




## ORIGINAL ARTICLE

# Are cultural or psychosocial factors associated with patient-reported outcomes at the conclusion of kidney transplant evaluation?

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## Abstract

**Background:** Kidney transplant evaluation (KTE) is a period marked by many stressors for patients, which may lead to poorer patient-reported outcomes (PROs). Research on the association of cultural and psychosocial factors with PROs during KTE is lacking, even though cultural and psychosocial variables may mitigate the relationship between acceptance status and PROs.

**Methods:** Using a prospective cohort study of 955 adults referred for KTE, we examined whether cultural factors and psychosocial characteristics, assessed at the initiation of KTE, are associated with PROs at KTE completion, controlling for demographics and medical factors. Also, we analyzed whether these factors moderate the relationship between transplant acceptance status and PROs.

**Results:** In multivariable regression models, a stronger sense of mastery was associated with higher physical and mental QOL. A stronger sense of self-esteem was associated with higher kidney-specific QOL. Depression was associated with a lower mental QOL, but only in those who were accepted for transplant. Having low levels of external locus of control was associated with better mental QOL in those who were

not accepted for transplant. Higher anxiety was associated with poorer kidney-specific QOL among those who were not accepted for KT, but trust in physician was only associated with greater satisfaction in transplant clinic service for those who were accepted for KT.

**Conclusions:** Targeting interventions to increase patient mastery and external locus of control, and reduce depression and anxiety in patients undergoing kidney transplant evaluation may be useful approaches to improve their experience during this stressful period.

#### KEYWORDS

health-related quality of life, kidney transplantation, patient satisfaction, patient-reported outcomes, transplant evaluation

## 1 | INTRODUCTION

Kidney transplantation (KT) is the optimal treatment for end-stage kidney disease (ESKD). It reduces mortality, improves quality of life (QOL), and costs less than dialysis.<sup>1–3</sup> Previous research demonstrated that receiving a KT is associated with many benefits post-transplant,<sup>4</sup> including improvements in QOL.<sup>5,6</sup> An unexplored period in ESKD patients' clinical experience is the KT evaluation (KTE) process. It is a period with many demands and stressors placed on a patient, which may lead to poorer patient-reported outcomes (PROs), including poorer QOL and low satisfaction with care.<sup>7</sup> Given that this period may last as much as 2–3 years in a patient's care trajectory, and that some never complete KTE, it is important that clinicians help patients minimize potentially negative outcomes during this period because pre-transplant QOL is associated with the receipt of a KT as well as post-KT survival.<sup>8,9</sup>

Reviews across the spectrum of solid-organ transplantation reveal that different patient assets and challenges may account for major differences in QOL outcomes often observed among patients post-transplant.<sup>10–12</sup> The KTE process is a unique period for understanding PROs and the characteristics that influence them. To date, there is little research on the factors that are associated with variation in PROs at the completion of KTE.<sup>6,13</sup> We hypothesized that patients' cultural and psychosocial characteristics can mitigate poor PROs at the completion of KTE if they are not accepted for transplant (either by being rejected for transplant by the transplant team, or due to a state of uncertainty from a prolonged evaluation period).

Previous work indicates that cultural and psychosocial factors are important to consider during the KTE process. For example, perceived discrimination,<sup>14,15</sup> religiosity,<sup>16</sup> social support,<sup>16,17</sup> and other psychosocial variables,<sup>14,16,17</sup> have been shown to predict clinical outcomes in patients with renal disease. Within the current cohort, our team already examined and demonstrated that several of these factors predict acceptance for KT<sup>17</sup> (e.g., social support, transplant knowledge) and receipt of transplant<sup>16</sup> (e.g., religiosity, social support, transplant knowledge). Similarly, although patient demographics (e.g., race<sup>18</sup> and medical status<sup>19</sup>) and clinical factors (e.g., dialysis type,<sup>20</sup> receipt of a

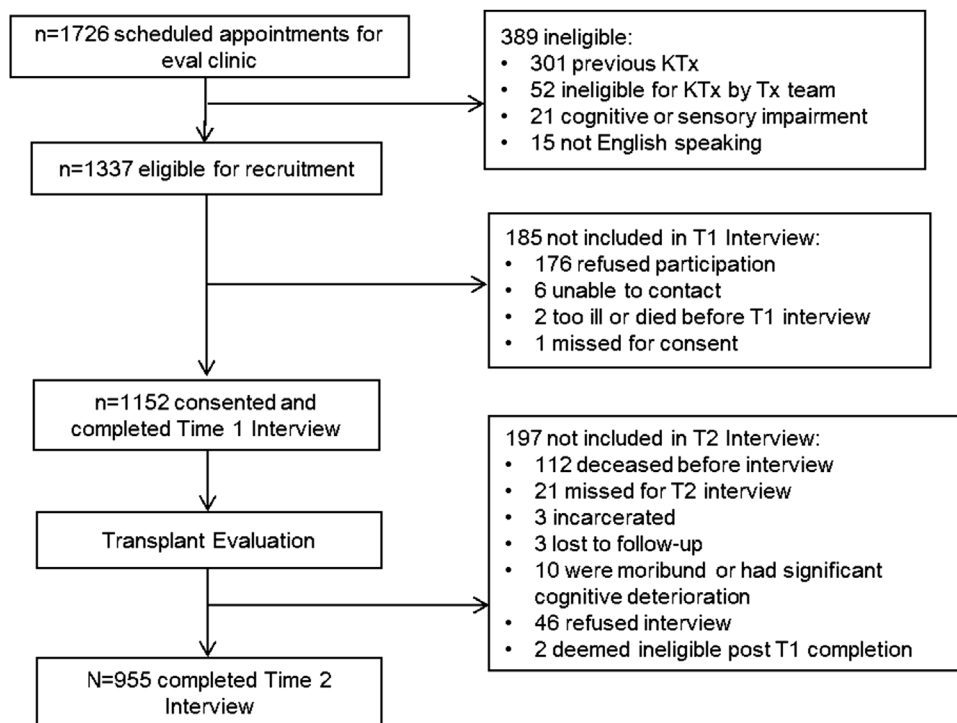
KT,<sup>13</sup> type of KT<sup>21</sup>) are known to predict PROs in renal disease patients, we do not know the association between cultural and psychosocial factors assessed at KTE initiation with PROs at the completion of KTE. To date, none of these studies examined the association of any of these factors with PROs at the conclusion of KTE. Our study is unique and novel because we examined how cultural and psychosocial factors, assessed at KTE initiation, may moderate the effect of transplant status on PROs at the conclusion of KTE. Researchers, clinicians, and transplant teams can use these results to understand PROs at KTE completion, and target patient assets or challenges to help improve them.

