comorbidities, personalized treatment, and management support are essential [62–64]. Additionally, older adults often have ingrained lifestyle habits that can affect adherence to self-care protocols [65]. As such, to promote self-care adherence among older adults, healthcare providers must account for these patients' personal, socioeconomic, and environmental characteristics and understand their specific self-care needs in a manner that respects their autonomy. Moreover, providing tailored educational interventions suitable for older adults is crucial to guiding them toward effective self-care rather than adhering to potentially harmful lifestyle habits.

Significant disparities were observed between the PKT and NPKT groups regarding monthly income, number of cohabiting family members, donor type, ABO compatibility, and surgery motivation. Approximately half (49.5 %) of the PKT group reported a monthly income of 5.01 million KRW or above. In contrast, a slightly lower percentage (48.1 %) of the NPKT group reported an income within the 2.01–4.99 million KRW range.

While there was no statistically significant difference in employment status between the PKT and NPKT groups ($p = .407$), the income disparity may still be partially related to employment patterns. Previous research indicates that employment is more prevalent among PKT recipients, potentially due to the shorter recovery time and reduced dialysis-related fatigue, which enhances their ability to maintain stable employment [66–68].

In addition to employment status, donor type and ABO compatibility likely contributed to income differences between the groups. The PKT group predominantly received organs from living donors (99.0 %), bore the full costs associated with surgery and subsequent treatment. Furthermore, ABO incompatible transplantations necessitate additional preoperative therapeutic plasma exchange and immunosuppressant therapy, which results in longer hospital stays and increased expenses [69]. These factors may contribute to the higher proportion of high-income patients in the PKT group, where the rates of living donor and ABO-incompatible transplantations were also greater.

However, it is important to recognize that other factors, such as educational level, health status, and the presence of comorbidities, may also influence income and employment outcomes in kidney transplant patients. Research shows that younger age, better health, and the absence of comorbidities are significant predictors of sustained employment among kidney transplant recipients [68,70]. Further exploration into these factors could provide a more comprehensive understanding of the financial disparities between PKT and NPKT groups.

In terms of donor type, a significant portion (41.6 %) of the PKT group received an organ from their spouse, compared to a much smaller percentage (15.7 %) in the NPKT group, where more than half (54.6 %) received organs from deceased donors. The spousal relationship likely affects the level of emotional and practical support available post-transplant. This dynamic, where the spouse may act as both caregiver and donor, requires further investigation to determine how it impacts self-care behaviors. The increased of spousal donors can be attributed, in part, to the rise of ABO-incompatible transplantations, which has allowed for greater flexibility in matching [71]. Furthermore, "family persuasion" was cited as the main motivation for surgery by roughly 39.6 % of PKT patients. Particularly in spousal transplantation scenarios, the donating spouse often becomes a significant advocate for the transplant [71], reinforcing previous findings suggesting that the degree of intimacy between donor and recipient is a crucial factor in deciding to undergo KT [72].

Examining the comparison of major study variables scores between the PKT and NPKT cohorts, PKT group demonstrated greater levels of family support (53.77 ± 6.09 out of 60) compared to their NPKT counterparts (48.96 ± 10.65 out of 60). The median wait time for transplantation in the United States stood at 4 years in 2011 [73], with approximately 18 % of patients experiencing a wait of 5

**Table 6**
Factors influencing self-care in PKT patients ($N = 101$).

| Variables | B | SE | β | t | p |
|---|---|---|---|---|---|
| (Constant) | 39.04 | 9.41 | | 4.15 | <.001 |
| Gender (Female) | 2.55 | 1.83 | .13 | 1.40 | .166 |
| Marital status (With spouse) | 4.58 | 2.12 | .19 | 2.16 | .033 |
| Employment status (No) | 2.72 | 1.95 | .13 | 1.39 | .168 |
| Stress | 0.06 | 0.04 | .16 | 1.71 | .091 |
| Family support | 0.44 | 0.16 | .28 | 2.83 | .006 |
| Healthcare provider support | 0.20 | 0.12 | .16 | 1.63 | .107 |
| | | | | $R^2 = .255$, Adj $R^2 = .207$, Durbin-Watson = 1.771, F = 5.36, $p < .001$ | |

Dummy variables (reference: Gender = Male; Marital status = Without spouse; Employment status = Yes). PKT = Preemptive kidney transplant.

