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Prevalence and Determinants of Physical Activity and Fluid Intake in Kidney Transplant Recipients

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Abstract

Background and Significance—Self-care for kidney transplantation is recommended to maintain kidney function. Little is known about levels of self-care practices, and demographic, psychosocial, and health-related correlates.

Aim—We investigated patients' self-reported exercise and fluid intake, demographic and psychosocial factors associated with these self-care practices, and health-related quality of life.

Methods—Eighty-eight of 158 kidney recipients from two academic medical centers completed a semi-structured interview and surveys 2 months post-transplant.

Results—Most patients were sedentary (76%) with a quarter exercising either regularly (11%) or not at current recommendations (13%). One third (35%) reported drinking the recommended three

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liters of fluid daily. Multivariate analyses indicated that private insurance, high self-efficacy, and better physical functioning were significantly associated with engaging in physical activity ($p<0.05$); while male gender, private insurance, high self-efficacy, and not attributing oneself responsible for transplant success were significant predictors of adherence to fluid intake ($p<0.05$). Despite the significance of these predictors, models for physical activity and fluid intake explained 10–15% of the overall variance in these behaviors. Multivariate analyses indicated that younger age, high value of exercise, and higher social functioning significantly ($p<0.05$) predicted high self-efficacy for physical activity, while being married significantly ($p<0.05$) predicted high self-efficacy for fluid intake.

Conclusion—Identifying patients at risk of inadequate self-care practice is essential for educating patients about the importance of self-care.

Keywords

Kidney transplantation; physical activity; exercise; oral rehydration; self-care; self-management; self-efficacy; self-regulation theory; health-related quality of life

INTRODUCTION

Even with advances in preventing and treating acute rejection, late kidney graft loss is a significant problem(1,2) and post-transplant morbidity and mortality rates remain high.(3) Accordingly, there has been greater emphasis on improving the management of renal transplant recipients to prevent complications after renal transplantation and ensure proper graft functioning and long-term patient survival.(4–7) Clinical guidelines provide recommendations for managing the long-term care of transplant recipients,(7) including monitoring patients' health promotion efforts that can mitigate risk factors, such as physical activity and fluid intake, among other self-care behaviors.(8) It is well documented that patient behavior, such as medication adherence, is critical to successful management after kidney transplantation.(9,10) However, little is known about the prevalence of self-care practices of physical activity and fluid intake among kidney transplant recipients. Moreover, the demographic and psychosocial factors that may be related to physical activity or fluid intake behaviors remain to be determined.

Exercising is of vital importance as a preventive measure for cardiovascular disease; cardiovascular disease is the primary cause of death among kidney recipients.(11,12) There is some evidence that physical activity is related to graft function. One study of 22 pediatric and adolescent kidney transplant recipients found that impaired maximal oxygen consumption measured using an exercise testing protocol is related to higher creatinine levels.(13) Other studies report that pre-transplant inactivity predicts poor post-transplant graft and patient survival.(14,15)

In light of the mounting evidence of the positive effect of exercise on graft function, it is imperative that patients routinely engage in physical activity. While kidney recipients engage in more physical activity post-transplant compared to while on dialysis (16–19), relatively few meet current recommendations for exercise for adults (20). Most studies of physical activity are cross-sectional and typically assess patients one or more years post-transplant, e.g., (19) thus limiting understanding of activity levels early post-transplant.

Few reports document that increased fluid intake has adverse effects in patients with renal insufficiency.(21,22) For such patients, clinical recommendations are to decrease fluid intake, since patients with chronic kidney disease do not make normal amounts of urine and a normal fluid intake would lead to congestive heart failure. The case for or against fluid intake in kidney transplant recipients has not been discounted in the literature, and has been

minimally empirically tested. Similarly, no study has surveyed transplant clinicians about their recommendations for fluid intake, but variation in practice is likely. Only one study has documented the positive bivariate relationship between fluid adherence and better graft function.(23) Kidney transplant recipients are clinically different from patients with chronic renal insufficiency. In patients with a functioning kidney graft, a normal or higher fluid intake is clinically recommended by some transplant clinicians to keep the kidney well hydrated. In anecdotal findings of adult kidney recipients' barriers to fluid intake, patients recounted that clinicians attributed dehydration as a cause of their elevated creatinine levels. (24)

This paper examines recent kidney recipients' physical activity and adherence to fluid intake recommendations because various transplant clinicians recommend these behaviors as essential to the long-term care of the transplant.(6,7) We also investigate the association between these self-care practices and self-efficacy for these practices, health beliefs, perceived social support, health-related quality of life, and patient demographics. Additionally, we examined the psychosocial determinants of self-efficacy for physical activity and fluid intake.

Examining self-care practices early post-transplant is important because they may be formative in establishing future habits. Examining the social and cultural factors that may affect self-care behaviors is also important for identifying modifiable risk factors. Analyzing self-care at the early post-transplant period (~ 2 months) is reasonable because various transplant clinicians involved in the study encourage patients to walk 1–2 days after surgery, and explain that gradually intensified exercise will foster faster recovery, reduce the risk of complications, and improve well-being. Recovery can take approximately 2 to 12 weeks. Since graft function declines over time, assessing physical activity when post-transplant health is optimal will provide a benchmark for comparison with future time points post-transplant. Transplant clinicians involved in this study also recommend that patients drink 3 liters of fluid daily. Clinicians educate patients about these self-care practices prior to discharge from the hospital, then repeatedly at every postoperative office visit, and then on average every other week for the first three months.

