ORIGINAL ARTICLE

VALIDITY BASED ON INTERNAL STRUCTURE OF THE KIDNEY TRANSPLANT UNDERSTANDING TOOL – BRAZIL (K-TUT-BR)

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Highlights: (1) This study performed the psychometric testing of the K-TUT-BR and its validity assessment was based on its internal structure. (2) The K-TUT-BR presents psychometric qualities that allow its appropriate use. (3) The K-TUT-BR represents an important instrument for assessing patients' knowledge about kidney transplantation.

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VALIDITY BASED ON INTERNAL STRUCTURE OF THE KIDNEY TRANSPLANT UNDERSTANDING TOOL – BRAZIL (K-TUT-BR)

ABSTRACT

This study aimed to evaluate the evidence of validity based on the internal structure of the "Kidney Transplant Understanding Tool - Brazil" (K-TUT-BR). This is a methodological study with quantitative approach in which the data collection took place through the application of a sociodemographic/clinical questionnaire and K-TUT-BR. The participants were pre-transplant renal patients or outpatient follow-up transplants. The sample consisted of 300 patients. The study was approved by the Research Ethics Committee under Opinion number 5,939,285. The data were analyzed in the software FACTOR version - 12.04.01 and JASP version 0.17.3.0. Successive exploratory factor analyses were performed for the set of items, followed by analysis of variance of the items. In this study, a 4-factor model (F1, F2, F3 and F4) was found for 11 items of the instrument under test, with good adjustment indices. The parallel analysis recommended extraction of four factors as the most representative for the data, which revealed acceptable composite reliability (greater than 0.70) for F1 and F3 factors. The overall reliability of the instrument was also acceptable (CRC=0.660). Thus, the K-TUT-BR represents an important instrument to evaluate patients' knowledge about kidney transplantation.

Keywords: Kidney transplantation; Health literacy; Health education; Chronic kidney disease; Nursing.

INTRODUCTION

Chronic Kidney Disease (CKD) is a global health problem. By 2030, 5.4 million people are expected to need some kind of Renal Replacement Therapy (RRT). Although dialysis is the predominant therapy in most countries, renal transplantation (RT) is the preferred treatment for selected patients[1].

Concerning this therapy, a median incidence of around 14 pmp (IQR:5-38) and prevalence of 255 pmp (IQR: 58-432 of renal TX is recorded annually in the world[2]. According to the data of the Brazilian Association for Organ[3] Transplants from 1997 to March 2024, 94,149 kidney transplants were performed in Brazil[3].

Renal TX improves the individual's quality of life compared to other therapies. However, the recipients need life-long care, as they must follow the recommendations of healthy habits, as well as a rigorous drug therapy[4,5].

Following such recommendations generates an important change not only in the lives of the recipients, but also in those of their families. Thus, patients must be able to receive, use and understand health information, as well as communicate with professionals[5].

These skills represent important aspects of Functional Health Literacy (FHL), which is defined as the patient's ability to obtain, process and understand health information, as well as basic services, to make decisions about their health and treatment. It should be noted that FHL can influence decision-making and effective self-care, which are essential aspects for the success in the treatment of chronic kidney patients[6].

The lack of health literacy is related to worse general health status and lower utilization of health services by the individual. In renal TX receptors, limited FHL is associated with multiple diagnoses as well as low adherence to drug treatment, depressive symptoms, lower levels of glomerular filtration rate (GFR) and higher creatinin[5,7].

To evaluate the level of FHL in Brazil, specific tools are needed that are validated for the Portuguese language and adapted to the Brazilian reality[6]. However, few tools accurately assess knowledge levels about renal TX[8].

Among the tools capable of evaluating the individual's understanding and knowledge about kidney transplantation is the "Kidney Transplant Understanding Tool" (K-TUT). It was developed in 2017 in Canada and can be used on patients waiting in line or those who have already received a kidney transplant. This instrument arose from the need to determine the effectiveness of educational interventions, as well as the need to evaluate the influence of individual knowledge on treatment adherence and self-efficacy[9].

