Influence of formalized Predialysis Education Program (fPEP) on the chosen and definitive renal replacement therapy option

Ewa Wojtaszek[A–F], Joanna Matuszkiewicz-Rowińska[A–C,E,F], Paweł Żebrowski[B,F], Tomasz Głogowski[B,F], Jolanta Małyszko[D–F]

Department of Nephrology, Dialysis and Internal Medicine, Warsaw Medical University, Poland

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation;
D – writing the article; E – critical revision of the article; F – final approval of the article

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Address for correspondence
Jolanta Małyszko
E-mail: jolmal@poczta.onet.pl

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Abstract

Background. It is widely accepted that patients with chronic kidney disease (CKD) should play an active role in the selection of renal replacement therapy (RRT) option. However, patients' knowledge about CKD and treatment options is limited. The implementation of structured education program and shared decision-making may result in a better preparation to RRT, more balanced choice of dialysis modalities and better access to kidney transplantation (TX).

Objectives. The aim of this long-term study was to assess the impact of formalized Predialysis Education Program (fPEP) on knowlege on RRT options, as well as on selected and definitive therapy.

Materials and methods. The study included 435 patients (53% men, mean age 60 years) with CKD stage 4 and 5, participating in fPEP at our center. The program included at least 3 visits, during which balanced information about all RRT options was presented and self-care and informed decision-making were encouraged. The knowledge about RRT options before and after fPEP attendance, and selected and definitive RRT options were assessed.

Results. Ninety-two percent of patients received prior nephrology care. After fPEP completion, in most patients, the knowledge about CKD and RRT options and selected preferred modality improved – 40% of participants chose hemodialysis (HD), 32% peritoneal dialysis (PD) and 18% TX. During the observation period, 4% of patients died before commencement of dialysis, 2.7% received preemptive kidney transplant, 8.6% were placed on transplant waiting list, and 94% started dialysis (30% PD and 70% HD). Among those who chose PD, 69% started PD and 24% started HD; the leading causes of the discrepancy between choosing and receiving PD was the deterioration in clinical condition (50%) and change of decision (32%).

Conclusions. The fPEP increases CKD patients' knowledge on RRT methods. The implementation of a decision-making process based on fPEP leads to a satisfying distribution between modalities, with a good concordance between chosen and definitive modality.

Key words: end-stage renal disease, chronic kidney disease, renal replacement therapy, predialysis education, modality selection

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Background

International guidelines for treatment of kidney disease recommend informing the patient about all renal replacement therapy (RRT) options, as well as involving them in the process of selection of treatment modality and promoting the informed patient decision-making.[1,2] When implemented properly, predialysis education programs may produce many benefits: deferred initiation of dialysis, less emergency dialysis starts, more balanced distribution of RRT options, less anxiety and fear, and probably better survival.[3–7]

It has been recognized that predialysis care and preparation for end-stage renal disease (ESRD) in Poland is suboptimal, contributing to the unbalanced distribution of RRT modalities and high morbidity and mortality after the initiation of dialysis. Despite dissemination of practice guidelines, predialysis education in Poland is provided infrequently, and if provided, its comprehensibility seems to be suboptimal.

In 2004, based on the general principles of multidisciplinary predialysis care clinics, the formalized Predialysis Education Program (fPEP) adapted to Polish organizational, social and cultural circumstances has been developed and implemented in the Department of Nephrology, Dialysis and Internal Diseases of Warsaw Medical University, Poland. Since 2005, it has become a part of clinical practice of predialysis care and remains ongoing.

Objectives

The aim of the present study was to assess the impact of fPEP on knowledge of RRT options, and chosen and definitive modality at the start of RRT treatment.

Materials and methods

This is an observational, prospective, long-term, single-center study aimed at determining the impact of formalized PEP on 435 chronic kidney disease (CKD) patients transitioning from CKD care to RRT. The fPEP was developed for the purpose of clinical practice in Department of Nephrology, Dialysis and Internal Medicine, Warsaw Medical University, Poland. Anonymized patient data were extracted from patient files prepared for the needs of fPEP and provided to the research team. According to Polish law, for educational interventions, ethics committee approval is not applicable.

Study population

The study included patients participating in fPEP at our center between January 2005 and December 2019. Patients were referred to fPEP regardless of potential contraindications to specified RRT modalities. The inclusion criteria were as follows: 1) CKD stage 4 or 5; 2) completion of education process (at least 2 visits) with a certificate issued; 3) initiation of dialysis or kidney transplantation (TX) or death at the end of the study. The exclusion criteria were: 1) incomplete education (only 1 visit and/or lack of certificate); 2) education after urgent-start dialysis; 3) education before return to dialysis due to transplanted kidney failure. The following demographic and clinical data were registered: age, sex, family status, duration of nephrology care, knowledge of kidney disease and different treatment options, cause of kidney failure and comorbidities (diabetes, coronary artery disease, heart failure, cerebrovascular disease, peripheral atherosclerosis, chronic pulmonary disease, chronic liver disease, cancer), potential medical, psychological and social contraindications to particular RRT options, and kidney function (measured with estimated glomerular filtration rate (eGFR)) at fPEP commencement.

