

Mitigating Social Isolation Among Peritoneal Dialysis Patients: The Impact of Educational Level, Physical Activity, and Familial Support

Huifang Cai^{1,*}, Zongbi Wu^{2,*}, Jieling Xu¹, Taifen Wang², Yanfeng Li³, Youli Jiang³, Mingming Xu²

¹Guangzhou University of Chinese Medicine Fourth Clinical Medical College, Shenzhen, People's Republic of China; ²Nursing Department, Shenzhen Traditional Chinese Medicine Hospital, Shenzhen, People's Republic of China; ³Department of Neurology, People's Hospital of Longhua, Shenzhen, People's Republic of China

*These authors contributed equally to this work

Correspondence: Youli Jiang; Mingming Xu, Email h2362120381@163.com; szszyh1b@163.com

Objective: This study investigates the prevalence and determinants of social isolation in peritoneal dialysis (PD) patients, focusing on the influence of environmental systems and individual behaviors on their social well-being.

Methods: We conducted a cross-sectional study from December 2023 to February 2024 at Shenzhen Traditional Chinese Medicine Hospital. A total of 259 PD patients were enrolled using a consecutive sampling method. Data were collected via validated tools including the Pittsburgh Sleep Quality Index (PSQI), Lubben Social Network Scale-6 (LSNS-6), Family APGAR Questionnaire, and Social Anxiety Subscale of Self-Consciousness Scale (SASS-CS). Statistical analyses utilized Spearman correlation and multiple linear regression to identify factors associated with social isolation.

Results: The average score for social isolation was 11 (range 7–15). Significant predictors of social isolation included education level, physical inactivity, and normal hemoglobin concentrations. Social isolation was negatively correlated with family functionality and positively correlated with social anxiety. Regression analysis confirmed education, family functionality, and social anxiety as significant independent predictors of social isolation.

Conclusion: Social isolation is common among PD patients, driven by factors such as education level, physical inactivity, and unexpectedly, normal hemoglobin levels linked to greater family isolation. Targeted interventions like education, physical activity promotion, and innovative therapies such as animal-assisted activities and social gardening can help reduce isolation and improve patient well-being.

Plain Language Summary:

1. Why is this study needed? Peritoneal dialysis is a common treatment for severe kidney disease. This study is crucial because it examines how being isolated affects patients undergoing this treatment, as social isolation can worsen their health outcomes.
2. What is the key problem/issue/question this manuscript addresses? The main issue addressed is understanding the factors that contribute to social isolation in peritoneal dialysis patients and how this isolation impacts their health and quality of life.
3. What is the main point of your study? The study explores how various factors such as education levels, physical activity, and family support influence social isolation among these patients. It also looks at the broader environmental and social settings that affect their interactions and mental health.
4. What are your main results and what do they mean? Our findings show that patients with higher education, better family support, and more physical activity are less socially isolated. Addressing these factors can greatly enhance the well-being and social interactions of peritoneal dialysis patients, suggesting the need for targeted support and community integration initiatives.

Keywords: peritoneal dialysis, social isolation, social support systems, physical inactivity, educational disparities, mental health

Background

Peritoneal dialysis (PD) is a widely adopted renal replacement therapy for patients with end-stage renal disease, offering advantages such as ease of management and minimal disruption to the patient's circulatory system.¹ Currently, approximately 280,000 individuals worldwide receive PD, with China contributing about 14% of the global total.^{2,3} A deeper understanding of the social interactions and support systems for these patients is crucial, particularly given the extensive impact of social isolation on their health. Social isolation, defined here as a voluntary or involuntary reduction in the frequency and quality of social contacts, entails a detachment from social activities, interactions, and relationships, leading to potential adverse physiological and psychological outcomes.⁴ This condition is recognized as a significant public health concern and a risk factor that negatively impacts health-promoting behaviors, particularly among the elderly, and is associated with declines in physical function, increased risks of dementia, and type 2 diabetes, as well as heightened feelings of loneliness, depression, and even suicide.⁵⁻⁷ Furthermore, studies have shown that PD patients, compared to those with other chronic conditions, experience exacerbated symptoms and significantly reduced survival rates due to social isolation.⁸ This distinct vulnerability highlights the urgent need for tailored interventions in this group. Good social relationships, defined as connections that provide emotional, informational, and practical support, are identified as an important determinant of positive treatment attitudes and survival chances.