Conceptual Model

Our approach to self-care is guided by the self-regulation model of illness management.(25) This model is based on Social Cognitive Theory which posits that people learn strategies to manage their chronic illness through self-regulation processes of observations, judgments, and reactions.(26) Self-regulation, a critical element to kidney transplant self-care, is the assessment that one can effectively perform a behavior to achieve a desired goal or outcome, (26,27) and is a predictor of chronic illness self-management.(28,29) Engagement in self-care requires that patients believe they have the skills, or perceived self-efficacy, to perform self-care practices; belief in one's ability is a critical element to motivation to perform self-care.(30) Thus, even if patients are highly motivated, they may not engage in self-care if they do not feel capable of doing so. Kidney recipients will continue engaging in recommended physical activity and fluid intake if they observe that their prior self-care practices successfully achieved their expected outcomes.(30) While positive observations reinforce patients' self-efficacy, those who were less successful in achieving goals will respond to their assessment by adjusting self-care practices accordingly.(27)

Self-efficacy for a specific self-care practice is shaped by interactions between personal, behavioral, and environmental factors.(30) High self-efficacy for physical activity and fluid intake is therefore expected to be guided by internal resourcefulness, health beliefs (attributions), health status, or the presence of social or contextual factors enabling self-care.

We had expected that lower levels of health-related quality of life would result in greater difficulty engaging in physical activity.

The self-regulation model posits that cognitive representations influence engagement in health-related behaviors as individuals seek to limit the threat of graft failure, improve health, and cope with illness.(31) Representations may include attributions of the cause of disease, perceived responsibility for care, and the value accorded to treatments for achieving a desired outcome.(32) Three sets of attributions relevant to kidney transplantation include: (1) attributions about the cause of kidney failure, which yields insight into patients' perceptions about responsibility for the original health problem; (2) attributions of responsibility for ensuring kidney graft survival, which yields insight into patients' perceptions of responsibility for the successful management of the transplant; and (3) attributions of how much engaging in each self-care practice can prevent loss of kidney function; which yields insight into patients' perceptions about whether recommended self-care practices make a difference in kidney transplant function. Patients who believe that the cause of kidney failure is their responsibility will be more likely to engage in self-care to improve their health if they also believe that they can perform the behavior and the behavior will help to manage the health concern. Attributions of responsibility for ensuring transplant success can indicate how much patients expect themselves or others to actively manage their own health. Attributions of how engaging in self-care practices can prevent loss of kidney function may provide insight into which self-care activities patients will most likely practice with the expectation that the behavior will enhance graft survival.

METHODS

Patients

All adult kidney transplant recipients were recruited in an incidence cohort from Loyola University Medical Center (LUMC) in Maywood, IL (July 2004 – May 2006) and Albany Medical Center (AMC) in Albany, NY (September 2006 – March 2008). Kidney transplant recipients were eligible for participation if they: were 18 years and older, spoke English, received a kidney transplant within the previous six weeks, and were currently taking immunosuppressants. We approached eligible patients in the transplant clinic waiting room and described the study to obtain initial oral consent and contact information for those interested in participating. For those who provided oral consent, we arranged a date for an interview or called them later that week to set the date.

Interview

Semi-structured interviews were conducted with kidney recipients within 2 months post-transplant either in person or by telephone. The data reported herein are part of a larger, longitudinal study examining self-care, social support, finances, and kidney graft outcomes. (23) This paper reports results from the baseline interview. Topics covered include: a) amount of daily fluid intake and performance of physical activity; b) patients' perceived ability to engage in fluid intake and physical activity (self-efficacy); c) attributions of causality, responsibility for ensuring graft survival, and perception of how self-care activities may foster graft survival; and d) demographics and medical information. See the Appendix for a copy of the interview schedule. All interviews lasted on average 2 hours. Respondents were compensated \$20 for participation. Institutional Review Board approval was obtained from Loyola University Medical Center and Albany Medical Center. Study participants provided written informed consent prior to starting the interview.

Measures

Self-Care Activities

Physical Activity: was assessed through the use of the Physical Activity Scale for the Elderly (PASE).(33) The PASE was designed to assess a continuum of physical activity in epidemiologic studies of people aged 65 years and older, and has been validated in patients on hemodialysis.(34) The PASE is an optimal measure of physical activity for patients with compromised health such as kidney recipients, as they suffer from chronic illnesses common to elderly populations, and even though they may be younger than elderly populations, many are frail. This instrument includes activities at the lower end of the activity spectrum, which are expected in the end-stage renal disease (ESRD) population.(35) The PASE is a self-administered, 21-item instrument that uses 4-point Likert scales to assess the frequency, intensity, and duration of physical activity in three key domains: participation in leisure time activities, i.e., recreational sports and fitness, household activities i.e., vacuuming or lawnwork, and occupational activities i.e., walking or operating machinery over the past 7-days. A sample question is as follows: “Over the past 7 days, how often did you do any exercises specifically to increase muscle strength and endurance, such as weights or pushups, etc.?” PASE scores range from 0 to 795 with higher values representing more physical activity. Internal consistency of all items was $\alpha = 0.69$, and test-retest reliability coefficient was 0.75.(35,36) Regular physical activity is defined here as 30 minutes of physical activity three or more times per week. Although PASE is analyzed as a continuous variable, for the purpose of presentation, we categorized PASE scores into ‘sedentary’ (0–99) and ‘active’ (100+). ‘Active’ encompasses both ‘moderate’ (100–150) and ‘regular’ (151+) physical activity levels.