Study protocol

Patients with advanced renal failure (eGFR ≤ 20 mL/min) with their families or caregivers are referred to the participation in fPEP. Nephrologists and highly trained nurses experienced in all RRT modalities are involved in the education process. The basic schedule includes 3 individual (face-to-face) meetings lasting 60–90 min (further visits are possible at the initiative of the patient or the educational team). Subsequent visits are arranged every 2–4 weeks. Educational materials to help discuss specific issues are available, as well as a presentation of dialysis equipment and meetings with patients treated with various RRT methods.

To improve the communication between educational team members, each visit is documented using short forms containing most important information about the patient, confirming acquisition of information provided to the patient during previous visit, and outlining the educational content planned for the next meeting.

Visit 1

During the first visit, a "patient profile" is created to establish an education plan tailored to the needs and cognitive abilities of the patient, and to identify contraindications and/or prejudice to any therapy option. This includes a history of kidney disease, comorbidities, symptoms of renal failure, patient's current life situation, degree of independence, as well as lifestyle and employment. The knowledge about the disease and motivation to participate in the treatment process are assessed using self-prepared questionnaire with a grading scale based on the Polish school grading scale (1–6). Regardless of the CKD stage, the explanation of the progressive and irreversible nature of CKD and its adverse effects on the functioning of other organs is essential. The analysis of test results allows for showing the relationship between deteriorating kidney

function and the changes in the patient's wellbeing. This is a background to discuss ways to slow down the progression of kidney disease and prevent its complications, and to emphasize patient's participation in the process. Discussing the symptoms of renal failure, the importance of patient self-control and timely preparation and initiation of RRT is the final part of the 1st visit.

Visit 2

The next visit (or visits) is devoted to the presentation and discussion of RRT options – TX, peritoneal dialysis (PD) and hemodialysis (HD). Regardless of the patient's preferences or potential indications and contraindications to any treatment method, all options are presented to establish the complementarity of RRT.

Visit 3

The 3rd visit (and sometimes more visits) is devoted to assessing the patient's understanding and acquisition of the information provided during previous meetings. It serves to clarify doubts and to rediscuss misunderstood problems, and offers an opportunity to learn more about the RRT method chosen by the patient.

At the end of the education process, post-fPEP assessment of CKD and RRT options knowledge evaluation are performed, and training certificate is issued, indicating the patient's preferred method of RRT. Most patients continue nephrology care, but, if indicated, further steps for preparation to the selected option are implemented.

Statistical analyses

Data are presented as median (interquartile range (IQR)) or frequencies and percentages for categorical variables. Differences between study groups were tested using the Mann–Whitney U test and Kruskal–Wallis test, and differences in the relative frequencies were tested using the Pearson's χ^2 test. A value of $p < 0.05$ was considered statistically significant. Univariate and multivariable logistic regression was used to determine the association between demographics, clinical factors, as well as factors associated with fPEP attendance (post-fPEP knowledge of RRT methods and personal selection), and selected and definitive RRT modality. Four models for HD, PD and TX selection (M1 – post-fPEP HD, PD and TX knowledge, M2 – M1+age and Charlson Comorbidity Index (CCI), M3 – M2+eGFR, M4 – M3+nephrology care), and definitive HD or PD treatment (M1 – post-fPEP HD, PD and TX knowledge and personal HD or PD selection, M2 – M1+age and CCI, M3 – M2 + eGFR, M4 – M3+nephrology care) were assessed. The models were ranked using Akaike Information Criterion (AIC). The models with lowest AIC value were considered to have the highest support explaining selection and definitive RRT modality. In Table 1 and Table 2, we added the details of statistical analyses regarding factors associated with the selection of RRT method (Table 1) and details of statistical analysis concerning factors associated with definitive dialysis modality (Table 2).

All statistical calculations were performed using STATISTICA software package v. 13 (StatSoft Polska, Kraków, Poland).