Research on the social interaction status of hemodialysis patients is well-documented, yet studies focusing on the social isolation status and influencing factors in PD patients remain limited.^{9,10} This gap underscores the need for targeted studies to address these disparities and enhance understanding. Existing literature indicates beneficial effects of social relationships on patients undergoing hemodialysis and transplantation, with noted improvements in mental and physical health outcomes.¹⁰ However, it remains crucial to explore whether these benefits uniformly extend to PD patients, who may experience different social dynamics due to the nature of their treatment.

To precisely gauge the unique consequences of social isolation on PD patients, we apply the social ecological systems theory.¹¹ This theory suggests that individuals are embedded within interacting environmental systems that significantly influence their development. For PD patients, these systems distinctly impact their social isolation and overall well-being, categorized into three layers:

1. **Microsystem:** This layer pertains to the patient's general condition and immediate living environment. It includes sociological factors such as insurance type and employment status, disease-related factors like anemia and other comorbidities that impact physical function, thereby influencing social activity and participation, and psychological status. The patient's family and healthcare settings are integral to the management of PD, as these environments play a crucial role in shaping daily interactions and emotional well-being. A well-organized family environment can enhance health management and mitigate feelings of loneliness.
2. **Mesosystems:** This layer includes smaller social networks such as family, friends, and work environments. These networks provide the social interactions that are vital for psychological support and coping with the disease, as well as affecting factors such as the type of health insurance and employment status that influence access to care and economic stability.
3. **Macrosystems:** Comprising broader societal structures like cultural beliefs, healthcare policies, and community resources, this layer shapes social attitudes towards illness and influences the social integration and mental health of PD patients.

Guided by this theoretical framework, our study aims to meticulously examine the current status and determinants of social isolation among PD patients, exploring each dimension's impact. This tri-level approach aims to deepen our understanding of social isolation in PD patients and provide insights that could significantly improve their social well-being and overall health.

Subjects and Methods

Study Population

This study employed a cross-sectional design and prospectively collected data from December 2023 to February 2024 at Shenzhen Traditional Chinese Medicine Hospital, a tertiary grade A institution with comprehensive departmental coverage, robust research, and clinical capabilities. We enrolled 259 PD patients from the nephrology department using a consecutive sampling method, aiming to minimize selection bias and enhance generalizability. Inclusion criteria included individuals aged 18

to 75 years with a diagnosis of end-stage renal disease who had been on peritoneal dialysis for at least three months, were of clear consciousness, and willing to sign an informed consent. The age limit of 75 was chosen to maintain study homogeneity and mitigate the risk of social isolation linked to diminished physiological functions in older adults. Exclusion criteria were an exacerbation phase of the disease, concurrent dementia or other psychiatric disorders, and hearing or visual impairments, as these could confound the effects of social isolation. The sample size, calculated to be sufficient for 33 independent variables, required at least 165 participants to account for potential invalid questionnaires, yet 259 valid questionnaires were ultimately collected. The study received ethical approval from the hospital's ethics committee (K-2023-104-01).

Survey Instrument

General Information Questionnaire

The questionnaire was developed through extensive review and discussions within our research team to ensure it was tailored to the study's context and objectives. Variables included gender, age, marital status, type of health insurance, employment status, living alone, exercise habits, duration of dialysis, complications associated with peritoneal dialysis, presence of chronic diseases, and the number of chronic conditions.

Pittsburgh Sleep Quality Index (PSQI)

The PSQI is employed to assess sleep quality and has been widely used globally with good reliability and validity.¹² The PSQI consists of seven domains and 23 items, covering subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each domain is scored on a scale from 0 to 3, with higher scores indicating poorer conditions in the respective domains. The cumulative scores across all domains yield the total PSQI score, which ranges from 0 to 21 points. A score of 7 or higher indicates poor sleep quality, with higher scores reflecting worse sleep quality.

Lubben Social Network Scale-6 (LSNS-6)

The Lubben Social Network Scale-6 (LSNS-6) is an abbreviated version of the original social network scale, designed for quick and accurate assessment of social isolation or social network adequacy among the elderly.¹³ The LSNS-6 includes two dimensions—family network and friends network—with three items each. Each item offers six response options ranging from 0 to 5 points, indicating none, one, two, three to four, five to eight, and nine or more connections respectively. The total score ranges from 0 to 30 points, with scores below 12 indicating social isolation or inadequate social networks. Scores below 6 points in either the family or friends dimension indicate isolation in that specific area. The Chinese version of LSNS-6 has a Cronbach's α coefficient of 0.832, while it was 0.830 in this study.