## 2 | MATERIALS AND METHODS

### 2.1 | Study design

Our prospective cohort study included patients who underwent KTE at the University of Pittsburgh Medical Center (UMPC) Starzl Transplant Institute (March, 2010–October, 2012).<sup>16,17</sup> We recruited patients during their initial KTE appointment. Shortly after this appointment, patients completed a semi-structured baseline telephone interview for Time 1 (~70 min). We tracked patients via medical record review to determine KTE completion through March 2014, and re-contacted them for their second interview (Time 2 ~30 min) even if they did not complete evaluation by this date (the conclusion of our study). We conducted the Time 2 interview with as many of our Time 1 patients as we could reach (83%), regardless of evaluation outcome. A majority of patients completed their second interview within 1 year of completing KTE ( $n \leq 6$  months = 80%,  $n > 6$  months to  $\leq 12$  months = 8%,  $n > 11$  months = 9%).

We offered patients a \$40 payment for completing the first interview and \$20 for the second interview. We obtained written informed consent from all study participants. The Institutional Review Boards at the University of Pittsburgh (IRB number PRO09060113) (where the study was conducted) and the University of New Mexico (IRB number 17–408) (where the analysis was conducted) approved this analysis in



**FIGURE 1** Study time points and cohort size.

accordance with the human subjects research guidelines outlined in the Declaration of Helsinki.

## 2.2 | Study sample

Inclusion criteria were: age 18 and older, English speaking, referred for a KT, and deemed eligible to proceed with KTE by the transplant team at their initial appointment. Because the majority of US KT recipients are first time recipients,<sup>22</sup> and to prevent patients' previous experience with KT from influencing current outcomes, we excluded patients with a previous history of KT (but not those with other organ transplants). Also, we excluded patients if they had a cognitive or sensory impairment that prevented them from completing the interview. Figure 1 displays the study timeline and included/excluded study participants.

## 2.3 | Independent variables (Time 1)

We assessed cultural factors, psychosocial characteristics, demographics, and medical information at Time 1.<sup>17</sup> **Cultural Factors** included *experience of discrimination* in medical settings (i.e., reporting of personal experience of discrimination in interactions with clinical providers),<sup>23</sup> *perceived racism* in healthcare (i.e., patients' belief that racism is common in healthcare),<sup>24</sup> *medical mistrust* (i.e., belief that their hospital is trustworthy, competent, and acting in their best interests),<sup>25</sup> *trust in physicians* (i.e., patient's trust in their specific physician),<sup>26</sup> *family loyalty* (i.e., participants' loyalty and mutual support regarding the family),<sup>27</sup>

*religious objections to LDKT* (i.e., whether patients' religious beliefs support LDKT),<sup>28</sup> and *religiosity* (i.e., importance and influence of religion in daily life).<sup>29</sup> **Psychosocial characteristics** included *social support* (i.e., assessment of availability of material aid from others, availability of someone to talk to about one's problems, availability of people with whom one can do things),<sup>30</sup> *mastery* (i.e., degree to which participants feel they have personal control over the things that happen to them),<sup>31</sup> *self-esteem* (i.e., patients' feelings of self-worth and self-respect),<sup>32</sup> *internal and external locus of control* (i.e., the extent to which recipients view their health condition is due to their own behavior, or the behavior of doctors, other people, chance, luck, or fate),<sup>33</sup> *anxiety* and *depression* (assessed via the subscales of the Brief Symptom Inventory, BSI).<sup>34</sup> **Demographics** included race/ethnicity, sex, age, marital status, education, income, insurance status, and occupation. **Medical factors** included time to waitlist status, dialysis type, dialysis duration, body mass index (BMI), Charlson Comorbidity Index (CCI),<sup>35,36</sup> indication for transplant, and whether the patient responded yes to having a living donor who either completed evaluation, is scheduled to donate, or is undergoing evaluation. **Acceptance status** Although most participants in our sample completed evaluation by the end of the study period and were either accepted or rejected for transplant ( $n = 597$  and  $61$ , respectively), a number of patients didn't complete KTE because they either chose to terminate KTE ( $n = 24$ ), their case was closed by the transplant team for incomplete evaluation ( $n = 222$ ), or they were still undergoing evaluation at the time of the T2 interview ( $n = 51$ ). Thus, we defined non-acceptance for transplant as being either (a) rejected for transplant, (b) still undergoing evaluation, or (c) evaluation closed by patient or transplant team, at the Time 2 interview, yielding a total sample of