In Brazil, the tool has already been adapted and its content validated to the Brazilian context. Costa et al. (2023), in their study, considers stages I to V of the guidelines proposed by Sousa and Rajjanasrirat (2011) for translation and cross-cultural adaptation of the tool in other countries. They are: i) Translation of the original instrument into the target language (direct or unidirectional translation); ii) Comparison of the two translated versions of the instrument: Synthesis I; iii) Blind back-translation of the preliminary version of the translated instrument; iv) Comparison of the two back translated versions of the instrument: Synthesis II; v) Pilot test of the pre-final version of the instrument in the target language: cognitive debriefing. The sixth step is optional[10].

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The seventh step of the process described by Sousa and Rajjanasrirat[11] aims to verify the reliability, homogeneity and validity related to the instrument construct through the analysis of the internal structure's validity. Thus, this study aimed to evaluate the evidence of validity based on the internal structure of the Kidney Transplant Understanding Tool - Brazil (K-TUT-BR).

METHOD

This is a methodological study with quantitative approach, in which the psychometric test of the final version of the translated instrument, the Kidney Transplant Understanding Tool - Brazil (K-TUT-BR) was performed. Refers to the seventh stage of translation, cross-cultural adaptation and validation of the instrument for the Brazilian reality, according to guidelines proposed by Souza and Rajjanasrirat. The sixth step, according to these guidelines, is optional [11].

K-TUT-BR, resulting from the previous five stages of translation, cross-cultural adaptation and validation of the instrument, has 69 items distributed in 22 questions. The first 9 questions appear as individual items with dichotomous answers (true or false) and the others refer to specific topics of treatment described in a statement followed by statements referring to these topics that must be defined as true or false by the patient. For example, the tenth question is written in the instrument as follows:

"When thinking about herbal or traditional therapies, which of the following statements are true? (check all correct answers):

a. Traditional treatments are safe for a person who has received a kidney TX because they are natural.
b. Herbal medicines recommended in the media (i.e., internet, television) are typically safe for those who have undergone TX.
c. Medicines that boost the immune system are safe for people who have had a transplant.
d. Family and friends may suggest herbal remedies or natural products, but you should confirm with your transplant team before trying them."

The psychometric evaluation step of the instrument, developed in this study, was performed in the nephrology department of a university hospital and in a hemodialysis clinic

located in northeastern Brazil. The sampling was by convenience, not probabilistic, with replacement. The sample was selected following the guidelines of Souza and Rajjanasrirat that establish 300-500 individuals.

Thus, 300 patients with chronic kidney disease before or after kidney transplantation, older than 18 years, were adopted as a sample. The pre-transplant participants corresponded to patients on the waiting list for TX, who are treated in hemodialysis services; and those of the post-transplant corresponded to the renal TX-receiving patients followed in the transplantation/nephrology outpatient clinic of the university hospital selected for this study. Patients who for various reasons did not attend the outpatient clinic for a scheduled appointment, or who did not attend their hemodialysis session shift during the data collection period and patients with some cognitive impairment were excluded.

Data collection was developed in the period from March to September 2023, through individual interviews, lasting 10 to 20 minutes. The researcher read the Informed Consent Form (ICF) and, after the participant's signature, there was the reading of the items of the research instruments to which the patient should answer.

A sociodemographic questionnaire was first applied, which included the following information: sex, age, self-report of color, relationship, income in minimum wages, years of study and issues related to treatment (beginning of treatment, current mode of treatment, waiting time in TX list; the type and time of stay in the treatment before TX, TX time and donor type), and then the K-TUT-BR, which already has transcultural adaptation and validation for use in Brazil. The tool contains 9 true or false questions and 13 multiple answers, totaling 69 items, which cover elements that seek to identify patients' knowledge about some aspects related to kidney transplantation.

The authors were asked for authorization to use the Kidney Transplant Understanding Tool - Brazil, as well as the approval of the Research Ethics Committee, under the number 5.939.285, and ICF signature by the participants of the study.

The data were organized in a spreadsheet of the software Excel version 2016 and analyzed with the aid of the softwares FACTOR version - 12.04.01 and JASP version 0.17.3.0. As for the characterization of the sample, frequencies and measures of central tendency were

presented. For the verification of validity evidence based on the internal structure of the instrument, an Exploratory Factor Analysis (EFA) was performed[12].

The EFA was implemented considering a polychoric matrix and Robust Unweighted Least Squares (RULS) extraction method. This extraction method is particularly suitable for large sets of items and samples that are not very big[13-16]. Moreover, it is an alternative to analyses in which the correlation matrix between items cannot be positive[16], a situation that occurred in this study.

