

The impact of therapeutic education on the readiness for discharge of patients after kidney and liver transplantation

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Abstract

Introduction: Kidney and liver transplantation are life-saving procedures, but long-term outcomes depend on the recipients' ability to perform effective self-care. Patient education is a fundamental component of discharge preparation and post-transplant management.

Aim of the research: The study aimed to assess the impact of therapeutic education on discharge readiness among kidney and liver transplant recipients and to identify practical recommendations for educational programs.

Material and methods: The study included 117 adult recipients (31.6% liver, 68.4% kidney) transplanted in several Polish transplant centres between February and May 2025. A diagnostic survey was conducted using a discharge readiness questionnaire from the C-HOBIC set supplemented with questions regarding patient characteristics, educational processes, and educators. Data were analysed statistically using IBM SPSS Statistics (v. 28).

Results: Therapeutic education delivered before and after transplantation significantly improved patients' readiness for discharge. Education provided by physicians, nurses, transplant coordinators, and dietitians had a positive effect on overall readiness and patient knowledge in key areas including pharmacotherapy, symptom recognition, emergency management, and self-care. Education delivered by psychologists showed no significant impact. Among self-education strategies, only reading medical literature was significantly associated with improved preparation for following recommendations and undertaking daily physical activity.

Conclusions: Therapeutic education delivered by an interdisciplinary care team plays a crucial role in preparing transplant recipients for discharge. Effective educational programs should be structured across multiple stages of care, tailored to patient needs, and reinforced by targeted self-education activities to support long-term adherence and self-management competence.

Introduction

Kidney and liver transplantation is a life-saving intervention, but the surgical procedure itself is only one step in the overall therapeutic process. The long-term success of transplantation depends not only on the technical efficiency of the procedure, but also primarily on the recipient's ability to engage in effective self-care, including proper administration of immunosuppressive medications, monitoring warning symptoms, preventing infections, managing lifestyle, and reducing metabolic risk factors. Meta-analyses and qualitative studies clearly indicate that patient education and active involvement in care are key elements of success of the therapy [1]. Comprehensive educational programs have been shown to have a positive impact on patient readiness for discharge, reduce rehospitalisation rates, and improve satisfaction with care [1, 2]. To meet the demands of self-care, patients need systematic educational preparation, which should include the pre-transplant phase, education during hospitalisation, and post-hospital support.

A review of the literature indicates a growing number of educational initiatives (including group sessions, printed materials, instructional videos, mobile applications) that aim to improve patients' knowledge about the process of transplantation, the risk of complications, and the requirements related to immunosuppressive treatment [3]. Attention is paid to digital interventions and the use of innovative technologies that also support patients in remembering and motivate them to follow recommendations [3, 4]. The literature also highlights the effectiveness of the "teach-back" method as a tool for assessing, understanding, and consolidating the knowledge provided, which contributes to increased readiness for discharge [2, 3].

In summary, there is a strong substantive and empirical rationale for making patient education a central component of post-transplant discharge preparation. It is emphasised that effective educational programs should be multi-channel, repeatable, and include an element of assessment of the level of understanding, as well as ensure continued support after discharge in

the form of telemedicine, telephone consultations, or mobile applications [2,4,5].

Aim of the research

The aim of the study was to assess the impact of pre- and post-transplant patient education and self-education on readiness for hospital discharge after kidney and liver transplantation, and to identify practical recommendations for educational programs.