955 participants (597 accepted; 358 not accepted for KT). We distinguished this group from those who were accepted for transplant at the Time 2 interview. We used this operational definition to distinguish between the predictably positive state of being accepted for transplant versus the negative experience of being rejected for transplant, closing the evaluation, or experiencing a prolonged evaluation period without a definitive answer of evaluation status at the Time 2 interview. We included a detailed list of all variables' psychometric properties and Cronbach's alphas in Table S1.

## 2.4 | Patient-reported outcomes (Time 2)

We assessed two categories of PROs at the Time 2 interview: **QOL** and **satisfaction with transplant clinic service**. We used the Kidney Disease Quality of Life Short Form Survey (KDQOL-SF),<sup>37</sup> a well-established and widely used measure of QOL for patients with renal disease,<sup>38</sup> and calculated three composite scores: physical health composite score (PCS), mental health composite score (MCS), and kidney-disease specific score (KSS). The PCS and MCS were scored using the standard approach and are T-scores. Peipert and colleagues recently developed and validated the KSS,<sup>39</sup> a composite score calculated by averaging the Burden of Kidney Disease, Symptoms/Problems of Kidney Disease, and Effects of Kidney Disease scales. The items making up the KSS composite score are distinct from the PCS and MCS items in the KDQOL-SF. Like the PCS and MCS, we transformed the KSS composite scores to T-scores with a mean of 50 and standard deviation of 10. For all three measures, a higher score indicated better QOL.<sup>37,39</sup>

We adapted the Client Satisfaction Questionnaire<sup>40</sup> to assess patient satisfaction with transplant clinic service. This scale consists of eight questions related to the patient's satisfaction with the providers and their interaction with clinic staff. We averaged the items into a scale score ranging from 1 (poor satisfaction) to 4 (excellent satisfaction). Because patient satisfaction with transplant clinic service was not continuously distributed, we dichotomized this outcome into "good," "very good," or "excellent," patient satisfaction versus "poor" patient satisfaction to improve the interpretability of this measure in all analyses.

## 2.5 | Statistical analysis

We used frequencies for categorical variables, and ranges and medians for continuous variables. We compared PROs in our sample to data from published studies using one sample t-tests.<sup>41,42</sup> We used Peipert et al.'s normative KSS scores referenced to the national US dialysis population<sup>41</sup> for comparison, but were not able to compare patient satisfaction to an external sample because we used an adapted version of the client satisfaction questionnaire specifically adapted for our population. We analyzed the relationship of the categorical and continuous variables with PROs using linear multivariable regression analysis for physical, mental, and kidney-specific QOL, and logistic regression for patient satisfaction with transplant clinic staff service

(because satisfaction was dichotomized). To determine which variables would be included in each final multivariable model, we performed univariable models for each outcome and set a conservative requirement for variables to be associated with the outcome at  $P\text{-value} \leq .10$ . Then we tested for pairwise correlations among statistically significant variables, and if the correlation between two variables was above .50, we excluded the variable that had a weaker association with the outcome, and used remaining variables in the final Stage 1 multivariable model. We chose this approach rather than combining variables because, although similar, the measures represent different characteristics, we had no empirical basis to combine them, and doing so could not be supported by existing literature.

In all four models, we controlled for the same set of demographic and medical factors, which included any medical or demographic factor that was significantly associated with any of the outcomes in univariable analyses. We tested for pairwise correlations to verify non-multicollinearity among the demographic and medical factors as well. Because our Time 1 variables were assessed across different scales, we reported standardized beta coefficients for our linear models to compare across the different Time 1 variables. For the logistic regression models examining patient satisfaction with service, we reported standardized beta coefficients in addition to unstandardized odds ratios.

To examine variables at Time 1 that may mitigate the effect of not getting accepted for transplant on PROs at Time 2, we assessed interactions between whether or not a person was accepted for transplant and social determinants of health (i.e., cultural factors and psychosocial variables) and adjusted for each significant interaction at a time, in our Stage 1 model. We considered an interaction significant at  $P < .1$  for our multivariable screening process. We included statistically significant interactions terms in our final Stage 2 multivariable models.

## 3 | RESULTS

### 3.1 | Baseline characteristics

Our final sample consisted of 955 participants who completed the Time 2 interview (Figure 1). Of these, we found that 68.9% of patients in our sample were non-Hispanic white, 60.8% male, 53.4% had a greater than high school education, 73.3% reported a household income less than \$50 000 per year, 35.2% reported relying solely on public insurance, 51.7% had a low occupational status, and 51.6% were married. The median age of the sample was 57. More than 75% of patients in our sample spent less than 1 year on dialysis (37.6% had no time on dialysis), and 53.2% had a living donor identified (Table 1). The number of patients on dialysis versus those seeking preemptive KT, with no time on dialysis, is consistent with data from the United States Renal Data System.<sup>43</sup> Of the 955 participants in our sample, 25 had already received a transplant by the time of their second interview. We include details about other patient medical, culturally-related, and psychosocial factors in Table 1.