**Table 7**
Factors influencing self-care in NPKT patients ($N = 108$).

| Variables | B | SE | β | t | *p* |
|---|---|---|---|---|---|
| (Constant) | 77.52 | 6.93 | | 11.18 | <.001 |
| Gender (Female) | −1.05 | 2.16 | −.05 | −0.49 | .627 |
| Marital status (With spouse) | 8.53 | 2.48 | .31 | 3.44 | .001 |
| Employment status (No) | 5.94 | 2.14 | .29 | 2.77 | .007 |
| Religion (No) | −0.63 | 1.86 | −.03 | −0.34 | .736 |
| Post-transplantation duration (month) | | | | | |
| <36 | −4.81 | 1.95 | −.22 | −2.47 | .015 |
| 36–72 | −8.82 | 2.45 | −.33 | −3.60 | .001 |
| Stress | −0.08 | 0.04 | −.20 | −2.24 | .028 |
| Family support | 0.01 | 0.09 | .01 | 0.14 | .888 |
| Healthcare provider support | 0.16 | 0.12 | .14 | 1.33 | .187 |
| | | | $R^2 = .309$, Adj $R^2 = .246$, Durbin-Watson = 2.054, F = 4.88, $p < .001$ | | |

Dummy variables (reference: Gender = Male; Marital status = Without spouse; Employment status = Yes; Religion = Yes; Post-transplantation duration (month) ≥72); NPKT = Non-preemptive kidney transplant; KT = Kidney transplant.

years or more by 2016. A similar trend was observed in Korea, with the average waiting time reaching 5 years in 2013 [74]. This study noted an average dialysis duration of 5 years or more for NPKT group. Yun and Lee's [75] research supports the premise that family support diminishes when dialysis extends beyond 5 years. Thus, these observations substantiate the hypothesis that prolonged dialysis induces alterations in family dynamics [76], and the degree of family support tends to diminish with an increase in dialysis duration [75].

Concerning the variations in self-care regarding general and disease-specific characteristics, it was noted that female patients attained better self-care than male patients. This aligns with numerous studies that reveal females exhibit superior levels of self-care knowledge and practice than males, and our findings corroborate this conclusion [77–80]. The observed discrepancy may be linked to men's higher engagement in social activities, such as employment, which may impede their adherence to self-care protocols.

Considering the predictors of self-care relative to preoperative dialysis status, marital status, and family support, they emerged as predictors explaining 20.7 % of the variance in the PKT group. Conversely, marital status, employment status, post-transplantation duration, and stress level were identified as predictors accounting for 24.6 % of the variance in the NPKT group. However, several other potential factors may account for the remaining variance observed but were not the focus of this study. These could include variables such as the patient's level of health literacy, access to post-transplant care, psychological resilience, and the presence of comorbid conditions. Future research should explore these additional factors to provide a more comprehensive understanding of the predictors influencing self-care in kidney transplant patients.

Within the PKT cohort, a significant predictor of self-care was observed family support, demonstrating that elevated family support resulted in improved self-care adherence. This observation corroborates prior research, emphasizing family support's influential role in enhancing health behavior compliance among pre-dialysis patients with chronic kidney failure [81]. Enhanced family support bolsters a positive perception of health status, subsequently fostering adherence to self-care [82]. Unlike NPKT patients, who consistently received support from their families during the dialysis period before transplantation, PKT patients received support from their families after transplantation, and it is thought that they greatly valued the role of their families in post-transplant self-care. Despite these findings, it remains challenging to discern which specific aspects of family support—be it emotional expressions of love, assistance with lifestyle habits such as dietary and medication adherence, financial support, or the general presence and emotional involvement of family members—most significantly impact self-care practices. Consequently, we recommend further research that explicitly categorizes and measures the various dimensions of family support. Such studies should aim to distinguish the differential effects of these support types on patient outcomes, thus enabling a more nuanced understanding of how family dynamics contribute to the health management of transplant recipients.

In the NPKT cohort, employment status emerged as a significant predictor of self-care, with unemployed patients exhibiting increased self-care adherence. The unique experiences of NPKT patients who underwent extended dialysis before transplant, regardless of gender, limited their social engagement. As these patients reintegrated into social activities, including employment, the physical burdens and fatigue they incurred presumably negatively impacted their self-care adherence. These findings align with earlier studies positing difficulties in resuming work post-transplant, with challenges escalating with longer preoperative dialysis durations [83–85]. Therefore, it is imperative to develop effective interventions assisting NPKT patients in self-care, coupled with institutional and policy support promoting post-transplant societal and occupational reintegration. Interestingly, other studies propose a positive correlation between employment and self-care [86,87], indicating a need for further research to elucidate this complex relationship.

For NPKT group, it is crucial to consider the post-KT to improve self-care. Our findings reveal improved self-care engagement in the early post-transplantation stages, a trend similarly observed, albeit insignificantly, in PKT group. This reflects previous studies indicating a decline in treatment adherence as time since transplantation increases [27,86,88,89]. Bae and Kim [27] further elucidated that self-care compliance areas decline variably with time post-transplantation. Similarly, Noh and Park [19] highlighted evolving unmet postoperative needs over time post-KT, advocating for time-conscious nursing interventions to foster self-care in KT patients. Therefore, it is imperative to pinpoint factors contributing to declining self-care over time in both NPKT and PKT cohorts and to develop nursing intervention protocols to augment self-care.