Fluid Intake: Patients were asked how many ounces or liters of fluid they ingested daily. Fluid adherence was determined if patients reported drinking three or more liters of fluid daily, which was the amount recommended at both transplant centers. Fluid intake was analyzed as a dichotomous variable (adherent vs. nonadherent).

Self-Care Perceptions & Beliefs

Self-Efficacy: for engaging in physical activity and for adhering to recommended fluid intake were measured separately, each measured on a 5-point Likert scale (1 = *not at all*, 5 = *a great deal*).

Attributions: Three sets of attributions were examined: 1) attributions about the cause of kidney failure, 2) attributions of responsibility for ensuring kidney graft survival, and 3) attributions of how much engaging in each self-care practice can prevent loss of kidney function. A sample question of the third attribution is: “How much do you believe that kidney rejection can be prevented by doing the following activities?” Each attribution set includes four to five questions, each measured on a 5-point Likert scale (1 = *not at all*, 5 = *a great deal*). Higher scores reflect greater agreement with the attribution. Individual attribution questions were analyzed either as a dichotomous variable in univariate analysis (1–3 = no agreement with attribution, 4–5 = agreement with attribution), or averaged and analyzed on a 5-point scale in bivariate or multivariate analysis.

Health-Related Quality of Life: was assessed using The Medical Outcomes Study short form 36 (SF-36), which is a general health survey consisting of 36 items scored in eight scales in two key domains of physical and mental health functioning including: physical functioning, role-physical, bodily pain, and general health in the former domain, and vitality, social functioning, role-emotional and mental health in the latter domain.(37) Each scale was tallied and then means were standardized using norm-based scoring described elsewhere,(38) which transforms scores to a mean of 50 and standard deviation of 10 in the

general population. Norm-based scoring enables clearer comparison across scales and to the general population. A score of 40 indicates that the health status is below average.(38) Reliability coefficients range from 0.65 to 0.94 across scales.(37) Each of the eight scales was analyzed separately.

Health Status: A measure of overall self-rated health was assessed with a single global item, “How would you rate your health compared to people your age with a transplant?” (‘excellent,’ ‘very good,’ ‘good,’ ‘fair,’ and ‘poor’).

Perceived Social Support: was assessed using the Medical Outcomes Study Social Support Survey (SSS).(39) The SSS was designed for use with chronically ill patients.(40) An example of one item from the SSS is: “Someone to confide in or talk to about yourself or your problems.” The SSS is a self-administered, 20-item instrument that uses a 5-point Likert scale to assess four categories of social support: emotional or informational support; tangible support; positive social interaction; and affection (Overall scale Cronbach $\alpha = 0.97$; and 0.91 to 0.96 for subscales).(39) Scores range from 0–100; higher scores signify higher levels of support.

Demographics: assessed included gender, age, education, income, primary insurer, race/ethnicity (which was based on self-identification and dichotomized [white versus non-white] due to limited variation in the sample), and travel time to the transplant center.

Clinical information: included cause of ESRD, organ donor source, number of transplants (dichotomized as one or more than one), and time with a transplant as of the date of the interview. This information was obtained from patient self-report and confirmed through medical record review.

Statistical Analysis

The simple analysis of categorical demographic, clinical, and psychosocial predictors of physical activity and self-efficacy (for activity and fluid adherence) was based on comparing the category-specific mean values of PASE scores and levels of self-efficacy. Two-sample t tests were computed for continuous independent variables with dichotomous predictors and one-way analysis of variance was used for predictors with three categories. Spearman correlation coefficients and associated p values were calculated for continuous predictors of physical activity and self-efficacy. For the simple analysis of fluid intake, associations with categorical predictors were tested using Pearson’s Chi-square test, while t tests were used for associations with continuous predictors.

Multivariate regression models were used to examine the statistically independent relationship between patient characteristics and self-care practices as well as self-efficacy. Independent variables included demographic (age, gender, education, race/ethnicity, marital status, travel time to transplant center), socioeconomic (income, education), clinical (cause of ESRD, source of donor kidney, number of transplants), individual attributions, health-related quality of life subscales, social support, and self-efficacy (for models assessing self-care practices). Dependent variables included the two self-care practices (physical activity, fluid intake) and self-efficacy for physical activity and adhering to recommended fluid intake. Linear regression was used for the analysis of physical activity, while logistic regression was used for the analysis of fluid intake and self efficacy (with the latter defined as high for Likert values of 4 or 5). Independent variables were entered into the regression models based on $p < 0.10$ in bivariate analyses and on conceptual justification. Patients with incomplete interviews for key outcome measures were excluded from some analyses resulting in a loss of 2–3 participants. All tests were two-tailed and $p < 0.05$ was considered

statistically significant. All statistical analyses were performed using SPSS 15.0 (SPSS, Inc., Chicago, IL).

