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Influence of the Expression of Personality Traits on Growing Intensity of Interdialytic Disorders and Change of Pro-Health Behaviors in Patients with Chronic Kidney Disease

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Background: The aim of this study was to assess the influence of socio-demographic and clinical factors on personality trait expression and their relationship with more intense interdialytic disorders and changes in health behaviors of patients with chronic kidney disease (CKD).

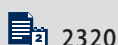
Material/Methods: A total of 200 participants were recruited for the research (84 women and 116 men; aged 61±12 years): 160 patients had CKD stage G4-G5 and 40 healthy participants constituted a control group. A diagnostic poll method was used in the research employing the following questionnaires to collect socio-demographic and clinical data: Health Behavior Inventory (IZZ), Personality Inventory (NEO-FFI), Beck Depression Inventory (BDI), and Researcher's Questionnaire Test.

Results: Statistically significant differences were found in the intensity of personal traits at different stages of treatment. The influence of factors resulting from CKD on the expression of personality traits increased with subsequent stages of treatment. Depression intensity was not connected with the expression of personality traits. A higher frequency of reported interdialytic disorders was significantly related to a higher degree of openness and conscientiousness and a lower degree of agreeableness. Increased extraversion, conscientiousness, and openness were significantly correlated with more intense health behaviors.

Conclusions: Personalities of patients with CKD changed with subsequent stages of treatment and were influenced by socio-demographic and clinical factors. Personalities affected the frequency of reported interdialytic disorders and health behaviors.

Keywords: **Adaptation, Psychological • Depression • Hemodialysis Solutions • Psychological Tests • Psychology • Renal Insufficiency, Chronic**

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Background

There have been many scientific theories and attempts made to clarify the personality structure, its construction and development, and possibilities of affecting it. Personality is an unusually complex structure, and the process of its development is long-lasting and multi-faceted. There is a widespread belief that the development processes related to personality are reciprocal. Moreover, it has been confirmed that a decisive factor in personality development is the mutual interaction between the genotype and external factors. External factors can suppress or strengthen genetically determined traits. According to personality-focused studies, the key characteristics of a fully functioning individual are openness to experience, conscientiousness, extraversion-introversion, agreeableness, and neuroticism [1].

Studies on changing personality traits in patients with chronic illness and the impact of personality on health behaviors have been increasing in the literature [2-6].

This study aimed to assess the influence of socio-demographic and clinical factors on the intensity of the expression of personality traits and then to identify the interrelations between personality traits and interdialytic disorders and health behaviors in patients at different stages of chronic kidney disease (CKD) treatment.

Material and Methods

The study included 200 participants who met the inclusion criteria for the research (84 women and 116 men; aged 61 ± 12 years). A total of 160 patients with CKD stage G4-G5 were recruited from a nephrology clinic and hemodialysis unit and 40 healthy participants constituted a control group. Depending on the stage of the disease and length of dialysis treatment, the patients were divided into 5 groups ($n=40$ in each group): group 1, a healthy control group; group 2, patients in pre-dialysis care with CKD stage G4-G5; group 3, patients treated with hemodialysis for less than 1 year; group 4, patients treated with hemodialysis for 1 to 5 years; and group 5, patients treated with hemodialysis >5 years. The inclusion criteria were age ≥ 18 years, voluntary consent to participate in the study, CKD diagnosis, and CKD stage G4-G5 for groups 2 to 5. The exclusion criteria were decompensated heart failure, acute medical conditions, such as fever or pain, and lack of consent to participate in the study.

The local bioethics committee approved our study. All participants were informed about the principles and purpose of the research, and gave their consent to participate.

The diagnostic poll method was used in the study, which employed the following questionnaires:

1. Health Behavior Inventory

The Health Behavior Inventory (IZZ) [7] questionnaire consists of 24 statements describing health-related behaviors. It is used to measure the general intensity of health behaviors and the intensity of 4 categories of health behaviors: appropriate eating habits, prophylactic behaviors, positive mental attitude, and health practices. The person surveyed rates the frequency of behaviors on a 5-point frequency scale (1=almost never, 2=rarely, 3=sometimes, 4=often, 5=almost always). The total value of the indicator ranges from 24 to 120 points. The higher the result is, the higher is the intensity of the declared health behaviors. After converting the total score into standardized units, the general index is interpreted as a standard tens (sten) score. The questionnaire is sufficiently reliable for the IZZ general result ($\alpha=0.85$), and for individual behaviors, the Cronbach's alpha fluctuated between 0.60 and 0.65. The IZZ has good psychometric properties in patients with CKD [8].