Table 1. Details of statistical analysis regarding factors associated with the selection of renal replacement therapy (RRT) method

HD choice										
Log likelihood	R^2 Cox–Snell	R^2 Nagelkerke	likelihood ratio test			Wald test			Hosmer–Lemeshow test	
			χ^2	df	p-value	χ^2	df	p-value	χ^2	p-value
−242.939	0.207	0.280	101.224	3	<0.0001	56.242	3	<0.0001	0.209	0.976
−240.896	0.215	0.290	105.310	5	<0.0001	58.142	5	<0.0001	6.449	0.597
−238.307	0.220	0.298	108.487	6	<0.0001	60.310	6	<0.0001	6.525	0.585
−238.711	0.222	0.300	109.680	7	<0.0001	60.677	7	<0.0001	1.592	0.991
PD choice										
−231.921	0.173	0.242	82.732	3	<0.0001	26.695	3	<0.0001	5.447	0.141
−226.544	0.193	0.270	93.486	5	<0.0001	35.899	5	<0.0001	13.263	0.103
−217.280	0.227	0.317	112.014	6	<0.0001	48.571	6	<0.0001	12.352	0.136
−215.283	0.234	0.327	116.008	7	<0.0001	51.171	7	<0.0001	7.362	0.498
TX choice										
−145.093	0.125	0.228	58.550	3	<0.0001	20.212	3	<0.001	0.474	0.788
−120.868	0.218	0.395	107.001	5	<0.0001	45.165	5	<0.0001	5.100	0.746
−119.427	0.223	0.405	109.882	6	<0.0001	45.070	6	<0.0001	4.477	0.811
−116.577	0.233	0.423	115.582	7	<0.0001	48.667	7	<0.0001	4.264	0.832

df – degrees of freedom; HD – hemodialysis; PD – peritoneal dialysis; TX – kidney transplantation; M1 – Model 1 – post formalized Predialysis Education Program (fPEP) HD, PD and TX knowledge; M2 – Model 2 – M1+age and Charlson Comorbidity Index (CCI); M3 – Model 3 – M2+estimated glomerular filtration rate (eGFR); M4 – Model 4 – M3+nephrology care.

Table 2. Details of statistical analysis regarding factors associated with definitive dialysis modality

Definitive HD												
Model	AIC	log likelihood	R^2 Cox–Snell	R^2 Nagelkerke	likelihood ratio test			Wald test			Hosmer–Lemeshow test	
					χ^2	df	p-value	χ^2	df	p-value	χ^2	p-value
M1	388.220	−189.110	0.347	0.478	185.981	4	<0.0001	70.333	4	<0.0001	5.703	0.126
M2	379.633	−182.816	0.366	0.504	198.567	6	<0.0001	76.870	6	<0.0001	15.480	0.054
M3	329.543	−156.771	0.437	0.602	250.657	7	<0.0001	104.535	7	<0.0001	4.936	0.764
M4	320.164	−151.082	0.452	0.622	262.036	8	<0.0001	101.208	8	<0.0001	11.732	0.163
Definitive PD												
M1	319.799	−120.202	0.380	0.545	208.170	3	<0.0001	76.699	3	<0.0001	2.768	0.597
M2	252.405	−226.544	0.474	0.679	279.564	5	<0.0001	85.889	5	<0.0001	1.629	0.990
M3	228.116	−107.058	0.504	0.724	305.853	6	<0.0001	108.371	6	<0.0001	5.018	0.756
M4	228.433	−106.216	0.506	0.726	307.566	7	<0.0001	111.112	7	<0.0001	4.191	0.833

AIC – Akaike Information Criterion; df – degrees of freedom; HD – hemodialysis; PD – peritoneal dialysis; M1 – Model 1 – post formalized Predialysis Education Program (fPEP) HD, PD and TX knowledge; M2 – Model 2 – M1+age and Charlson Comorbidity Index (CCI); M3 – Model 3 – M2+estimated glomerular filtration rate (eGFR); M4 – Model 4 – M3+nephrology care.

Results

Among 652 patients registered in our fPEP between January 2005 and December 2019, 435 met predefined inclusion criteria to the present study. Demographic and clinical characteristics of the studied group are presented in Table 3.

Based on the data collected in the "patient profile" and discussions among the educational team members, 97 (22%) patients were deemed not suitable for free choice of dialysis modality. Medical contraindications to PD were revealed in 29 (7%), social contraindications in 10 (2%) and psychological contraindications in 58 (13%) patients. However, psychological contraindications were considered absolute only in 25 (6%) patients, when PD assisted by family was not possible.

Table 3. Demographic and clinical characteristics of the studied group (n = 435)

Parameter	Value
Age [years] ≥65 years of age, n (%)	Me = 61; IQR = 23 n = 200 (46)
Male sex, n (%)	n = 231 (53)
CCI	Me = 6; IQR = 5
eGFR at fPEP commencement [mL/min]	Me = 16; IQR = 7
The cause of kidney disease, n (%) diabetic nephropathy glomerulonephritis hypertensive/vascular interstitial nephropathy ADPKD other unknown	 n = 87 (20) n = 115 (26) n = 118 (27) n = 49 (11) n = 36 (8) n = 14 (3) n = 16 (4)
Nephrology care, n (%) Nephrology care >1 year, n (%)	n = 399 (92) n = 291 (67)
Living alone, n (%)	n = 105 (24)
Employed, n (%)	n = 222 (51)

Me – median; IQR – interquartile range; CCI – Charlson Comorbidity Index; eGFR – estimated glomerular filtration rate; fPEP – formalized Predialysis Education Program; ADPKD – autosomal dominant polycystic kidney disease.