Material and methods

A cross-sectional analytical study was conducted, including 117 organ recipients (31.6% after liver transplantation, 68.4% after kidney transplantation) who were hospitalised in several Polish transplant centres, with the centres' managers providing consent for patients to participate in the project. The study employed a non-probability sampling strategy, involving consecutive recruitment of all eligible patients (consecutive sampling) between February and May 2025. The sampling frame consisted of adult kidney or liver transplant recipients hospitalised at the study centres during the specified period. Inclusion criteria were as follows: (1) age ≥ 18 years; (2) kidney or liver transplant; (3) clinical condition sufficient for participation; (4) participant consent; and (5) ability to complete the survey independently in Polish language. Exclusion criteria were as follows: (1) acute delirium or other significant cognitive/psychiatric impairments precluding participation; (2) lack of consent; and (3) significant missing data. Due to the multicentre nature and limited time horizon, an approach based on case availability was used, without *a priori* calculation of sample size and power parameters. The aim was to obtain a cohort as complete as possible, reflecting the real flow of patients within the selected time window.

The study was conducted on the day before discharge; patients could choose between a paper or electronic version (QR code). The vast majority chose the paper version, and only 6 people used the online version.

To assess hospital discharge readiness, we used the Hospital Discharge Readiness Assessment Questionnaire from the Canadian Health Outcomes for Better Information and Care (C-HOBIC) project. During the adaptation process, the tool achieved reliability measured by internal consistency using a Cronbach's α of 0.816. Its purpose is to assess self-care readiness. This tool includes 8 questions regarding the following: knowledge of medications and their purpose, ability to take medications, recognition of health symptoms, adherence to therapeutic recommendations, knowledge of available people and institutions supporting daily functioning and in emergency situations, as well as the ability to undertake daily physical activity. Responses were provided on a 6-point Likert scale (0–5), with 0 indicating no

preparation and 5 indicating very good preparation. The total score ranged from 0 to 40, with a higher score indicating better readiness for discharge [6, 7]. The questionnaire was supplemented with questions about educational support received before and after the procedure. Patients were asked to subjectively assess their readiness for discharge and their knowledge about self-care after leaving the hospital. Questions relating to the quality of communication and information support during hospitalisation were also included. Responses were given on a 5-point Likert scale (1 – I strongly disagree, 5 – I strongly agree). The questionnaire concluded with questions regarding sociodemographic and clinical data.

Statistical analysis

Statistical analysis was performed using the IBM SPSS Statistics package (v.28). Quantitative variables were described using the mean, standard deviation, median, minimum, and maximum values, and qualitative variables were described using frequencies and percentages. The Mann-Whitney *U* test was used for comparisons between two groups, and the Kruskal-Wallis rank ANOVA test was used for comparisons of more than two groups. Correlations were assessed using the Spearman coefficient. The obtained results of the analyses were considered statistically significant at $p < 0.05$.

Material and methods

Characteristics of the research group

In the group of 117 patients, men predominated (56.4%), and the mean age was 47.6 ± 13.6 years. Nearly half of the respondents lived in rural areas (41%), and the rest in cities. The most frequently declared level of education was secondary (45.3%) followed by higher (36.8%). More than half of the respondents were professionally active (56.4%). Patients after kidney transplantation predominated (68.4%), and for 87.2% it was the first transplantation. The mean hospitalisation duration was 19.6 ± 11.5 days; in 35% of the patients the stay was extended due to complications (Table 1).

Results

Professional education before transplantation was received by 76.1% of the surveyed patients, and 67.5% of them undertook educational activities independently. Post-transplant education was provided to 82.1% of respondents, while 68.4% received educational materials during hospitalisation.

The average overall assessment of readiness for discharge on the C-HOBIC scale was 34.51 ± 5.37 points. The highest mean values were obtained in the area of the ability to take medications and to follow the rec-

Table 1. Characteristics of the research group ($N = 117$)

