Original Article

Factors Contributing to the Burden of Depression Amongst Patients Receiving Hemodialysis at Public and Private Dialysis Centres

Abstract

Background: Chronic kidney disease poses significant morbidity on patients and subjects them to stressors in financial, occupational, and social aspects, making them vulnerable to mental health problems. We estimated the prevalence of depression in CKD patients undergoing maintenance hemodialysis (MHD) and evaluated the factors affecting it. **Materials and Methods:** This cross-sectional survey included 282 patients from four Apex Kidney Care centers, Mumbai. Their mental health was assessed using PHQ-9 survey, a validated questionnaire for identifying depression. Categorical variables were compared using the Chi square test and continuous variables with the Mann Whitney U test. Logistic regression was used for multivariate analysis and odds ratios were calculated. **Results:** Females constituted 36.52% of the study population. There was an equal distribution of patients from charitable centers (142 patients) and private centers (140 patients). The current analysis focused on those patients (n = 60) with significant depression i.e. a PHQ-9 score of 10 or greater, and these were compared to the rest of patients (n = 222). In logistic regression, female gender ($p = 0.002$), catheter as access ($p = 0.025$), stress of food restriction ($p < 0.0001$) showed statistically significant positive association, whereas being employed ($p = 0.022$) showed statistically significant negative association with depression. The distribution of patients with significant depression in both public (21.10%) and private (21.40%) centers was equal. **Conclusion:** The prevalence of depression in MHD patients is substantial. Employment status, catheter access, and food restrictions are the modifiable factors influencing mental health. A focused approach on maximizing arterio-venous fistula creation, diet counseling, employment friendly shift adjustments, and mental health counseling can help mitigate this challenge.

Keywords: *Mental health, Depression, Hemodialysis, PHQ-9 score*

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Introduction

Chronic kidney disease (CKD) is increasing in prevalence globally, contributing to the growing number of patients requiring maintenance hemodialysis (MHD). In India, nearly 2 lakh new patients are being diagnosed with end-stage renal disease (ESRD) every year. Depression, although a well-established independent mental health issue, remains largely under-evaluated, under-addressed, and sometimes ignored in patients with chronic kidney disease on dialysis. This is because many symptoms of uremia mimic depression, potentially masking true organic depression caused by CKD itself. Being on dialysis generates stressors, including physical, financial, occupational, social, and dietary challenges, which add to the already overburdened mental makeup patients. This study aims to determine the prevalence of depression in patients undergoing MHD at public and private dialysis centers and analyze the factors affecting it.

Materials and Methods

This study is a cross-sectional survey of patients undergoing MHD at four dialysis centers of Apex Kidney Care in Mumbai. The survey was conducted from August to September 2023. Institutional Review Board approval was obtained. Out of the initially targeted 300 patients, 18 refused consent, leaving a study group of 282 patients who provided consent.

Two of the four centers were public charitable centers, and the other two were private, fee-for-service centers. Out of these 282 patients, 142 were from public centers,

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and the remaining 140 were from private centers. The survey gathered information on all parameters that could influence the mental health of these patients, including, demographics, education, family size, socio-economic status, and employment status for individuals aged 18–60 years, and the stress induced by food and fluid restrictions. The socio-economic status of patients was calculated using the modified Kuppuswamy scale.[1] Individuals educated beyond the 12th grade were classified as 'significantly educated'. All patients were assessed for depression using the Patient Health Questionnaire 9 (PHQ-9) survey format [Supplementary File 1]. The survey is a validated questionnaire for assessing depression. It scores each of the 9 DSM-IV criteria as 0 (not at all) to 3 (nearly every day. In addition, a 10th question gauged the difficulty in a patient's daily life based on the results of the previous nine questions. The score from this questionnaire categorized subjects into 6 groups: (A) No depression = score 0, (B) Minimal depression = score 1–4, (C) Mild depression = score 5–9, (D) Moderate depression = score 10–14, (E) Moderately severe depression = score 15–19, and (F) Severe depression = score 20–27.[2] This analysis focused on patients with 'significant depression,' i.e., a PHQ-9 score of 10 or greater (moderate, moderately severe, and severe depression), comparing this group with patients who had lesser degrees of depression (nil, minimal, or mild depression).

