Indus Journal of Social Sciences

Online ISSN: 2960-219X
Print ISSN: 2960-2203
Volume 3, Number 2, 2025, Pages 1106 – 1114
Journal Home Page
https://induspublishers.com/IJSS/about

Determinants of Adjustment Problems in Hemodialysis Patients: The Role of Medical Trauma and Cognitive Impairments

Dr. Iram Naz[1] & Saba Rehman[2]

[1]*Assistant Professor, University of Gujrat, Punjab, Pakistan, Email: iram.naz@uog.edu.pk*
[2]*Student MS Clinical Psychology, National University of Medical Sciences NUMS, Email: sabarehman7805@gmail.com*

ARTICLE INFO

Article History:

Received:	*April*	*04, 2025*
Revised:	*May*	*18, 2025*
Accepted:	*June*	*06, 2025*
Available Online:	*June*	*20, 2025*

Keywords:

Medical Trauma, Cognitive Problems, Adjustment Problems and Hemodialysis Patients

Corresponding Author:
Dr. Iram Naz
Email:
iram.naz@uog.edu.pk

ABSTRACT

The objective of the study was to explore the Medical Trauma and Cognitive Problems as a significant determinant of Adjustment Problems in Hemodialysis patients. It was cross sectional study in which 200 hemodialysis patients were evaluated from either gender over the age older than 19 were studied. There were 52% male participants and 48% female participants. Hemodialysis patients were studied from different hospitals of Pakistan, such as Sialkot Kidney Hospital, Saad Hospital Daska, Hameeda Bashir Hospital Daska, District Head Quarter Daska, Bhati Hospital Gujranwala and District Head Quarter Gujranwala. The Scale of Adjustment for Adults, Experience of Medical Trauma Scale (EMTS) and Urdu version of the Montreal Cognitive Assessment was used in the study. Consent form and demographic information was also taken. The Multiple linear regression and Neural Network analysis was applied to examine the hypotheses. Results has confirmed that medical trauma and cognitive problems were the significant predictor of adjustment problems in hemodialysis patients [R^2=.285; F (2, 197) = 39.309, p<.01]. Trauma can alter how we remember specific events from the past. Findings explained 28.5% variation in the adjustment problems of hemodialysis patients was because of cognitive problems and medical trauma. According to the percentage, medical trauma is the most significant predictor of adjustment problems, with a 0.641 (normalized importance of 100%) followed by cognitive problems, 0.359 (normalized importance of 56%). Among the factors, medical trauma contributes more to adjustment problems than cognitive problems do both factors were influencing and predicting the issues related to adjustment.

Introduction

Chronic kidney disease (CKD) is a growing public health concern on a global scale. Chronic kidney disease (CKD) is associated with increased morbidity and medical resource utilization. In Pakistan, people with chronic kidney disease (CKD) are frequently detected late (Shafi et al., 2018). Chronic kidney disease (CKD) is a public health concern that significantly impairs a patient's quality of life and has the potential to become epidemic in nature. Diabetes, high blood pressure, and glomerulonephritis can contribute to kidney issues. Chronic renal disease patients are treated with hemodialysis. However, there are disadvantages to this treatment as well, like mental and psychological disorders. For many of these patients, stress, anxiety, depression, and low self-esteem make it difficult to manage their illness. Chronic kidney disease (CKD) is a common general health issue. It has been discovered that psychiatric problems affect more than 50% of individuals undergoing hemodialysis for end-stage kidney disease. Unfortunately, their attending physicians and nurses often ignore these psychological disorders (Alkhaqani, 2022). Dialysis is used to treat individuals with end-stage renal disease (ESRD), another name for kidney failure. One of the most popular therapies for people with end-stage renal disease or kidney failure is hemodialysis. Hemodialysis uses a machine to clean and filter your blood in order to temporarily removed toxic waste products, excess salt, and water from your body. Hemodialysis comprises a difficult process for patients. It entails numerous visits to hospital or dialysis centers. It generally two or three times a week. Hence indicating significant changes in the regular way of patients' living (Avramovic, & Stefanovic, 2012, Landreneau & Landreneau, 2010). Hemodialysis is a medical or therapeutic knowledge applied for several renal illnesses, disorders and diseases (Noto, Miyazaki, Takeuchi & Saito 2020). Many of these patients may face many problems but the current study was done to see the medical trauma in them.