Absolute contraindications to TX were found in 115 (26%) patients. They resulted from high comorbidity burden (CCI ≥ 9). In patients with CCI < 9, contraindications or limitations to eligibility for TX were evaluated individually.

The knowledge about kidney disease and RRT methods

At baseline, 252 (58%) patients had had at least sufficient (43% sufficient, 15% good) knowledge about kidney disease. Only 30 (7%) fPEP participants had had at least perceived knowledge about all RRT modalities, 248 (57%) about HD and 104 (24%) about TX. Surprisingly, 400 (92%) of patients had had no knowledge or even never heard about PD.

After fPEP completion, 383 (88%) participants improved their knowledge about kidney disease and 239 (55%) patients proved to have knowledge about all RRT options; 387 (89%) about HD, 326 (75%) about PD and 248 (57%) about TX.

Finally selected RRT option

After fPEP completion, 59 (14%) of participants did not make a final decision, while 376 (86%) patients indicated their preferred RRT option – 176 (40%) patients HD and 140 (32%) PD, and among those who were deemed eligible to transplantation (324), 60 patients (18%) selected TX.

Patients unable to indicate a preferred modality were significantly older (69 ±13 years compared to 60 ±16 years, Mann–Whitney U test: U = 6725.5; p < 0.0001) and had higher comorbidity burden (CCI 8 ±3 compared to 6 ±3, Mann–Whitney U test: U = 6905.5; p < 0.0001) and better preserved kidney function (eGFR 22 ±5 mL/min compared to 17 ±5 mL/min, Mann–Whitney U test: U = 4268.0; p < 0.0001). They had lesser knowledge on HD (53% compared

Table 4. Characteristics of patients who chose their preferable renal replacement therapy (RRT) option (n = 376)

Variable	Chose HD n = 176	Chose PD n = 140	Chose TX n = 60	HD vs PD vs TX	p-value
Age [years]	Me = 67; IQR = 18	Me = 59; IQR = 21.5	Me = 44; IQR = 19	74.21*	<0.0001
Male sex (%)	59	53	42	4.37#	0.09
CCI	Me = 7; IQR = 4	Me = 6; IQR = 5	Me = 2; IQR = 2	76.76*	<0.0001
eGFR [mL/min]	Me = 16; IQR = 5	Me = 14.5; IQR = 7	Me = 15.6; IQR = 4.5	6.37*	<0.05
Nephrology care (%)	93	88	98	6.9#	<0.05
Post-fPEP knowledge about HD (%)	91	98	98	11.25#	<0.01
Post-fPEP knowledge about PD (%)	59	99	95	86.83#	<0.0001
Post-fPEP knowledge about TX (%)	39	75	97	79.21#	<0.0001

Me – median; IQR – interquartile range; * – Kruskal–Wallis test; # – χ^2 test; HD – hemodialysis; PD – peritoneal dialysis; TX – kidney transplantation; CCI – Charlson Comorbidity Index; eGFR – estimated glomerular filtration rate; fPEP – formalized Predialysis Education Program.

Table 5. AIC ranks for models tested for likelihood of selecting specific RRT modality

Model	HD choice	PD choice	TX choice
	AIC	AIC	AIC
Model 1 – post-fPEP HD, PD and TX knowledge	493.879	471.843	298.187
Model 2 – M1+age, CCI	493.793	465.089	253.736
Model 3 – M2+eGFR	492.615	448.560	252.855
Model 4 – M3+nephrology care	493.423	446.567	249.155

AIC – Akaike Information Criterion; HD – hemodialysis; PD – peritoneal dialysis; TX – kidney transplantation; CCI – Charlson Comorbidity Index; eGFR – estimated glomerular filtration rate; fPEP – formalized Predialysis Education Program; RRT – renal replacement therapy; M1 – Model 1 – post formalized Predialysis Education Program (fPEP) HD, PD and TX knowledge; M2 – Model 2 – M1+age and Charlson Comorbidity Index (CCI); M3 – Model 3 – M2+estimated glomerular filtration rate (eGFR); M4 – Model 4 – M3+nephrology care.

to 89%, $\chi^2 = 33.66$, degrees of freedom (df) = 1; $p < 0.0001$), PD (51% compared to 75%, $\chi^2 = 24.76$, df = 1; $p < 0.0001$) and TX (26% compared to 57 %, $\chi^2 = 27.35$, df = 1; $p < 0.0001$).

