

# WITHDRAWN: The Influence of the Expression of Personality Traits on Growing Intensity of Interdialytic Disorders and Change of Pro-Health Behaviours in CKD Patients.

Magdalena Lech

acidlandd@tlen.pl

Department of Internal Medicine <https://orcid.org/0000-0002-0447-9528>

Lech Adrian

Psychiatric Department

Niemczyk Stanisław

Military Institute of Medicine

Lubas Arkadiusz

Military Institute of Medicine

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## Research article

**Keywords:** personality, hemodialysis, chronic kidney disease, pro-health behaviours, depression

**Posted Date:** August 24th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-42324/v1>

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## EDITORIAL NOTE:

The full text of this preprint has been withdrawn by the authors while they make corrections to the work. Therefore, the authors do not wish this work to be cited as a reference. Questions should be directed to the corresponding author.

# Abstract

**Background:** Personality traits can change in the course of chronic disease and affect health behaviour.

The aim of the work was to assess the influence of socio-demographic and clinical factors on the expression of personality traits and their relationship with more intense interdialytic disorders and change in health behaviours of patients suffering from chronic kidney disease (CKD).

**Methods:** A total of 200 participants were recruited for the research (84 F, 116 M; age 61 ±12 years): 160 patients with CKD stage G4-G5 and 40 healthy persons constituting a control group. A diagnostic poll method was used in the research employing the following questionnaires to collect socio-demographic and clinical data: Health Behaviour Inventory (IZZ), Personality Inventory (NEO-FFI), Beck Depression Inventory and Researcher's Questionnaire Test.

**Results:** Statistically significant differences were found in the intensity of personal traits at different stages of treatment. The patients in the pre-dialysis period revealed more openness to new experiences and more extraversion than those who were hemodialysed. The influence of factors resulting from CKD on the expression of personality traits increased with subsequent stages of treatment. Depression intensity, according to the Beck Depression Inventory, 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 significantly correlated with more intense health behaviours.

**Conclusions:** Personalities of patients with CKD change with subsequent stages of treatment and undergo the influence of socio-demographic and clinical factors. Personalities affect the frequency of reported interdialytic disorders and revealed health behaviour.

## Background

There are many scientific theories and attempts to clarify the personality structure, its construction, 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 is a mutual interaction between genotype and external factors. External factors can suppress or strengthen the 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].

The issue of changing personality traits in chronically ill persons and the impact of personality on health behaviours are more and more often tackled in literature [2–6].

The work 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 behaviours in patients at different stages of CKD treatment.

## Methods

The study involved 200 participants who met the inclusion criteria for the research (84 F, 116 M; age  $61 \pm 12$  years): 160 patients with CKD stage G4-G5 from a nephrology clinic and hemodialysis unit and 40 healthy people constituting a control group. Depending on the stage of the disease and length of dialysis treatment the patients were divided into five groups of 40 people each: Group 1 – a control group, healthy people; Group 2 – patients in the pre-dialysis care (BD) with CKD stage G4-G5; Group 3 – hemodialysed patients (HD) treated less than 1 year; Group 4 - HD 1–5 years and Group 5 - HD > 5 years. The inclusion criteria enclosed: age  $\geq 18$  years, voluntary consent to participate in the study, diagnosed chronic kidney disease, stage G4-G5 (Groups 2–5). The exclusion criteria were: decompensated heart failure, acute medical conditions (e.g. fever, pain), lack of consent to participate in the research.

The Local Bioethical Committee approved our study. All the investigated persons were informed about the principles and purpose of the research. They gave their consent to their participation. The diagnostic poll method was used in the work which employed the following questionnaires:

Health Behaviour Inventory (IZZ) [7]. The questionnaire consists of 25 statements describing health-related behaviours. It helps to measure the general intensity of health behaviours and intensity of 4 categories of health behaviours: appropriate eating habits - PN1, prophylactic behaviours - ZP, positive mental attitude - PN2 and health practices - PZ. The person surveyed rates the frequency of a particular behaviour on a 5-point frequency scale (1 – almost never, 2 – rarely, 3 – from time to time, 4 – often, 5 – almost always). The value of the indicator ranges from 24–120 points. The higher the result is, the higher the intensity of declared health behaviours is. After converting into standardised units, the general index is interpreted as a sten score. The questionnaire is sufficiently reliable for the IZZ general result ( $\alpha = 0.85$ ) and for individual scales (Cronbach's alpha fluctuated between 0.60 and 0.65). ). The IZZ has good psychometric properties in patients with CKD [8].