In this sense, the absolute value of asymmetry and kurtosis of each item was evaluated in order to find a set of plausible data to perform the EFA. According to Kline[17], data with absolute values of asymmetry greater than three are considered extremely asymmetric. Kurtosis values higher than ten may indicate problems and values above 20 may indicate a more serious problem. Thus, it is suggested that the absolute value of asymmetry and kurtosis should not be higher than 3 and 10, respectively[17]. Successive EFA were performed for the set of items, as item by item was removed to the limit of asymmetry and kurtosis recommended by Kline[17]. However, the problem of the undefined positive matrix was not solved. Thus, the variance analysis of the items was carried out. Items with low variance were removed one by one and new EFAs were performed. For a set of 18 items, with variance greater than 0.20, it was possible to find a positive matrix defined in the EFA. From these items, the model fit indices, correlations between items and factor loads were evaluated. Thus, in this study, a 4-factor model was evidenced for 11 items of the instrument under test, with good adjustment indices.

The suitability of the sample for EFA was investigated using the Kaiser-Meyer-Olkin (KMO) test. The closer to 1.0, the better the result. For some authors, KMO values of at least 0.5 are acceptable[18]. This statistic indicates the proportion of variance in the data that can be explained by latent factors or traits. Still on the adequacy of the sample for EFA purposes, the Bartlett's test was determined to be statistically significant ($p < 0.05$)[18,19].

The technique of Parallel Analysis with random permutation of the observed data[16,20] was used for factor retention purposes. In this type of analysis, the results of the random matrices are compared with the data from the original/collected data matrix, so that only the factor of the original data matrix that have an explained variance greater than that found in the randomized data is retained[16,20]. The rotation used was Robust Promin[21,22].

The adjustment indices used to evaluate the quality of the model were: x^2 (chi-square); Comparative Fit Index (CFI); Tucker-Lewis Index (TLI); Standardized Root Mean Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA). Values of x^2 should not be significant ($p>0.05$); values of CFI and TLI should be greater than or equal to 0.90 and preferably above 0.95; SRMR should be at most 0.08, and the value of RMSEA should be less than or equal to 0.06 or at most 0.08 with confidence interval (upper limit) less than or equal to 0.10[12].

In addition to these indices, the standardized factor loads and the mean extracted variance (MEV) were evaluated. Factor loads of at least 0.30[18] were considered. In the occurrence of cross-factorial loads, it was chosen not to exclude the item and the decision on which factor the item should remain was based on the relative measure of Pratt (Pratt's importance measures). This is a measure that indicates how much each factor explains the common variance of item[23]. The evaluation of this measure occurred through the value of Unique directional correlation (ETA). The higher the ETA value, the greater the common variance explanation of the item by a given factor.

To verify the reliability of the factorial structure, it was used Composite Reliability Coefficient (CRC)[24]. Regarding this index, it is necessary to be cautious when using single and fixed cut-off points, due to its variability as a function of the number of items in the instrument and factor loads. However, some authors recommend the value of 0.70[18] or even 0.60[25].

The stability of the factors was evaluated by means of the *H* index[21,22]. The *H* index evaluates how well a set of items represents a common factor[21,22]. *H* values range from 0 to 1. High *H* values (> 0.80) suggest a well-defined latent variable, which is more likely to be stable in different studies. Low *H* values suggest a poorly defined latent variable, and probably unstable between different studies[21,22].

RESULTS

The sample consisted of 300 participants, of whom 37.3% (n=112) were awaiting kidney transplantation and 62.7% (n=188) had already performed the transplant. Among the pre-transplant participants, the mean age was 44.48 years (±11.75), there was predominance of males (55.4%; n=62), white color (31.3%; n=35), income of a minimum wage (67.0%; n=75)

and above half (53.6%; n=60) reported companion. The average number of years of studies was 3.81 (±2.13). All patients undergo hemodialysis, and the average duration of this treatment was 39.44 months (±41.3). The mean time on the kidney transplant list was 18.43 months (± 18.12).