Family APGAR Questionnaire

The Family APGAR Questionnaire, measures family functioning across five dimensions: adaptability, partnership, growth, affection, and resolve.¹⁴ Using a Likert scale of three levels ranging from 0 to 2, scoring options include almost never, sometimes, and often, with a total score ranging from 0 to 10 points. Scores of 0–3, 4–6, and 7–10 indicate severe, moderate, and good family functioning, respectively. The validity of the Chinese version of the APGAR is 0.80, with test-retest reliability between 0.80 and 0.83. The Cronbach's α coefficient for this questionnaire in our study was 0.790.

Social Anxiety Subscale of Self-Consciousness Scale (SASS-CS)

The Social Anxiety Subscale of the Self-Consciousness Scale (SASS-CS) includes six items, assessing experiences in unfamiliar settings, being the focus of attention, embarrassing situations, unfamiliar conversations, public speaking, and interactions with groups.¹⁵

Data Collection Methods

Prior to the survey, peritoneal dialysis nurses, acting as distributors, used a standardized questionnaire guide to explain the study's objectives face-to-face with the participants, clarify the questionnaire content, and address any questions. After obtaining informed consent, an electronic questionnaire link (<https://www.wjx.cn/vm/PmauhKd.aspx#>) was provided. This link directs to Wenjuanxing, a platform specifically designed for questionnaire development and data collection, supporting features such as electronic form creation, encrypted data storage, and data export. To ensure the

privacy and confidentiality of the respondents' data, all data transmissions were encrypted using secure socket layer (SSL) technology, and access to the data was restricted to authorized personnel only. Additionally, for participants who found it difficult to fill out the questionnaire on their own, research team members patiently assisted them by asking the questions and recording their responses. Questions were set as mandatory to ensure complete data collection. Questionnaires were collected on the spot and the quality of the responses was checked immediately. Data were organized using Excel 2010 software and were double-checked by two team members. The team also performed data preprocessing using Python scripts for data cleaning and normalization to ensure data quality and completeness. A total of 266 questionnaires were distributed, 7 were discarded due to insufficient response time (less than 5 minutes) or patterned responses, resulting in 259 valid questionnaires and an effective response rate of 97.3%.

Statistical Methods

Data analysis was performed using R version 4.3.3. An initial descriptive statistical analysis was conducted to assess the current state of social isolation among PD patients, using frequency counts and proportions to describe categorical data, and medians (P25, P75) for non-normally distributed quantitative data. To compare differences in social isolation scores between groups, non-parametric tests were used due to the skewed nature of the data. Specifically, the Mann–Whitney *U*-test was applied for two independent samples, and the Kruskal–Wallis test was used for comparisons across more than two groups. These tests were chosen because they do not assume a normal distribution of the data, making them appropriate for the types of variables and data distribution observed in this study. Spearman's rank correlation test was employed for correlation analysis to account for the ordinal nature of some of the survey data. Variables significantly associated with social isolation scores ($P<0.05$) were analyzed using multiple linear regression to identify independent factors influencing social isolation. Prior to conducting the regression analysis, assumptions such as linearity, independence, homoscedasticity, and normality of residuals were checked to ensure the appropriateness of the model.

Results

General Characteristics of Participants

The scores for social isolation among the 259 PD patients were 11 (7–15) points, with scores for family and friend isolation dimensions being 7 (5–9) points and 4 (1–7) points, respectively. Details are presented in [Table 1](#).

Comparison of Social Isolation Among PD Patients with Different Characteristics

The study findings reveal significant statistical differences in social isolation scores among PD patients based on education level, number of chronic diseases, and employment status ($P<0.05$). Family isolation scores also showed significant variation across different levels of educational attainment, exercise habits, dialysis duration, and hemoglobin concentration ($P<0.05$). Friend isolation scores differed significantly according to patients' age, types of health insurance, cultural backgrounds, number of chronic diseases, and employment statuses ($P<0.05$). These results are detailed in [Table 2](#).