**TABLE 1** Demographic, clinical, cultural, and psychosocial characteristics of study participants ( $n = 955$ )\*

| Characteristic <sup>a</sup>                            | n (%) or median (IQR) <sup>b</sup> |
|--|------------------------------------|
| <b>Demographic characteristics</b>                     |                                    |
| Race, $n$ (%)  |                                    |
| Non-Hispanic white                                     | 658 (68.9%)                        |
| Non-Hispanic Black                                     | 220 (23.0%)                        |
| Others   | 77 (8.0%)                          |
| Age, median (IQR)                                      | 57 (47, 65)                        |
| Sex (Female), $n$ (%)                                  | 374 (39.2%)                        |
| Education ( $\leq$ High school), $n$ (%)               | 445 (46.6%)                        |
| Household income ( $<$ US \$50 000), $n$ (%)           | 672 (73.3%)                        |
| Insurance, $n$ (%)                                     |                                    |
| Public   | 336 (35.2%)                        |
| Private  | 213 (22.3%)                        |
| Public and private                                     | 406 (42.5%)                        |
| Occupation ( $\geq$ skilled manual worker), $n$ (%)    | 461 (48.3%)                        |
| Marital status (Married), $n$ (%)                      | 493 (51.6%)                        |
| <b>Medical factors</b>                                 |                                    |
| Time to evaluation outcome (months), median (IQR)      | 10.9 (4.5, 16.3)                   |
| Accepted for kidney transplant waitlist (yes), $n$ (%) | 597 (62.5%)                        |
| Body Mass Index, $n$ (%)                               |                                    |
| Underweight ( $BMI \leq 18.5$ )                        | 12 (1.3%)                          |
| Normal weight ( $18.5 < BMI \leq 25$ )                 | 233 (24.4%)                        |
| Overweight ( $25 < BMI \leq 30$ )                      | 268 (28.1%)                        |
| Obese ( $BMI > 30$ )                                   | 442 (46.3%)                        |
| Charlson comorbidity scale (range: 0–19), median (IQR) | 4 (3, 5)                           |
| Years on dialysis at T1, $n$ (%)                       |                                    |
| No time on dialysis                                    | 359 (37.6%)                        |
| 0 to $<$ 1 year  | 386 (40.4%)                        |
| 1 to $<$ 5 years                                       | 155 (16.2%)                        |
| 5 or more years  | 55 (5.8%)                          |
| Dialysis type, $n$ (%)                                 |                                    |
| Hemodialysis   | 506 (53.0%)                        |
| Peritoneal dialysis                                    | 90 (9.4%)                          |
| No dialysis  | 359 (37.6%)                        |
| Indication for transplant                              |                                    |
| Diabetes   | 373 (39.1%)                        |
| Glomerulonephritis                                     | 126 (13.2%)                        |
| Hypertensive nephrosclerosis                           | 188 (19.7%)                        |
| Others   | 268 (28.1%)                        |
| Have a living donor at T1, $n$ (%)                     | 508 (53.2)                         |

(Continues)

**TABLE 1** (Continued)

| Characteristic <sup>a</sup>                                | n (%) or median (IQR) <sup>b</sup> |
|--|------------------------------------|
| <b>Cultural factors</b>                                    |                                    |
| Experienced discrimination, $n$ (%)                        | 244 (25.6%)                        |
| Perceived racism (range: 1–5), median (IQR)                | 2.3 (2.0, 2.8)                     |
| Medical mistrust (range: 1–5), median (IQR)                | 2.4 (2.1, 2.7)                     |
| Trust in physician <sup>c</sup> (range: 1–5), median (IQR) | 3.8 (3.6, 4.1)                     |
| Family loyalty (range: 8–80), median (IQR)                 | 50 (44, 56)                        |
| Religious objection, $n$ (%)                               |                                    |
| No objection   | 343 (36.2%)                        |
| Neutral  | 78 (8.2%)                          |
| Any objection  | 526 (55.5%)                        |
| Overall religiosity (range: 1–9), median (IQR)             | 7 (5, 9)                           |
| <b>Psychosocial characteristics</b>                        |                                    |
| Social support (range: 12–48), median (IQR)                | 44 (39, 48)                        |
| Self-esteem (range: 1–4), median (IQR)                     | 3.1 (2.9, 3.6)                     |
| Mastery (range: 1–4), median (IQR)                         | 3.0 (2.7, 3.1)                     |
| Locus of control, median (IQR)                             |                                    |
| Internal locus of control (range: 1–6)                     | 4.0 (3.2, 4.8)                     |
| External locus of control (range: 1–6)                     | 3.4 (2.8, 4.0)                     |
| Anxiety ( $>$ = moderate), $n$ (%)                         | 36 (3.8%)                          |
| Depression ( $>$ = moderate), $n$ (%)                      | 32 (3.4%)                          |

Note: Of the 955 participants in our sample, 25 had already received a transplant by the time of their follow-up interview.