Regarding the characterization of participants who have already undergone kidney transplantation (n=188), the mean age was 47.18 years (±11.7), there was predominance of females (53.2%; n=100), white color (35.1%; n=66), income from a minimum wage (65.4%; n=123); and 60.6% (n=114) reported having a partner. The average of years of studies was 3.84 (±1.27). Regarding the treatments performed prior to renal transplantation, hemodialysis was the most cited (82.4%; n=155) and the average length of stay in treatment before transplantation was 50.12 months (±47.5). The living donor was the most frequent (58.5%; n=110), and the sibling was the most prevalent family member among the donors (43.1%; n=81). The mean time of renal transplantation was 137.8 months (±95.9).

The EFA was performed for the set of 69 items. However, the analysis resulted in an undefined positive matrix. Therefore, the values of asymmetry, kurtosis and variance of the items were analyzed, and EFA was performed with the exclusion item by item. Table 1 shows the values of variance, asymmetry and kurtosis for the set of 69 items.

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Table 1: Variance, skewness, and kurtosis values of the K-TUT-BR instrument (n=300). Recife, Pernambuco, Brazil, 2023

Items	Variance	Asymmetry	Kurtosis
1) Everyone who receives a kidney transplant feels better than they did before the transplant.	0.113	-2.211	2.910
2) Transplant-related medications are necessary to prevent rejection.	0.007	12.186	147.473
3) Some diseases that cause kidney failure can recur after a kidney transplant.	0.068	3.290	8.883
4) Anti-rejection medications are also called immunosuppressant drugs.	0.130	1.934	1.752
5) Your transplanted kidney is also called a graft.	0.159	1.534	0.355
6) You should always take your anti-rejection medications, unless otherwise instructed by your transplant team.	0.016	7.589	55.965
7) You will need to have blood tests at least once a month for as long as your transplanted kidney is functioning.	0.101	2.452	4.038
8) In general, it is safe to take herbal supplements during your transplant, as they are natural products.	0.152	1.616	0.617
9) Most people can return to work after a kidney transplant.	0.165	1.456	0.121
10.1) Traditional treatments are safe for someone who has received a kidney transplant because they are natural.	0.148	1.674	0.808
10.2) Herbal medications recommended in the media (i.e., online, on television) are generally safe for those who have had a kidney transplant.	0.020	6.892	45.800
10.3) Medications that stimulate the immune system are safe for people who have had a kidney transplant.	0.218	0.776	-1.408
10.4) Family and friends may suggest herbal remedies or natural products, but you should check with your transplant team before trying them.	0.054	3.854	12.942
11.1) Anti-rejection medications increase the risk of infection.	0.223	0.711	-1.505
11.2) Anti-rejection medications can be stopped after ten years if the transplanted kidney is functioning well.	0.079	2.953	6.766
11.3) Anti-rejection medications increase the risk of cancer.	0.251	0.054	-2.011
11.4) Anti-rejection medications can be stopped if side effects are very severe.	0.232	0.571	-1.685
11.5) Sometimes, anti-rejection medications can be changed if side effects are very severe.	0.060	3.604	11.061
12.1) Continue taking medications as prescribed.	0.222	0.727	-1.482
12.2) Contact your transplant team.	0.007	12.186	147.473
12.3) Reduce the dose of anti-rejection medications to see if it helps.	0.082	2.880	6.335
12.4) Stop taking anti-rejection medications until you see your doctor.	0.016	7.589	55.965
12.5) Try to manage side effects with over-the-counter medications.	0.135	1.864	1.485
13.1) Wash the hands.	0.013	8.529	71.215
13.2) Get vaccinated, such as the annual flu shot.	0.020	6.892	45.800
13.3) Avoid unnecessary contact with people who are unwell.	0.013	8.529	71.215
13.4) Quit your job because you're in contact with sick people.	0.170	1.382	-0.090