Correlation Analysis of Social Isolation and Scale Scores Among PD Patients

Spearman correlation analysis indicated strong associations in our dataset: total social isolation scores in PD patients were positively correlated with the Family APGAR scores ($r=0.493$, $P<0.001$), suggesting that better family functioning is

Table 1 Social Isolation Among PD Patients

Category	Subcategory	Number	Percentage (%)	Score [M,(P2575)]
Social Isolation	None	118	45.6	15 (13–19)
	Present	141	54.4	7 (5–9)
Family Isolation	None	175	67.6	9 (7–10)
	Present	84	32.4	5 (4–6.5)
Friend Isolation	None	97	37.5	7 (6–9)
	Present	162	62.5	2 (0–4)

Table 2 The General Information of the Subjects and the Univariate Analysis of Social Isolation in Peritoneal Dialysis Patients

Characteristic	Subgroup	Number (%)	Social Isolation score [M,(P25,P75)]	Family Isolation score [M,(P25,P75)]	Friend isolation score [M,(P25,P75)]
Age	<50	135 (52.1%)	11 (8–16)	7 (5–9)	4 (3–7)
	≥50	124 (47.9%)	11 (6–14.75)	7 (5–9)	3 (0–7)
	Z-value		–1.530	–0.504	–2.835
	P-value		0.126	0.614	<0.05
Gender	Male	134 (51.7%)	11 (6.75–14.25)	6 (5–8.25)	4 (1–7)
	Female	125 (48.3%)	11 (7–15)	7 (5–9)	4 (1–7)
	Z-value		–0.665	–1.624	–0.052
	P-value		0.506	0.104	0.959
Marital Status	Unmarried	26 (10%)	12 (6.75–15)	6.5 (3.75–9)	5 (2–7)
	Married	223 (86.1%)	11 (7–15)	7 (5–9)	4 (1–7)
	Divorced	6 (2.3%)	8.5 (3.5–12.5)	4.5 (2–7.5)	4 (0.75–5.75)
	Widowed	4 (1.5%)	10.5 (3–16.5)	6 (3–8.25)	4 (0–8.75)
	K-value		3.683	0.740	1.654
	P-value		0.298	0.201	0.687
Health Insurance	Non-urban	29 (11.2%)	9 (6–14)	7 (6–8.5)	1 (0–6)
	Urban	230 (88.8%)	11 (7–15)	7 (5–9)	4 (1.75–7)
	Z-value		–1.519	–0.557	–2.834
	P-value		0.129	0.577	<0.05
Education	Primary	91 (35.1%)	9 (6–13)	6 (5–8)	3 (0–6)
	High School	86 (33.2%)	9.5 (6–14)	6 (4–8)	3 (0–7)
	College	77 (29.7%)	13 (10–18)	8 (6–10)	6 (4–8)
	Postgrad	5 (1.9%)	14 (12.5–18.5)	7 (6–9.5)	8 (5.5–9.5)
	K-value		26.777	14.348	28.223
	P-value		<0.001	<0.05	<0.001
Chronic Diseases	≤2	247 (95.4%)	11 (7–15)	7 (5–9)	4 (1–7)
	>2	12 (4.6%)	6 (5–11.75)	5.5 (5–7.5)	0 (0–5.75)
	Z-value		–1.994	–1.321	–2.083
	P-value		<0.05	0.187	<0.05
Employment Status	Unemployed	145 (56%)	9 (6–14)	6 (5–8.5)	3 (0–6)
	Employed	114 (44%)	12 (9–17)	7 (5–9)	5 (3–8)
	Z-value		–3.690	–1.573	–4.616
	P-value		<0.001	0.116	<0.001
Living Arrangement	Alone	26 (10%)	9 (5.5–14.25)	6 (2–8.25)	4 (1–7)
	With family	233 (90%)	11 (7–15)	7 (5–9)	4 (1–7)
	Z-value		–1.212	–1.793	–0.350
	P-value		0.225	0.073	0.727
Exercise	No	90 (34.7%)	10 (6–14.25)	6 (4–8.25)	4 (0.75–7)
	Yes	169 (65.3%)	11 (7–15)	7 (5–9)	4 (1–7)
	Z-value		–1.392	–1.996	–0.621
	P-value		0.164	<0.05	0.534
Dialysis Duration	≤1 year	94 (36.3%)	11.5 (8–15)	7 (6–9)	4 (1–7)
	1–5 years	118 (45.6%)	11 (7–16.25)	6 (5–9)	4 (2–7)
	5–10 years	28 (10.8%)	9.5 (5.25–13.75)	6 (4.25–9)	3 (0–5.75)
	≥10 years		19 (7.3%)	9 (4–14)	6 (3–7)
	K-value		4.133	7.879	3.382
	P-value		0.247	<0.05	0.336
Hemoglobin (Hb)	<120g/L	209 (80.7%)	11 (7–15)	7 (5–9)	4 (1–7)
	≥120g/L	50 (19.3%)	11 (6–14.25)	6 (4–7.25)	4 (1–7.25)
	Z-value		–0.916	–2.025	–0.091
	P-value		0.360	<0.05	0.927

(Continued)

Table 2 (Continued).