Variable	<i>N</i>	%/ <i>M</i> ± <i>SD</i> (range)
Gender		
Woman	50	42.7
Man	66	56.4
Other	1	0.9
Age [years]		47.6 ±13.6 (20–78)
Education		
Primary	4	3.4
Vocational	17	14.5
Secondary	53	45.3
Higher	43	36.8
Place of residence		
Village	48	41.0
City of 20–50,000 inhabitants	20	17.1
City of 51–100,000 inhabitants	9	7.7
City of 101–200,000 inhabitants	9	7.7
City of 201–500,000 inhabitants	6	5.1
City of > 500,000 inhabitants	25	21.4
Professional status		
Pupil/student	3	2.6
Employed	66	56.4
Unemployed	9	7.7
Retired	20	17.1
Annuitant	19	16.2
Length of hospitalisation [days]		19.6 ±11.5 (5–74)
Prolonged hospitalisation due to complications		
Yes	41	35.0
No	76	65.0
Transplanted organ		
Kidney	80	68.4
Liver	37	31.6
Which transplantation		
First	102	87.2
Another	15	12.8

M – mean, *SD* – standard deviation.

ommendations related to the applied treatment, while the lowest scores were given to the ability to recognise changes in health condition and knowledge related to people to whom one can turn for help in performing everyday activities. Subjective readiness for discharge and knowledge of self-care were rated highly (mean 4.36 ± 0.60 and 4.39 ± 0.82 , respectively) with a maxi-

mum score of 5. Communication and information support were highly rated – the average was 4.53 ± 0.75 , and the median reached a maximum value of 5.00. The distribution of this variable was characterised by a clear left-sided asymmetry ($A = -2.09$) and high kurtosis ($K = 5.31$), which indicates a significant predominance of high scores in this area.

Table 2. Assessment of readiness for discharge depending on participation in pre- and postoperative education

Variables	Pre-transplant education			Post-transplant education		
	Yes M ± SD	No M ± SD	Z-Statistics; <i>p</i>	Yes M ± SD	No M ± SD	Z-statistics; <i>p</i>
Overall assessment of readiness for discharge	4.46 ± 0.55	3.87 ± 0.83	−3.774; < 0.001	4.41 ± 0.60	3.87 ± 0.83	−3.115; 0.002
Knowledge of medicines	4.43 ± 0.85	3.71 ± 1.18	−3.224; 0.001	4.35 ± 0.91	3.81 ± 1.21	−2.150; 0.032
Knowledge about the reasons for taking medications	4.63 ± 0.65	3.93 ± 1.15	−3.391; 0.001	4.57 ± 0.78	3.95 ± 0.97	−3.293; 0.001
Ability to take prescribed medications	4.71 ± 0.55	4.32 ± 0.94	−2.478; 0.013	4.68 ± 0.64	4.33 ± 0.80	−2.367; 0.018
Ability to notice health-related symptoms/changes	4.26 ± 0.79	3.75 ± 0.97	−2.541; 0.011	4.22 ± 0.84	3.76 ± 0.89	−2.203; 0.028
Ability to follow treatment recommendations	4.64 ± 0.51	4.21 ± 1.03	−2.048; 0.041	4.61 ± 0.57	4.19 ± 1.03	−2.015; 0.044
Knowledge about people you can turn to for help in performing everyday activities	4.31 ± 1.19	3.57 ± 1.75	−2.711; 0.007	4.26 ± 1.28	3.57 ± 1.69	−2.089; 0.037
Knowledge about people/institutions to call in case of an emergency	4.37 ± 0.96	3.46 ± 1.29	−3.735; < 0.001	4.33 ± 0.94	3.33 ± 1.46	−3.142; 0.002
Ability to engage in daily physical activity	4.29 ± 0.98	3.96 ± 1.17	−1.491; 0.136	4.26 ± 0.99	4.00 ± 1.22	−0.920; 0.358

Z – Mann-Whitney *U* test.

In terms of the overall assessment of readiness for discharge, statistically significant differences were found in favour of people who participated in pre-transplant education. These patients achieved a higher level of readiness compared to those who did not receive such support. This effect was observed especially in relation to knowledge about medications and awareness of the reasons for their use – participants in education achieved higher results than those not covered by education. Educated patients demonstrated greater competence in taking prescribed medications, recognising symptoms and changes in health, and following treatment recommendations. Higher scores were also recorded in knowledge about people who can provide assistance in everyday activities and people/institutions to contact in emergency situations.