In Table 4, characteristics of the patients who indicated preferred RRT options are presented.

Selection of preferred RRT modality was associated with knowledge about this method. For HD selection, all assessed models were comparable ($\Delta AIC < 2$); however, for PD and TX selection, the full model (M4) reached the lowest AIC value (Table 5). In Table 6, the full model (M4) for HD, PD and TX selection is presented in details.

Definitive RRT option

During study period, 407 (94%) patients started dialysis – 283 (70%) HD and 124 (30%) PD. Death in predialysis period occurred in 19 (4%) cases, and 9 (2.7%) patients received preemptive kidney transplant. Figure 1 shows patient flow and the distribution of selected and definitive RRT options.

The best concordance between selected and definitive modality was noticed for HD (98%). Despite their personal choice, 43 patients did not start PD – 9 patients died before dialysis and 34 (24%) started HD. The most prevalent reason of the discrepancy between indicated and definitive modality was the deterioration of clinical condition and losing independence – 17 (50%). Eleven (32%) patients changed their decision, and in 6 (18%) cases Tenckhoff

Table 6. Factors associated with the selection of RRT option in multivariate logistic regression (Model 4)

Variable	Choice of HD				Choice of PD				Choice of TX			
	OR	95% CI	Wald stat	p-value	OR	95% CI	Wald stat	p-value	OR	95% CI	Wald stat	p-value
Age	1.02	0.9; 1.05	3.72	0.05	0.99	0.96; 1.02	0.19	0.7	0.99	0.95; 1.02	0.29	0.6
CCI	0.95	0.83; 1.1	0.35	0.5	1.28	1.1; 1.5	10.47	0.001	0.56	0.42; 0.76	14.33	0.0002
eGFR	0.96	0.92; 1.0	3.0	0.08	0.9	0.86; 0.95	17.36	<0.0001	1.05	0.98; 1.13	1.68	0.19
Nephrology care (yes)	1.57	0.68; 3.6	1.14	0.3	0.44	0.19; 0.99	3.91	0.05	7.17	0.89; 57.49	3.44	0.06
Post-fPEP knowledge about HD (yes)	28.13	9.07; 87.23	33.39	<0.0001	0.63	0.08; 4.9	0.19	0.7	0.21	0.009; 4.7	0.97	0.3
Post-fPEP knowledge about PD (yes)	0.062	0.023; 0.17	30.63	<0.0001	55.17	8.93; 341.02	18.62	<0.0001	1.83	0.37; 9.13	0.55	0.5
Post-fPEP knowledge about TX (yes)	0.47	0.26; 0.86	6.041	0.01	2.47	1.3; 4.69	7.73	0.005	7.9	0.96; 65.13	3.67	0.05

RRT – renal replacement therapy; OR – odds ratio; 95% CI – 95% confidence interval; HD – hemodialysis; PD – peritoneal dialysis; TX – kidney transplantation; CCI – Charlson Comorbidity Index; eGFR – estimated glomerular filtration rate; fPEP – formalized Predialysis Education Program.

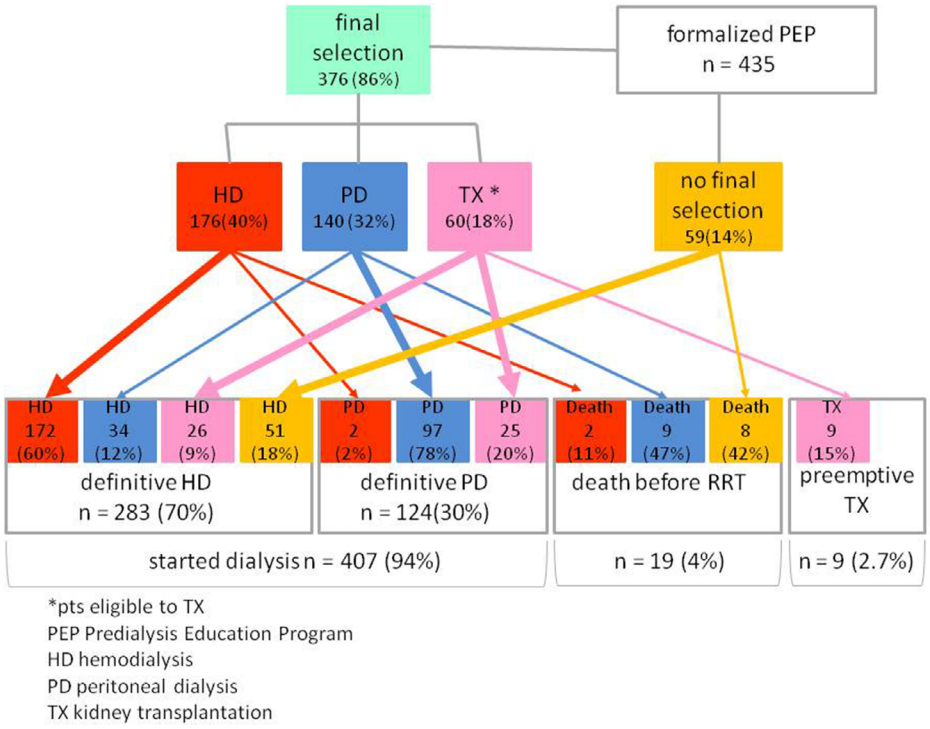

Fig. 1. Patient flow and the distribution of selected and definitive renal replacement therapy (RRT) options