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13.5) Wear a mask when in crowded environments.	0.013	-8.529	71.215
14.1) Other medications may not combine well with anti-rejection medications.	0.010	9.899	96.633
14.2) Anti-rejection medications increase your chances of getting infections.	0.221	0.743	-1.458
14.3) Anti-rejection medications increase your chances of getting cancer, so regular checkups are important.	0.233	0.556	-1.702
14.4) Some medications can harm your transplanted kidney.	0.126	2.008	2.044
14.5) Anti-rejection medications can affect how you recover after surgery.	0.249	-0.188	-1.978
14.6) You don't need to tell your doctors that you received a transplant.	0.045	4.320	16.776
15.1) Other medications may not combine well with anti-rejection medications.	0.023	6.347	38.540
15.2) Your pharmacist can help you decide if you should treat common problems (such as heartburn or cold sores) with over-the-counter medications.	0.111	-2.256	3.111
15.3) Some over-the-counter medications can be harmful to your transplanted kidney. 15.4) You don't need to tell your pharmacist that you've had a transplant.	0.163	1.482	0.196
16.1) Creatinine is measured through a blood test.	0.106	2.351	3.548
16.2) Creatinine levels can tell us how well your kidney is functioning.	0.003	17.321	300.000
16.3) Your creatinine will always be normal after your kidney transplant.	0.023	6.347	38.540
16.4) An increase in your creatinine will always mean rejection.	0.227	0.648	-1.591
17.1) Rejection cannot be treated.	0.248	0.216	-1.967
17.2) Sometimes stronger anti-rejection medications can treat rejection.	0.142	1.766	1.126
13.5) Wear a mask when in crowded environments.	0.137	1.831	1.360
17.3) If there is a good compatibility, rejection may not occur.	0.223	-0.711	-1.505
17.4) If you take anti-rejection medications correctly, rejection may not occur.	0.202	-0.985	-1.037
17.5) You'll know if you have rejection because you'll feel unwell.	0.176	-1.312	-0.280
18.1) You may get infections more easily because anti-rejection medications are stronger.	0.023	6.347	38.540
18.2) You should avoid changing your glasses or contact lenses because your vision may change.	0.235	-0.526	-1.735
18.3) Regular blood tests are not important.	0.007	12.186	147.473
18.4) The patient is encouraged to travel internationally.	0.077	3.030	7.231
19.1) Some anti-rejection medications may be harmful to your transplanted kidney.	0.209	0.895	-1.208
19.2) High blood pressure can be harmful to the transplanted kidney.	0.039	4.718	20.400
19.3) Other medications may be needed to treat transplant complications.	0.139	1.798	1.241
19.4) Your transplant team may lower the dose of your anti-rejection medications.	0.077	3.030	7.231

19.5) Your transplant team may need to increase the dose of your anti-rejection medications.	0.071	3.198	8.284
20.1) Some anti-rejection medications can cause birth defects.	0.235	0.526	-1.735
20.2) Anti-rejection medications can be discontinued during pregnancy.	0.135	1.864	1.485
20.3) Pregnancy can cause an increase in creatinine.	0.248	0.216	-1.967
20.4) Pregnancy is always possible after a kidney transplant.	0.249	0.148	-1.991
20.5) You should discuss your desire to become pregnant with your transplant team.	0.045	4.320	16.776
21.1) Becoming a biological father is always possible after a kidney transplant.	0.166	-1.431	0.048
21.2) A kidney transplant will always resolve your erection problems.	0.137	1.831	1.360
21.3) Some medications the father takes can be harmful to the baby.	0.208	-0.912	-1.175
21.4) You should discuss your desire to become a biological father with your transplant team.	0.096	2.561	4.590
22.1) Birth control pills can prevent STIs.	0.126	2.008	2.044
22.2) Condoms can prevent all types of STIs.	0.144	-1.735	1.016
22.3) All sexually transmitted infections can be cured.	0.166	1.431	0.048
22.4) Anti-rejection medications increase the risk of contracting STIs during sexual activity.	0.185	1.202	-0.558

Source: research data

After the removal of several items, selected based on the analysis of asymmetry, kurtosis and variance, it was possible to conduct the EFA with a set of 11 items, with good adjustment indices. The results of the Bartlett sphericity test (1121.0, df = 55, $p < 0.001$) and the KMO index (0.56) indicated the adequacy of the items correlation matrix for factorial analysis. The parallel analysis recommended the extraction of four factors as the most representative for the data, that is, they represent the constructs that explain the set of variables observed (see Table 2).

Table 2: Results of the Parallel Analysis for the instrument (n=300). Recife, Pernambuco, Brazil, 2023

Factors	Percentage of explained variance of real data	Percentage of explained variance of random data (95% CI)
1	29.3375*	18.5296
2	19.7012*	16.2450
3	15.4081*	14.3302
4	14.1070*	12.4720
5	7.7799	10.6858
6	5.0901	8.9678
7	4.0486	7.2841
8	2.2365	5..483
9	1.6609	3.8642
10	0.6301	2.0729

Source: research data.
Note: The number of factors to be retained is four, since four factors of the real data have a greater % of explained variance than the random data.