RESULTS

Demographics

A total of 90 out of 158 (57%) eligible patients participated. Twenty-two percent (n=35) refused participation due to post-surgical complications, feeling overwhelmed with the transplant, time commitments, burden of paperwork involved, or disinterest; 4% were undecided (n=7); and 16% (n=26) gave oral consent but did not provide written consent or were unable to be reached for an interview. Since two participants had incomplete data, they were excluded from analysis; our final analysis is based on a sample of 88 (42 from LUMC, 46 from AMC). Study participant characteristics are summarized in Table 1. The majority of patients were European American (69%; 17% African American, 8% Hispanic, and 7% other). Ages ranged from 18 to 74, with a mean of 48 years. At the time of the interview, patients had their transplant for an average (mean) 1.6 months (range: 0.5–6.5) (SD: 0.94). There was no significant difference in known demographics between those who participated and refused to participate in the study or between transplant centers. Psychosocial characteristics are presented in Table 3. Patients reported generally high levels of social support. All domains of health-related quality of life were below the general population average, except mental health was slightly above it.

Self-Care Practice Levels

Table 1 presents the prevalence of physical activity and appropriate fluid intake and the demographic correlates of these self-care practices. As shown, few patients reported reaching optimal self-care levels, with 24% engaging in moderate to regular physical activity, and 35% drinking the recommended three liters of fluid each day. The mean PASE score (75) (SD: 64.6) was lower than that reported in the sedentary elderly general population (131) (SD: 70.4) (age 66.5 $\pm$ 5.3 years).⁽³³⁾ Engaging in more physical activity was associated with having private insurance ($p < 0.02$). Patients who were more likely to adhere to fluid intake requirements were male ($p < 0.01$) and had with private insurance ($p < 0.04$).

Self-Efficacy in Self-Care Practice

Patients' levels and demographic correlates of self-efficacy for physical activity and fluid intake are presented in Table 2. On average, most patients (83%) reported having high self-efficacy for fluid intake, but only half (49%) had high self-efficacy for exercise. High self-efficacy for exercise was associated with better self-rated health ($p < 0.001$). High self-efficacy for fluid intake was associated with male gender ($p = 0.004$), being married ($p < 0.02$), mid-higher incomes ($p < 0.05$), and better self-rated health ($p < 0.01$).

Table 3 presents the associations between participants' psychosocial characteristics and self-care and self-efficacy levels. As expected, self-efficacy for exercise was positively correlated with engaging in physical activity ($p < 0.001$). Similarly, self-efficacy for fluid intake was positively correlated with adhering to fluid intake requirements ($p < 0.001$). Psychosocial characteristics, including health-related quality of life domains of physical functioning, role physical, social functioning, vitality, and general health were associated with greater engagement in physical activity and/or self-efficacy for physical activity. . Patients who engaged in more physical activity and had higher self-efficacy for exercise reported better health-related quality of life in several SF36 subscales. Patients who had greater tangible support and total social support reported having higher self-efficacy for fluid intake.

Attributions Relating to Self-Care Management

Table 4 presents findings pertaining to the association between attributions and self-care practices. This includes the level of attribution for cause of kidney failure, responsibility for managing their transplant, and the level of belief that the self-care practice can prevent kidney rejection. Virtually all patients attributed responsibility for ensuring graft survival to themselves (99%), followed closely by their doctor (78%), God (51%), and their family (40%). This means that patients felt responsible for managing their transplant, but they also believed that their physician played a role in transplant management. However, the fact that half of the patients believed that God was very or entirely responsible for managing their transplant suggests that patients may play a passive role in transplant management.

An examination of the relationship between attributions and self-care behaviors revealed that patients who engaged in more physical activity attributed less responsibility to their family ($p<0.05$). The negative correlation suggests that lower belief in the attribution leads to higher physical activity. Patients who were more adherent with fluid intake attributed less responsibility to themselves for transplant success ($t=-1.99$; $p<0.06$) (findings not presented).

Patients attributed the greatest value to drinking fluids for preventing loss of kidney function (85%), followed by exercising (68%), and maintaining one's diet (66%). Patients with higher self-efficacy for physical activity were more likely to attribute importance to exercise for ensuring graft survival ($r=0.42$; $p<0.001$) (findings not presented).

Multivariate Analysis for Self-Care Practices

Multivariate analysis was performed for predictors of physical activity and for adherence to fluid recommendations, as presented in Table 5. The overall predictive ability of our models was in the 10–15% R-squared range. Significant predictors of physical activity included: having private insurance, high self-efficacy for exercise, and better health-related quality of life, physical functioning ($p<0.05$). The PASE score of patients with private insurance was 29 points higher than the score of patients with public insurance. An increase of one on the Likert scale for exercise self-efficacy was associated with an increase in PASE by 13 points. An increase by 1 standard deviation in SF36 was associated with an increase in PASE by 20 points. Predictors of adherence to fluid intake recommendations included: male gender, private insurance, high self-efficacy for fluid intake, and attributing one-self as not responsible for the transplant's success ($p<0.05$). For example, the logistic coefficients for the prediction of fluid intake indicate that the odds of adherence were 5.8 times greater for men than women, and 7.6 times greater with every unit increase in self-efficacy for meeting the recommendation for fluid intake.