Table 7. Patient characteristics according to definitive dialysis method (n = 407)

Variable	Definitive HD n = 283	Definitive PD n = 124	HD vs PD	p-value
Age [years]	Me = 63; IQR = 18	Me = 52; IQR = 25	9081*	<0.0001
Male sex (%)	54	50	0.75#	0.5
CCI	Me = 7; IQR = 5	Me = 4; IQR = 4	10389.5*	<0.0001
eGFR	Me = 17; IQR = 7	Me = 13; IQR = 5	8698*	<0.0001
Nephrology care (%)	94	89	15.5#	0.06
Post-fPEP knowledge about HD (%)	87	98	310.84#	<0.001
Post-fPEP knowledge about PD (%)	66	100	260.22#	<0.0001
Post-fPEP knowledge about TX (%)	46	82	193.06#	<0.0001
Selected RRT modality (%) HD PD TX	 61 12 9	 2 78 20	319.67#	<0.0001

Me – median; IQR – interquartile range; * – Mann–Whitney U test; # – χ^2 test; HD – hemodialysis; PD – peritoneal dialysis; TX – kidney transplantation; CCI – Charlson Comorbidity Index; eGFR – estimated glomerular filtration rate; fPEP – formalized Predialysis Education Program; RRT – renal replacement therapy.

catheter implantation was abandoned due to extensive intraperitoneal adhesions.

During the study period, 51 (85%) patients who indicated TX as their preferred modality had to start dialysis therapy; however, 28 (47%) of them were placed on transplant list before dialysis. More often, the patients started PD (60%). The characteristics of the patients who finally started therapy on PD and HD are presented in Table 7.

The initiation of PD and HD therapy was strongly associated with the choice and knowledge about the modality; however, PD knowledge decreased the probability of HD initiation. The model including all assessed parameters reached the lowest AIC value for prediction of definitive dialysis modality (Table 8). The details are presented in Table 9.

Table 8. AIC ranks for models tested for likelihood of definitive RRT modality

Model	Definitive HD	Definitive PD
	AIC	AIC
Model 1 – post-fPEP HD, PD and TX knowledge and personal HD or PD selection	388.220	319.799
Model 2 – M1+age, CCI	379.633	252.405
Model 3 – M2+eGFR	329.543	228.116
Model 4 – M3+nephrology care	320.164	228.433

AIC – Akaike Information Criterion; RRT – renal replacement therapy; HD – hemodialysis; PD – peritoneal dialysis; TX – kidney transplantation; CCI – Charlson Comorbidity Index; eGFR – estimated glomerular filtration rate; fPEP – formalized Predialysis Education Program.

Table 9. Factors associated with definitive dialysis modality in multivariate logistic regression (Model 4)

Variable	Definitive HD				Definitive PD			
	OR	95% CI	Wald stat	p-value	OR	95% CI	Wald stat	p-value
Age	1.03	1.0; 1.07	4.22	0.04	0.93	0.89; 0.96	10.63	<0.0001
CCI	0.86	0.71; 1.03	2.68	0.1	0.94	0.77; 1.14	2.33	0.5
eGFR	1.24	1.16; 1.33	42.17	<0.0001	0.82	0.75; 0.89	35.28	<0.0001
Nephrology care	6.19	2.07; 18.58	10.61	0.001	0.49	0.20; 1.23	2.27	0.1
Selected HD (yes)	54.03	19.37; 150.65	58.15	<0.0001	–	–	–	–
Selected PD (yes)	–	–	–	–	74.82	30.73; 182.13	90.37	<0.0001
Post-fPEP knowledge about HD (yes)	10.72	1.11; 103.73	4.19	0.04	3.18	0.69; 14.71	2.19	0.1
Post-fPEP knowledge about PD (yes)	0.07	0.008; 0.58	6.04	0.01	55.65	6.63; 226.12	67.20	<0.0001
Post-fPEP knowledge about TX (yes)	0.77	0.34; 1.76	0.37	0.5	2.52	1.28; 4.96	7.15	0.007

OR – odds ratio; 95% CI – 95% confidence interval; HD – hemodialysis; PD – peritoneal dialysis; TX – kidney transplantation; CCI – Charlson Comorbidity Index; eGFR – estimated glomerular filtration rate; fPEP – formalized Predialysis Education Program.

