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Psychological burden and disease-related quality of life in dialysis patients during the first wave of the COVID-19 pandemic – a cross-sectional observational study

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Summary

Aim. Since the first reports of the spread of the new SARS-CoV-2 virus, experts have pointed to the possible psychological consequences of the pandemic. In this study, we tried to answer the question of whether the level of perceived stress related to the pandemic affects the quality of life related to the disease and the functioning of patients on peritoneal and hemodialysis.

Material and methods. Out of 106 patients from the dialysis center of the University Clinical Hospital in Wrocław during the first wave of the pandemic, 73 patients were enrolled, including 61 hemodialysis (HD) and 12 peritoneal dialysis (PD). The study used The Perceived Stress Scale (PSS), The General Health Questionnaire (GHQ-28), The Impact of Events Scale-Revised (IES-R), and The Kidney Disease and Quality of Life (KDQOL-SF™).

Results. Nearly half of the respondents (48%) experienced psychological distress and 5.6% of the respondents showed clinically significant psychopathological symptoms (GHQ). Half of the study group declared a significant occurrence of post-traumatic stress symptoms (IES-R). A high score of subjectively perceived stress related to the pandemic was observed in both study groups. Numerous significant negative correlations were found between the results of the KDQOL subscales and psychopathological symptoms (IES-R and GHQ) without significant differences between the two groups (HD vs. PD). Almost all KDQOL subscales were significantly moderately or strongly correlated with the level of perceived stress related to the pandemic.

Conclusions. The level of subjectively assessed stress related to the pandemic and the severity of psychopathological symptoms, including post-traumatic stress, were significant in

the entire group of patients undergoing renal replacement therapy, regardless of the dialysis type. Numerous confirmed relationships between the domains of the quality of life related to the disease and the level of perceived stress and psychopathological symptoms indicate an urgent need to provide effective psychological support to this group of patients and to develop preventive programs in the field of mental health of people undergoing renal replacement therapy.

Key words: dialysis, COVID-19, quality of life

Introduction

The spread of the SARS-CoV-2 virus quickly affected most of the world and on March 11, 2020, it resulted in the announcement of a global pandemic by the World Health Organization. Among the consequences of the rapidly spreading virus, apart from the health aspects, there have been economic, political and social changes caused by changing circumstances, politics and the social and professional environment. Since the beginning of the pandemic, experts have pointed to possible psychological consequences resulting not only from the disease itself, but above all from significant lifestyle and social changes resulting from strict sanitary policies aimed at stopping the spread of the disease, e.g., in terms of quarantine [1].

Reports from previous epidemics, such as the Severe Acute Respiratory Syndrome (SARS) epidemic, the H1N1 influenza pandemic and the Ebola virus outbreak, point to several short – and long-term psychological consequences that have emerged as a result of diseases. The most frequently reported symptoms included symptoms of depression and anxiety, as well as post-traumatic stress and stigmatization [2–5]. Although it is still too early to determine the long-term consequences of the SARS-CoV-2 pandemic, there is already evidence to support the claim that this most current state of emergency will be no different. A systematic review and meta-analysis by Wang et al. [6] report that one-third of adults in the general population have experienced psychological stress related to COVID-19. In a Chinese online survey of 52,730 respondents, which began on the day the WHO announced that SARS-CoV-2 was an international public health emergency, 35% of respondents reported psychological distress (tool: the Peritraumatic Distress Index – CPDI) [7]. Another study, started at the beginning of the pandemic and based on the Chinese population, showed that out of 1,060 participants, more than 70% reported moderate or high levels of psychopathological symptoms, (Symptom Checklist 90 – SCL-90) [8]. Among the psychological consequences of the pandemic, the literature mentions also a high level of uncertainty and stress, sleep disorders, and symptoms of anxiety and depression [9].

In addition to the psychological burden of global uncertainty, the pandemic has also placed a huge strain on healthcare systems around the world. Excessive exploitation of health care by a new threat meant that patients treated for other reasons were additionally exposed to the risk of infection, as well as restrictions in access to health care caused by the pandemic.

In this study, we focused on a special group of chronically ill patients, namely those with End Stage Renal Disease (ESRD) who were undergoing one of two forms of Renal Replacement Therapy (RRT): Peritoneal Dialysis (PD) or Hemodialysis (HD).

Peritoneal dialysis is usually done at home and the patient visits the clinic only every 6–8 weeks. On the other hand, hemodialysis requires the patient to strictly adhere to the schedule of visits to the dialysis unit (even several times a week). Progression of chronic kidney disease (CKD) to the stage where RRT is necessary is a very stressful event for every patient [10]. Both forms of therapy require extensive and largely permanent lifestyle changes that effectively interfere with the patient's daily functioning. The burden of dialysis involves a significant shift in social and occupational roles. Dialysis patients often have a limited ability to perform work-related activities, which for many is associated with a deterioration of their financial situation. Dialysis also requires adherence to a strict treatment schedule, regardless of family or social events, which implies severe restrictions on the patient's mobility (e.g., holidays, trips, etc.) and general uncertainty about the future [11]. In addition to changes in social and professional functioning, hemodialysis exposes the patient to a number of negative experiences, including limitations in daily functioning (schedule of visits, fluid intake, nutrition), additional somatic complaints directly or indirectly resulting from dialysis, and a number of unpleasant and sometimes painful medical procedures [12].