Similar relationships were observed with regard to postoperative education. Patients who received such support scored higher on the overall assessment of readiness for discharge compared to those who did not participate in post-transplant education. Statistically significant differences concerned knowledge about medications used and the reasons for taking them, as well as the ability to use them correctly, identify disturbing symptoms, and follow recommendations. In this group, knowledge about available forms of support was also assessed better – both in terms

of assistance in everyday activities and the possibility of contacting people/institutions responsible for providing assistance in emergencies (Table 2).

The Mann-Whitney *U* test analysis showed that patients who received educational materials during hospitalisation achieved significantly higher scores on the overall assessment of readiness for discharge ($M = 4.41$; $SD = 0.59$) compared to those who did not receive such materials ($M = 4.11$; $SD = 0.78$; $Z = -2.026$; $p = 0.043$). Statistically significant differences were noted in the area of knowledge about people/institutions to contact in case of an emergency ($M = 4.36$; $SD = 0.96$ vs. $M = 3.70$; $SD = 1.29$; $Z = -2.893$; $p = 0.004$), as well as in the area of the ability to undertake daily physical activity ($M = 4.46$; $SD = 0.75$ vs. $M = 3.68$; $SD = 1.33$; $Z = -3.220$; $p = 0.001$). In the remaining analysed areas, no statistically significant differences were found (all $p > 0.05$).

Independent educational activities undertaken before transplantation did not differentiate the results. There were no statistically significant differences between patients who declared that they independently sought information and those who did not undertake such activities (all $p > 0.05$).

Education both before and after transplantation was provided by various members of the medical staff. The most frequently indicated person providing ther-

Table 3. Areas where education provided by different providers was associated with significantly higher patient outcomes

Parameter	Educators	Areas with significantly higher scores	No significant differences
Before transplantation	Physician	– Overall readiness for discharge ($p = 0.006$) – Knowledge about medications ($p = 0.014$) – Knowledge regarding the reasons for taking medication ($p = 0.026$) – Ability to take prescribed medications ($p = 0.036$) – Knowledge related to who to go to for help with everyday activities ($p = 0.049$) – Knowledge related to people/institutions to call in case of an emergency ($p = 0.006$) – Knowledge of self-care ($p = 0.025$)	– Subjective readiness
	Nurse	– Overall readiness for discharge ($p = 0.047$) – Knowledge about the reasons for taking medications ($p = 0.049$) – Ability to notice health symptoms/changes ($p = 0.021$) – Knowledge related to people/institutions to call in case of emergency ($p = 0.007$)	– Subjective readiness – Knowledge of self-care
	Transplant coordinator	– Overall readiness for discharge ($p = 0.045$) – Knowledge about the reasons for taking medications ($p = 0.010$) – Ability to take prescribed medications ($p = 0.019$) – Knowledge about people supporting them in everyday activities ($p = 0.033$) – Knowledge of self-care ($p = 0.029$)	– Subjective readiness
After transplantation	Physician	– Knowledge about the reasons for taking medications ($p = 0.028$) – Ability to take prescribed medications ($p = 0.009$),	– Other areas – Subjective readiness – Knowledge of self-care
	Nurse	– Overall readiness for discharge ($p = 0.001$) – Knowledge about medications ($p = 0.021$) – Ability to notice health symptoms/changes ($p = 0.001$) – Knowledge related to people/institutions to call in case of an emergency ($p = 0.001$) – Ability to undertake daily physical activity ($p = 0.006$) – Knowledge about self-care ($p < 0.001$)	– Other areas – Subjective readiness (result bordering on significance)
	Dietician	– Overall readiness for discharge ($p = 0.014$) – Ability to notice health symptoms/changes ($p < 0.001$) – Ability to comply with treatment recommendations ($p = 0.022$) – Knowledge related to people/institutions to call in case of an emergency ($p = 0.014$) – Knowledge about self-care ($p = 0.008$)	– Subjective readiness
	Physiotherapist	– Ability to notice health symptoms/changes ($p = 0.049$)	– Other areas – Subjective readiness – Knowledge of self-care
Before/after transplantation	Psychologist/therapist	–	– All surveyed areas
Self-education	Reading medical literature	– Ability to comply with treatment recommendations ($p = 0.032$) – Ability to undertake daily physical activity ($p = 0.047$)	– Other areas examined (including other sources of self-education of no significant importance)