Discussion

In this single-center study, we present the results of the implementation of fPEP in the population of Polish patients with CKD and its influence on selected and definitive RRT method.

Potential contraindications to specified RRT options or perceived mental limitations were not restrictive for the referral to education. In fact, it is quite common not to offer PD to obese patients and to patients with a history of surgical abdomen procedures or with polycystic kidney disease, not to offer HD if the problem with vascular access is anticipated, and to not discuss RRT options when some mental limitations are perceived. These contraindications or limitations are often unjustified, and regardless of them patients have the right to obtain comprehensive information and make an informed decision.

In our study, despite long-term nephrology care, 42% patients had no knowledge about kidney disease. Only 8% knew about PD and only 7% had at least perceived knowledge about all methods. Our results stand out significantly from the literature data.[3,8,9] In our study, nephrology care was associated with the knowledge about kidney disease and HD, but not PD and TX.

Most of the patients proved to be receptive to the psycho-educational intervention we used. Post-fPEP assessment revealed that 89% patients had knowledge about HD, 75% about PD, 57% about TX, and 55% about all RRT options. It seems comparable to previous data; however, more often, the impact of educational intervention on the choice or receipt of RRT method was assessed.[5–7,10–13] Knowledge on a given method not necessarily must mean its choice. It is an essential factor in making a personal, informed decision and adjusting a treatment option to the patient's needs and expectations, making patients willing to learn more about the preferred method. However, one should be aware that in treatment decision-making, CKD patients very often do not use objective knowledge, but rather are guided by their feelings, beliefs, the possibility of family support, or the impact of the treatment on their quality of life.[14,15]

In our study, elderly patients with higher comorbidity burden proved to be less susceptible to educational intervention. One possible explanation for this association may be cognitive impairment due to vascular or Alzheimer's disease; however, it is worth remembering that after the age of 65, even without additional pathologies, the cognitive functions in terms of information processing, memory and understanding abstraction deteriorate. Therefore, the method, rapidity and perhaps the scope of education should be tailored to these limited perception capabilities. In the authors' opinion, for all patients in question, one-to-one sessions may be the optimal method of education. Sensitive and tactful communication, motivational interviewing to engage the patient to change behaviors, and providing well-balanced, unbiased information are considered key factors for successful education. Repeating the most important information and making sure that the discussed issues have been understood by the patient, as well as positive feedback from the patients about what they have learned can ensure that they received the most as possible comprehensive information necessary for shared decision-making.[2,16,17]

The distribution between selected dialysis methods in our study was almost equal – 40% patients chose HD and 32% chose PD, which is in line with previous studies.[5–7,10–13] Nevertheless, such distribution can be associated with additional factors that extend beyond patient choice, including patient characteristics, healthcare system, reimbursement policy, provider factors such as "home dialysis first" policy, or clinician behavior.

In our cohort, 22% of patients have been considered not suitable for free personal choice of dialysis modality, which is similar to previous data.[13,18,19] Medical and psychological (or both) contraindications for the choice of PD were the most common. In general, old age and high comorbidity burden are perceived as contraindications to PD and those patients are less likely to receive PD, even

though they have decreased mortality risk on PD.[20] However, quite a large group of elderly patients consciously chose HD because of concerns about the lack of support, being a burden on the family and social isolation. It appears to be, in a certain sense, an expression of a wider problem of shortcomings in healthcare systems and social care in many countries in the face of an aging population. In some countries, the use of assisted PD has been suggested to increase the probability of the choice and the prevalence of PD.[21,22]

The knowledge about PD was strongly associated with PD selection, while reducing the likelihood of HD choice. It was also reported in previous studies and a meta-analysis by Devoe et al.[5,6,10,19,23]

Our study encompassed patients who, at the end of the follow-up, had established outcome (initiation of dialysis, TX or death). During the study period, 94% of fPEP participants began dialysis – 70% of patients started HD and 30% started PD. It is in sharp contrast to the Polish and international ESRD statistics, where PD incidence and prevalence is well below these values.[24–26]

Patient flow analysis revealed that 98% patients who selected HD started HD, and 69% who indicated PD as preferred option finally started PD. Generally, this is in concordance with the data from previous educational studies.[6,10,11,13,19,27–29] In fact, in our study, 1/3 of patients who had selected PD have not started the treatment – 6% died before dialysis commencement and 24% eventually began HD treatment, predominantly due to deterioration in clinical condition and loss of independence (50%). One-third of fPEP participants with final PD selection had changed their mind before the dialysis began. At least in part, the deterioration in their clinical condition or a change in family or social circumstances may be associated with the re-evaluation of the decision. Nevertheless, timing of modality education, regular follow-up, repeating education when needed, and support may be essential to support the decision.[10,17,19] In our study, patients who initiated PD have had lower eGFR at the time of education, thus the period between selecting and starting dialysis was certainly shorter. Seventy eight percent of patients who ultimately started PD chose PD as preferred option, while 20% had to start dialysis despite final TX selection. Patients who chose PD were significantly younger and had lower comorbidity burden; however, the most important factors associated with initiation of PD were PD knowledge and final PD selection, but not CCI.