Personality Inventory (NEO-FFI) [9]. The sheet contains 60 items – 12 for each of 5 scales: Neuroticism (NEU), Openness to experience (OTW), Agreeableness (UGD), Conscientiousness (SUM), Extraversion (EKS). The person surveyed marks a response on a 5-point scale (1 – strongly disagree, 2 – disagree, 3 – have no opinion, 4 – agree, 5 – strongly agree). The raw result on each scale ranges from 0 to 48; the result is interpreted in sten scores. The standards are made separately for men and women with a subdivision into five age groups. A higher result on a given scale means the higher intensity of a particular personality trait. Cronbach's alpha for scales is between 0.68 and 0.82. ). The NEO-FFI has good psychometric properties in patients with CKD [10].

Researcher's questionnaire test was developed for this work. It was to collect socio-demographic (age, gender, marital status, number of people in the household, presence of the household assistant, professional activity, nature of work, domicile, financial status, having children, the recent loss of a close person, stimulants) and clinical (time from starting dialysis, number of medications taken, comorbidities,

disorders between dialyses, qualifying for a transplant, transplantation in the disease history, type of vascular access, dialysis frequency and duration time, distance and transportation to the dialysis unit) data.

Beck Depression Inventory is a tool to assess depression symptoms in adults and youth before 13 years of age [11]. The test consists of 21 multiple-choice questions which the person surveyed answers 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 (among others, mood, interests, appetite, sleep quality). The BDI has good psychometric properties in patients with CKD.

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

## Statistics

The PQ Stat 1.6.8 statistical package was used for carrying out statistical analysis. In the study, descriptive statistics were applied for quantitative and qualitative variables (the mean with standard deviation, the median with minimum and maximum values). Calculations were made for the variables converted from raw values to sten scores (if they were required for a given test). The Mann-Whitney U test was used to check the differences between the two groups. Where more than two groups were compared, the Kruskal-Wallis (ANOVA) test was applied. If the differences occurred between groups in the ANOVA test, 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 measure – Pearson's  $r$  (for variables with normal distributions) or Spearman's rank correlation coefficient being a nonparametric correspondent of Pearson's  $r$ . The value of  $p < 0.05$  was adopted as statistically significant.

## Results

As far as personality traits are concerned all the hemodialysed patients revealed 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 noted in the groups of patients dialysed for 1–5 years (Table 1). Agreeableness was higher in dialysed patients than in those in the pre-dialysis period, but it was at its highest in the group of patients who were dialysed for the shortest period. No statistically significant differences in the levels of conscientiousness and neuroticism were found between considered groups.

Table 1

Intensity of the expression of personality traits at different stages of the disease (according to NEO-FFI)

	Group	Median	Standard deviation	Significance within the group (p)	Differences in pairs
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
	2	24.8	5.2		5:1 - p < 0.001
	3	19.7	8.0		3:2 - p < 0.001
	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
	2	26.0	5.4		5:1 - p < 0.001
	3	19.0	6.8		3:2 - p < 0.001
	4	21.5	7.4		4:2 - p < 0.010
	5	17.1	6.0		5:2 - p < 0.001
Agreeableness	1	31.7	5.4	p < 0.001	3:2 - p < 0.001
	2	29.9	4.0		4:2 - p < 0.050
	3	35.5	5.5		
	4	33.6	8.1		5:2 - p < 0.001

\*NS-non-significant

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	Group	Median	Standard deviation	Significance within the group (p)	Differences in pairs
	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					
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An analysis of factors affecting personality (Table 2) showed the significant exclusive influence of the factors unrelated to the illness (education, presence of a house assistant, recent loss of a close person) in group 2 (Table 3).

