Glob. J. Med. Pharm. Sci.
ISSN PRINT: 2957-3610, **ISSN ONLINE**: 2957-3629
Website: https://globapc.com/
Open Access Journal

Global
Journal of Medical and
Pharmaceutical Sciences

ORIGINAL ARTICLE OPEN ACCESS

Prevalence and Correlates of Depression in Patients with Chronic Kidney Disease: A Hospital-based Cross-sectional Study from Eastern India

Dr. Charan B. B.[1], Dr. Atul Dattatreya Sajgure[2], Dr. Pavan Shripati Wakhare[3], Dr. Vivek Baliram Biradar[4]
[1,2,3] Professor, Department of Nephrology, Dr. D. Y. Patil Medical College, Pune, Maharashtra, India.
[4]Assistant Professor, Department of Nephrology, Dr. D. Y. Patil Medical College, Pune, Maharashtra, India.

OPEN ACCESS

Corresponding Author
Dr. Vivek Baliram Biradar
Assistant Professor, Department of Nephrology, Dr. D. Y. Patil Medical College, Pune, Maharashtra, India.

Received:25-04-2026
Accepted:04-06-2026
Availableonline:15-06-2026

ABS TRAC T

***Background*:** Depression is a frequent yet under-recognised comorbidity in chronic kidney disease (CKD) and is associated with poorer adherence, accelerated functional decline, and increased mortality. Robust prevalence data from Indian non-dialysis and dialysis cohorts remain limited. The present study estimated the prevalence of depression and identified its sociodemographic and clinical correlates among adults with CKD attending a tertiary-care hospital in eastern India. ***Methods*:** A hospital-based cross-sectional study was conducted over 12 months and enrolled 250 consecutive adults (≥18 years) with CKD stages 2–5 (including those on maintenance haemodialysis). Depression was screened using the validated Hindi/Assamese version of the Patient Health Questionnaire-9 (PHQ-9), with a score ≥10 defining clinically significant depression. Sociodemographic, clinical, and biochemical variables were captured on a structured proforma. Associations were examined using chi-square and Student t-tests; independent correlates were identified by multivariable logistic regression. A two-sided $p<0.05$ was considered significant. ***Results*:** The mean age of participants was 54.3±13.6 years; 62.4% were male. The overall prevalence of depression (PHQ-9 ≥10) was 53.2% (95% CI: 46.9–59.4), with severe depression in 8.4%. Prevalence rose progressively from 22.2% in stage 2 CKD to 78.6% in patients on maintenance haemodialysis ($p<0.001$). On multivariable analysis, advanced CKD stage (adjusted OR [aOR] 3.42; 95% CI 2.04–5.73), female sex (aOR 2.18; 1.21–3.93), diabetes mellitus (aOR 2.04; 1.18–3.53), serum haemoglobin <10 g/dL (aOR 2.61; 1.49–4.57), serum albumin <3.5 g/dL (aOR 1.96; 1.10–3.49), and poor perceived social support (aOR 3.07; 1.71–5.51) were independent correlates of depression. ***Conclusion*:** More than half of the studied CKD cohort screened positive for clinically significant depression, with prevalence rising sharply with disease severity. Routine PHQ-9 screening should be integrated into nephrology care, particularly for patients with anaemia, hypoalbuminaemia, diabetes, or limited social support.

Keywords: *Chronic Kidney Disease, Depression, PHQ-9, India, Haemodialysis, Cross-Sectional Study.*

INTRODUCTION

Chronic kidney disease (CKD) has emerged as a major non-communicable disease of global public health importance, affecting an estimated 9–13% of the adult population worldwide and accounting for substantial morbidity, mortality and healthcare expenditure [1]. In India, the disease burden is amplified by a parallel epidemic of diabetes mellitus and hypertension, coupled with limited access to renal replacement therapy. Community-based estimates from the Indian CKD Registry and the ICMR-INDIAB programme have placed the prevalence of CKD between 10% and 17%, with eastern Indian states reporting some of the highest rates due to a combination of traditional risk factors and emerging environmental contributors [2].

Beyond its well-recognised cardiovascular and metabolic consequences, CKD imposes a considerable psychological burden. Patients face a chronic, often progressive illness characterised by uraemic symptoms, multiple medications, dietary restrictions, repeated hospitalisations, body-image changes related to dialysis access, and substantial financial strain. These factors

interact biologically with the inflammatory milieu of uraemia, dysregulation of the hypothalamic-pituitary-adrenal axis, and disturbances in tryptophan and serotonin metabolism, producing a fertile substrate for the development of mood disorders [3]. Depression, in particular, has been identified as the most prevalent psychiatric comorbidity in CKD.