Due to the significant impact of treatment on everyday life, these groups of patients have been extensively studied in terms of psychological consequences of the disease and their impact on somatic health and prognosis. The most common psychopathological symptoms in CKD patients on dialysis are depression and anxiety [12], with reports indicating the importance of the method of renal replacement therapy (PD vs. HD) for the severity of symptoms, which was not confirmed in the extensive meta-analysis by Zazzeroni et al. [13]. In a systematic review by Murtagh et al. [14], the weighted average prevalence of anxiety and depression in patients with end-stage renal disease was found to be 38% and 27%, respectively. The reason for such a high incidence of psychopathological symptoms is attributed to several factors, including: comorbidities, pain, fatigue, numerous hospital stays, severe limitations in daily functioning, including diet and fluids, and dependence on the availability of treatment and medical staff [12, 15]. It is worrying that symptoms of depression in patients with CKD are predictors of unfavorable clinical outcomes, such as a faster decrease in the estimated glomerular filtration rate (eGFR), initiation of RRT, admission to hospital or death [16]. In addition, in a study by Kusztal et al. [17], the authors concluded that depressive symptoms are a significant predictor of mortality in hemodialysis patients, and this relationship is independent of nutritional status or inflammation parameters.

Studies suggest that, apart from specific anxiety or depressive symptoms, the quality of life (measured by the HRQoL) of RRT patients is lower than in the general population and tends to decrease over time and with the progression of the disease and treatment [18]. A study by Rebollo Rubio et al. [10] analyzed the HRQoL results of 152 CKD patients who had progressed to stage 5 at the time of starting RRT, as well as the relationship between anxiety and depressive symptoms and HRQoL. The results showed that the introduction of RRT had a strong impact on HRQoL, both compared to the reference population and other patients with CKD (stage <5).

In addition to the impairment of the immune system, a commonly reported risk factor for the acute course and higher mortality of COVID-19 are comorbidities,

which are also a common comorbidity factor in patients with chronic kidney disease [19, 20]. In their article, Rombolà and Brunini [19] point out that the characteristics of dialysis patients include several factors exposing them to higher mortality associated with COVID-19, such as: malnutrition, lung diseases, old age, and cardiovascular diseases. The authors also point to dialysis station overcrowding as an additional risk factor for increased transmission, and thus an overall higher possible risk of infection in these patients.

The additional burden on medical facilities of all specialties caused by the pandemic has also affected dialysis stations. Some reports suggest overloading of nephrology departments as a result of the influx of patients requiring dialysis due to COVID-19 – directly as a result of the disease (acute kidney damage requiring immediate dialysis in the course of infection, infected patients with CKD) or indirectly (patients skipped, forced to change deadline as well as staff shortages related to the pandemic) [20].

The objective of this study was to answer the question whether the psychological consequences of the pandemic affect the quality of life related to the disease and the functioning of dialysis patients, as well as the form of dialysis (PD vs. HD) and demographic factors.

Material and methods

Participants

In the period from April 30, 2020 to June 5, 2020, during the first wave of the pandemic, out of 106 patients treated at the dialysis center of the University Clinical Hospital in Wroclaw, a total of 73 dialysis patients were recruited, including hemodialysis patients (HD, $n = 61$) and peritoneal dialysis patients (PD, $n = 12$). Data were collected using paper questionnaires delivered to patients by ward staff during hospital visits. The study was approved by the Bioethical Committee of Wroclaw Medical University and conducted in accordance with the Declaration of Helsinki. All participants gave written, informed consent to participate in the study. The inclusion criteria included being over 18 years of age and undergoing hemodialysis or peritoneal dialysis. Exclusion criteria were limited to patients who were minors and unable to give informed consent. The study was financed by Wroclaw Medical University, with funds No. SUBZ.C230.22.062. This study followed the Strengthening Reporting of Observational Studies in Epidemiology (STROBE) guidelines and checklist [21].

Measures

In order to answer the research questions, the following areas of measured variables were distinguished: demographic data, psychopathological symptoms (including post-traumatic stress symptoms) and the level of subjective stress related to the pandemic and quality of life related to kidney disease. The collected demographic data included age, gender, marital status and occupation.

The following questionnaires were used to measure psychological and psychopathological variables:

The General Health Questionnaire (GHQ-28) [22] is a self-assessment screening tool designed to detect and measure the presence of psychopathological symptoms. It consists of 28 items concerning 7 groups of symptoms: somatic symptoms, anxiety and sleep disorders, functional disorders (personal and social), and depressive symptoms. Based on the literature [22], the cut-off point for psychological distress was set at above 24 points, and for clinically significant psychopathological symptoms above 70 points.

The Impact of Events Scale Revised (IES-R) [23] is a 22-item tool with a 5-point Likert scale describing subjective stress caused by a traumatic event. The scale includes 3 dimensions that can be distinguished in post-traumatic stress disorder: intrusions, arousal and avoidance. Based on previous literature, the cut-off point for PTSD symptoms was set at 33 points.

The Perceived Stress Scale (PSS) [24] is a self-completed 10-item questionnaire designed to measure the subjective level of stress related to the pandemic in the last month.