Medical trauma defined as, it is the form of trauma, which appear from direct exposure to medical setting. It emerged through complex collaboration between the patients; the medical setting, the medical staff as well as the diagnostic or procedural encountering that can have very influential influence due to patient's unique understanding of the incidents. A definition of medical trauma that highlights its key features. These features include the fact that medical trauma is relational, contextual, continuum, biopsychosocial, and subjective. These four factors are contributing in medical trauma and exploring the categories of medical trauma. Through medical model formula that seems to explain factors. These factors comprises the patients, diagnosis/procedure, medical staff and medical environment (Hall & Hall, 2016).

Medical trauma is evident HD patients .Medical trauma is encounter as result of medical processes, diseases, and having long stay in hospital can have enduring and long long-term effects. Those who encounter medical trauma can originate clinically substantial responses towards Post-Traumatic Stress Disorder, depression, anxiety, somatic complaints and complicated grief (Hall & Hall 2013). Medical trauma is trauma that develops because of close personal contact with the medical environment. It results from multifaceted interactions between patients, medical personnel, the medical setting, and diagnostic and procedural incidents. Medical trauma can have significant psychological consequences because the patient has a unique understanding of the incident. It divides the definition into different parts such as, direct interaction, medical setting, Complex interaction, psychological impact and patient's unique interpretation (Hall & Hall, 2016). Along with medical trauma this study was also done to measure the cognitive functioning of these patients.

Cognitive functioning defined as distinctive mental abilities, comprising reasoning, thinking, learning, attention, language, concentration and visuospatial functioning (Fisher, et al., 2019). In recent years, cognitive functioning in (ESRD) patients has grown to be a significant problem. A meta-analysis of the impact of both treatments on cognitive function found that patients getting hemodialysis had lower cognitive functioning and a higher risk of dementia than those receiving PD (Tian et al., 2019). Research is conduct by Lynch and Lachman in 2020, that exhibit that lifetime trauma experience connected with considerably higher cognitive decline in adulthood. The following cognitive domains listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V). Three types of attention, sustained, split, and selective—as well as processing speed are included in the complex attention domain. An executive function area is a different kind that focuses on a person's capacity for planning and making decisions. Additionally, it addressed issues with working memory, the capacity to take feedback, the ability to remedy mistakes, inhibition, and mental flexibility. Additionally, the fields of learning and memory have discussed the three categories of memory: immediate, recent, and extremely long term. The expressive language category of cognitive ability includes the ability to name objects, recognize words, speak clearly, check grammar, structure sentences, and know the meanings of specific language words. Additionally, visual perception, visuo-constructive thinking, and perceptual motor coordination are the foundations of perceptual-motor function. Finally, the capacity for social cognition aids in the recognition of emotions, evaluation of one's insight, and comprehension of one's own and others' beliefs, desires, and intentions (American Psychiatric Association, 2013).

Since hemodialysis patients frequently experience severe emotional difficulties, such as stress, worry, and depression, as a result of the interruption of their everyday life, psychological adjustment is essential. Emotional instability may result from the need for frequent hemodialysis sessions, lifestyle modifications, and worries about long-term health (Ozkan, & Taylan, 2022; Helali, et al., 2025). The medical trauma and cognitive functioning may hinder these patients adjustment. There effects were also studied on the adjustment problems of these patients.