2. Personality Inventory

The Personality Inventory (NEO-FFI) [9] questionnaire contains 60 items, 12 for each of the following 5 traits: neuroticism, openness to experience, agreeableness, conscientiousness, and extraversion. The person surveyed marks a response on a 5-point scale (1=strongly disagree, 2=disagree, 3=no opinion, 4=agree, 5=strongly agree). The raw result on each scale ranges from 0 to 48, and the result is interpreted as a sten score. The standards were made separately for men and women, with a subdivision into 5 age groups. A higher result on a given scale indicates a higher intensity of a particular personality trait. The Cronbach's alpha for traits was between 0.68 and 0.82. The NEO-FFI has been shown to have good psychometric properties in patients with CKD [10].

3. Beck Depression Inventory

The Beck Depression Inventory (BDI) is a tool used to assess depression symptoms in youth over 13 years of age and adults [11]. The test consists of 21 multiple-choice questions, which are answered by choosing 1 of 4 possible options. Each response is assigned a value from 0 to 3, which corresponds to the depression severity in a given area, including mood, interests, appetite, and sleep quality. The BDI has been shown to have good psychometric properties in patients with CKD [11].

4. Researcher's Questionnaire Test

A researcher's questionnaire test was developed for this study to collect socio-demographic data including age, sex, marital

status, number of people in the household, presence of a household assistant, professional activity, nature of work, domicile, financial status, children, the recent loss of a close person, and stimulants and clinical data including time from starting dialysis, number of medications taken, comorbidities, disorders between dialyses, qualification for a transplant, transplantation in the disease history, type of vascular access, dialysis frequency and duration time, and distance and transportation to the dialysis unit.

The datasets used and analyzed during the present study are available from the corresponding author upon reasonable request.

Statistical Analysis

The PQ Stat 1.6.8 statistical package was used for conducting statistical analysis. In the study, descriptive statistics were used for quantitative and qualitative variables (the mean with standard deviation, the median with minimum and maximum values, respectively). Calculations were made for the variables converted from raw values to sten scores, when they were required for a given test. The Mann-Whitney U test was used to check the differences between 2 groups. Where more than 2 groups were compared, the Kruskal-Wallis (ANOVA) test was applied. If ANOVA showed differences between groups, the Dunn-Bonferroni post hoc test value was calculated for identifying the groups which differed significantly. Interdependencies between the variables, assuming continuous values, were checked by calculating the correlation using Pearson's *r* for variables with normal distributions, or Spearman's rank correlation coefficient as a nonparametric correspondent of Pearson's *r*. The value of $P < 0.05$ was considered statistically significant.

Results

For personality traits, patients on hemodialysis had lower levels of openness to new experiences and extraversion than the patients in the pre-dialysis period. In contrast, the highest levels of openness and extraversion were found in the groups of patients on hemodialysis for 1 to 5 years (group 4) (Table 1). Agreeableness was higher in patients on hemodialysis (groups 3-5) than in those in the pre-dialysis period (group 2), but it was highest in the group of patients who received hemodialysis for the shortest period (group 3). No statistically significant differences in the levels of conscientiousness and neuroticism were found between the groups.

An analysis of factors affecting personality (Table 2) showed the significant exclusive influence of factors unrelated to the illness (body mass index, education, presence of a household assistant, recent loss of a close person) in group 2 (Table 3).

However, the influence of comorbidities, especially diabetes and coronary heart disease, was also significant. Transplant status and vascular access did not have an impact on personality.

The influence of CKD-related factors on the expression of personality traits increased with the successive stages of disease treatment. Hence, in group 5, 3 illness-related factors, namely chronic disease burden, number of medications taken, and distance to the dialysis unit, were significantly correlated with the expression of personality traits.

Although our research revealed a significant relationship between the successive stages of treatment and increases in depression ($r=0.46$; $P < 0.001$), the intensity of depression on the BDI scale was not correlated with the expression of personality traits (Table 4).

The analysis of interdependencies between personality traits and the frequency of reported interdialytic disorders showed a significant correlation between a higher level of openness and conscientiousness in group 3 as well as more frequent reporting of interdialytic problems in patients with lower levels of agreeableness and conscientiousness in group 5 (Table 5).