The Kidney Disease and Quality of Life (KDQOL-SF™) scale [25] is a self-administered questionnaire measuring perceived quality of life. The questionnaire contains 24 items in the following domains: health, kidney disease, impact of kidney disease on daily functioning, and satisfaction with care. The questionnaire was developed especially for patients suffering from nephrological diseases.

Data analysis

Before data analysis, the respondents were divided into two groups: one with patients undergoing hemodialysis ($n = 61$) and the other consisting of patients treated with peritoneal dialysis ($n = 12$). In order to characterize the groups and the results, percentages (for variables presented on a nominal scale) or descriptive statistics were used: quartiles (including the median), range and standard deviation (*SD*). The statistical significance of intergroup differences for numerical values was determined using the Mann-Whitney *U* test, for analyzes involving more groups, the Kruskal-Wallis test was performed. Relationships between categorical variables were measured with Fisher's and chi-square tests. Spearman's *r* coefficient was used for the correlation, which can take a value from – 1 to 1, with the following criteria adjusted to classify the correlation strength: $0.0 \leq |r| \leq 0.2$ – no correlation; $0.2 \leq |r| \leq 0.4$ – weak (+), $0.4 \leq |r| \leq 0.7$ – moderate (++); $0.7 \leq |r| \leq 0.9$ – strong (+++); $0.9 \leq |r| \leq 1.0$ – very strong correlation (++++). Missing data were replaced with mean values (KDQoL) or median (other measurements). Analyzes were performed using R statistical software version 3.6.

Results

Participants

The HD group included 61 patients, of whom 52.5% were male and 47.5% female. The age range in this group was between 26 and 89 years. The majority of the respondents were married (61.0%), 18.6% were widowed and 10.2% were in a relationship. The majority never received psychiatric treatment or psychological help (95.1%, and 95.0%, respectively). None of the respondents reported having anyone close who had been infected with the SARS-COV-2 virus or quarantined. The PD group included 12 patients, with 58.3% being male and 41.7% being female. The age range was between 35 and 72 years. 83.3% of the respondents were married, while 16.7% were single. None of the patients had previously received psychiatric or psychological treatment. None of the respondents reported having anyone close who had been infected with the SARS-COV-2 virus or quarantined.

The most common cause of renal failure in the HD group was ischemic nephropathy and glomerulonephritis (27.87%), and glomerulonephritis (58.33%) in the PD group. Detailed demographic data are presented in Table 1.

Table 1. **Demographic data for the PD (n = 12) and HD (n = 61) groups**

Variable		HD (N = 61)		PD (N = 12)
Sex	Female	47.5% (N = 29)		41.7% (N = 5)
	Male	52.5% (N = 32)		58.3% (N = 7)
Age	Mean (SD)	64.21 (15.8)		58.33 (13.03)
	Median (IQR)	67 (58.25–75.25)		61 (48–68)
	Range	26–89		35–72
Marital status	Single	3.4% (N = 2)		16.7% (N = 2)
	In a relationship	10.2% (N = 6)		0% (N = 0)
	Married	61% (N = 36)		83.3% (N = 10)
	Separated	1.7% (N = 1)		0% (N = 0)
	Divorced	5.1% (N = 3)		0% (N = 0)
	Widowed	18.6% (N = 11)		0% (N = 0)
Number of children	Mean (SD)	1.4 (0.95)		1.8 (1.32)
	Median (IQR)	1 (1–2)		2 (1–2.75)
	Range	0–4		0–4
Occupation	Physician	0% (N = 0)		0% (N = 0)

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	Nurse	1.7% (N = 1)		0% (N = 0)
	Paramedic	0% (N = 0)		0% (N = 0)
	Employed	72.1% (N = 43)		63.6% (N = 7)
	Retired	21.3% (N = 13)		36.4% (N = 4)
	Lack of answer	4.9%(N = 3)		
Professional experience	Mean (SD)	26 (15.34)		25.33 (15.53)
(years)	Median (IQR)	30 (15–36.25)		27 (12.5–38.5)
Psychiatric treatment		4.9% (N = 3)		0% (N = 0)
Psychological treatment		5% (N = 3)		0% (N = 0)
Cause of renal failure	Ischemic nephropathy	32.6% (N = 20)	Glomerulonephritis	58.3% (N = 7)
	Glomerulonephritis	27.7% (N = 17)	Vasculitis	16.7% (N = 2)
	Diabetic nephropathy	19.7% (N = 12)	Interstitial nephritis	8.3% (N = 1)
	Secondary glomerulonephritis in course of autoimmune diseases	6.5% (N = 4)	Diabetic nephropathy	8.3% (N = 1)
	Obstructive nephropathy	4.9% (N = 3)	Ischemic nephropathy	8.3% (N = 1)
	Interstitial nephritis	3.3.% (N = 2)		
	Polycystic kidney disease	3.3% (N = 2)		
	Secondary amyloidosis	1.6% (N = 1)		
Mean time of dialysis		3.98 years		1.6 years

PD – patients treated using peritoneal dialysis; HD – patients treated using hemodialysis; N – number of patients