Final HD selection was strongly associated with initiation of HD, and 60% of patients started HD in accordance with their choice. The 2nd most populous group commencing HD were those who have been unable to indicate preferred RRT option during the education process. They were significantly older, had higher commordity burden and presented the weakest response to the educational intervention compared to other groups of patients. It is possible that older patients have fear or no interest in being an active part of the decision-making process, and prefer to transfer responsibility for medical decision to the doctor or family.[14,15,30] To overcome these barriers, the following solutions may be effective: allowing more time for the patient to reach a decision, involve family members in the education process or arrange contact with other patients. Nevertheless, in these patients, optimal preparation and elective dialysis start is perceived as the benefit of predialysis education.[6,28]

We assumed that, according to recommendations, all patients with advanced kidney disease should be informed about the possibility of TX.[1,31] For the purpose of fPEP, we assumed that patients with CCI ≥ 9 (26%) had absolute contraindications to TX, and we decided not to discuss this option during the education process. In some patients, when relative contraindications or limited eligibility to TX had been established, individual consultations regarding suitability for transplantation have been provided.

At baseline, ¼ of fPEP participants had had the knowledge about TX, which is comparable to the reports from other patient populations.[3,8,9] Participation in fPEP resulted in doubling the number of patients with TX knowledge, and 60 (18%) patients indicated TX as preferred RRT option.

During the follow-up, 2.7% of patients received preemptive TX, while 8.6% of patients were placed on transplant waiting list before dialysis initiation. Our results appear to be worse than Poltransplant data; however, it should be emphasized that the single-center nature of our study may limit the value of the comparison with nationwide data.[32] Regardless of this, our data seem to confirm the evidence that predialysis education attendance increases the probability of placement on transplant waiting list before dialysis initiation[7] and preemptive TX.[6,33]

The RRT modality decision-making is a complex process requiring an appropriate and individualized educational process. Identification and acknowledgement of emotions should be a first step in building effective communication and education to ensure that patients received knowledge appropriate for shared decision-making. Therefore, the emotional support and creation of an atmosphere of mutual trust between the patient and the educational team was one of the essential elements of our program; however, the evaluation of this factor on fPEP results is impossible. Our study also supports the opinion that there is no single education curriculum that can be applied to all CKD patients, and thus education must be flexible and tailored to each patient.

Limitations

We are aware of the limitations of our study, being a single-center and observational study. However, this single-center character allowed for the implementation of consistent approach to education and shared decision-making, and exclusion of bias connected with center and educational team characteristics. The 2nd limitation was

the lack of control group; however, we assessed the influence of formalized Predialysis Education Program on the chosen RRT modality in relation to the pre-education period. In a real-life scenario, the standard group of patients such as described in this study is under nephrology care, and sometimes even not under nephrology care, and the patients have no opportunity for any education regarding RRT modality. Due to lack of choice, these patients cannot serve as controls to the group who was offered predialysis education. Therefore, as in the educational studies, we chose to compare the knowledge of RRT options and chosen and definitive modality at the start of RRT treatment.

Nevertheless, it would be desirable to evaluate the effectiveness of fPEP in the entire population of Polish CKD patients transitioning from conservative care to RRT. The implementation of this educational intervention may be beneficial not only to patients but also to the whole healthcare system. However, we are fully aware that the legacy of the pandemic includes all the shortcomings of telemedicine, lack of access to specialists and lots of "crash-landers" (patients with late referral for dialysis) coming to dialysis units. Thus, all the educational programs were either suspended or limited and this situation has been affecting the choice or rather lack of choice of RRT modality for patients with advanced stages of CKD.

Conclusions

The implementation of fPEP improves patients' knowledge and willingness to shared decision-making. This results in a balanced choice between PD and HD, and increases the incidence of PD and likely access to TX. It would be valuable to evaluate in randomized trials or large observational studies the influence of specific educational process elements, and the contribution of patient-specific factors to its effectiveness.

ORCID iDs

Ewa Wojtaszek https://orcid.org/0000-0001-5970-8466
Joanna Matuszkiewicz-Rowińska https://orcid.org/0000-0001-7644-823X
Paweł Żebrowski https://orcid.org/0000-0003-2826-0253
Tomasz Głogowski https://orcid.org/0000-0001-8198-5646
Jolanta Małyszko https://orcid.org/0000-0001-8701-8171

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