apeutic education both before and after transplantation was a physician (80.9% and 78.1% of respondents, respectively). The next indication concerned a nurse (24.7% before and 55.2% after transplantation). Education was significantly less frequently provided by dietitians (9.0% and 22.9%), physiotherapists (9.0% and 27.1%), and psychologists/therapists (12.4% and 9.4%). The share of transplant coordinators was significantly higher before the procedure (32.6%) than after it (14.6%). The “other” categories were of marginal importance (< 1% before transplantation, no indications after transplantation). Most patients (67.5%) undertook educational activities on their own, usually searching for information on the Internet (91.1% of respondents). The next responses included Reading brochures/information materials (39.2% of respondents), Contact with medical staff (21.5%), and Contacting support groups/patient associations (16.5%). A smaller group of respondents indicated Reading professional medical literature (13.9%) and Contact with the transplant coordinator (12.7%), while 7.6% indicated other forms of self-education.

The analysis showed that education provided both before and after transplantation by a physician, nurse, transplant coordinator, and dietitian significantly increased patients’ level of discharge readiness and knowledge in several key areas. Most often, this concerned a general assessment of preparedness and areas such as knowledge of medications, recognition of symptoms and health changes, handling emergency situations, and self-care. Education provided by a physiotherapist was important, especially in terms of recognising symptoms and health changes, while interventions by a psychologist/therapist were not associated with significant differences in the areas studied. In the case of educational activities undertaken independently by the patient, significantly better results were obtained only in terms of the ability to follow the recommendations related to the treatment and the ability to undertake daily physical activity by those who read medical literature (Table 3).

Discussion

The results of this study confirm the key role of therapeutic education in preparing patients for discharge after kidney and liver transplantation. Both preoperative and postoperative education were associated with significantly higher levels of readiness for discharge, and better knowledge of medications, reasons for their use, and the ability to adhere to treatment recommendations. A particularly pronounced impact was observed in the group of patients who received education from doctors, nurses, transplant coordinators, and dietitians.

The role of therapeutic education is also emphasised by other researchers who indicate that pre- and postoperative education is an important factor in

determining the effectiveness of long-term self-care after transplantation and in reducing the number of rehospitalisations [1]. Similar results were obtained by Frank-Bader *et al.* [2], emphasising the importance of a structured educational program in increasing the safety of patients after transplantation.

An important result of the study is the role of nurses in patient education. Patients educated by nurses achieved higher scores in terms of overall readiness for discharge, particularly in the areas of knowledge about medications, the ability to notice disturbing symptoms, and knowledge about institutions to contact in emergency situations. The role of nurses in the education of transplant patients has been confirmed in other studies, indicating that their participation helps improve understanding and compliance with recommendations [8].

The influence of education provided by a dietitian is also worth noting, because in our own observations it contributed to significantly higher results in terms of overall readiness for discharge and some of its aspects, such as the ability to monitor symptoms and adhere to therapeutic recommendations. According to the results of Langarizadeh *et al.* [4], diet-oriented educational interventions (e.g. mobile applications for liver transplant patients) promote better content retention and strengthen competences in self-care, including diet and pharmacotherapy. This is particularly important in the group of people after transplantation, for whom proper eating habits and avoiding drug-food interactions have a direct impact on clinical stability and long-term results [9–11].

Physiotherapists, although less frequently involved in the educational process, proved to be important in the early recognition of disturbing symptoms and in preparing patients to undertake physical activity.