The adjustment indices of the four-factor model were adequate (χ^2 = 1025.73, *df* = 55; $p < 0.001$; RMSEA = 0.037; CFI = 0.993; TLI = 0.997; SRMR = 0.043).

In relation to factor loads, the items considered representative of each factor are those whose factor loads presented values greater than 0.30. As shown in table 3, factor 1 consists of five items, factor 2 consists of four items, while factors 3 and 4 are each composed of three items. However, it is observed that items 12.1, 14.2, 20.4 and 21.3 exhibited cross loads, that is, they are explained in some way by more than one factor.

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Table 3: Factor loads of the component items of the four-factor model for the instrument (n=300). Recife, Pernambuco, Brazil, 2023

Items	Factor Loads			
	F1	F2	F3	F4
10.3) Medications that stimulate the immune system are safe for people who have had a transplant.	--	--	--	0.384
11.1) Anti-rejection medications increase the risk of infection.	0.801	--	--	--
11.3) Anti-rejection medications increase the risk of cancer.	--	--	0.870	--
11.4) Anti-rejection medications can be stopped if the side effects are very severe.	--	--	--	0.703
12.1) Continue taking the medications as prescribed.	0.858	-0.607	--	--
14.2) Anti-rejection medications increase your chances of getting infections.	0.472	--	0.369	--
14.3) Anti-rejection medications increase your chances of getting cancer, so regular checkups are important.	--	--	0.830	--
19.1) Some anti-rejection medications can be harmful to your transplanted kidney.	--	0.578	--	--
20.1) Some anti-rejection medications can cause birth defects.	--	0.516	--	--
20.4) Pregnancy is always possible after a kidney transplant.	0.514	--	--	0.452
21.3) Some medications taken by the father can be harmful to the baby.	-0.449	0.531	--	--

Source: research data

For items with crossed factor loads (factor load greater than 0.30 in more than one factor) (14.1, 14.2, 20.4 and 21.3), the ETA measure was evaluated to determine which factor best explains the variance of the item. From the ETA values, it is observed that items 12.1, 14.2 and 20.4 are more adequately explained by factor 1, while item 21.3 is better explained by factor 2 (Table 4).

Table 4: ETA value of the component items of the four-factor model for the instrument (n=300). Recife, Pernambuco, Brazil, 2023

Items	Factor loads			
	F1	F2	F3	F4
10.3) Medications that stimulate the immune system are safe for people who have had a transplant.	0.093	0.070	0.132	0.368
11.1) Anti-rejection medications increase the risk of infection.	0.818	0.000	0.272	0.023
11.3) Anti-rejection medications increase the risk of cancer.	0.000	0.000	0.844	0.018
11.4) Anti-rejection medications can be stopped if the side effects are very severe.	0.088	0.017	0.099	0.706
12.1) Continue taking the medications as prescribed.	**0.709**	0.479	0.155	0.152
14.2) Anti-rejection medications increase your chances of getting infections.	**0.550**	0.280	0.445	0.137
14.3) Anti-rejection medications increase your chances of getting cancer, so regular checkups are important.	0.164	0.000	0.849	0.155
19.1) Some anti-rejection medications can be harmful to your transplanted kidney.	0.293	0.577	0.115	0.000
20.1) Some anti-rejection medications can cause birth defects.	0.258	0.541	0.000	0.023
20.4) Pregnancy is always possible after a kidney transplant.	**0.480**	0.000	0.097	0.462
21.3) Some medications taken by the father can be harmful to the baby.	0.354	**0.435**	0.000	0.184

Source: research data

Table 5 presents the composition of the four-factor model for this study, after evaluation of factorial loads and ETA values.