We also found a significant correlation between the expression of personality traits and the intensity of health behaviors. Intense extraversion was significantly correlated with increased prophylactic behaviors in group 2 and health-enhancing practices, dietary habits, and prophylactic behaviors in group 3 (Table 6). Increased conscientiousness was correlated with higher levels of pro-health behaviors in groups 3 and 5, and with increased prophylactic behaviors in group 4. On the other hand, increased openness to new experiences was correlated with enhanced prophylactic behaviors in group 4 and a better mental attitude in group 5.

Discussion

Along with the progression of age, extreme personality traits decline in intensity unless they are enhanced by stressful life experiences [12-17]. Chronic diseases are associated with long-lasting stress and numerous limitations. Earlier research, which focused on the personalities of patients with CKD and was based on the "Big Five" model [24], showed the impact of personality on, among other things, health status, nutrition, depression, mortality, and quality of life.

The data obtained on the influence of chronic diseases on personality indicate that the intensity of personality traits changes under the influence of an illness [2,3]. Our research revealed significant differences between patients on hemodialysis and those in the pre-dialysis period but showed similarities between

Table 1. The intensity of the expression of personality traits at different stages of chronic kidney disease.

	Group	Median	Standard deviation	Difference within the group (p)	Differences in pairs (p)
Neuroticism	1	21.0	7.2	p=0.550	NS
	2	21.9	5.8		
	3	23.9	11.3		
	4	19.7	11.2		
	5	22.4	7.8		
Extraversion	1	28.2	6.9	p<0.001	3: 1 – p<0.001 5: 1 – p<0.001 3: 2 – p<0.001
	2	24.8	5.2		
	3	19.7	8.0		
	4	24.2	5.8		
	5	22.0	6.0		
Openness to experiences	1	23.7	6.0	p<0.001	3: 1 – p<0.050 5: 1 – p<0.001 3: 2 – p<0.001 4: 2 – p<0.010 5: 2 – p<0.001
	2	26.0	5.4		
	3	19.0	6.8		
	4	21.5	7.4		
	5	17.1	6.0		
Agreeableness	1	31.7	5.4	p<0.001	3: 2 – p<0.001 4: 2 – p<0.050 5: 2 – p<0.001
	2	29.9	4.0		
	3	35.5	5.5		
	4	33.6	8.1		
	5	34.0	6.2		
Conscientiousness	1	32	7.3	p=0.330	NS
	2	31.9	4.6		
	3	30	9.1		
	4	32.2	5.9		
	5	29.8	6.1		

* NS – non-significant.

patients on dialysis for less than 1 year and longer than 5 years. Lower agreeableness and openness to new experiences in all patients on hemodialysis in comparison to patients before dialysis can show decreased trust and growing uncertainty of patients in connection with a “new stage” in the disease and its treatment. At the same time, similarities between the patients on hemodialysis <1 year and >5 years can result from the acceptance of the disease and adaptation to dialysis over time [18]. However, the similarities observed in the group of patients on hemodialysis can result from diametrically opposed situations. It is possible that the start of a new stage of

treatment (hemodialysis) significantly different from the previous therapy in group 3 was connected with a sense of failure and uncertainty (high neuroticism, reduced extraversion, openness, and conscientiousness), which in group 4 yielded to the feeling of stability, disease control, and hope (low neuroticism, relatively higher levels of extraversion, openness, agreeableness, and conscientiousness) for health improvement and further plans, including kidney transplantation. Further, the lack of significant health improvement, complications occurring in the course of disease treatment, and loss of vascular access or progression of comorbidities (3 factors linked to

Table 2. Selected socio-demographic and clinical factors in researched groups.