Multivariate Analysis for Self-Efficacy for Self-Care Practices

Multivariate analysis was separately performed for predictors of self-efficacy for physical activity and fluid intake as shown in Table 6. Self-efficacy for physical activity was significantly greater ($p<0.05$) among younger patients, those who accorded high value to physical activity for ensuring graft survival, and patients with better social functioning. The logistic coefficients and specified differences in the predictors can be used to quantify these associations. For example, with every additional 10 years of age there is a 50% reduction in the odds of self-efficacy for physical activity; an increase of one on the Likert scale for the attribution that exercise prevents rejection was associated with a nearly threefold increase in the odds of high self-efficacy for exercise; while an increase by one standard deviation (10 points) in the SF-36 social function score was associated with almost a two-fold increase in the odds of high self-efficacy for exercise. In the logistic regression model for self-efficacy

in fluid intake, the only statistically significant ($p < 0.05$) predictor of high self-efficacy was being married.

DISCUSSION

This study identified several key behavioral and psychosocial predictors of self-care behaviors associated with post-transplant success. Specifically, we found that most patients are not appropriately engaging in recommended physical activity and fluid intake. Other research corroborates our findings.(16,17,19) The low rates of adherence are of serious concern because greater physical activity is positively related to improved kidney graft function over time.(23) Additionally, greater physical activity is related to improved cardiorespiratory fitness, muscle strength, physical functioning,(17) and quality of life,(20) a reduction in cardiovascular risk factors,(12,41) and in adverse effects associated with immunosuppressive therapy including weight gain,(42) and reductions in osteoporosis and sarcopenia.(43,44) Because of the wide-spread beneficial effects of physical activity for ESRD, it is imperative to increase kidney transplant recipients' exercise levels.

We found that patients with private insurance as their primary insurer were more likely to engage in physical activity. Other studies have similarly found that lower SES is related to less physical activity in diabetics and the general population.(45) Sanchez and colleagues found that barriers to self-reported exercise were more likely to be experienced by older patients and those with worse physical or health conditions.(19)

Our study corroborates and advances the literature on psychosocial correlates of physical activity among kidney transplant recipients. We found that self-efficacy for physical activity is associated with physical activity levels, consistent with self-regulation theory. This finding is compatible with reviews of the literature that found that self-efficacy for exercise was consistently associated with physical activity.(46) Sanchez and colleagues likewise found that patients *believing in their ability* to be physically active were significantly more likely to be active. (19) Self-efficacy has been shown to be the single most important predictor of engaging in physical activity.(46) This suggests that strategies to promote self-efficacy for exercise among kidney recipients may ultimately increase the likelihood that they will engage in physical activity. Greater emphasis must therefore be placed on improving kidney recipients' self-efficacy for physical activity in the post-transplant period. Self-efficacy for exercise was related to the attribution that exercise contributes to graft function, as well as to patients' better overall health and better social functioning. Sanchez and colleagues found that 11% reported lack of knowledge of the benefits of physical activity was a barrier, but was not significantly related, to activity levels.(19) Similar to Sanchez and colleagues,(19) we found that this attribution was not directly related to kidney recipients' engagement in physical activity. This suggests that efforts to modify patients' attributions may result in greater self-efficacy for engaging in physical activity.

Contrary to expectations, adherence to fluid recommendations was negatively related to higher responsibility for oneself for fluid intake. Qualitative interviews corroborate this point, as kidney recipients reported relying on family members to remind them to drink or bring them fluids.(24) It may be that some patients lack the ability to monitor fluid intake and thirst, and require others to remind them. Additional research cuing in on the ability to effectively monitor fluid intake should be explored as a possible explanation for a sense of responsibility for fluid intake.

We found that most patients believed that physical activity and fluid intake were only moderately important for maintaining proper kidney function. This indicates that many patients do not recognize the value that self-care activities confer to health. Without such

knowledge, patients are less likely to engage in self-care practices. Other research has similarly shown that attributions are associated with health outcomes including self-care practice, less care seeking, functional decrements in chronic disease, and mortality.(47,48) Systematic post-transplant education and documentation about the value of self-care over time is essential. While current Centers for Medicare and Medicaid Services regulations mandate that all transplant centers provide recipients nutritional assessments,(49) it is not clear whether these other self-care practices have been incorporated into routine post-transplant education.

Recommendations

More effective patient management is needed to improve patients' physical activity and fluid intake. Clinical recommendations for managing kidney recipients should include guidance regarding patients at risk of inactivity and dehydration. Specifically, more effective communication is needed among females and patients with Medicare or Medicaid as the primary insurer, with regard to fluid intake. Our findings of low self-efficacy for physical activity (49%) and for fluid intake (17%), suggests that educational strategies should also focus on motivational strategies to build confidence in self-care practices, thereby suggesting the need for new communication approaches. This is particularly relevant given that recent legislation supports educational services to patients with kidney disease as a quality improvement measure.(50) In light of the benefits of regular exercise for ESRD patients noted above, repeated health education messages involving clinicians as well as health educators is well justified. Monitoring and documenting such efforts in clinical settings may facilitate this process (51). Incorporating structured educational messages during the post-transplant period is warranted and has been documented by recent studies. (52,53)