The authors of this manuscript (one of whom is a Psychiatry resident) administered the PHQ-9 questionnaire to every patient regardless of their literacy level. The authors read out the questions to each patient in their native language and recorded the patient responses themselves in a Google form.

Statistical analysis

The dataset comprised 60 data points for significantly depressed patients and 222 for the remainder, highlighting an imbalance issue. To rectify this, we employed the Synthetic Minority Oversampling Technique (SMOTE), a statistical method that balances the dataset by generating new instances for significantly depressed patients based on existing data points. This approach mitigates class imbalance effects, enhancing the robustness and accuracy of our analysis. We compared the categorical variables using the Chi square test and the continuous variables using the Mann–Whitney U test. Logistic regression was utilized for multivariate analysis comprising significantly depressed patients versus the rest, with calculated odds ratios.

Results

The median age of the surveyed patients was 55 (range 15-88) years. There were 179 males and 103 females. The majority of patients depression (76%). Given the high prevalence of depression in these hemodialysis patients, this analysis focused on those patients with 'significant depression' i.e., a PHQ-9 score of 10 or greater (moderate, moderately severe, and severe depression) to evaluate those patients at highest risk. The group with significant depression was compared with remaining patients [Table 1].

Table 1: Factors associated with significant depression in hemodialysis patients

	Significantly depressed (n = 60) PHQ-9 score 13	Rest (n = 222) PHQ-9 score 3	p value
AV fistula	73.3% (44)	91% (202)	0.0003*
Catheter	26.7% (16)	9% (20)	
Male	50% (30)	77.1% (149)	0.0146*
Females	50% (30)	32.9% (73)	
Employed	17.39 (8)	34.51% (49)	0.0282*
Unemployed	82.61% (38)	65.49% (93)	
Significantly educated	25% (15)	25.3% (56)	0.9716
Low/no education	75% (45)	74.7% (166)	
Married	75% (45)	75.7% (168)	0.9140
Single	25% (15)	24.3% (54)	
Public center	50% (30)	50.5% (112)	0.9506
Private center	50% (30)	49.5% (110)	
Lower socio-economic class	16.67% (10)	24.77% (55)	0.1858
Non-lower socio-economic class	83.33% (50)	75.23% (167)	
Stressed by food restriction	40% (24)	8.6% (19)	<0.0001*
Not stressed	60% (36)	91.4% (203)	
Age (years)	54.5 (27-86)	55 (18 - 88)	0.6114
Dialysis vintage (years)	2.85 (0.15 - 21.69)	3.37 (0.21 - 21.54)	0.1224
Family size	4 (1 - 14)	4 (1 - 15)	0.3908
Serum albumin (gm/dl)	4.1 (2.6 - 4.9)	4.1 (3.1 - 5.1)	0.4927
Hemoglobin (gm/dl)	9.675 (5.65 - 13.80)	10.05 (5.7 - 15.25)	0.0516

*: significant, PHQ: Patient Health Questionnaire, AV Fistula: Arterio-venous Fistula

There were no differences found in age, duration of dialysis, education, marital status, type of dialysis center, family size, socio-economic status, and the mean hemoglobin and serum albumin levels between those suffering from significant depression and the rest of the patients. Parameters that were statistically significant between the two groups in univariate analysis were - stress induced by food restrictions, having a catheter as vascular access, female gender, and being unemployed. In logistic regression [Table 2], female gender ($p = 0.002$), having a catheter as vascular access ($p = 0.025$), and stress induced by food restrictions ($p < 0.0001$) showed statistically significant positive associations with depression, while being employed ($p = 0.022$) showed a statistically significant negative association.