Characteristic	Subgroup	Number (%)	Social Isolation score [M,(P25,P75)]	Family Isolation score [M,(P25,P75)]	Friend isolation score [M,(P25,P75)]
Number of Complications	≤2	67 (25.9%)	12 (7–16)	7 (5–9)	4 (1–8)
	>2	192 (74.1%)	11 (7–14)	7 (5–8.75)	4 (1–7)
	Z-value		–1.092	–1.144	–1.094
	P-value		0.275	0.253	0.274

associated with less social isolation. Conversely, these scores negatively correlated with the SASS-AC scores ($r=-0.316$, $P<0.001$), indicating that higher social anxiety is linked to greater isolation. Family isolation scores were positively correlated with Family APGAR scores ($r=0.457$, $P<0.001$) and negatively correlated with SASS-AC scores ($r=-0.213$, $P<0.001$). Friend isolation scores were positively correlated with Family APGAR scores ($r=0.411$, $P<0.001$) and negatively correlated with SASS-AC scores ($r=-0.313$, $P<0.001$). These findings are detailed in [Table 3](#).

Multiple Linear Regression Analysis of Social Isolation in PD Patients

Social isolation, family isolation, and friend isolation scores were analyzed as dependent variables in a multiple linear regression analysis, using ten variables identified as significant in univariate and correlation analyses (age, health insurance type, education, number of chronic diseases, employment status, exercise habits, hemoglobin concentration, dialysis duration, Family APGAR, and SASS-AC) as independent variables. Scale scores were entered as raw data, categorical variables like cultural level were dummy coded, and continuous variables were entered as raw numerical values. The analysis showed that education and Family APGAR and SASS-AC scores were independent predictors of both social and friend isolation ($P<0.05$), while Family APGAR scores, hemoglobin grouping, and exercise habits were independent predictors of family isolation ($P<0.05$). Results are provided in [Table 4](#).

Table 3 Correlation Analysis Between Social Isolation and Scores of Various Scales in Peritoneal Dialysis Patients

Scale	Family isolation score	Friend isolation score	Social isolation score
PSQI	–0.129*	–0.181**	–0.172**
APGAR	0.457**	0.411**	0.493**
SASS-AC	–0.213**	–0.313**	–0.316**

Note: * $p < 0.05$, ** $p < 0.01$.

Table 4 Logistic Regression Analysis of Social Isolation in Elderly Patients with Peritoneal Dialysis

Dependent variables	Variable	B value	SE value	Beta value	t value	p value
Social Isolation	(Constant)	6.502	0.814		7.991	0.000
	Education (reference: Junior High School and below)					
	Bachelor's Degree	2.219	0.745	0.188	2.978	0.003
	APGAR	0.656	0.090	0.397	7.289	0.000
	SASSCS	–0.201	0.063	–0.175	–3.203	0.002
Family Isolation	(Constant)	4.495	0.522		8.618	0.000
	APGAR	0.350	0.049	0.419	7.154	0.000
	Hemoglobin Grouping	–0.926	0.384	–0.133	–2.410	0.017
	Exercise	0.678	0.330	0.118	2.057	0.041
	(Constant)	0.935	0.860		1.088	0.278
Friend Isolation	Education (reference: Junior High School and below)					
	Bachelor's Degree	1.353	0.490	0.180	2.761	0.006
	APGAR	0.319	0.059	0.304	5.401	0.000
	SASSCS	–0.136	0.041	–0.186	–3.297	0.001

Discussion

Social isolation profoundly affects both the physical and mental health of patients by contracting their social networks, limiting interactions with family, friends, neighbors, and the broader community, thereby heightening feelings of loneliness and increasing susceptibility to depressive and anxious states. Extended periods of social isolation have been shown to erode psychological resilience and diminish self-efficacy, undermining patients' confidence in overcoming illness and negatively impacting their coping strategies and treatment outcomes.^{16,17} Furthermore, social isolation adversely affects individual immunity, as high levels of isolation negatively influence health behaviors and immune function, impeding recovery and increasing the risk of rehospitalization. In PD patients, reduced social contacts may compromise their immune system, heightening their vulnerability to infections and other complications. Thus, it is crucial for healthcare providers and family members to vigilantly monitor the social and mental health needs of PD patients, providing necessary psychological support and promoting greater social participation through enhanced patient education and training to improve self-care capabilities and treatment adherence.