<sup>a</sup>Missing data: age,  $n = 1$ ; months to transplant decision,  $n = 1$ ; income,  $n = 38$ ; perceived racism,  $n = 4$ ; experienced discrimination,  $n = 2$ ; overall religiosity,  $n = 2$ ; religious objection  $n = 8$ ; internal locus of control,  $n = 2$ ; external locus of control,  $n = 2$ ; total hours of learning activities,  $n = 4$ ; willing to accept living donor volunteer,  $n = 14$ .

<sup>b</sup>IQR = Interquartile Range, that is, the interval between the 25th and 75th percentiles.

<sup>c</sup>Higher score = more trust in physician.

To address the possibility of attrition bias, we compared the demographic and medical characteristics of those with and without a Time 2 interview. We found no difference by age, race, sex, income, occupation, education, marital status, or having a potential living donor. However, those who did not complete a Time 2 interview had more comorbidities, had lower BMI, were more likely to have public insurance, less likely to have been accepted for the transplant waitlist, took longer to complete KTE, were more likely to be on dialysis, or differed by indication for transplant (see Table S2).

### 3.2 | Patient-reported outcomes

We found that physical QOL measured by the SF-36 PCS in our sample,  $M(SD) = 37.44(11.53)$ , was lower than normative scores ( $P < .001$ ),  $M(SD) = 54.45(24.46)$ ,<sup>42</sup> but mental QOL in our sample, measured

**TABLE 2** Multivariable linear regression analysis of factors associated with health related quality of life (QOL)<sup>a,b</sup>

|  | Physical QOL         |         | Mental QOL           |         | Kidney-Specific QOL  |         |
|--|----------------------|---------|----------------------|---------|----------------------|---------|
|  | Standardized $\beta$ | P value | Standardized $\beta$ | P value | Standardized $\beta$ | P value |
| <b>Stage 1</b>                                   |                      |         |                      |         |                      |         |
| Accepted for kidney transplant waitlist (yes)    | .12                  | <.001   | .05                  | .190    | .01                  | .822    |
| <b>Cultural factors</b>                          |                      |         |                      |         |                      |         |
| Experienced Discrimination (yes)                 | -.03                 | .356    | -.03                 | .339    | -.12                 | <.001   |
| Medical mistrust                                 | -.07                 | .037    | -.02                 | .579    | -.04                 | .187    |
| Religiosity                                      | -.07                 | .036    |                      |         |                      |         |
| <b>Psychosocial characteristics</b>              |                      |         |                      |         |                      |         |
| Social support                                   | .01                  | .746    | .04                  | .282    | .05                  | .171    |
| Mastery  | .17                  | <.001   | .23                  | <.001   |                      |         |
| Self-esteem                                      |                      |         |                      |         | .25                  | <.001   |
| Anxiety ( $\geq$ = moderate)                     |                      |         | -.06                 | .093    | -.06                 | .070    |
| Depression ( $\geq$ = moderate)                  | -.03                 | .365    | -.10                 | .003    | -.07                 | .044    |
| Internal locus of control                        |                      |         |                      |         | .05                  | .158    |
| External locus of control                        | .02                  | .548    | .001                 | .965    | -.02                 | .504    |
| <b>Stage 2<sup>b</sup> - Interactions</b>        |                      |         |                      |         |                      |         |
| Anxiety $\times$ Accepted for transplant         |                      |         |                      |         | .13                  | .008    |
| Depression $\times$ Accepted for KT waitlist     |                      |         | -.11                 | .039    |                      |         |
| External locus $\times$ Accepted for KT waitlist | -.23                 | .091    | .39                  | .004    |                      |         |

<sup>a</sup>Stage 1 results present main effects only. Stage 2 results present interactions that are adjusted for main effects.

<sup>b</sup>All analyses controlled for: Demographic characteristics, including race, age, sex, income, insurance category, and occupation; and, medical factors, including BMI category, Charlson comorbidity index, dialysis type, indication for transplant.

by the SF-36 MCS,  $M(SD) = 53.01(10.27)$ , was not statistically different ( $P = .10$ ) than normative scores,  $M(SD) = 52.46(24.46)$ .<sup>42</sup> Kidney-specific QOL in our sample, measured by the KDQOL-SF KSS,  $M(SD) = 50.00(10.01)$ , was not statistically different ( $P = .53$ ) when compared to a sample of dialysis patients  $M(SD) = 50.20(9.70)$ .<sup>41</sup> The number of participants in our sample with good or higher satisfaction with transplant team service was 734, or almost 77% of participants. We were not able to compare patient satisfaction to an external sample because we used an adapted version of the client satisfaction questionnaire specifically adapted for our population.

### 3.3 | Cultural factors

We found that more medical mistrust ( $\beta = -.07, P = .037$ ) and stronger religiosity ( $\beta = -.07, P = .036$ ) was associated with lower physical health QOL. Experiencing discrimination in a healthcare setting was associated with lower kidney-specific QOL ( $\beta = -.12, P < .001$ ) (Table 2, Stage 1). Greater trust in physician, and a stronger sense of family loyalty were each associated with greater satisfaction in transplant clinic service ( $\beta = .15, P = .002$  and  $\beta = .18, P < .001$ , respectively) (Table 3, Stage 1).