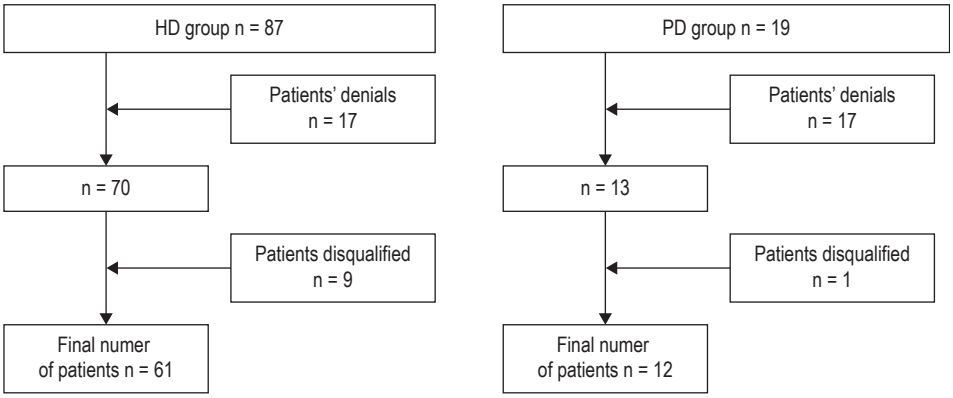

Chart. **Patient recruitment scheme for the study group**

* Disqualification – patients were disqualified from the study if they skipped at least one questionnaire or did not sign every paper agreement for this study

Psychopathological symptoms, including post-traumatic stress symptoms and perceived stress

The GHQ cut-off point for clinically significant psychopathological symptoms in the whole group was achieved only by 5.6% of respondents ($n = 4$) and all of them were in the HD group. The cut-off point for psychological distress was set at >24 points. In the study sample, 48% ($n = 35$) of patients scored above the cut-off point, 39.2% ($n = 24$) in the HD group and 92% ($n = 11$) in the PD group. There were no significant differences in the severity of psychopathological symptoms measured with the GHQ-28 between the HD and PD groups (Mann-Whitney *U* test). It is worth mentioning, however, that most patients in the PD group scored slightly lower than the HD group.

The level of perceived stress related to the pandemic, as measured by the PSS-10, showed no significant differences between the two groups. The mean score for the PSS-10 were $M = 18$, SD=7.81 for the PD group and $M = 19.34$, $SD = 6.81$ for the HD group. Polish sten standards for the PSS-10 assume scores from 0 to 13 in the range of 1–4 sten (low scores), scores from 14 to 19 in the range of 5–6 sten (medium) and scores from 20 to 22 in the range of 7–10 sten (high) [23]. Thus, in this study the respondents are in the upper limit of the average range of the level of perceived stress. Detailed results are shown in Table 2b, significant results are shown in Table 2a below.

In addition to general psychopathological symptoms and the level of perceived stress, the IES-R measured the severity of stress reactions associated with PTSD symptoms. The cut-off point for the IES-R was set at 33 points. 50% of the group scored above this value. The number of respondents above the cut-off point was evenly distributed in both groups (41.7% in the PD group and 51.7% in the HD group). Significant differences between the PD and HD groups were observed in the IES-R "Avoidance" subscale (Mann-Whitney *U* test, $p < 0.05$). HD patients also overall scored higher on

the IES-R than the PD group for both range (max. value PD =17; HD = 32), median (PD = 9; HD = 13) and mean values (PD = 9.08 ± 4.93; HD = 12.6 ± 7.31).

Table 2a. **Comparison of the GHQ, PSS-10, IES-R, and KDQOL-36 scores for the PD[1] (n = 12) and HD[2] (n = 61) groups**

	PD (N = 12)		HD (N = 61)		
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	p-value
GHQ-28	–	–	–	–	ns
PSS-10	–	–	–	–	ns
IES-R					
Avoidance	9.08 (4.93)	9 (7–11.5)	12.78 (7.16)	13 (10–16)	0.0464*
KDQOL-36					
Work status	45.83 (33.43)	50 (37.5–50)	100 (0)	100 (100–100)	<0.0001***
Dialysis staff encouragement	86.46 (16.39)	87.5 (84.38–100)	72.34 (18.97)	75 (62.5 –87.5)	0.0218*
Pain	76.88 (21.32)	78.75 (67.5–90.62)	54.58 (26.92)	46.25 (32.5–75.62)	0.0088**

[1] PD – patients treated using peritoneal dialysis.

[2] HD – patients treated using hemodialysis.

[3] Statistically significant results: * p <0.05, ** p <0.01 and *** p <0.001.

GHQ-28 – General Health Questionnaire; IES-R – Impact of Events Scale Revised; PSS-10 – Perceived Stress Scale; KDQOL-SF™ – Kidney Disease and Quality of Life; N – number of patients; ns – statistically not significant.

Quality of life related to kidney disease and psychopathology and stress

The highest scores for the KDQoL questionnaire were observed for the "Work status" subscale with a total score of 90.97 (±24.21). In this questionnaire, the HD group also showed significantly higher scores than the PD group (Mann Whitney *U* test; p <0.001). The mean values for the two groups differed by 54.17. Significant differences were observed for the subscale "Dialysis staff support" (Mann-Whitney *U* test; p <0.05), with a significantly higher score for PD, where the mean value was 86.46 (+16.39) (compared to 72.34 ± 18.97 for HD; mean score for the entire study group: 74.66 ± 19.2). Similarly, the Pain subscale showed a significantly higher score for PD (Mann-Whitney *U* test; p <0.01), where the mean score was 22.3 points higher than HD. The mean result of the whole group for this subscale was 58.3 (±27.25). Other subscales did not present any significant differences between the two groups. The detailed results are listed in Table 2b.