Table 5: Factor loadings of the component items of the four-factor model for the instrument (n=300). Recife, Pernambuco, Brazil, 2023

Items	Factor loadings			
	F1	F2	F3	F4
10.3) Medications that stimulate the immune system are safe for people who have had a transplant.	--	--	--	0.384
11.1) Anti-rejection medications increase the risk of infection.	0.801	--	--	--
11.3) Anti-rejection medications increase the risk of cancer.	--	--	0.870	--
11.4) Anti-rejection medications can be stopped if the side effects are very severe.	--	--	--	0.703
12.1) Continue taking the medications as prescribed.	0.858	--	--	--
14.2) Anti-rejection medications increase your chances of getting infections.	0.472	--	--	--
14.3) Anti-rejection medications increase your chances of getting cancer, so regular checkups are important.	--	--	0.830	--
19.1) Some anti-rejection medications can be harmful to your transplanted kidney.	--	0.578	--	--
20.1) Some anti-rejection medications can cause birth defects.	--	0.516	--	--
20.4) Pregnancy is always possible after a kidney transplant.	0.514	--	--	--
21.3) Some medications taken by the father can be harmful to the baby.	--	0.531	--	--

Source: research data

Regarding the reliability of the four-factor factorial structure, the composite reliability was acceptable (greater than 0.70) for factors 1 and 3. In addition, the overall instrument reliability was CRC = 0.660, a value also considered acceptable. However, on the replicability indexes of this factorial structure in future studies, none of the factors presented h-observed within the expected value (> 0.80), which indicates that the latent variable is not well defined and that this four-factor structure is possibly not replicable in future studies.

DISCUSSION

K-TUT allows the measurement of the knowledge of patients about several domains related to renal TX, such as healthy lifestyle habits, adherence to drug treatment, transplantation terminology, traditional therapies, complications, infections, examination routines and pregnancy. Furthermore, it allows to identify the gaps that exist in the patient's FHL[9].

The various types of SRT require different skills from the individuals who perform them. In the case of renal TX, the patient needs to adhere to drug treatment, as well as apply informed care. Therefore, patients must be able to understand, signify and apply the guidelines they receive.

In this study, there was a prevalence of transplanted patients (62.7%), with an average of 137.8 months of TX. For patients on a waiting list (37.3%), the mean time on the transplant list was 18.43 months. In a study conducted in China, using the K-TUT in its Chinese version to evaluate the knowledge of 440 patients about renal TX, the prevalence was of transplant patients (61.4%; n=270), of which 22.6% were transplanted 60-120 months ago. The other 170 participants (38.6%) were candidates for renal TX and of these, 102 (60.0%) had been waiting for a kidney for less than 1 year[26].

The literature shows some tools applied to evaluate the FHL of patients with CKD, such as the Rapid Estimate of Adult Literacy of Medicine-Transplant (REALM), Newest Vital Sign (NVS), and the Decision-Making Capacity Assessment Tool (DMCAT). However, most of the tools are not designed specifically for renal TX patients, they are original to the English language and do not have validation process and adaptation to other languages[6].

In the case of tools specific to renal SRT type TX, the literature describes the existence of 13 tools. Of these, 7 were prepared for post-transplant patients, 5 for renal TX candidates and 3 for the two groups (K-TUT case). These instruments originate from Korea, Canada, Germany, the United States of America, Bangladesh, Hungary and Norway. In addition, of the 13 tools, 10 were available for quality assessment, 2 were classified as adequate, 4 as weak and 4 as very bad[8].

The need for kidney transplants has been increasing, so that patients with indications of this therapy need to have appropriate knowledge about how to manage their renal TX before and after surgery. This concerns knowing how to take the immunosuppressant drugs properly, adopt healthy lifestyle habits, habits to prevent infections and know how to recognize signs and symptoms of graft rejection. For this, it is necessary to use validated and well-structured tools in order to measure the knowledge of patients with chronic kidney disease about this type of treatment. In addition, for an accurate evaluation, questions of true or false, single or multiple answers are the most appropriate[8].

The EFA with a set of 69 items resulted in an undefined positive matrix, being necessary to perform other EFAs excluding item by item, so that it was only possible to conduct the EFA with a set of 11 items. Depending on the database, it may be necessary to identify problematic variables and their exclusions, thus adjusting the model. This action is important because, as in

other statistical analyses, factor analysis is a data modeling process. Thus, any variable included or not intervenes in the result of all others. After the exclusion of problematic variables, it is very likely that the values of factor loads[27].

Regarding the overall reliability of this instrument, acceptable indices were observed (CRC=0.660)[25]. In the validation process in other countries, researchers used Cronbach's Alpha; however, CRC is a more robust indicator compared to alpha[28]. Acceptable Cronbach alpha values are in the range of 0.70 and 0.95[29]. K-TUT, in its original Canadian version, presented values from 0.79 to 0.88, indicating a favorable internal consistency. In the Chinese version, values of 0.769 were reported in the post-transplant group and 0.778 in the pre-transplant group, indicating that it is also an acceptable and reliable tool to evaluate knowledge about renal transplants[26]. K-TUT in its Korean version, and other tools that also used Cronbach's Alpha were reliable: R3K-T presented α=0.81 and Knowledge about clinical outcomes with live donor kidney transplantation α= >0.5[8].