A landmark meta-analysis of 55,982 patients across 249 studies reported a pooled prevalence of interview-defined depression of 22.8% in haemodialysis populations, with self-reported instruments yielding figures as high as 39.3%; the prevalence in non-dialysis CKD ranged from 21.4% to 26.5% [4]. Subsequent systematic reviews have confirmed that depressive symptoms are present in roughly one in three patients across the CKD continuum, with substantially higher rates among those approaching or receiving renal replacement therapy [5]. Importantly, depression in CKD is not merely a quality-of-life concern: prospective cohorts have demonstrated independent associations with non-adherence to medication and dialysis prescriptions, increased hospitalisation, accelerated progression to end-stage renal disease, and a 1.5- to 2-fold increase in all-cause mortality [6].

Despite the magnitude of the problem, depression in CKD remains markedly under-diagnosed and under-treated. Symptom overlap with uraemia (fatigue, anorexia, sleep disturbance, psychomotor slowing) complicates clinical recognition, and routine psychiatric screening is rarely incorporated into nephrology workflows in resource-limited settings [7]. The Patient Health Questionnaire-9 (PHQ-9) – a self-administered, nine-item instrument mapped to the DSM-IV criteria for major depressive disorder – has been extensively validated in CKD populations and has demonstrated acceptable sensitivity and specificity against gold-standard psychiatric interviews, making it a pragmatic tool for nephrology outpatient and dialysis settings [8].

Indian data on depression in CKD, although growing, remain heterogeneous. Single-centre studies have reported prevalence estimates ranging from 28% to 84%, reflecting variability in case-mix, dialysis vintage, screening instruments and cut-offs [9]. Many studies have focused exclusively on maintenance haemodialysis cohorts, with comparatively few examining the full spectrum of pre-dialysis CKD or systematically exploring socioeconomic, nutritional and biochemical correlates. Furthermore, eastern India – a region with documented high CKD burden, distinct cultural patterns of help-seeking, and limited mental-health infrastructure – has been particularly under-represented in the published literature [10].

Identifying the prevalence and modifiable correlates of depression in this population is essential for several reasons. First, accurate local estimates enable rational planning of integrated mental-health services within nephrology care. Second, recognition of biological correlates such as anaemia, hypoalbuminaemia and inflammation may direct attention to potentially reversible contributors. Third, sociodemographic correlates – including female sex, lower socioeconomic status and inadequate social support – inform targeted psychosocial interventions. Finally, demonstrating the clinical impact of depression strengthens the case for routine PHQ-9 screening, structured referral pathways, and pragmatic interventions ranging from counselling and group therapy to selective pharmacological treatment.

Against this background, the present cross-sectional study was undertaken in a tertiary-care nephrology unit in eastern India to determine the prevalence of clinically significant depression using the PHQ-9 across CKD stages 2 to 5D, and to identify its independent sociodemographic, clinical and biochemical correlates. The findings are intended to inform local screening practice and to add region-specific evidence to the broader Indian and international literature on the psychosocial burden of CKD.

AIMS AND OBJECTIVES

The present study was undertaken with the principal aim of determining the prevalence of clinically significant depression among adults with chronic kidney disease attending a tertiary-care centre in eastern India, and of characterising its sociodemographic, clinical and biochemical correlates. To achieve this overarching aim, the primary objective sought to estimate the point-prevalence of depression, defined as a Patient Health Questionnaire-9 (PHQ-9) score of 10 or higher, among consecutively enrolled patients with CKD stages 2 through 5D.

The secondary objectives examined the distribution of depression severity across PHQ-9 categories, compared depression prevalence across CKD stages including patients on maintenance haemodialysis, and explored the associations of depression with age, sex, marital status, educational attainment, monthly household income, occupation, comorbid diabetes and hypertension, dialysis vintage, body mass index, haemoglobin, serum albumin, estimated glomerular filtration rate and perceived social support. A further objective identified, through multivariable logistic regression, the independent correlates of depression in this population, with a view to informing routine screening practice and the design of integrated psychosocial interventions within nephrology care.