Table 2b. **Comparison of the GHQ, PSS-10, IES-R, and KDQOL-36 scores for the PD (n = 12) and HD (n = 61) groups**

	PD (N= 12)		HD (N= 61)		
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	p-value
GHQ					
Total score	22.64 (11.75)	18 (15.5–30.5)	24.26 (12.8)	21 (15.75–32)	0.7205
Somatic symptoms	6 (3.26)	6 (4.5–7)	6.84 (3.62)	6 (4–9)	0.6141
Anxiety and insomnia	5.55 (4.48)	7 (1.5–8)	6.1 (4.26)	6 (3–8)	0.8751
Social dysfunction	8.45 (2.11)	8 (7–10)	8.39 (3.43)	8 (6–10)	0.8068
Severe depression	2.64 (4.11)	0 (0–5)	2.82 (3.32)	2 (1–4)	0.1657
PSS-10					
Total score	18 (7.81)	19 (12.5–21)	19.34 (6.81)	19 (15–24)	0.5887
IES					
Total score	30.33 (22.94)	24.5 (11.75–47.75)	33.62 (17.68)	35 (25–43)	0.5329
Arousal	8.42 (7.68)	6.5 (2.5–13.75)	8.23 (5.33)	8.5 (4.25–10.75)	0.7369
Intrusion	12.83 (11.36)	10 (4–19)	12.6 (7.31)	13 (8.25–17)	0.7312
Avoidance	9.08 (4.93)	9 (7–11.5)	12.78 (7.16)	13 (10–16)	0.0464*
KDQOL-36					
Symptoms	72.84 (16.81)	77.08 (61.27–80.73)	70.57 (19.12)	75 (60.42–84.09)	0.8757
Effects of kidney disease on daily life	70.31 (20.66)	71.88 (67.97–82.81)	60.57 (22.14)	59.38 (43.75–78.91)	0.1228
Burden of kidney disease	39.58 (30.89)	40.62 (15.62–57.81)	36.48 (21.44)	37.5 (18.75–56.25)	0.8753
Work status	45.83 (33.43)	50 (37.5–50)	100 (0)	100 (100–100)	<0.0001***
Cognitive function	81.11 (15.26)	83.33 (71.67–93.33)	71.09 (20.43)	70 (53.33–86.67)	0.1208
Quality of social interaction	70 (17.87)	70 (53.33–81.67)	67.05 (15.45)	66.67 (53.33–80)	0.6582
Sexual function	67.5 (33.44)	75 (56.25–93.75)	52.84 (42.44)	50 (9.38–100)	0.4491
Sleep	55.42 (19.48)	55 (36.25–68.12)	56.28 (19.13)	57.5 (40–70)	0.7149

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Social support	79.16 (17.59)	75 (66.66–100)	71.58 (21.16)	66.66 (66.66–83.33)	0.3484
Dialysis staff encouragement	86.46 (16.39)	87.5 (84.38–100)	72.34 (18.97)	75 (62.5–87.5)	0.0218*
Patient satisfaction	63.89 (33.21)	66.67 (45.83–87.5)	61.39 (20)	66.67 (50–66.67)	0.4596
Physical functioning	57.92 (15.73)	55 (48.75–66.25)	44.29 (30.5)	0.0864	0.0864
Role-physical	39.58 (49.38)	0 (0–100)	40.44 (41.77)	25 (0–75)	0.7883
Pain	76.88 (21.32)	78.75 (67.5–90.62)	54.58 (26.92)	46.25 (32.5–75.62)	0.0088**
General health	47.36 (21.43)	45 (33.75–60)	37.34 (17.3)	40 (25–45)	0.1158
Emotional well-being	66.08 (24.52)	62 (52–86.75)	64.73 (16.64)	64 (52–80)	0.7818
Role emotional	63.89 (45.97)	100 (25–100)	69.95 (42.03)	100 (33.33–100)	0.7857
Social function	55.21 (22.9)	50 (37.5–75)	55 (27.25)	50 (37.5–75)	0.9451
Energy/fatigue	51.25 (17.07)	50 (43.75–62.5)	46.17 (19.34)	47.5 (33.75–55)	0.3828

PD – patients treated using peritoneal dialysis; HD – patients treated using hemodialysis; GHQ-28 – General Health Questionnaire; IES-R – Impact of Events Scale Revised; PSS-10 – Perceived Stress Scale; KDQOL-SF™ – Kidney Disease and Quality of Life; N – number of patients

The KDQoL subscales showed many significant relationships (Table 3). Statistically significant negative correlations were confirmed between the stress score related to the pandemic, measured using the PSS, and the results of almost all subscales of the KDQoL: "Effects of kidney disease on daily life" ($r = – 0.5861$), "Burden of kidney disease" ($r = – 0.5119$), "Cognitive function" ($r = – 0.6916$), "Quality of social interaction" ($r = – 0.6393$); "Sexual function" ($r = – 0.349$); "Sleep" ($r = – 0.5007$); "Social support" ($r = – 0.3941$); "Dialysis staff encouragement" ($r = 0.2723$); "Patient satisfaction" ($r = – 0.3614$); "Physical functioning" ($r = – 0.3649$); "Role-physical" ($r = – 0.2678$); "Pain" ($r = – 0.3984$); "General health" ($r = – 0.4241$); "Emotional well-being" ($r = – 0.8302$); "Role emotional" ($r = – 0.4616$); "Social function" ($r = – 0.4913$); "Energy/Fatigue" ($r = – 0.7423$).