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
<b>Age</b>	52 ± 9	65 ± 15	64 ± 9	61 ± 14	63 ± 9
<b>Gender</b>	M = 35% F = 65%	M = 80% F = 20%	M = 52.5% F = 47.5%	M = 62.5% F = 37.5%	M = 60% F = 40%
<b>Education:</b>					
Primary	0%	10%	20.51%	17.5%	27.5%
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%
<b>Domicile:</b>					
City	70%	82.5%	77.5%	70%	35%
Village	30%	17.5%	22.5%	30%	65%
<b>Professional activity:</b>					
Employed	75%	12.5%	5%	17.95%	2.5%
Unemployed	25%	87.5%	95%	82.05%	97.5%
<b>Monthly income:</b>					
Very low	2.5%	10%	25%	22.5%	20%
Low	45%	47.5%	65%	62.5%	72.5%
Medium	50%	40%	10%	15%	7.5%
High	2.5%	2.5%	0%	0%	0%
<b>Number of comorbidities:</b>					
0	100%	2.5%	0%	0%	2.5%
1-3	0%	75%	55%	60%	45%
>3	0%	22.5%	45%	40%	52.5%

	1	2	3	4	5
	n = 40				
<b>Number of medications taken:</b>					
0	87.5%	5%	2.5%	2.5%	2.5%
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%

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

Group	Variable	Personality	r, U, p
2	better education	↑neuroticism	r = 0.56, p = 0.001
	recent loss of a close person	↑ extraversion	U = 50, p = 0.047
	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	↑neuroticism	U = 39, p = 0.015
	recent loss of a close person	↑ extraversion	U = 28, p = 0.003
	↑ dialysis duration time	↑ agreeableness	r = 0.42, p = 0.007
	↑ number of medications taken	↑neuroticism	r = 0.42, p = 0.045
4	↑ alcohol consumption	↑neuroticism	r = 0.35, p = 0.02
5	↑ alcohol consumption	↑ openness	r = 0.37, p = 0.029
	↑ number of medications taken	↑ agreeableness	r = 0.46, p = 0.003
	↑ number of chronic diseases	↑ extraversion	r = 0.32, p = 0.041
	↓ distance to dialysis unit	↑conscientiousness	r = 0.49, p = 0.046

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

Although our research revealed a significant relationship between successive stages of the disease treatment and growing 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).

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

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

Table 5  
Analysis of the influence of personality on the frequency of reported of 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 = 0.01
		↓ agreeable	r = 0.49; p = 0.01

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

Table 6  
Analysis of the influence of personality on health behaviour

Personality	Health behaviour	Group	r, p
↑extraverted	↑prophylactic behaviour	2	r = 0.38, p = 0.015
	↑health practices	3	r = 0.32, p = 0.047
	↑ prophylactic behaviours		r = 0.34, p = 0.033
	↑dietary habits		r = 0.36, p = 0.023
↑conscientious	↑general enhancement of health behaviours		r = 0.44, p = 0.005
	↑prophylactic behaviours		r = 0.43, p = 0.006
	↑general enhancement of health behaviours	4	r = 0.40, p = 0.010
↑open	↑ prophylactic behaviours		r = 0.36, p = 0.024
	↑positive attitude	5	r = 0.33, p = 0.04

## 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. The earlier research, which was focused on personalities of patients with CKD and based on the “Big Five” model, proves the impact of personality on, among others, health status, nutrition, depression, mortality and quality of life.

The data obtained so far and dealing with the influence of chronic diseases on personality indicates that the intensity of personality traits changes under the influence of an illness [2, 3]. Our research revealed significant differences between hemodialysed patients and those in the pre-dialysis period, but similarities between patients dialysed for less than 1 year and longer than 5 years. Lower agreeableness and openness to new experiences in all dialysed patients in comparison to patients before dialysis can be a proof of decreased trust and growing uncertainty in connection with a “new stage” in the disease and its treatment. At the same time, similarities between the patients dialysed < 1 year and > 5 years can result from the growing with time acceptance of the disease and adaptation to dialysis [18]. On the other hand, the similarities observed in the group of hemodialysed patients can result from diametrically opposed situations. It is possible that starting a new stage of treatment (hemodialysis), significantly different from previous therapy, in group 3 is connected with a sense of failure and uncertainty (high neuroticism, reduced extraversion, openness and conscientiousness), which in group 4 yield to the feeling of stability, disease control and hope for health improvement and further plans, e.g. kidney transplant (low neuroticism, relatively higher levels of extraversion, openness, agreeableness and conscientiousness). What is more, the lack of significant health improvement, complications occurring in the course of disease treatment (3 factors linked to the disease), loss of vascular access or progression of comorbidities can intensify

depressive reactions and the sense of resignation (moderate extraversion, agreeableness, lowest conscientiousness and openness) [19].

Beside anxiety disorders, depressive disorders are among the two 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 the quoted research are not consistent in respect of specific personality traits as indicators of depression [21–23]. Similarly, our work did not confirm a significant correlation between the examined personality traits and intensity of depression.