In Adjustment problem disorders were first listed in the Diagnostic and Statistical Manual of Mental Disorders' third edition, which was introduced in 1968. Disability categories related to human psychological adjustment are part of DSM-5. Changes in emotional and behavioral activity associated with coordinating symptoms and observable responses to stressors are characteristic of this disorder. The period between the stressor's beginning as well as its recurrence is three months. Any of these must have significant clinical disability. Moreover, the symptoms should not be the usual symptoms of mourning. Anxiety, Sad mood, mixed anxiety, depressed mood, conduct disorder, mixed disturbance of emotions, unspecified as well as conduct disorder are all possible diagnoses. The following types of psychological adjustment can be seen if you evaluate the adjustment disorder specifiers: sad mood, anxiety, depressed mood, mixed anxiety, mixed disturbance of emotions, disturbance of conduct and behavior, and unspecified. (American Psychiatric Association, 2013).

Cognitive functioning and adjustments issues are also important to study in dialysis patients because, patients received dialysis treatment for long period they develop cognitive problems and adjustment issues. Research has confirmed that According to a Medical Research Council (MRC) research, 18% of people in the UK had cognitive impairment. The prevalence of cognitive decline is rising globally, and it is more crucial than ever to take action to delay this decline (Rait, et al., 2005).

Chronic kidney disease is more common among African Americans, American Indians, Hispanics, and South Asians, particularly those from Bangladesh, India, Sri Lanka, and Pakistan. In Pakistan, 75 (25.60%) of 293 (97%) individuals acquired chronic renal disease (Imran et al., 2015).

In every community, psychological problems are a disturbing trend. Assessment tools are necessary for identifying and addressing problems. Patients who are receiving hemodialysis treatment may experience unpleasant impacts from psychological issues. Trauma is very significant issue which is experienced by the individuals in any age. Patients receiving hemodialysis had increased rates of depression, anxiety, and stress. Actually, kidney patients who received hemodialysis are very significant population in the Pakistan. Where the physical support of hemodialysis patients is very necessary, due to physically deteriorated, week and unable to perform their daily life task. They faced many psychological issues. As patients received 3-time dialysis treatment in a week, they may develop medical trauma. As a medical trauma is person own psychological and physical experience towards the treatment process. For example, a child frightened from injection every time he develops fear and pain as the dialysis patients could develop medical trauma. By name you can depict that Medical trauma is developed in medical setting.). If we trigger and sum up these psychological issues in hemodialysis patients, then we know about the intensity of the problem and also handle their coping way that how much they have coping abilities to deal these types of psychological problems in hemodialysis patients.

Methodology:

A cross-sectional study was conducted at the Department of Psychology, University of Gujrat. The data for the study were gathered from the hemodialysis patients on the inclusion criteria of age above 19, patients receiving chronic hemodialysis treatment and completed at least 3 months of dialysis. Those with any other physical and psychological disorder must be excluded from the study, along with participants below the age of 19 years. The purposive non-probability sampling technique was used to sample 200 hemodialysis patients from Sialkot, Daska and Gujranwala hospitals.

The Experience of Medical Trauma Scale (LPCC-S, Hall et al., 2015b), Montreal Cognitive Assessment Urdu version (Habib et al., 2010), and Scale of Adjustment Problems for Adults Urdu Version (Naz et al., 2018) were the instruments that were utilized in order to measure the constructs of Medical Trauma, cognitive functioning and adjustment problems.

A thorough demographic questionnaire was also used in order to find out the participants' characteristics. The researcher first approached the authors to request permission to use their instruments for research purposes. After that, the department head provided the official permission letters for the data gathering, which were subsequently turned in to the hospital administration office for approval. In order to gather information, the researcher visited the hospitals personally and spoke with each patients individually. The patient’s informed consent was taken through in-person interviews before giving them the scale battery. In addition to the basic and crucial facts that could be found in relation to the study, the respondents were provided instructions at the start of the research project. Most importantly, respondents might leave the study at any time without facing any consequences. The survey respondents were persuaded to see the scale statements logically and to give an honest response that appropriately expressed their feelings. The questionnaire was used to capture the responses. The complete ethical justifications of each response were maintained.

Data Analysis:

Data analysis was carried out utilizing SPSS version 24.0 was used for statistical analysis. The data was analyzed using neural network analysis, multiple regression, and descriptive statistics to forecast the relationship between the variables.