The "Impact of kidney disease" subscale of the KDQoL negatively correlated with the following scales: "Somatic symptoms" (GHQ-28) – strong correlation; "Anxiety and Insomnia," "Personal and Social Functioning Disorders," "Depressive Symptoms" (GHQ-28), "Agitation," and overall score (IES-R) – moderate correlation; "Intrusion," "Avoidance" (IES-R) – weak correlation. The above results contributed to a significant negative correlation between the KDQoL subscales and the overall GHQ-28 score ($p < 0.001$).

The "Burden of kidney disease" subscale showed several statistically significant negative correlations of moderate strength with the total GHQ-28 score, "Anxiety and insomnia," and "Depression" (GHQ-28). Other statistically significant correlations

presented a weak relationship. “Work status” was significantly correlated only with the “Avoidance” scale (IES-R) ($r = 0.2678$).

“Quality of social interaction” as well as “Sleep” mostly correlated negatively with the “Cognitive functions” subscale, with a strong correlation between “Sleep” and “Anxiety and Insomnia” (GHQ-28) ($r = – 0.6281$). Both KDQoL subscales also negatively correlated with total GHQ-28 score. “Patient satisfaction” showed a weak negative correlation with GHQ-28 subscales.

Results of “Somatic symptoms” and the total GHQ-28 score significantly negatively correlated with the “Role-physical” (KDQoL) subscale. The results of both psychopathological scales (GHQ-28; IES-R) significantly negatively correlated with the subscale “Pain” (KDQoL), in particular the subscale “Somatic symptoms” (GHQ-28) ($r = 0.6111$). A higher score on the “Pain” Subscale (KDQoL) was significantly associated with a lower GHQ-28 overall score ($p <0.001$). Strong negative correlations were also observed for the subscales “Anxiety and Insomnia” as well as “Depressive symptoms” (GHQ-28) and “General mental health” (KDQoL) ($r = – 0.7375$ and $– 0.6509$, respectively) as well as the overall GHQ-28 score ($p <0.001$; $r = – 0.7001$).

All GHQ-28 subscales correlated with the “Social Activity” (KDQoL) subscale with a strong correlation for “Somatic symptoms” (GHQ-28) ($r = – 0.634$).

Table 3. **Spearman's correlations between the KDQOL and PSS-10, GHQ-28 and IES-R for the PD (n = 12) and HD (n = 61) groups**

KDQOL-SF 36	PSS-10	IES-R				GHQ-28				
	Total score	Intrusion	Avoidance	Arousal	Total score	Somatic symptoms	Anxiety and insomnia	Social dysfunction	Depressive symptoms	Total score
Symptoms										
Effects of kidney disease on daily life	r = – 0.5861***	r = – 0.3867**[2]	r = – 0.3229**	r = – 0.4728***	r = – 0.4143**	r = – 0.5676***	r = – 0.4307**	r = – 0.4997***	r = – 0.4636**	r = – 0.5806***
Burden of kidney disease	r = – 0.5119***	r = 0.3251**		r = – 0.3951**	r = – 0.3179**	r = – 0.3919**	r = – 0.432**	r = – 0.3459**	r = – 0.4658***	r = – 0.4889***
Work status			r = 0.2678*							
Cognitive function	r = – 0.6916***	r = – 0.3862*	r = – 0.2516*	r = – 0.4445**	r = – 0.3908**	r = – 0.6462***	r = – 0.6323***	r = – 0.5699***	r = – 0.5201***	r = – 0.676***
Quality of social interaction	r = – 0.6393***	r = – 0.405**	r = – 0.2548*	r = – 0.4215**	r = – 0.3896**	r = – 0.4395**	r = – 0.5234***	r = – 0.3907**	r = – 0.4839***	r = – 0.5238***
Sexual function	r = – 0.349*		r = – 0.2864*			r = – 0.4501**	r = – 0.2941*	r = – 0.3792**		r = – 0.3692**
Sleep	r = – 0.5007***	r = – 0.4309**		r = – 0.3905**	r = – 0.3518**	r = – 0.4675***	r = – 0.6281***	r = – 0.3982**	r = 0.4373**	r = – 0.5656***
Social support	r = – 0.3941***	r = – 0.2893*		r = – 0.3455**	r = – 0.2486*	r = – 0.412***	r = – 0.3563**	r = – 0.399***	r = – 0.4461***	r = – 0.5047***
Dialysis staff encouragement	r = – 0.2723*									
Patient satisfaction	r = – 0.3614**					r = – 0.2725*		r = – 0.2783*	r = 0.2938*	r = – 0.3183**