The incidence of social isolation among PD patients is significantly high at 54.4%, with rates of friend isolation reaching 62.5% and family isolation at 32.4%. These figures surpass those reported among HD patients, where rates of social isolation range from 28.89% to 45.2%, friend isolation from 28.25% to 60.4%, and family isolation from 10.09% to 18.73%.^{16,18} Such isolation in HD patients is predominantly attributed to factors like frailty, depression, and inadequate family and social support, paralleling findings in PD patients.¹⁸ Both PD and HD treatments, being chronic, often impose heavy disease burdens, escalating risks of anxiety, depression, and social isolation, thereby underscoring the necessity for robust familial and societal support. Notably, PD patients experience more severe social isolation compared to HD counterparts, a disparity arising from their treatment modalities. Moorthi et al note that chronic kidney disease patients generally interact more with friends than family, a dynamic differing for HD patients who benefit from supportive networks in dialysis centers.¹⁹ In contrast, PD treatment, typically administered at home, substantially limits such interactions. The home-based nature of PD, although offering autonomy and comfort, restricts routine social interactions available to those in hemodialysis settings, leading to reduced contact with healthcare professionals and fellow patients.²⁰ Moreover, PD treatment protocols, which require multiple daily sessions of dialysis fluid infusion and retention, severely restrict patients' mobility and flexibility. The necessity to transport and manage dialysis equipment exacerbates the burden, compounding the challenges associated with maintaining social activities. Consequently, while HD patients often need direct family involvement in care, PD patients' relative independence might reduce family support, inadvertently increasing their isolation risk. Moreover, the daily responsibility of managing one's own treatment can induce considerable psychological stress and social withdrawal, factors well-documented as heightening social isolation risks.⁹ The presence of dialysis equipment at home can further augment stigma perceptions, prompting patients to self-isolate to avoid social judgment.²¹ These elements combine to create a unique social environment for PD patients that differs markedly from those on hemodialysis, necessitating targeted interventions to address these specific challenges and improve social integration and support for this vulnerable population.

Our findings identify education level as an independent determinant of social isolation in PD patients, a pattern consistent with observations in hemodialysis populations.²² Education impacts understanding of illness, treatment options, and social support resources, functioning within the microsystem of the socio-ecological framework. Patients with higher educational attainment tend to have stronger social networks, better information access, and enhanced communication skills, which enable them to participate more actively in health-related seminars and patient organizations, thereby reducing their risk of social isolation. Conversely, those with lower educational levels face challenges in comprehending medical information, leading to increased uncertainty in disease management and greater social isolation. This underscores the need for targeted educational interventions to address disparities and enhance social integration.²² Physical activity also plays a critical role in mitigating social isolation among PD patients, influenced by the limitations imposed by the treatment's demand on time and energy. Reduced physical mobility, fears related to post-exercise complications, and the general weakness associated with PD treatment contribute to increased isolation. Additionally, emotional responses to the chronic nature of the condition and decreased sympathetic nervous system output further reduce social interaction.^{23–26} To counteract these effects, it is crucial to promote exercise through educational initiatives

that highlight its benefits, encouraging participation in accessible physical activities and organized recreational events. This approach can expand social networks and improve social participation, particularly important for those unemployed due to their illness, who face prolonged isolation at home. Enhancing community services and advocating for more job opportunities for PD patients are recommended to facilitate their integration into community life and improve their overall well-being.