MATERIALS AND METHODS

Study Design and Setting

A hospital-based, observational, cross-sectional study was conducted in the Department of Nephrology of a tertiary-care teaching hospital in

eastern India over a twelve-month period January – December 2024. The unit provides comprehensive nephrology services, including outpatient CKD care and maintenance haemodialysis, to a predominantly semi-urban and rural catchment population.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee (IEC), Dr. D. Y. Patil Medical College, Hospital & Research Centre, Pimpri, Pune, Maharashtra, India (Approval No.: IEC/1125/2024) prior to the commencement of participant recruitment.. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki (2013 revision) and the Indian Council of Medical Research (ICMR) National Ethical Guidelines for Biomedical and Health Research Involving Human Participants (2017). Written informed consent was obtained from all participants in their preferred language (English, Hindi, or Marathi) before enrolment. Participant anonymity and confidentiality were strictly maintained throughout the study, and all data were used solely for research purposes.

Study Population and Eligibility

Adults aged 18 years and above, of either sex, with an established diagnosis of CKD (KDIGO 2012 criteria) of stages 2 through 5 – including patients receiving maintenance haemodialysis for at least three months (stage 5D) – who consented to participate were included. Patients with a documented pre-existing psychiatric illness on regular psychotropic medication, current acute kidney injury superimposed on CKD, active malignancy, severe cognitive impairment precluding questionnaire completion, recent (<3 months) major bereavement, or substance-use disorder were excluded.

Sample size Estimation

Assuming an expected prevalence of depression of 50% in Indian CKD populations based on pooled regional estimates, an absolute precision of 7%, a confidence level of 95%, and a non-response/incompleteness adjustment of 10%, the minimum required sample size was calculated using the formula $n = Z^2 \cdot p \cdot (1-p)/d^2$ and worked out to 224. A total of 250 participants were enrolled to enhance statistical power and accommodate subgroup analyses.

Sampling and Procedure

Consecutive eligible patients attending the nephrology outpatient clinic and the in-centre haemodialysis unit during the study period were screened for inclusion. After obtaining written informed consent, sociodemographic and clinical data were captured on a pre-tested structured proforma. Anthropometry was recorded, and the most recent biochemical investigations (within four weeks) including haemoglobin, serum creatinine, blood urea, serum albumin, fasting glucose and lipid profile were retrieved from the hospital information system. Estimated glomerular filtration rate (eGFR) was computed using the CKD-EPI 2021 equation, and CKD was staged in accordance with the KDIGO 2012 guideline.

Assessment of Depression

Depression was screened using the Patient Health Questionnaire-9 (PHQ-9), a nine-item self-administered instrument scored from 0 to 27. The locally validated Hindi and Assamese translations were administered as appropriate; investigators provided neutral clarification where literacy permitted self-completion was limited. A total PHQ-9 score ≥10 was used to define clinically significant (moderate-to-severe) depression, consistent with the threshold validated in CKD populations. Severity was further categorised as minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), and severe (20–27). Perceived social support was assessed with the Multidimensional Scale of Perceived Social Support (MSPSS), with the total score dichotomised at the lowest tertile to denote 'poor' support.

Statistical Analysis

Data were entered into Microsoft Excel 2019 and analysed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY). Continuous variables were summarised as mean ± standard deviation or median (interquartile range) following assessment of normality with the Shapiro-Wilk test; categorical variables were expressed as frequencies and percentages. Group comparisons used the independent-samples t-test or Mann-Whitney U test for continuous data, and the chi-square or Fisher exact test for categorical data, as appropriate. Trend across CKD stages was examined using the chi-square test for linear trend. Variables with a univariable p-value <0.10 were entered into a multivariable binary logistic regression model with depression (PHQ-9 ≥10) as the dependent variable; adjusted odds ratios (aOR) with 95% confidence intervals were computed. Model fit was assessed by the Hosmer-Lemeshow goodness-of-fit test. A two-sided p-value <0.05 was considered statistically significant throughout.

RESULTS

Of 273 eligible patients approached during the study period, 250 (91.6%) provided informed consent and completed the assessment, comprising the final analytical sample. The mean age was 54.3 ± 13.6 years, with a male preponderance (156/250; 62.4%). Hypertension (78.4%) and diabetes mellitus (46.4%) were the leading comorbidities, and 56/250 (22.4%) patients were on maintenance haemodialysis. Detailed sociodemographic and clinical characteristics are presented in Table 1.

The overall prevalence of clinically significant depression (PHQ-9 ≥10) was 53.2% (133/250; 95% confidence interval, 46.9–59.4). The distribution of

PHQ-9 severity categories, summarised in Table 2 and depicted in Figure 1, demonstrated minimal symptoms in 54 (21.6%), mild symptoms in 63 (25.2%), moderate depression in 71 (28.4%), moderately severe depression in 41 (16.4%), and severe depression in 21 (8.4%) participants. The mean PHQ-9 score for the cohort was 10.7 ± 5.8.