table continued on the next page

Physical functioning	r = – 0.3649**					r = – 0.5474***	r = – 0.315**	r = – 0.4813***	r = – 0.29*	r = – 0.4601**
Role-physical	r = – 0.2678*					r = – 0.5062***		r = – 0.6091***		r = – 0.4523**
Pain	r = – 0.3984**	r = – 0.4388**	r = – 0.2663*	r = – 0.2663***	r = – 0.5004**	r = – 0.6111***	r = – 0.4493**	r = – 0.3605**	r = – 0.4174**	r = – 0.5573***
General health	r = – 0.4241**	r = – 0.262*	r = – 0.3371**		r = – 0.2814*	r = – 0.4661***	r = – 0.3843**	r = – 0.3368**	r = – 0.4979***	r = – 0.4801***
Emotional well-being	r = – 0.8302***	r = – 0.4113**		r = – 0.4105**	r = – 0.3285**	r = – 0.5444***	r = – 0.7375***	r = – 0.4703***	r = – 0.6509***	r = – 0.8302***
Role emotional	r = – 0.4616***	r = – 0.2524*	r = – 0.2482*	r = – 0.2959*	r = – 0.3046*	r = – 0.5611***	r = – 0.3596**	r = – 0.5634***	r = – 0.4058**	r = – 0.556***
Social function	r = – 0.4913***	r = – 0.2769*		r = – 0.3986**	r = – 0.3316**	r = – 0.634***	r = – 0.4196**	r = – 0.4573**	r = – 0.3652**	r = – 0.5709***
Energy/fatigue	r = – 0.7423***	r = – 0.3664**	r = – 0.1444**	r = – 0.4371**	r = – 0.3415**	r = – 0.6758***	r = – 0.6141***	r = – 0.6092***	r = – 0.6188***	r = – 0.7635***

Statistically significant results: * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$

Discussion

Psychological distress and psychopathological symptoms

The presented study found that 5.6% of the researched sample exhibited psychopathological symptoms and close to half of the respondents (48%), experienced psychological distress. Previously published literature seems to confirm our findings with similar prevalence, despite the use of different scales (e.g., GHQ-12) or cut-off points. In a similar study by Yang et al. [26] on 273 dialysis patients in China, the authors estimated the prevalence of nonspecific psychiatric morbidity at 45.8% (GHQ-28) [26]. Other studies on the subject reported prevalence rates of psychological distress at the level of 55.2% to 75.0% using the GHQ-12 [27, 28]. In comparison with our results and with an established high prevalence of depressive and anxiety symptoms in the ESRD (End-Stage Renal Disease) populations these numbers do not seem to be higher than expected. As the described study was conducted during the SARS-CoV-2 pandemic in Poland, it stands to reason that the epidemiological situation either did not affect psychological distress among ESRD patients or the psychological distress levels in the studied group were lower at baseline. Nadort et al. [29], who examined perceived stress as well as depressive and anxiety symptoms in hemodialysis patients during the first and second wave of the SARS-CoV-2 pandemic in the Netherlands, concluded that the SARS-CoV-2 pandemic did not significantly influence mental health in hemodialysis patients, but patients with pre-existent mental health problems may be more susceptible to experience COVID-19-related stress. Similarly, Bonenkamp et al. [30] report that the mental health of dialysis patients seems to be unaffected by the COVID-19 pandemic. The authors suggest, that the reason of that could be their high resilience and small susceptibility to influence of social distancing. Nevertheless, a recent meta-analysis and systematic review regarding psychopathological symptoms during the pandemic, lists chronic diseases as one of the significant risk factors for adverse, pandemic-related, mental health reactions in the general population, underlining the need for special attention and support for chronically ill patients during that time [31].

The results related to previous psychiatric or psychological treatment, where patients had higher stress levels, as well as anxiety and insomnia seems to be self-explanatory, as psychiatric or psychological patients experience additional symptoms which would independently lead to an increase in GHQ scores and perceived stress levels. Nonetheless, as this particular group consisted of only three individuals, the conclusion should be regarded with caution and requires additional confirmation on a larger patient sample.

PTSD symptoms

The results related to the level of stress, including PTSD symptoms, are slightly different. In contrast to the GHQ, in our study 50% of the group (41.7% in the PD and 51.7% in the HD group) scored above the cut-off point for the IES-R. Due to the nature of the questionnaire, where the respondents are asked to give answers related

to a specified traumatizing event (in this case the pandemic), these results may be a reflection of the additional burden of COVID-19 in this group. Research regarding the occurrence of PTSD symptoms in the general population during the pandemic, places their prevalence between 7 and 53%. In that regard a 50% PTSD symptoms prevalence, found in our study, renders our results as rather high and suggests a high PTSD incidence in the studied group [32]. In their study on dialysis patients during the COVID-19 pandemic, Yu et.al. [33] found that over half of the PD patients and 25.6% of the HD patients in their study fell into the normal range for IES-R scores, which constitutes a fairly low score, compared to our data.

Significant differences between the PD and HD groups were observed for the "Avoidance" subscale of the IES-R. The HD patients also generally scored higher on the IES-R, than the PD group. This result stands in contrast to the outcomes reported by Karaca et al. [34] from Turkey during the COVID-19 pandemic, where IES-R scores were significantly higher in PD patients than those in HD patients. In this study, 20% of HD patients and 40% of PD patients scored above the cut-off point for the IES-R, which is generally lower compared to the data obtained by us. The authors suggest, that the cause of this outcome could be a fact of the face-to-face contact of HD patients with healthcare workers and other patients in hospital. The "Avoidance" subscale generally refers to attempts made by the patient to avoid thinking about a specific topic. In the case of hemodialysis this strategy is more manageable by the patient as they are confronted with their disease directly only in hospital settings, peritoneal dialysis on the other hand becomes more of a part of daily life, with associations present to the patient's home and everyday activities.