The role of the transplant coordinator turned out to be important in preoperative education. Education provided by these individuals resulted in improved knowledge of how to take medications, recognise sources of help in daily activities, and develop self-care skills. This indicates the importance of the coordinator as a link between medical education and the patient’s practical preparation for life after transplantation.

It is interesting to note that education provided by a psychologist did not significantly impact outcomes related to readiness for discharge or knowledge about self-care. This may be because psychologists focus on emotional and adaptive support rather than on the practical aspects of pharmacological therapy or self-care. However, other studies emphasise that the role of the psychologist may be more visible in the long term, especially in the area of adherence and quality of life [12, 13]. Qualitative studies show that psychological interventions support emotional adaptation, reduce anxiety, improve quality of life, and may improve adherence to recommendations, indicating the need to supplement future studies with the measurement of such variables [13].

In this study, independent educational activities undertaken by patients before transplantation had a limited impact. Only people who read professional medical literature achieved better results in terms of compliance with recommendations and undertaking daily physical activity. This suggests that spontaneous and unstructured forms of knowledge acquisition are less effective than education conducted by qualified personnel. This result is consistent with the review by Hamid *et al.* [3], who indicated that informal knowledge sources do not provide patients with sufficient preparation for post-transplant care. In the future, it is worth developing verified digital resources for transplant patients to enhance the positive effects of self-education.

In the context of transplantation, the literature emphasises the value of continuous and multidimensional education as an educational dialogue tailored to the patient and their family [14, 15].

The obtained results have practical implications – they indicate that an effective educational program for transplant patients should be multi-stage and interdisciplinary, begin before the procedure, continue during hospitalisation, and also cover the period after discharge, where re-education may be particularly important. Doctors and nurses play a key role, but the participation of dietitians, physiotherapists, and transplant coordinators significantly expands the scope of educational support. It is also worth taking into account elements of self-education by patients, through recommendations of proven literature and multimedia tools. Combining traditional education (individual sessions, printed materials) with modern forms of support (telemedicine, mobile applications) may be particularly effective [4, 16]. An important activity is monitoring and evaluating education in the post-hospital period (e.g. assessing which topics the patient remembered) because they are crucial to detect educational gaps and adapt the program to fill those gaps [16, 17].

The study has several limitations. First, the lack of an *a priori* calculation of the sample size and the use of non-probabilistic sampling (consecutive sampling) may limit the detectability of small effects and the generalisation of results beyond contexts similar to the studied centres. Second, the study included a small group of patients from several transplant centres in Poland, which may limit the generalisability of the results. Furthermore, the assessment of readiness for discharge was based on patient self-reporting, which may be associated with a risk of subjective bias. Third, the impact of psychological education on psychosocial and emotional dimensions was not assessed. Only quantitative methods were used, and qualitative research could provide additional information about patient experiences and educational barriers. Fourth, the lack of long-term data does not allow for the assessment of the relationship between education and

long-term clinical outcomes (transplant rejection, complications, rehospitalisations). Prospective studies combining quantitative and qualitative measurements are recommended in the future. Furthermore, in future studies, prospective power planning is necessary, taking into account the expected effects and variability of key indicators.

Conclusions

Therapeutic education conducted by members of the therapeutic team significantly increases patients' readiness for discharge and their self-care competencies. The strongest effect was observed in the case of education provided by nurses and physicians.

Independent educational activities have limited effectiveness and should therefore be supported by professional educational programs with access to reliable sources.

The educational program should be interdisciplinary, multi-stage, repeatable, and include support in the post-hospital period.

Future studies should evaluate the psychosocial and long-term effects of education, including its impact on clinical outcomes and patient quality of life.

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Ethical approval

The study complies with the principles of the 1989 Helsinki Declaration and received a positive opinion from the local Bioethics Committee (AKBE/7/2025). Participation in the study was voluntary and anonymous.

Conflict of interest

The authors declare no conflict of interest.

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