	1 n=40	2 n=40	3 n=40	4 n=40	5 n=40	Significance (p)
Age	52 ±9	65 ±15	64 ±9	61 ±14	63 ±9	
Gender	M=35% F=65%	M=80% F=20%	M=53% F=47%	M=63% F=37%	M=60% F=40%	p=0.010
BMI	26.95	27.51	26.04	24.65	23.68	p=0.296
Education:						
Primary	0%	10%	20.51%	17.5%	27.5%	p<0.001
Vocational	20%	12.5%	35.9%	45%	55%	
Secondary	30%	35%	33.33%	25%	12.5%	
Higher	50%	42.5%	10.26%	12.5%	5%	
Domicile:						
City	70%	82.5%	77.5%	70%	35%	p<0.001
Village	30%	17.5%	22.5%	30%	65%	
Professional activity:						
Employed	75%	12.5%	5%	17.95%	2.5%	p<0.001
Unemployed	25%	87.5%	95%	82.05%	97.5%	
Monthly income:						
Very low	2.5%	10%	25%	22.5%	20%	p<0.001
Low	45%	47.5%	65%	62.5%	72.5%	
Medium	50%	40%	10%	15%	7.5%	
High	2.5%	2.5%	0%	0%	0%	
Alcohol consumption	40%	2.5%	7.5%	12.5%	25%	p<0.001
Smoking	20%	15%	17.5%	15%	25%	p=0.755
Comorbidities:						
Diabetes	0%	32.5%	27.5%	25%	35%	p=0.002
Hypertension	0%	80%	92.5%	87.5%	97.5%	p<0.001
Glomerulopathies	0%	35%	0%	7.5%	5%	p<0.001
Coronary heart disease	0%	12.5%	5%	10%	5%	p=0.284
Number of comorbidities:						
0	100%	2.5%	0%	0%	2.5%	p<0.001
1-3	0%	75%	55%	60%	45%	
>3	0%	22.5%	45%	40%	52.5%	
Number of medications taken:						
0	87.5%	5%	2.5%	2.5%	2.5%	p<0.001
1-5	5%	25%	17.5%	27.5%	25%	
6-7	0%	22.5%	32.5%	35%	42.5%	
>7	7.5%	47.5%	47.5%	35%	30%	
Distance to dialysis unit (km)	-	-	13.96 ±10.21	10.14 ±7.77	16.36 ±10.23	p=0.197
Vascular access:						
Hemodialysis catheter	-	55%	25%	25%	17.5%	p<0.001
Arteriovenous fistula	-	45%	75%	75%	82.5%	
Kidney tansplant status:						
Eligible for transplant	-	-	2.5%	17.5%	2.5%	p<0.001
After kidney transplantation	-	-	2.5%	2.5%	5%	
Presence of a house assistant	75%	68%	73%	85%	85%	p=0.242
Recent loss of a close person	0%	15%	15%	17.5%	10%	p=0.154

Table 3. Analysis of socio-demographic and clinical factors affecting personality.

Group	Variable	Personality	r, U, p, t
2	Better education	↑ neuroticism	r=0.56, p=0.001
	Recent loss of a close person, ↑ BMI	↑ extraversion	U=50, p=0.047 r=0.32, p=0.020
	Diabetes		t=-2.38, p=0.022
	Better education	↑ openness	r=0.43, p=0.005
	Lack of home assistant	↑ agreeableness	U=97.5, p=0.022
3	Recent loss of a close person ↑ number of medications taken	↑ neuroticism	U=39, p=0.015 r=0.42, p=0.045
	Recent loss of a close person	↑ extraversion	U=28, p=0.003
	↑ dialysis duration time	↑ agreeableness	r=0.42, p=0.007
	Heart failure	↑ conscientiousness	t=-2.12, p=0.040
	Glomerulonephritis	↑ openness	t=-2.40, p=0.020
4	↑ alcohol consumption	↑ neuroticism	r=0.35, p=0.02
	Coronary heart disease	↓ neuroticism	t=2.45, p=0.020
	Diabetes	↑ conscientiousness	t=-2.89, p=0.006
	↑ alcohol consumption	↑ openness	r=0.37, p=0.029
	↑ number of medications taken	↑ agreeableness	r=0.46, p=0.003
5	↑ number of chronic diseases	↑ extraversion	r=0.32, p=0.041
	↓ distance to dialysis unit	↑ conscientiousness	r=0.49, p=0.046
	Coronary heart disease	↓ neuroticism	t=2.35, p=0.020
	Diabetes	↓ neuroticism ↑ agreeableness	t=2.45, p=0.019 t=-2.04, p=0.048

Table 4. Relationship between depression and the expression of personality traits.

Group	Conscientiousness		Neuroticism		Extraversion		Openness		Agreeableness	
	r	p	r	p	r	p	r	p	r	p
1	-0.054	0.723	-0.082	0.616	0.075	0.644	0.210	0.191	0.109	0.502
2	0.059	0.717	0.131	0.419	0.092	0.569	0.008	0.959	0.009	0.956
3	0.006	0.969	0.039	0.807	-0.003	0.986	0.034	0.836	-0.001	0.997
4	0.027	0.869	0.233	0.147	-0.020	0.904	-0.268	0.094	0.125	0.444
5	0.022	0.889	-0.294	0.065	0.105	0.519	0.198	0.219	0.217	0.179

the disease) can intensify depressive reactions and the sense of resignation (moderate extraversion and agreeableness, low conscientiousness and openness) [19].