Moreover, a significant difference between the male and female participants was found for the "Arousal" subscale (IES-R), where men scored significantly lower than women. This result is confirmed by previous research on mental health during the SARS-CoV-2 pandemic, where psychological distress was more prevalent in women, but also by publications regarding CKD patients, regardless of the pandemic [27, 35, 36]. In their study of CKD patients, Hettiarachchi and Abeysena [27] found that female participants had higher rates of psychological distress (measured by the GHQ), the same result was reported by Sfyrkou [36,] where women with ESRD also scored higher on psychological distress than men (measured by the *Kessler Psychological Distress Scale* – K10).

Quality of life, stress level and psychopathological symptoms

Few significant differences between both of the researched groups (HD vs. PD) in terms of "Quality of life" were found. The results suggest a difference between the groups in regard to "Work status," where the HD group scored significantly higher. This result is in contrast with previous studies by Gonçalves et al. [37] who found PD patients to have better scores on "Work-status" than hemodialysis patients. The PD group, on the other hand, scored significantly higher on the "Pain" subscale than the HD group. Another significant difference between the groups concerns "Dialysis staff encouragement" subscale with significantly higher results for the PD group. This

result in turn is in accordance with previous findings [37–39]. The results, however, should be treated with caution due to the limitations imposed by the small sample size for PD patients in this study and very few significant results obtained for inter-group comparisons.

Despite some evidence of a different reaction to RRT between patients treated with different modalities, in a recent meta-analysis and systematic review Zazzeroni et al. [13] also concluded that no unanimous conclusions can be drawn in regard to preferential treatment methods from a quality of life perspective. Thus, the option, that the selected treatment modality could not have had a decisive impact on the quality of life in dialysis patients, but other co-occurring variables (e.g., personality, stress level, level of psychopathological symptoms, other circumstances) remains to be considered as an interpretation.

In combination with high (compared to previous literature) results for PTSD symptoms as well as the fact that close to 50% of the respondents exhibited a level of psychopathological symptoms above the cut-off point for psychological distress, moderately high PSS-10 scores seem to fall below expectations for the researched sample. In the study by García-Llana et.al. [40], conducted on a group of 60 patients undergoing HD or PD outside of the pandemic, the PSS-10 scores revolved around $M = 14.28$, $SD = 8.18$. In a study by McClelland et.al. [41], which involved 151 ESRD patients and the PSS-4, average scores were $M = 3.2$, $SD = 2.9$, and only 14.5% scored ≥7 (determined to be indicative of high stress levels by the authors). In the light of comparative data, it stands to reason that patients in this group achieve rather low PSS scores and therefore the PSS results obtained in our study may be trated as elevated. The authors of the cited papers did not discuss these results, but perhaps the rather general character of the PSS items, which is not a clinical scale, affects the results and therefore should be treated with caution when used in clinical populations, especially that the provided norms are meant for the general population.

In regard to the entire group of dialysis patients, a few interesting results emerged as well. The associations between the KDQoL and the psychopathological measurements (PSS, IES-R and GHQ) indicate numerous negative correlations between the respondent's quality of life and the existence of psychopathological symptoms. Most of the KDQoL subscales also significantly correlated with the GHQ total score as well as the PSS, indicating a significant relationship between psychological distress, perceived stress levels and certain domains of quality of life. Negative correlations between PSS and almost all KDQoL subscales indicate that despite moderate PSS outcomes compared do general population, even such stress level had significant influence on quality of life in this group.

The study conducted by Yang et al. [26], comparing HD patients using the KDQoL and SF-36 during the ongoing SARS-CoV-2 pandemic and again, when the pandemic has been contained in China, demonstrated that although KDQoL and SF-36 scores improved, GHQ and IES-R scores did not change significantly at the end of the pandemic. The authors found dialysis duration to be the only factor correlated with the mental health and quality of life as well as a correlation between changes in the patients' mental health and their quality of life, and interpreted the results as a com-

bined effect of the dialysis and the pandemic, highlighting the need for psychological interventions in this group [26].

There are several limitations of the study, the most obvious being the lack of baseline measures, which were impossible to obtain due to the unexpected nature of the epidemiological circumstances. This can be mitigated by follow-up assessments in the future, when the pandemic alleviates. Another important limitation is the number of patients recruited in the PD group, that does not allow for adequate inter-group comparisons as well as the lack of a control group. Due to significant limitations in reaching dialysis patients during the lockdown period, the access to patients undergoing peritoneal dialysis was difficult. Future studies should also include social support measures as the results suggest those would be important for the interpretation of the results from the remaining measurements.

Conclusions

The level of subjectively assessed stress related to the pandemic and the severity of psychopathological symptoms, including post-traumatic stress, were significant in the entire group of patients undergoing renal replacement therapy. There were not many significant differences between the hemodialysis and peritoneal dialysis groups, indicating a similar response among patients regardless of the treatment method used. Numerous confirmed relationships between the domains of the quality of life related to the disease and stress related to the pandemic and psychopathological symptoms indicate an urgent need to provide additional psychological support to this group of patients and to develop preventive programs in the field of mental health of people undergoing renal replacement therapy.

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