Result:

The 200-hemodialysis patients were studied in the research. The majority of the respondents belong to an age range of 21-30, 51-60, 41-50, and 31-40 respectively. The male female participation difference was not much as female 48% and male 52%. Most of the respondents having education of matriculation. The majority of the respondents belongs to middle class family and were married.

Table 1: ***Regression analysis of Medical Trauma and Cognitive Functioning in Hemodialysis Patients (N=200)***

R	R^2	R^2 Adj	F	P	SE
.534	2.285	.278	39.309	<.001	15.06851

To find out if medical trauma and cognitive issues predicted adjustment issues among hemodialysis patients, a multiple regression analysis was performed. The results are shown in Tables 1 and 2. Overall, the model was statistically significant (F (2,197) = 39.31, P<.001), with medical trauma and cognitive functioning accounting for around 28% of the variance in adjustment issues (R2=.285).

Table 2: ***Regression analysis of Medical Trauma and Cognitive Functioning predicting Adjustment Problems in Hemodialysis Patients (N=200)***

						95.0% Confidence Interval for B	
Variables	**B**	**SE**	**Beta**	**T**	**P**	**Lower Bound**	**Upper Bound**
Constant	63.674	3.384		18.82	<.001	57.000	70.348
Cognitive Problems	.006	.179	.002	.034	.973	-.347	.359
Medical Trauma	.302	.034	.534	.034	<.001	.234	.369

SE = Standard Error , CI = Confidence Interval

Further, as the overall model was statistically significant, If look individually, medical trauma emerged as a significant positive predictor of adjustment problems, indicating that higher levels of medical trauma were associated with greater adjustment difficulties. In contrast, cognitive problems were not a significant predictor, suggesting they did not contribute meaningfully to the variance in adjustment problems.

Table 3: ***Predictor association among variables based on training and testing relative error***

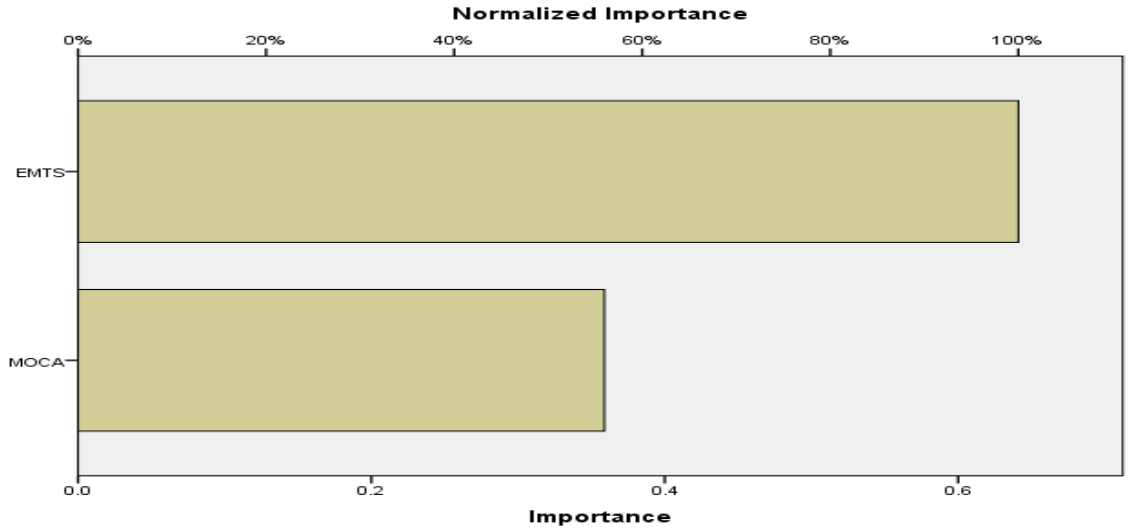
Relative Error	
Training	**Testing**
.777	.776

This study investigate and predict the association among variables based on training and testing. Neural network analysis used to anticipate the perceived importance of the medical trauma and cognitive problems in effecting the adjustment of hemodialysis patients. The higher the predictability of the link between the variables, the smaller the difference between the relative errors of training and testing. We found no difference. Hence, it confirmed that medical trauma and cognitive problems are the determinant of adjustment problems in hemodialysis patients