We have identified a novel correlation where PD patients with normal hemoglobin (Hb) levels exhibit a higher risk of family isolation, a phenomenon not extensively documented in the chronic kidney disease (CKD) literature. For chronic kidney disease patients, the WHO recommends that adult males with hemoglobin levels below 130 g/L, non-pregnant females below 120 g/L, and pregnant females below 110 g/L can be diagnosed with anemia. Therefore, in this study, an Hb level of 120 g/L was chosen as the cutoff for anemia.²⁷ Prior to our cross-sectional survey, our research hypothesis was that “Hb levels influence the degree of social isolation in PD patients, with anemic patients experiencing higher levels of social isolation”, based on the traditional view that “anemic patients might reduce social interactions due to physical weakness and lack of energy, thus increasing the risk of social isolation”. Conversely, patients with lower Hb levels, who are more likely to be clinically anemic, often require more assistance from family members, thereby maintaining stronger family ties and reducing the risk of isolation. This inverse relationship between Hb levels and social support needs highlights a complex interplay between physical health and social dynamics in chronic illness management.²⁸ Future research should explore longitudinal data to better understand the causal relationships and develop targeted interventions that consider both medical and social needs of PD patients.²⁹ Additionally, incorporating a broader range of biochemical parameters could provide a more comprehensive understanding of how different aspects of health influence social isolation.

This association suggests potential oversights in social support structures for non-anemic individuals, highlighting a need for further research to elucidate the mechanisms underlying disparities in the perceived need for support among non-anemic patients.²⁴ Our findings also emphasize the significant role of family dynamics in patient well-being, demonstrated by the correlation between low Family APGAR scores and increased social isolation—a trend observed in both PD and hemodialysis populations.³⁰ Family support, a meso-level component of the socio-ecological theory, alleviates stress and boosts confidence, thus reducing social isolation. PD patients, who face continuous physical and psychological pressures, benefit immensely from the care and support of family, which not only alleviates feelings of loneliness and helplessness but also enhances self-confidence, enabling more active engagement in social activities and reducing tendencies towards self-isolation.²⁵ Families help bridge social gaps by encouraging reintegration into community life through companionship and guidance, thereby mitigating the profound impacts of isolation. Szeto et al’s research underscores the importance of family involvement, linking social support to improved survival outcomes in PD patients.²⁶ Consequently, we advocate for intensified efforts from healthcare providers and families to fortify support systems, encouraging family participation in managing the patient’s condition to enhance social and emotional welfare and mitigate isolation risks.

This study establishes social anxiety as a significant independent risk factor for social isolation in PD patients, exacerbated by the elevated physiological and psychological stresses associated with long-term PD.³¹ Social anxiety is associated with moderate levels of social support. Prior research supports the notion that deficits in robust social support systems play a crucial role in exacerbating social anxiety and subsequent isolation among these patients.³² To counteract these effects, we recommend that healthcare providers and families focus on establishing stable social support networks, promoting patient participation in external social activities, and facilitating active integration into broader community life. Innovative interventions like animal-assisted therapy and engaging PD patients in horticulture activities have shown promise in moderating emotional balance and enhancing social interaction, thereby reducing feelings of loneliness and social anxiety.^{33,34} Organizing patient care groups and implementing initiatives like “Nurse Listening Day” can significantly bolster patients’ sense of belonging and reduce social anxieties within healthcare settings. Broader societal initiatives, including conducting kidney care awareness campaigns and enhancing job opportunities for those undergoing PD, are crucial for integrating the PD population more fully into the community, ultimately enhancing their quality of life and well-being.

A limitation of this study is its small sample size and cross-sectional design, which restricts the generalizability of the findings. Future research should involve large-scale, multicenter studies to more definitively ascertain the impact of hemoglobin levels on social isolation among PD patients. Additionally, incorporating longitudinal follow-up would

provide deeper insights into the long-term effects of social isolation on this patient population, allowing for a more comprehensive understanding of its implications over time.

Conclusion

Our study highlights the pervasive impact of social isolation among PD patients, exacerbated by the solitary nature of home-based dialysis. Key determinants identified include education level, physical activity, and hemoglobin concentration, each playing a significant role in the degree of isolation experienced. Our findings suggest that enhancing educational outreach, promoting physical engagement, and strengthening family involvement are crucial for mitigating social isolation. Furthermore, interventions such as animal-assisted therapy and community gardening have demonstrated potential in fostering patient engagement and reducing feelings of isolation. Addressing these factors is vital for improving the integration of PD patients into community life, enhancing their overall quality of life, and ensuring better health outcomes.

Ethical Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki. This study received ethical approval from the hospital ethics committee (K-2023-104-01).

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors have no relevant financial or potential conflicts of interest to disclose.

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