Future Research

Research found that kidney recipients are confused about clinicians' recommendations for physical activity and fluid intake, which limited their engagement in these practices.(24) Accordingly, research should examine how transplant clinicians educate patients about self-care activities, and whether clinicians appropriately emphasize the importance of self-care activities for graft survival. The findings suggest that the educational component should include strategies to improve patients' self-efficacy levels for physical activity and fluid intake. While there are several strategies for improving self-efficacy for physical activity, recommendations for best practices in physical activity education and counseling recommend strategies such as: health contracts, tailoring exercise programs to the needs and interest of individuals, and encouraging social support for exercise.(46,54) Kidney transplant recipients may also benefit from attribution retraining about the value of physical activity and responsibility for managing the transplant. Attribution retraining has been used successfully to change older adults' attributions about exercise, which improved their health outcomes.(55)

Limitations

The recruitment attrition rate of 43% may have resulted in a biased sample. Recruitment attrition may be related to poor health which may be correlated with poorer engagement in self-care behaviors. That 22% of patients refused participation due to slow recovery and feeling overwhelmed by the transplant among other reasons, supports this point. Generalizability of our findings should be cautioned. The relatively highly educated sample may be a vestige of characteristics of patients willing to participate in the study. Second, the small sample size limited our ability to undertake multivariable analyses and the R-squared values of 10–15% were relatively modest. The statistical power to detect predictors of behavior and self-efficacy is limited by the size of our study population, so some moderate

associations of interest may not be revealed in these analyses. The multi-site study design provides support for the external validity; no significant differences in self-care practices were found between sites. Since we assessed self-care practices early post-transplant, patients are likely to be more adherent to clinicians' physical activity and fluid intake recommendations given their high excitement level. Research demonstrating declines in medication adherence over time supports this point.⁽⁵⁶⁾ Although patients may not have adequately recovered from surgery or fully integrated self-care practices into daily routines, patients in the present study reported establishing self-care routines early post-transplant. ^(24,57) While the assessment of self-care was based on self-report, patients' estimates of fluid intake are likely relatively accurate given they are required to track the milliliters of fluid they drink and void for the first two weeks post-transplant.

CONCLUSION

Kidney transplant recipients are not practicing optimal physical activity or fluid intake in the early post-transplant period. Improved post-transplant patient management is needed to enhance patients' self-care care practices. Since self-efficacy and health attributions were predictors of self-care practice, transplant clinicians should focus educational efforts on addressing patients' health beliefs and removing barriers to self-care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1
Demographic Characteristics of Study Participants in Total and by Self-Care Levels (n=88)

Variable	Total Sample ^c	Physical Activity ^d (n=87)			Fluid Intake ^d (n=86)	
		N (%)	N (%) Active	Mean (SD) PASE	N (%) Adherent	P
Demographics						
Total Self-Care Practices	75 (65) (PASE)		21 (24)		30 (35)	--
Gender						<0.01
Female	37 (42)		6 (16)	67 (49.8)	6 (17)	
Male	51 (58)		15 (30)	81 (73.4)	24 (48)	
Age (years)						0.51
18–48	45 (51)		13 (30)	88 (72.5)	18 (40)	
49–74	43 (49)		8 (19)	62 (52.8)	12 (29)	
Ethnicity/Race						0.81
White	61 (69)		16 (26)	78 (61.4)	20 (34)	
Non-white	27 (31)		5 (19)	68 (72.1)	10 (37)	
Education (years) ^a						0.68
< & = High School	33 (38)		6 (18)	66 (54.8)	13 (39)	
13 yrs +	54 (61)		15 (28)	82 (70.0)	17 (33)	
Gross Household income ^a						0.44
<\$29,999	22 (25)		6 (27)	71 (53.4)	8 (36)	
\$30,000–\$59,999	24 (27)		6 (26)	83 (80.6)	6 (25)	
\$60,000+	35 (40)		8 (23)	71 (41.7)	14(41)	
Primary Insurer ^a						<0.04
Private insurance	46 (52)		13 (29)	91 (75.2)	21 (47)	
Medicare/Medicaid	40 (46)		8 (20)	58 (46.3)	9 (23)	
Clinical Factors						
Travel Time to transplant center						0.90
0–30 minutes	31 (35)		4 (13)	61 (43.3)	10 (33)	
31–60 minutes	32 (36)		8 (25)	75 (64.0)	13 (41)	
61+ minutes	24 (27)		8 (33)	91 (83.2)	7 (30)	

Variable	Total Sample ^c	Physical Activity ^d (n=87)			Fluid Intake ^d (n=86)	
		N (%)	N (%) Active	Mean (SD) PASE	N (%) Adherent	P
Demographics						
Cause of ESRD ^b						0.22
Diabetes	8 (9)		2 (25)	87 (112.5)	4 (50)	
Hypertension	21 (24)		6 (29)	71 (56.6)	9 (45)	
Glomerulonephritis	18 (21)		2 (11)	75 (76.4)	7 (39)	
PKD	19 (22)		5 (26)	76 (46.3)	7 (37)	
Other	22 (25)		6 (29)	74 (57.6)	3 (14)	
Organ donor source						1.00
Deceased donor	48 (55)		15 (31)	80 (65.0)	16 (35)	
Living donor	40 (46)		6 (15)	69 (64.2)	14 (35)	
Number of Transplants						0.78
1	70 (80)		16 (23)	76 (68.7)	25 (36)	
2+	18 (20)		5 (28)	71 (46.8)	5 (29)	
Self-rated health						0.75
Excellent	13 (15)		3 (23)	95 (95.8)	5 (42)	
Very Good	31 (35)		9 (29)	83 (67.7)	11 (36)	
Good	32 (36)		8 (26)	70 (49.8)	12 (39)	
Fair	10 (11)		0	42 (24.6)	2 (20)	
Poor	1 (1)		0	0	0 (0)	

^a Percentages do not equal 100% since not all respondents provided this information.