### 3.4 | Psychosocial characteristics

In our multivariable model of QOL (Table 2, Stage 1) a stronger sense of mastery was associated with higher physical ( $\beta = .17, P < .001$ ) and mental QOL ( $\beta = .23, P < .001$ ). Additionally, a stronger sense of self-esteem was associated with greater kidney-specific QOL ( $\beta = .25, P < .001$ ), but greater depression was associated with lower mental ( $\beta = -.10, P = .003$ ) and kidney-specific QOL ( $\beta = -.07, P = .044$ ).

### 3.5 | Moderators of patient-reported outcomes and KT acceptance status

We found a significant interaction between high external locus of control and not getting accepted for transplant on mental QOL ( $\beta = .39, P = .004$ ; see Table 2, Stage 2 and Figure 2, Panel A). Low external locus of control was associated with better mental QOL in those who were not accepted for transplant rather than those who were accepted for KT. There was also a significant interaction between depression and being accepted for transplant on mental QOL ( $\beta = -.11, P = .039$ ; see Table 2, Stage 2 and Figure 2, Panel B). A history of depressive symptoms was worse in the mental QOL of those who were accepted than in those who were not accepted for transplant. Also, we found that

**TABLE 3** Multivariable logistic regression analysis of factors associated with patient satisfaction of transplant clinic service<sup>a,b</sup>

| Factors   | OR <sup>c</sup> | 95% CI       | Standardized $\beta$ | P-value |
|---|-----------------|--------------|----------------------|---------|
| <b>Stage 1</b>  |                 |              |                      |         |
| Accepted for kidney transplant waitlist (yes)           |                 |              | .265                 | <.001   |
| <b>Cultural factors</b>                                 |                 |              |                      |         |
| Experienced Discrimination (yes)                        | .73             | (.49, 1.10)  | -.07                 | .130    |
| Trust in physician <sup>d</sup>                         |                 |              | .18                  | <.001   |
| Family loyalty  |                 |              | .15                  | .002    |
| <b>Psychosocial characteristics</b>                     |                 |              |                      |         |
| Social support  |                 |              | .04                  | .411    |
| Mastery scale   | 1.15            | (.75, 1.77)  | .03                  | .521    |
| Anxiety (> = moderate)                                  | .66             | (.30, 1.46)  | -.04                 | .304    |
| <b>Stage 2 - Interactions</b>                           |                 |              |                      |         |
| Trust in physician                                      |                 |              | .80                  | .029    |
| Trust in physician $\times$ accepted for transplant     | 2.91            | (1.70, 4.98) |                      |         |
| Trust in physician $\times$ not accepted for transplant | 1.34            | (.84, 2.13)  |                      |         |
| Family loyalty  |                 |              | .43                  | .085    |
| Family loyalty $\times$ accepted for transplant         | 1.05            | (1.02, 1.08) |                      |         |
| Family loyalty $\times$ not accepted for transplant     | 1.01            | (.99, 1.04)  |                      |         |
| Social support  |                 |              | .44                  | .198    |
| Social support $\times$ accepted for transplant         | 1.04            | (.99, 1.09)  |                      |         |
| Social support $\times$ not accepted for transplant     | 1.00            | (.96, 1.04)  |                      |         |

<sup>a</sup>Stage 1 results present main effects only. Stage 2 results present interactions that are adjusted for main effects.

<sup>b</sup>All analyses controlled for: Demographic characteristics, including race, age, sex, income, insurance category, and occupation; and, medical factors, including BMI category, Charlson comorbidity index, dialysis type, indication for transplant.

<sup>c</sup>OR = Unstandardized Odds ratio; Note that there is no OR for main effects when the interaction is in the model.

<sup>d</sup>Higher score = more trust in physician.

anxiety moderated the relationship between transplant acceptance and kidney-specific QOL ( $\beta = .13$ ,  $P = .008$ ; see Table 2, Stage 2 and Figure 2, Panel C). Higher anxiety was associated with poorer kidney-specific QOL for those who were not accepted for transplant than for those who were accepted for transplant. Finally, we found that trust in physician significantly moderated the relationship between being accepted for transplant and satisfaction with service (Table 3, Stage 2, Figure 2, Panel D). Greater trust in a physician was associated with higher odds of being satisfied with transplant clinic service (OR = 2.91, 95% CI = 1.70, 4.98, standardized  $\beta = .80$ ,  $p$  for interaction = .029) when a patient was accepted for transplant, but this association was not significant in patients not accepted for transplant. We found no other significant interaction effects for any cultural or psychosocial factor with KT acceptance status.