Table 2: Results of logistic regression

Parameters	p value	Odds ratio	CI
Gender: Female	0.002	1.9829	(1.2841, 3.0621)
Vascular access: Catheter	0.025	2.0366	(1.0945, 3.7782)
Food restriction stress: Yes	<0.001	6.5095	(3.7187, 11.3947)
Employment: Employed	0.022	0.5166	(0.2939, 0.9081)

CI: Confidence Interval

There was similar number of patients in public (142 patients) and private (140 patients) centers [Table 2]. Expectedly, there was a higher prevalence of patients from lower socioeconomic strata (42.25%) in the public centers compared to the private centers (3.57%). This socioeconomic effect was also reflected in their education, with 9.10% of the patients in public centers educated at or above 12th grade, compared to 41.50% in the private centers. There was a significantly higher unemployment rate in the public centers (74.59%) compared to the private centers (60.61%, $p = 0.0465$). Patients in public centers had been on dialysis longer [median 4.87 (0.21-21.69) years] compared to those in private centers [median 2.55 (0.15-18.86) years] ($p < 0.0001$). There were fewer females (31.7%) in public centers compared to private centers (41.4%, $p = 0.0895$). The stress of food restriction equally impacted patients in both groups, at about 15%. The prevalence of significant depression was equal in both groups (21.1% in the public centers, 21.4% in private centers).

When comparing the differences between public and private centers regarding the four major factors contributing to significant depression [Table 3], we observed several disparities. Patients at public centers had lesser catheter use as access (7%) compared to private centers (18.60%, $p = 0.0037$), a lower proportion of females (31.47% vs 41.40%, $p = 0.08$), and a higher unemployment rate (74.59% vs 60.61%, $p = 0.0465$) compared to those at private sectors.

Table 3: Difference between patients on dialysis at public and private centers

	Public (n = 142)	Private (n = 140)	p value
Significantly depressed	21.1% (30)	21.4% (30)	0.9506
Not depressed	78.9% (112)	78.6% (110)	
Lower socio-economic class	42.25% (60)	3.57% (5)	<0.001*
Non-lower socio-economic class	57.75% (82)	96.43% (135)	
Significantly educated	9.1% (13)	41.5% (58)	<0.0001*
Poorly educated	90.9% (129)	58.5% (82)	
Males	68.3% (97)	58.6% (82)	0.0895
Females	31.7% (45)	41.4% (58)	
AVF	93% (132)	81.4% (114)	0.0037*
Catheter	7% (10)	18.6% (26)	
Employed	25.41% (31)	39.39% (26)	0.0465*
Unemployed	74.59% (91)	60.61% (40)	
Stressed by food restriction	15.49% (22)	15% (21)	0.9083
Not stressed	84.51%(120)	85% (119)	

*: statistically significant, AVF: Arterio Venous Fistula

Discussion

There is a wide spectrum of psychiatric illnesses to which patients on hemodialysis are susceptible, including depression, anxiety, organic disorders, dementias, and substance abuse.[3] Their true prevalence is unknown because these conditions are not proactively looked for. Additionally, their diagnosis is confounded by varying definitions and a variety of screening methods, which overlap with symptoms of uremia and effects of medication. As a result, psychiatric disorders in patients with ESRD are largely under-recognized both in research and clinical care.[4,5]

Several factors contribute to depression in hemodialysis patients. Ongoing physical symptoms, dietary restrictions, travel limitations and frequent hospital visits impact their quality of life (QOL).[6] These patients experience social isolation due to physical limitations imposed by their dialysis treatments, which further contributes to depression.[7] Additionally, the financial burden of dialysis and medication costs are a constant source of stress.[8] The patients' perceptions of their illness and their abilities to cope also impact their emotional well-being. Negative perceptions and maladaptive coping strategies contribute to this issue.[9] Changes in physical appearance due to fluid retention, weight gain or loss, and other dialysis-related factors can also affect body image and self-esteem, all contributing to depression.[10,11]

The issue of mental health is a commonly overlooked in the management of patients undergoing hemodialysis.

This is because the dialysis team at the center primarily focusses on the treatment itself and to address the patient's medical conditions, such as blood sugar, blood pressure, vascular access, and nutrition, during the 4-hour session. This leaves limited time to address mental health. Additionally, patients who already visit the dialysis center three times a week are generally reluctant to schedule additional visits to see a mental health specialist issue. Factors such as time constraints, societal attitudes, and cost implications of seeking help contribute to this mindset.