^b End-stage renal disease.

^c Due to partially complete data, analyses of physical activity levels are based on 87 participants, and analyses of fluid intake are based on 86 participants.

^d P-values represent the level of statistical significance for the overall association between the variable in the column (Physical Activity or Fluid Intake) and variable in the row.

Table 2Patient Characteristics Associated with Self-Efficacy for Self-Care Practices^{a,b}

Patient Characteristics	Physical Activity		Fluid Intake	
	Mean (SD)	% High SE ^c	Mean (SD)	% High SE ^c
All Patients	3.5 (1.3)	49%	4.3 (0.8)	83%
Age	r=-0.20, p=0.08		r=0.04, p=0.70	
18–47	3.8 (1.1)	59%	4.3 (0.9)	84%
48–74	3.3 (1.4)	38%	4.3 (0.8)	83%
Gender	t=-1.12, p=0.27		t=-2.93, p<0.01	
Female	3.4 (1.2)	43%	4.0 (0.9)	73%
Male	3.7 (1.3)	53%	4.5 (0.7)	92%
Education	r=-0.10, p=0.38		r=-0.01, p=0.91	
< High School & High School	3.7 (1.3)	50%	4.4 (0.7)	94%
13+ years	3.4 (1.3)	49%	4.3 (0.9)	78%
Race	t=-0.902, p=0.37		t=0.327, p=0.75	
White	3.4 (1.3)	46%	4.3 (0.8)	86%
Non-white	3.7 (1.2)	55%	4.2 (0.9)	76%
Marital Status	t=0.04, p=0.97		t=2.42, p=0.02	
Married	3.5 (1.3)	44%	4.4 (0.7)	91%
Not married	3.5 (1.3)	59%	4.0 (1.0)	70%
Income	F=0.13, p=0.88		F=3.26, p=0.05	
< \$29,999	3.4 (1.3)	52%	4.0 (0.9)	81%
\$30,000—\$59,999	3.5 (1.3)	48%	4.6 (0.7)	91%
\$60,000+	3.6 (1.2)	46%	4.4 (0.7)	85%
Primary Insurer	t=1.43, p=0.16		t=0.44, p=0.66	
Private insurance	3.7 (1.2)	49%	4.3 (0.9)	82%
Medicare/ Medicaid	3.3 (1.3)	46%	4.2 (0.8)	84%
Travel Time to transplant center	r=-0.13, p=0.26		r=-0.00, p=0.98	
0–30 minutes	3.6 (1.3)	57%	4.2 (0.9)	80%
31–60 minutes	3.5 (1.1)	39%	4.4 (0.7)	87%
61+ minutes	3.4 (1.4)	50%	4.2 (0.8)	83%
Cause of ESRD	F=1.32, p=0.29		F=0.74, p=0.57	
Diabetes	3.0 (1.4)	33%	3.9 (1.0)	50%
Hypertension	3.4 (1.6)	53%	4.2 (1.0)	82%
Glomerulonephritis	4.0 (1.0)	67%	4.3 (0.8)	83%
PKD	3.3 (1.1)	32%	4.4 (0.6)	95%
Other	3.6 (1.2)	50%	4.4 (0.9)	86%
Organ Donor Source	t=0.51, p=0.62		t=-1.02, p=0.31	
Deceased donor	3.6 (1.3)	52%	4.2 (0.8)	82%

Patient Characteristics	Physical Activity		Fluid Intake	
	Mean (SD)	% High SE ^c	Mean (SD)	% High SE ^c
Living donor	3.5 (1.2)	45%	4.4 (0.8)	85%
Number of Transplants	t=0.30, p=0.76		t=1.01, p=0.32	
1	3.6 (1.3)	52%	4.3 (0.8)	83%
2+	3.4 (1.3)	39%	4.1 (0.8)	83%
Self-Rated Health	F=6.12, p<0.001		F=4.85, p<0.01	
Excellent	4.5 (0.8)	83%	4.9 (0.4)	100%
Very good	3.6 (1.1)	52%	4.4 (0.8)	87%
Good	3.5 (1.2)	43%	4.2 (0.9)	76%
Fair	2.3 (1.3)	11%	3.9 (0.6)	80%
Poor	1.0		2.0	

^a F-values, t-tests, and rho values represent the statistical association between variable in the column and variable in the row.

^b Percentages do not equal 100% since not all respondents provided this information or stated 'don't know'.