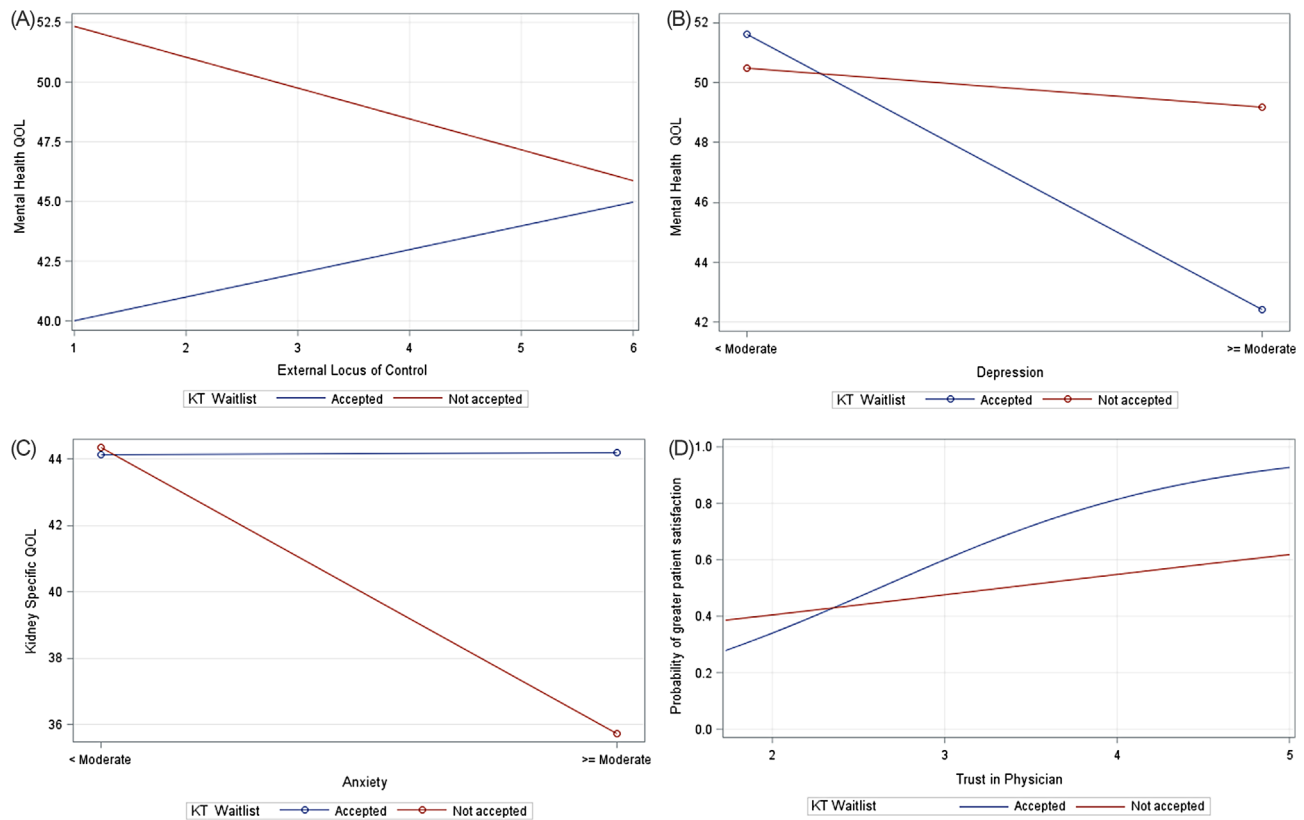
## 4 | DISCUSSION

Despite a number of recently published papers discussing the effects of social determinants of health on transplant access and outcomes, to our knowledge, our study is the first to prospectively examine how these determinants, including cultural factors and psychosocial char-

acteristics assessed at KTE initiation (Time 1) moderate the effect of transplant status on PROs assessed at the conclusion of KTE (Time 2). We found that several of these factors were significantly associated with PROs (after adjusting for important medical and demographic covariates), including experience of discrimination, medical mistrust, religiosity, mastery, self-esteem, and depression.

Of all of the factors, we found that a higher sense of mastery at the beginning of KTE, was associated with better physical and mental QOL after completing KTE (Table 2). This finding confirms previous research on QOL among Dutch patients with diabetes,<sup>44</sup> which also found that mastery was correlated with patients' perceived autonomy and self-management skills. Also, this finding confirms previous research in patients with multiple sclerosis, where mastery was found to predict both improved physical health QOL and improved mental health QOL.<sup>45</sup> Thus, improving patients' sense of mastery may be an important target for future interventions on QOL. Because existing evidence-based interventions to improve patient empowerment and mastery already exist,<sup>46</sup> future work can focus on implementing such an intervention in patients undergoing KTE.

Our finding that experiencing discrimination in a medical settings was significantly associated with poorer kidney-specific QOL (Table 2), supports our teams' and others' research on the importance of patient



**FIGURE 2** Panel A. Interaction of external locus of control and accepted/not accepted for transplant on mental health QOL. Panel B. Interaction of depression and accepted/not accepted for transplant mental health QOL. Panel C. Interaction of anxiety  $\times$  accepted/not accepted for transplant on kidney-specific QOL. Panel D. Interactions of trust in physician  $\times$  accepted/rejected for transplant on satisfaction with transplant clinic service. *Note:* Because patient satisfaction was dichotomized, we used a logistic regression analysis and created an interaction plot that displays the probability of high patient satisfaction. As such, although one of the lines is curved, it is not a higher order parameter, rather the curve occurs because logistic regression is on a log scale.

experiences in health care, and their subsequent PROs.<sup>47,48</sup> A study of patients with spinal cord injury showed that patients' report of experience of discrimination in healthcare was associated with lower levels of satisfaction with service.<sup>48</sup> In a general community sample of older Blacks, perceived discrimination was associated with poorer QOL.<sup>47</sup> It is important to note that medical mistrust and religiosity were also associated with lower physical QOL in our sample. Our findings confirm work in kidney disease and other clinical populations demonstrating associations between medical mistrust and religiosity, engagement with the healthcare system, and health outcomes.<sup>49–51</sup> Given these complex findings, we believe that more research on the relationship between culturally-related factors and QOL is warranted. Additionally, we recommend that healthcare organizations take measures to reduce healthcare discrimination, racial and socio-economic exclusion, and decrease mistrust in medical institutions. Such interventions may include e-health interventions, participatory research, and expanding access to health care. For readers who are interested in this topic, we recommend a special issue of *Behavioral Medicine* edited by Jaiswal and colleagues<sup>52</sup> which includes several papers that focus on specific interventions, and a Personal Viewpoint published in the *American Journal of Transplantation* by Purnell and colleagues.<sup>53</sup>