Table 4: ***Predictive importance of independent factors***

Variables	**Importance**	**Normalized Importance**
Experience of Medical Trauma Scale (EMTS)	.641	100.00%
Montreal cognitive assessment (MOCA)	.359	56.00%

Table 4 investigates the predictive importance of independent factors, Experience of Medical Trauma Scale (EMTS) & Montreal Cognitive Assessment (MOCA). According to the proportion, medical trauma is the most significant predictor of adjustment problems (0.641, 100% normalized relevance), followed by cognitive impairments (0.359, 56% normalized importance). Medical trauma is one of the factors that contributes more to adjustment issues than cognitive issues. The psychological adjustment problems were predicted and contributed to by both variables.



Discussion

Dialysis unlike other treatment process is a traumatic incident that leads to distressing consequences in patients. Patients who suffer from the symptoms of ESRD can treated with HD, which will ultimately help those live better lives. It classified as hemodialysis and peritoneal dialysis. The study conducted on hemodialysis patients, and the objective of the study is the medical trauma and cognitive functioning would be the significant determinant of adjustment Problems. According to the regression analysis, hemodialysis patients' adjustment issues were significantly influenced by medical trauma and cognitive functioning [R2=.285; F (2,197) =

39.309, p<.01]. Furthermore, the neural network's results demonstrated the correlation between variables while maintaining the same relative error for testing and training. This smaller discrepancy, according to our research, indicates that the model is not over trained. Medical trauma and cognitive issues have a 0.641 (100% normalized relevance) and 0.359 (56% normalized importance) impact on hemodialysis patients' adjustment issues, respectively. Prior research has also demonstrated a significant correlation between medical trauma and cognitive performance as a driver of adjustment problems.

Chronic kidney disease is a universal and public health issue. People suffering from chronic kidney disease worldwide about 50 million (Ahmed, et. al., 2020). Dialysis unlike other treatment process is a traumatic incident that leads to distressing consequences in patients. Patients who suffer from the symptoms of ESRD can treated with HD, which will ultimately help those live better lives. It classified as hemodialysis and peritoneal dialysis. Although research into medical trauma is still in its infancy, studies have found prominent psychological distress and there is less literature available that confirmed the relationship between medical trauma and adjustment problems in hemodialysis patients. However, the literature of trauma that cited in recent study can confirm the relationships. Literature confirm that anyone encounter a very problematic and unpleasant phenomenon, can cause mental or emotional problems for a long period. (Hall & Hall, 2016). Literature also confirmed that there was emerging sign that adjustment disorder could associated with stressful life incidents. Furthermore, it might happen to subsequent experience to traumatic instances, such for example terror attack or serious injury (O'Donnell, et. al., 2016; Mahat-Shamir, et. al., 2017).

People who have cancer (8–34%), heart disease (8–20%), or catastrophic injuries (8–51%) are consistently recognized to have medical trauma and symptoms of post-traumatic stress disorder (PTSD) (Marziliano et al., 2020; Marques et al., 2020; Muller et al., 2021; Roberge et al., 2010).

Hemodialysis patients are at higher risk of associated psychiatric disorders such as depression, anxiety, and stress symptoms, (Chen, Tsai, Hsu, Wu, Sun, Chou & Wang, 2010). Experience to previous trauma specifies a higher risk of stress symptoms from following trauma (Breslau, Chilcoat, Kessler & Davis, 1999). A complex phenomenon, adjustment. When a person finds it challenging to adapt to their surroundings, they use a variety of coping mechanisms (World Health Organization, 2018).

According to a 2013 study by Jung and colleagues, people with chronic renal failure frequently exhibit cognitive impairment. It is unclear how depression and cognitive function relate to people receiving continuous dialysis. Cognitive function and the frequency of depression symptoms were negatively correlated. According to the findings, depression and cognitive issues are strongly correlated (Jung et al., 2013).