^c SE = self-efficacy

Table 3
 Psychosocial Characteristics of Study Participants by Self-Care Levels and Self-Efficacy (n=88)

	Total	Self-Care Practice			Self-Efficacy	
		Score ^a	Physical Activity	Fluid Intake	Physical Activity	Fluid Intake
	N	Mean (SD)	r ^b	t	r	r
HRQOL						
Physical Functioning	87	41.2 (9.5)	0.41**	0.36	0.26*	-0.02
Role Physical	87	33.8 (11.5)	0.25*	0.36	0.33**	0.04
Role Emotional	84	44.0 (13.6)	0.00	0.02	0.02	0.11
Social Functioning	87	39.5 (13.1)	0.11	0.03	0.30**	0.08
Bodily Pain	87	38.9 (11.1)	0.10	-0.24	0.18	-0.05
Mental Health	87	51.9 (9.2)	-0.09	0.55	0.11	0.17
Vitality	87	49.0 (9.2)	0.11	0.52	0.31**	0.19
General Health	87	45.6 (9.9)	0.19	0.47	0.26*	0.09
Self-Efficacy						
Physical Activity	83	3.5 (1.3)	0.41***	1.27	-	0.24*
Fluid Intake	82	4.3 (0.8)	0.19	5.27***	-	-
Social Support						
Emotional	87	87 (14.1)	0.10	0.64	0.16	0.21
Tangible	87	91 (13.0)	0.05	1.92	0.09	0.24*
Affection	87	92 (16.0)	0.03	0.43	0.14	0.07
Social Interaction	87	89 (14.7)	0.01	-0.07	0.06	0.20
Total Social Support	87	90 (12.8)	0.06	0.70	0.11	0.25*

* p<0.05,

** p<0.01,

*** p<0.001

^aScores for HRQOL are normalized.

ρ Rho and t-test values represent the statistical association between variable in the column and variable in the row.

Table 4Relationship Between Attributions about Transplantation and Self-Care Practices^a

	N	% Agree with Attribution ^b	Self-Care Practices	
			Physical Activity ^c	Fluid Intake
			r	t
Cause of ESRD				
Genetics/Inherited	85	33%	−0.01	−0.43
Yourself/Behavior	87	16%	−0.18	0.56
Your Doctor	86	16%	0.15	−0.03
God's will	85	26%	0.10	0.13
Responsibility for transplant success				
Self	87	99%	0.01	−2.00 *
Family	87	40%	−0.22 **	−0.08
Doctor	86	78%	−0.14	−0.07
God	83	51%	−0.17	0.38
How much each self-care practice can prevent kidney rejection				
Diet	86	66%	0.04	−0.60
Fluid	84	85%	−0.04	−1.58
Exercise	84	68%	0.07	0.36

*
p<0.10,**
p<0.05,***
p<0.01,****
p<0.001^aPercentages do not equal 100% since not all respondents provided this information or stated 'don't know.'^bPercentages are based on respondents reporting 'A lot' or 'A Great Deal' (4–5).^cRho and t-test values represent the statistical association between variable in the column and variable in the row.

Table 5

Multivariate Analyses of Self-Care Practices

Variable (range)	Physical Activity		Fluid Intake	
	β	(95% CI)	β	(95% CI)
Age (18–74)	–0.558	(–1.672, 0.557)	--	--
Gender (female=1, male=0)	--	--	–1.757	(–3.21, –0.30)
Primary Insurer (private=1, public=2)	–29.345	(–54.100, –4.591)	–1.906	(–3.31, –0.49)
Self-Efficacy for Physical Activity (1–5)	13.222	(2.894, 23.549)	--	--
Self-Efficacy for Fluid Intake (1–5)	--	--	2.030	(0.72, 3.34)
SF36- Physical Functioning (19–57)	2.046	(0.624, 3.468)	--	--
Attribution: Self-responsibility (1–5)	--	--	–1.421	(–2.83, –0.01)
Attribution: Family responsibility (1–5)	–5.752	(–15.109, 3.605)	--	--
Social Support (Social) (1–45)	--	--	–0.019	(–0.06, 0.03)
				0.39

-- not applicable; the variable was not entered into the regression analysis.

Table 6

Multivariate Analyses of Self-Efficacy for Self-Care Practices

Variable (range)	Physical Activity (PA)			Fluid Intake		
	β	(95% CI)	P	β	(95% CI)	P
Age (18–74)	–0.068	(–0.12, –0.01)	0.015	--	--	--
Gender (female=1, male=0)			--	–1.194	(–3.12, 0.73)	0.223
Marital status (married=0, unmarried=1)			--	–2.033	(–3.90, –0.17)	0.033
Gross Income: \$30,000–\$59,000 (yes=1, no=0)			--	0.759	(–1.89, 3.41)	0.574
Gross Income: \$60,000 + (yes=1, no=0)			--	–1.081	(–3.18, 1.02)	0.313
Attribution: PA prevents rejection (1–5)	1.028	(0.36, 1.70)	0.003			--
Attribution: Family Responsibility (1–5)			--	–0.201	(–0.87, 0.47)	0.555
Self-rated health (1–5)	–0.566	(–1.27, 0.14)	0.116	–0.943	(–1.92, 0.03)	0.057
SF36 - Social Functioning (13–57)	0.058	(0.01, 0.11)	0.019			--
MOS total composite score (38–100)	--	--	--	0.035	(–0.03, 0.10)	0.316

-- the variable was not entered into the regression analysis.