We found some other associations between cultural factors, psychosocial characteristics, and PROs worth noting. Family loyalty was associated with greater satisfaction with transplant clinic service. To our knowledge this finding has not been demonstrated before and warrants further investigation. Having lower depression or greater self-esteem were significantly associated with higher kidney related QOL. These results are consistent with previous findings demonstrating that lower depression or greater self-esteem are related to QOL in chronic and end-stage kidney disease populations.<sup>54,55</sup> Thus, transplant teams may consider referral for psychological support those patients who are assessed with psychosocial issues.

In terms of the moderating role of cultural and psychosocial factors on not being accepted for transplant, we found that having a low external locus of control (a low sense that one's health is due to the behavior of doctors, other people, chance, luck, or fate) was associated with better mental QOL in those who were not accepted for transplant, but not in those who were accepted for KT (Figure 2, Panel A). The greater mental health in those who were not accepted for transplant with low external locus of control supports research findings in acute clinical populations, including bariatric patients<sup>56</sup> and patients with traumatic brain injury,<sup>57</sup> which showed an inverse relationship



between external locus of control and mental health-related QOL; but, contradicts research in patients with chronic conditions, including adults with Type 2 diabetes mellitus,<sup>58</sup> patients with psoriasis,<sup>59</sup> and hemodialysis patients,<sup>60</sup> where external locus of control was associated with poorer mental health QOL. We believe the mental QOL results of patients who were not accepted for transplant matches those of acute clinical populations rather than chronic ones because, as with acute illness, not being accepted for transplant is a relatively new event in an ESKD patient's clinical trajectory.

We found that a history of depressive symptoms was worse in the mental QOL of those who were accepted but made no difference in those who were not accepted for transplant (Figure 2, Panel B). This finding contradicts previous research findings comparing hemodialysis patients to transplant recipients<sup>11,61</sup> and studies showing depression to predict lower mental QOL in transplant recipients.<sup>62,63</sup> In contrast, confirming previous literature,<sup>11,61,63</sup> we found that higher anxiety was associated with poorer kidney-specific QOL in those who were not accepted for transplant than in those who were accepted for transplant (Figure 2, Panel C). Finally, we found that our hypothesis that physician trust may mitigate the effects of not being accepted for transplant on satisfaction with service was not supported (Figure 2, Panel D). Not surprisingly, greater trust in a physician was associated with higher satisfaction with transplant clinic service in patients accepted for transplant, but this association was not significant in patients not accepted for transplant.

An important limitation of the current analysis was that we did not include a measure of QOL at the start of evaluation, which prevented us from controlling for patients' pre-existing QOL on their QOL at evaluation completion. Although the time to complete the second questionnaire from completing KTE was less than 1 year for most patients (91%), this extra length of time for a small number of patients may have influenced PROs in ways that we were unable to capture with our data. Finally, there were several variables with relatively small influences on physical, mental, or kidney-disease related QOL and patient satisfaction, wherein the effect size was less than a tenth of a standard deviation (or a very small difference in odds ratio). Thus, in light of previous literature on clinically meaningful differences in QOL composites,<sup>64</sup> although these results were statistically significant, they may be too small to be clinically meaningful.

Despite these limitations, our work is novel and relevant because it highlights the role that cultural factors and psychosocial characteristics play in the PROs of kidney transplant eligible patients undergoing transplant evaluation. This study examined a large number of variables, which allowed us to consider a wider array of cultural factors and psychosocial characteristics in one longitudinal cohort, than has ever been examined within this population. This information may help researchers, clinicians and transplant teams develop targeted interventions to improve patients' experiences during the transplant evaluation process.

#### AUTHOR CONTRIBUTIONS

Research idea and study design: Mary Amanda Dew, Ron Shapiro, Kellee Kendall, Emilee Crowell, Larissa Myaskovsky. Data acquisition:

Emilee Crowell, Kellee Kendall. Data analysis/interpretation: Samuel L. Swift, Yuri Leyva, Shu Wang, Chung-Chou H. Chang, John Devin Peipert, Mary Amanda Dew, Ron Shapiro, Mark Unruh, John Devin Peipert, Larissa Myaskovsky. Drafting the article or revising it: Samuel L. Swift, Yuri Leyva, Larissa Myaskovsky. Providing intellectual content of critical importance to the work described: Mary Amanda Dew, Ron Shapiro, Mark Unruh, John Devin Peipert, Larissa Myaskovsky. Supervision or mentorship: Larissa Myaskovsky. Final approval of the version to be published: all co-authors. Each author contributed important intellectual content during manuscript drafting or revision and agrees to be personally accountable for the individual's own contributions and to ensure that questions pertaining to the accuracy or integrity of any portion of the work, even one in which the author was not directly involved, are appropriately investigated and resolved, including with documentation in the literature if appropriate.

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#### CONFLICT OF INTEREST

The authors have no competing interests to declare.

#### 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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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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