Depression is a medical condition that is diagnosed through a clinical interview conducted by a qualified professional but can also be identified using screening questionnaires administered to patients. There are several such screening tools available. A 2002 literature review found that the median sensitivity across 16 screening tools for major depression was 85%, ranging from 50% to 97%, while the median specificity was 74%, ranging from 51% to 98%.[12] Some of these screening tools include the Hamilton Depression Rating Scale (HDRS), Beck Depression Inventory (BDI), Patient Health Questionnaire (PHQ), Major Depression Inventory (MDI), Center for Epidemiologic Studies Depression Scale (CES-D), and Zung Self-Rating Depression Scale (SDS).

We used the PHQ-9 tool as it offers several advantages over other tools, contributing to its popularity. It consists of 9 questions, which makes it quick to administer. Based on DSM-IV criteria for major depressive disorder, it ensures alignment with diagnostic standards for depression. In addition, we used a PHQ-9 score more than 10 as the threshold to compare the two patient groups. This cut-off ensures high sensitivity and specificity of the diagnosis compared to a structured mental health professional interview.[13,14] Additionally, this scoring system has been validated in various populations, including different cultural and language groups, demonstrating its reliability and validity across diverse settings.[15] In this study, the mean PHQ-9 score in the significantly depressed group was 14.05±1.23 compared to 3.38±2.62 in the rest of the patients.

A systematic review and meta-analysis by Palmer *et al.* examined the prevalence of depression in 216 studies involving 55,982 patients with CKD or ESRD. Among patients with CKD, the prevalence of depression was 26.50%, while among those on dialysis, it was higher at 39.30% based on the screening questionnaires.[16] In our study, which included 282 CKD patients undergoing MHD, 76% of all patients suffered from some degree of depression. The prevalence of significant depression (moderate to severe depression, that is, a PHQ-9 score ≥ 10) was found to be 21.28%. These figures are much higher than the study by Ahlawat R *et al.*, which reported a prevalence of the same degree of depression among hemodialysis patients as 9.80%.[17] In a similar study involving a Saudi dialysis patient cohort, the prevalence of depressive disorder was found to be 6.80%, with major depression in 3.20% of patients.[18]

The increase in the prevalence of depression in patients on MHD in this study, compared to published literature, could be attributed to several factors. Improved recognition and diagnosis of depression in these patients due to the them being more outspoken about these symptoms may have contributed to the observed increase. Additionally, as healthcare providers, we have become more aware of the psychological challenges faced by these patients.[19] Evolving treatment practices in hemodialysis, such as the introduction of more intensive or frequent dialysis regimens, may impact patients' physical and psychological well-being, potentially contributing to higher rates of depression.[20] It is a fact that higher levels of depression in patients on MHD are associated with increased mortality. The effects of depression on patient survival are of the same order of magnitude as medical risk factors. Advances in medical care and dialysis technology have led to improved survival rates among MHD patients, despite living with associated psychological challenges, including depression.[21] Changes in the demographic profile of these patients, including an increase in the prevalence of older individuals and those with multiple comorbidities, could be associated with higher rates of depression.[7] In our study, patients with significant depression had a median dialysis vintage of 2.85 (0.15-21.69) years compared to 3.36 (0.21-21.54) years, in the rest of the patients. However, this was not statistically significant.

This study also analyzed the factors contributing to significant depression in dialysis patients. Various factors, including age, gender, educational status, employment status, socioeconomic status, family strength, marital status, type of dialysis center, type of vascular access, dialysis vintage, stress of dietary restrictions, and laboratory parameters such as hemoglobin and albumin, were studied to assess their association with the development of significant depression.

The type of vascular access used is also a factor affecting mental health. Patients with significant depression had a higher usage of HD catheters as vascular access compared to the rest of the patients ($p < 0.0001$). While dialysis catheters are convenient for immediate use, they are associated with a higher risk of infection, thrombosis, and other complications compared to AVFs. These complications along with their cosmetic implications and the need for multiple replacements, may contribute to increased stress, including depression in patients using a catheter as an access. Patients with AVFs, therefore, experience superior overall outcomes, including mental health, compared to patients with dialysis catheters.[22,23]

The prevalence of significant depression in females (29.13%) was much higher than that in males (16.76%), which was statistically significant ($p = 0.0146$). The

caregiving responsibilities and societal expectations placed on a woman are stressors that can conflict with her hemodialysis treatments. A woman's coping mechanisms may become maladaptive and the limited social support compared to men could impact her ability to manage stressors associated with hemodialysis.[24,25] The effects of CKD and MHD on a woman's physical appearance could also impact her body image and self-esteem.[9] All these factors increase the risk of depression in women undergoing MHD. Gender disparities in access to mental health services and treatment may also contribute to differences in depression rates between men and woman undergoing MHD.