Brickman *et al.* proved that neurotic patients after a kidney transplant more often reported abnormal post-transplantation symptom [24]. In our research personal traits also affected the frequency of reported dialysis-related problems. The patients characterised by higher levels of conscientiousness and openness more often reported health problems. This can result from the fact that they are more scrupulous and aim to achieve higher effectiveness of undertaken medical activities, which was also noticed 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 characterised by a bad attitude towards therapy, more focus on oneself and one's own health problems.

Our research indicates a significant influence of personality traits on pro-health behaviours [28]. Extensive research by Axelsson and co-workers, which covered 750 patients with chronic diseases, found a correlation between personality and medical adherence. Christensen *et al.* indicated conscientiousness as the only domain correlating with medical adherence in hemodialysed patients [29]. In our study, intensified conscientiousness, extraversion and openness were significantly associated with patients' health-enhancing behaviours. 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 exchange of information concerning all this which can help them. Conscientious persons are more disciplined and are characterised by the ability to delay gratification. They reveal the strength of self-control in initiating and maintaining health behaviours referring to recreation, sleep and physical activity.

## Conclusions

Socio-demographic and clinical factors are significantly related to the expression of personality traits, which, in turn, change as successive stages of the CKD treatment follow. The intensity of the personality trait expression correlates with the frequency of reported interdialytic health-problems and presented health behaviours. Routine evaluation of personality examining tests could be helpful in planning the individual therapy methods supporting pro-health behaviours of patients with chronic kidney disease.

## Abbreviations

CKD: chronic kidney disease; IZZ: Health Behaviour Inventory; NEO-FFI: Personality Inventory; BDI: Beck Depression Inventory; BD: patients in the pre-dialysis; HD: hemodialysed patients; PN1: appropriate eating habits; ZP: prophylactic behaviours; PN2: positive mental attitude; PZ: health practices; NEU: Neuroticism; OTW: Openness to experience; UGD: Agreeableness; SUM: Conscientiousness; EKS: Extraversion;

## **Declarations**

### **Ethics approval and consent to participate**

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study protocol was approved by the bioethical committee of Regional Medical Chamber in Warsaw. All participants provided voluntary and informed written consent to participate in the study.

### **Consent for publication**

Not applicable.

### **Availability of data and materials**

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

### **Competing interests**

The authors declare that they have no competing interests.

### **Funding**

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

### **Contributions**

ML: conceptualisation, methodology, resources, investigation, formal analysis, writing – original draft; AL: data curation, formal analysis, writing original – draft; SN: conceptualisation, resources, writing – review and editing; ALu: conceptualisation, methodology, data curation, supervision, writing – original draft. All authors read and approved the final manuscript and are responsible for all aspects of the work.

### **Acknowledgments**

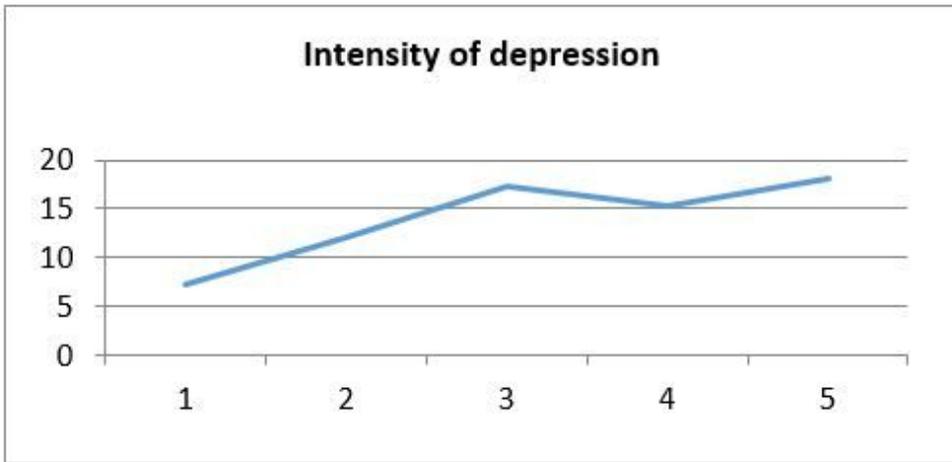
We would like to thank all the participants of this study.

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## Figures



**Figure 1**

Intensity of depression at different stages of the disease (the BDI scale)