In addition, NPKT group exhibiting high-stress levels exhibited poorer self-care. Dialysis patients bear significant stress, primarily

due to dietary restrictions, the continual treatment burden, and future uncertainties [90]. While NPKT patients experience fewer restrictions post-KT, they still grapple with dietary constraints, prolonged immunosuppressive medication usage, concerns over potential immunosuppressive side effects, fear of graft loss, and future uncertainties [91]. These persistent stressors manifest as physical and psychological symptoms, hindering the treatment journey [92] and serving as barriers to self-care. Hence, identifying major stressors for NPKT patients and devising effective nursing strategies to manage them is paramount.

The presence of a spouse was found to significantly influence self-care outcomes in both PKT and NPKT groups. The emotional support derived from a spouse is a significant facilitator of self-care behaviors in KT patients [93]. This can be attributed to the mutual sharing of health-related knowledge and the encouragement of beneficial health behaviors [94]. This assertion aligns with prior research, where it was established that transplant patients with a supportive spouse demonstrated improved compliance with self-care practices [71,88,93]. Moreover, studies in other health conditions similarly underscore the significance of spousal support. For instance, in patients with multiple sclerosis (MS), spouses have been shown to enhance intrinsic motivation for physical activity, prompting the development of partner-oriented interventions that foster competence, autonomy, and relationship strength [95]. Similarly, in patients with type 2 diabetes, higher confidence in a spouse's ability to provide dietary support correlated with greater relationship satisfaction, further illustrating the emotional and practical benefits of spousal involvement in chronic disease management [96]. Given the evidence from both transplant and non-transplant patient populations, healthcare providers, especially registered nurses, should emphasize the crucial role of spouses in post-transplant care. This involves training spouses to assist in medication management, recognize signs of complications, and provide emotional support, thereby improving the overall management of the patient's condition.

For patients lacking spousal support, it is critical to establish tailored interventions designed to replicate the psychosocial benefits typically provided by a spouse. These interventions could include peer support groups and enhanced community resource engagement, which are vital in maintaining the quality of care and outcomes for these individuals. Recognizing the instrumental role of spousal support in the self-care of KT patients, healthcare providers must proactively identify and leverage comparable support mechanisms. This approach ensures that KT patients, particularly those without a spouse, receive continuous encouragement and assistance in adopting and maintaining health-promoting behaviors. Effective implementation of these targeted interventions is essential for fostering robust support networks that enhance patient outcomes.

### *4.1. Strengths and limitations of the study*

Our study provides significant insights by identifying self-care predictors according to preoperative dialysis status and demonstrating the varying predictors between NPKT and the rapidly increasing PKT patient population. This further underscores the need for customized nursing strategies to promote post-transplant self-care tailored to individual patient characteristics. However, when considering the generalizability of these results, several factors need to be taken into account. Firstly, the study was conducted within a specific healthcare setting and geographical location, which may have particular healthcare policies, transplant protocols, and patient demographics. While data were collected from a single institution, this hospital is one of the largest kidney transplant centers in South Korea, known for handling a high volume of transplant cases, which strengthens the relevance of the findings. However, despite this, the generalizability of our results to different regions or healthcare systems may still be limited. Further studies are needed in diverse settings to validate our findings and to see if similar predictors emerge in other populations. Additionally, our research focused on self-care predictors among patients categorized by preoperative dialysis status, which might not encompass all factors influential in other transplant patient groups, such as those defined by age, ethnicity, or other comorbid conditions. Researchers and practitioners should be cautious in applying these findings to broader transplant populations without considering these variations. By expanding on these points, future research could explore the extent to which these predictors of self-care apply across broader KT patient populations, thus enhancing the external validity of our study and supporting the development of universally effective post-transplant care strategies.

### *4.2. Implications for nursing practice and health policy*

Drawing from our findings, we propose three key recommendations. First, the presence of a spouse significantly enhances self-care practices in KT patients. Therefore, it is critical to identify and engage alternative support systems for patients without spousal support to positively impact their self-care practices. Second, our findings reveal a progressive decline in self-care over time post-transplantation. Hence, periodic monitoring of self-care levels among KT patients and ongoing interventions to help maintain optimal self-care practices are crucial. Finally, we confirmed that the types of treatment that can be selected, such as transplantation from a living donor and ABO-incompatible transplantation, differ depending on the patient's socioeconomic level. Consequently, policy interventions and financial support are necessary to ensure that patients with ESRD are not disadvantaged by their socioeconomic status when considering KT.

## 5. Conclusions

Our findings indicate a varying set of self-care predictors according to the preoperative dialysis status of the patients. Among patients with PKT, we identified marital status and family support as crucial predictors. Conversely, in NPKT patients, predictors encompass marital status, employment status, post-transplantation duration, and stress levels. Therefore, it is essential for nursing strategies designed to bolster post-KT self-care to consider these disease-associated characteristics alongside the preoperative dialysis status.

## CRediT authorship contribution statement

**Hyeiyeon Im:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Hye-Young Jang:** Writing – review & editing, Supervision, Formal analysis, Conceptualization.

## Data availability

Data will be available on request.

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## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e40237.

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