Another important finding in this study is the effect of employment status which significantly influences the occurrence of depression in these patients. The employment rates among those who were significantly depressed was much lower (17.39%) than among the rest of the patients (34.51%, $p = 0.028$). Employment provides a sense of identity, purpose, and social connection, providing opportunities for social interaction and support that can buffer against depression and improve overall well-being. Unemployment among hemodialysis patients is associated with higher rates of depression due to financial stress, difficulty affording healthcare costs, loss of purpose, and decreased social interaction and social isolation.[15,26] While being gainfully employed has tremendous benefits for these patients, it may also affect dialysis adherence due to scheduling problems. Accommodating working patients with early morning or late evening shifts can facilitate their work schedule. Addressing the employment needs of hemodialysis patients through vocational rehabilitation, workplace accommodations, and support services can help mitigate the adverse effects of unemployment on mental health and improve overall outcomes.

Adherence to strict dietary regimens can be challenging for patients on hemodialysis, giving rise to feelings of deprivation, stress, and frustration, all of which could contribute to depressive symptoms. In this study we found that 40% of significantly depressed patients were troubled by dietary restrictions, compared to 8.6% of the rest of the patients ($p < 0.0001$). A recent meta-analysis examining the relationship between depressive symptoms and dietary non-adherence found a significant association between the two.[27]

In recent times, there has been increasing penetration of hemodialysis services even into remote areas of the country through state and centrally sponsored schemes. This availability of free MHD treatments in the public sector has made access of this treatment easier even for the lower socioeconomic strata of society. In this study we also compared patients with this condition in public and private hemodialysis centers. The prevalence of significant depression in public centers was 21.10%, compared to 21.40% in private centers, implying that this is a universal problem in patients receiving MHD irrespective of the center type – private or public. The literature supports the view that patients from the financially weaker sections are more likely to have depression than those who are financially stronger.[28] Despite this socio-economic class divide, our study found that there is no difference in the prevalence of depression between these two patient populations.[29] We had initially imagined that patients in public centers would suffer from a higher degree of depression due to financial challenges posed by their low socioeconomic status. In Table 2, when comparing the differences between the two groups on the four major factors causing significant depression in the univariate analysis, we found that the patients in public centers had significantly lower catheter usage and lower employment rates compared to private patients. However, the effect of gender and stress from food restriction did not significantly differ between the two types of centers. The financial challenge posed by their socioeconomic status was probably mitigated by the availability of free dialysis provided by the government and charitable trusts at these public centers.

Addressing mental health challenges in patients on MHD is important. Focusing on this is essential to help these patients steer clear of adverse outcomes such as, suicide, substance abuse and marital discord.[30-32]

Conclusion

The high prevalence of depression among CKD patients on hemodialysis underscores the necessity of integrating mental health services within the renal care framework and providing psychological support and mental health resources as a standard care. This paper aims to alert healthcare practitioners and policymakers to the reality that mental health disorders, such as depression, coexist with other health issues and may not merely be a symptom of the primary health condition. The importance of employment status as an impacting factor in this context is noteworthy, suggesting that employers, healthcare providers, and policymakers should collaborate to prioritize flexible dialysis schedules and vocational support to facilitate ongoing employment, potentially improving mental health outcomes. A concerted effort to increase AVF usage over catheters, not only improves morbidity and mortality, but can also lead to better mental health in patients. Additionally, adopting a holistic approach that focuses on dietary options rather than restrictions could alleviate the anxiety patients face about their diet. This requires a comprehensive approach that includes psychological support, counseling, patient education, social interventions, and tailored medical management to meet the unique needs of hemodialysis patients.

Conflicts of interest

There are no conflicts of interest.

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