A study by Nyberg et al. (2021) examined cross-sectional associations between anxiety severity and executive function in patients with primary care diagnosis of anxiety disorders. The findings showed that, regardless of the presence of concurrent severe depression, the severity of anxiety in people with anxiety disorders was linked to working memory-related executive functions but not to lower IQ. More severe anxiety was also associated with lower digit span test scores (R2=0.109, B=-0.040, p=0.018).

Recent study on the topic of medical trauma and cognitive problems would be significant determinant of adjustment problems is unique. There is no study on this topic any before. This

study is unique in this way. In recent study, it confirmed that both medical trauma and cognitive problems contribute to adjustment issues in hemodialysis patients.

Conclusion

The study shows that adjustment problems were the result of medical trauma and cognitive functioning in hemodialysis Patients. Medical trauma and cognitive problems were the determinants of adjustment problems in hemodialysis patients. Additional, medical trauma plays more important role in affecting adjustment problems as compared to cognitive problems.

References

1. Ahmad, B., Zaman, F. U., Abrar, S. M., Rahim, S., Hussain, M. A., & Shah, S. A. (2020). Effect of Age and Gender on Acute Complications of Hemodialysis in Patients With Chronic Kidney Disease Secondary to Diabetes Mellitus. *Pakistan Armed Forces Medical Journal*, (3), 781.
2. Alkhaqani, A. L. (2022). Psychological impact of chronic kidney disease and Hemodialysis: Narrative review. *Psychosom Med Res*, *4*(2), 1-5.
3. American Psychiatric Association. Trauma- and stressor-related disorders. In Diagnostic and Statistical Manual of Mental Disorders (DSM-5®), 5th ed.; American Psychiatric Association Publishing: Washington, DC, USA, 2013
4. Avramovic, M., & Stefanovic, V. (2012). Health-related quality of life in different stages of renal failure. Artificial organs, 36(7), 581-589.
5. Breslau, N., Kessler, R. C., Chilcoat, H. D., Schultz, L. R., Davis, G. C., & Andreski, P. (1998). Trauma and posttraumatic stress disorder in the community: the 1996 Detroit Area Survey of Trauma. *Archives of general psychiatry*, *55*(7), 626-632.
6. Chen, C. K., Tsai, Y. C., Hsu, H. J., Wu, I. W., Sun, C. Y., Chou, C. C., ... & Wang, L. J. (2010). Depression and suicide risk in hemodialysis patients with chronic renal failure. *Psychosomatics*, *51*(6), 528-528.
7. Deatrich, K. G., & Boyer, B. A. (2016). Post-traumatic stress disorder related to surgery: Prevalence and risk factors. Springer
8. Fisher, G. G., Chacon, M., & Chaffee, D. S. (2019). Theories of cognitive aging and work. In Work across the lifespan (pp. 17-45). Academic press.
9. Habib, F., Evans, J. J., & Raiz, M. N. (2010). Montreal Cognitive Assessment - Test Urdu. http://www.mocatest.org/wp content/uploads/2015/03/MoCA-Test-Urdu.pdf
10. Hall, M. F., & Hall, S. E. (2013). When treatment becomes trauma: Defining, preventing, and transforming medical trauma. *America Counseling Association*, *73*.
11. Hall, M. F., & Hall, S. E. (2016). *Managing the psychological impact of medical trauma: A guide for mental health and health care professionals*. Springer Publishing Company
12. Helali, B. A. N., Eliwa, S. M., Nosir, F. A. A. E. S., & Adam Mohamed, S. S. (2025). Impact of a psychoeducational nursing program on self-efficacy and psychological adjustment in hemodialysis patients. *Scientific Reports*, *15*(1), 19568.
13. Imran, S., Sheikh, A., Saeed, Z., Khan, S. A., Malik, A. O., Patel, J., ... & Hussain, A. (2015). Burden of chronic kidney disease in an urban city of Pakistan, a cross-sectional study. *J Pak Med Assoc*, *65*(4), 366-69.
14. Jung, S., Lee, Y. K., Choi, S. R., Hwang, S. H., & Noh, J. W. (2013). Relationship between Cognitive Impairment and Depression in Dialysis Patients. *Yonsei Medical Journal*, *54*(6), 1447