Anxiety disorders and depressive disorders are among the 2 most frequent psychological problems in patients with CKD [20]. The latest scientific reports show that some personality

traits have an impact on the risk of depression occurrence in chronically ill patients. However, results of those studies are not consistent in respect to specific personality traits as indicators of depression [21-23]. Similarly, our study did not confirm a significant correlation between the examined personality traits and intensity of depression.

Table 5. Analysis of the influence of personality on the frequency of reported interdialytic health problems.

Group	Interdialytic health problems	Personality	r, p
3	↑	↑ conscientious	r=0.49; p=0.001
		↑ open	r=0.38; p=0.016
4		No correlation found	
5	↑	↓ conscientious	r=0.40; p=0.010
		↓ agreeable	r=0.49; p=0.010

Table 6. Analysis of the influence of personality on health behaviors.

Personality	Health behaviour	Group	r, p
↑ extraverted	↑ prophylactic behaviour	2	r=0.38, p=0.015
	↑ health practices		r=0.32, p=0.047
	↑ prophylactic behaviours		r=0.34, p=0.033
↑ conscientious	↑ dietary habits	3	r=0.36, p=0.023
	↑ general enhancement of health behaviours		r=0.44, p=0.005
	↑ prophylactic behaviours		r=0.43, p=0.006
↑ open	↑ general enhancement of health behaviours	4	r=0.40, p=0.010
	↑ prophylactic behaviours		r=0.36, p=0.024
	↑ positive attitude		r=0.33, p=0.040

Brickman et al showed that patients with high neuroticism after a kidney transplant reported abnormal post-transplantation symptoms more often than those with low neuroticism [24]. In our present study, personality traits also affected the frequency of reported dialysis-related problems. The patients characterized by higher levels of conscientiousness and openness reported health problems more often. This could result from the fact that they are more scrupulous and aim to achieve higher effectiveness of undertaken medical activities, which has been reported in other chronically ill patients [25-27]. In our research, more frequent reporting of health problems was linked to lower agreeableness. Antagonism is a hostile attitude which is characterized by a bad attitude toward therapy and more focus on oneself and one's own health problems.

Research has found a significant influence of personality traits on pro-health behaviors [28]. Extensive research by Axelsson et al, which included 750 patients with chronic diseases, found a correlation between personality and medical adherence. Christensen et al reported that conscientiousness is the only domain correlating with medical adherence in patients on hemodialysis [29]. In the present study, intensified conscientiousness, extraversion, and openness were significantly associated with patients' health-enhancing behaviors. Openness to new experiences and extraversion are the features of an active attitude connected with broadening one's knowledge about health and the disease, which promotes interactions

with other people and an exchange of information which can help them. Conscientious patients are more disciplined and are characterized by the ability to delay gratification. They show the strength of self-control in initiating and maintaining health behaviors related to recreation, sleep, and physical activity.

Although our results are promising, the present research has some limitations. To show the influence of the expression of personality traits on the intensity of interdialytic disorders and change of pro-health behaviors, we compared 4 groups of patients with different stages of CKD with a group of healthy individuals as controls. This could confound the presented results by different patient characteristics such as income, employment, and having a household helper. Moreover, it is possible that a change in study protocol, for example, to a longitudinal study in the pre-dialysis group and/or a cross-sectional study in dialysis groups, would be more effective in identifying factors related to the expression of personality traits and their influence on dialysis outcome. However, this requires further studies in larger groups of CKD patients.

Conclusions

Socio-demographic and clinical factors were significantly related to the expression of personality traits, which, in turn, changed with the successive stages of CKD treatment. The intensity of

personality trait expression correlated with the frequency of reported interdialytic health problems and health behaviors. Routine evaluation of personality-examining tests could be helpful in planning individual therapy methods to support pro-health behaviors of patients with CKD.

Ethics Approval and Consent to Participate

The study protocol was approved by the bioethics committee of the Regional Medical Chamber in Warsaw. All participants provided voluntary and informed written consent to participate in the study.

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Conflicts of Interests

None.