In the estimation of the stability of continuous variables, the Intraclass Correlation Coefficient (ICRC) is a widely used test, since it takes into account the measurement errors 30. K-TUT presented ICRC=0.76 to 0.93, while the Korean version of K-TUT presented ICRC=0.91 for transplant candidates and ICRC=0.88 for already transplanted patients[8].

The set of 11 items presented 4 factors as the most representative for the data. These items concern immunosuppression and pregnancy in renal TX.

Items 10.3, 11.1, 11.3, 11.4, 12.1, 14.2, 14.3, 19.1, 20.1, 21.3 mainly deal with immunosuppressant drugs. For patient safety and longer life of the graft, adherence to immunosuppressive drugs is essential. Low adherence to drug treatment is common (between 28% and 52%) in renal post-transplant patients and may be influenced by poor health literacy. Approximately a quarter of CKD patients have low FHL. Thus, a factor of extreme importance to prevent rejection of the graft is adherence to immunosuppressant drugs. Therefore, assessing adherence, non-adherence and implementing interventions to improve adherence when necessary is crucial for transplant patients[31].

The item with the highest factorial load was 11.3 (anti-rejection drugs increase cancer risks; F3=0.870). In addition to this, item 14.3 also relates knowledge about immunosuppressant drugs and the risks of having cancer. It is important for the patient to be

aware of the risks. Cancer rates increase continuously after kidney transplantation, with prolonged exposure to immunosuppression being the most relevant risk factor, contributing to this disease[32].

Concerning pregnancy, it is advisable only after 1 year post-transplant, when there is no history of rejection during the last year, no recent infection, absent or controlled hypertension, minimal or absent proteinuria and stable graft function. Still, risks of pre-eclampsia, premature birth, low birth weight, among others, there are[33]. This explains the importance of items 20.1 (some anti-rejection drugs may cause malformations) and 20.4 (a pregnancy will always be possible after a kidney transplant; F1=0.514) to evaluate knowledge of this topic.

In addition, item 21.3 (some medications that the father takes may be harmful to the baby) is of utmost importance. Mycophenolate, an immunosuppressive drug, is teratogenic. Therefore, parental exposure to it during conception may pose a threat to the fetus. It is recommended that men with an active sex life using mycophenolate and their partners use highly effective contraceptive methods[33].

Unfortunately, the lack of more available and validated tools to measure the results of educational interventions in health is a problem. This makes it difficult to evaluate the success of the strategies applied. This evaluation is important to define the effectiveness of educational interventions, related to patient knowledge about adherence and self-efficacy[9].

This study used the minimum sample size, which represented a limitation. Future studies should use larger samples.

CONCLUSIONS

The psychometric evaluation of the Kidney Transplant Understanding Tool – Brazil (K-TUT-BR) allowed the verification of its validity based on internal structure. The instrument resulting from this study has 11 items with appropriate model adjustment indices. The items address aspects related to the use of medicines, infections, cancer risk and reproductive health of the transplanted individual, so that K-TUT-BR can help in evaluating the knowledge of renal patients about these topics. The overall reliability of the instrument was acceptable. However, studies are necessary to ensure the use of the scale with the four factors due to the values of the replicability indices.

Thus, the K-TUT-BR represents an alternative to evaluate the knowledge of patients about renal TX, which can be used by the health team in their care practice. In addition, K-TUT-BR has the advantage of being indicated for patients on a waiting list or already transplanted. Such evaluation is essential in this audience, since knowledge-mediated adherence increases the patient's self-management capacity, reducing complications related to this treatment.

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VALIDITY BASED ON INTERNAL STRUCTURE OF THE KIDNEY TRANSPLANT UNDERSTANDING TOOL – BRAZIL (K-TUT-BR)

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VALIDITY BASED ON INTERNAL STRUCTURE OF THE KIDNEY TRANSPLANT UNDERSTANDING TOOL – BRAZIL (K-TUT-BR)

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