15. Lynch, K. S., & Lachman, M. E. (2020). The effects of lifetime trauma exposure on cognitive functioning in midlife. Journal of traumatic stress, 33(5), 773-782.
16. Mahat-Shamir, M., Ring, L., Hamama-Raz, Y., Ben-Ezra, M., Pitcho-Prelorentzos, S., David, U. Y., ... & Lavenda, O. (2017). Do previous experience and geographic proximity matter? Possible predictors for diagnosing Adjustment disorder vs. PTSD. Psychiatry research, 258, 438-443.
17. Marques, P. T., Beltrami, L. P. B., Rosa, C. T., Massuda, R., Barbosa, F. J. L., Zetola, V. F., & Lange, M. C. (2020). Post-traumatic stress disorder in non-disabled ischemic stroke patients. General Hospital Psychiatry, 67, 150–151.
18. Marziliano, A., Tuman, M., & Moyer, A. (2020). The relationship between post-traumatic stress and post-traumatic growth in cancer patients and survivors: A systematic review and meta-analysis. Psycho-Oncology, 29, 604–616.
19. Naz, I., Bano, Z., & Leghari, N. U. (2018). Construction of scales on depression, anxiety and conduct disturbance of adjustment for adults: Developing a reliable measure. Isra Journal of Medical Sciences, 10(5), 310–314.
20. Noto, S., Miyazaki, M., Takeuchi, H., & Saito, S. (2020). Research Relationship Between Hemodialysis and Health-Related Quality of Life-A Cross-Sectional Study of Diagnosis and Duration of Hemodialysis.
21. Nyberg, J., Henriksson, M., Wall, A., Vestberg, T., Westerlund, M., Walser, M., ... & Åberg, M. (2021). Anxiety severity and cognitive function in primary care patients with anxiety disorder: a cross-sectional study. *BMC psychiatry*, *21*(1), 1-13.
22. O'Donnell, M. L., Alkemade, N., Creamer, M., McFarlane, A. C., Silove, D., Bryant, R. A., ... & Forbes, D. (2016). A longitudinal study of adjustment disorder after trauma exposure. American Journal of Psychiatry, 173(12), 1231-1238.
23. Ozkan, I., & Taylan, S. (2022). Diet and fluid restriction experiences of patients on hemodialysis: A meta-synthesis study. *Revista de Nefrología, Diálisis y Trasplante*, *42*(1), 22-40.
24. Rait, G., Fletcher, A., Smeeth, L., Brayne, C., Stirling, S., Nunes, M., ... & Tulloch, A. J. (2005). Prevalence of cognitive impairment: results from the MRC trial of assessment and management of older people in the community. *Age and ageing*, *34*(3), 242-248.
25. Rait, G., Fletcher, A., Smeeth, L., Brayne, C., Stirling, S., Nunes, M., ... & Tulloch, A. J. (2005). Prevalence of cognitive impairment: results from the MRC trial of assessment and management of older people in the community. *Age and ageing*, *34*(3), 242-248.
26. Shafi, S. T., Saleem, M., Anjum, R., Abdullah, W., & Shafi, T. (2018). Refusal of hemodialysis by hospitalized chronic kidney disease patients in Pakistan. *Saudi Journal of Kidney Diseases and Transplantation*, *29*(2), 401-408.
27. Tian, X., Guo, X., Xia, X., Yu, H., Li, X., & Jiang, A. (2019). The comparison of cognitive function and risk of dementia in CKD patients under peritoneal dialysis and hemodialysis: A PRISMA-compliant systematic review and meta-analysis. *Medicine*, *98*(6), e14390.
28. Tian, X., Xia, X., Yu, H., Chen, H., Jiang, A., & Xin, L. (2022). Cognitive dysfunction and its risk factors in patients undergoing maintenance hemodialysis. *Neuropsychiatric Disease and Treatment*, 2759-2769.
29. World Health Organization. (2018). International classification of diseases for mortality and morbidity statistics (11th revision).