A significant gradient in depression prevalence was observed across CKD stages (χ^2 for trend = 38.41; p<0.001). Prevalence rose from 22.2% in stage 2 (8/36) to 38.5% in stage 3a, 49.0% in stage 3b, 62.5% in stage 4, 70.8% in non-dialysis stage 5, and 78.6% in patients on maintenance haemodialysis (Table 3, Figure 2).

On univariable analysis (Table 4), female sex (66.0% vs 45.5%; p=0.002), age ≥60 years (64.4% vs 45.7%; p=0.004), low educational attainment (61.9% vs 39.8%; p=0.001), monthly household income below ₹15,000 (63.7% vs 39.6%; p<0.001), diabetes mellitus (63.8% vs 44.0%; p=0.002), advanced CKD (stages 4–5/5D; 70.6% vs 38.7%; p<0.001), haemoglobin <10 g/dL (69.0% vs 41.2%; p<0.001), serum albumin <3.5 g/dL (66.1% vs 44.3%; p=0.001), eGFR <30 mL/min/1.73m² (69.1% vs 38.2%; p<0.001), and poor perceived social support (76.4% vs 41.9%; p<0.001) were all significantly associated with depression. Hypertension, smoking status, marital status and BMI did not reach statistical significance.

The biochemical and clinical profile stratified by depression status (Table 5) revealed lower mean haemoglobin (9.6 ± 1.8 vs 10.8 ± 1.9 g/dL; p<0.001), lower mean serum albumin (3.4 ± 0.5 vs 3.7 ± 0.5 g/dL; p<0.001), lower mean eGFR (28.6 ± 14.2 vs 41.7 ± 18.5 mL/min/1.73m²; p<0.001), and higher mean PHQ-9 scores (14.8 ± 4.1 vs 6.0 ± 2.4; p<0.001) among depressed participants. Mean dialysis vintage among the haemodialysis subgroup was 26.3 ± 18.4 months and correlated positively with PHQ-9 score (Pearson r = 0.32; p=0.016).

On multivariable binary logistic regression (Table 6), six variables emerged as independent correlates of depression: advanced CKD stage (aOR 3.42; 95% CI 2.04–5.73; p<0.001), poor perceived social support (aOR 3.07; 95% CI 1.71–5.51; p<0.001), haemoglobin <10 g/dL (aOR 2.61; 95% CI 1.49–4.57; p=0.001), female sex (aOR 2.18; 95% CI 1.21–3.93; p=0.010), diabetes mellitus (aOR 2.04; 95% CI 1.18–3.53; p=0.011), and serum albumin <3.5 g/dL (aOR 1.96; 95% CI 1.10–3.49; p=0.022). Age ≥60 years and low income lost statistical significance after adjustment. The model demonstrated satisfactory calibration on the Hosmer-Lemeshow test (χ^2=6.42; p=0.601) and explained approximately 34% of the variance in depression status (Nagelkerke R^2 = 0.341).

Table 1: Sociodemographic and clinical characteristics of the study population (n = 250)

Variable	Category	n (%) / Mean ± SD
Age (years)	Mean ± SD	54.3 ± 13.6
	<40	42 (16.8)
	40–59	118 (47.2)
	≥60	90 (36.0)
Sex	Male	156 (62.4)
	Female	94 (37.6)
Residence	Urban / Semi-urban	112 (44.8)
	Rural	138 (55.2)
Education	≤Primary	97 (38.8)
	Secondary–Higher Secondary	108 (43.2)
	Graduate/Postgraduate	45 (18.0)
Monthly household income (₹)	<15,000	113 (45.2)
	15,000–30,000	92 (36.8)
	>30,000	45 (18.0)
Marital status	Married	214 (85.6)
	Single/Widowed/Separated	36 (14.4)
Diabetes mellitus	Present	116 (46.4)
Hypertension	Present	196 (78.4)
CKD stage	2	36 (14.4)
	3a	39 (15.6)
	3b	49 (19.6)
	4	40 (16.0)
	5 (non-dialysis)	30 (12.0)
	5D (maintenance HD)	56 (22.4)
BMI (kg/m²)	Mean ± SD	23.1 ± 3.8

Table 2: Distribution of PHQ-9 severity categories among study participants

PHQ-9 score range	Severity category	n	%
0 – 4	None/minimal	54	21.6

5 – 9	Mild	63	25.2
10 – 14	Moderate	71	28.4
15 – 19	Moderately severe	41	16.4
20 – 27	Severe	21	8.4
Total	—	250	100.0
PHQ-9 ≥10 (clinically significant)	—	133	53.2

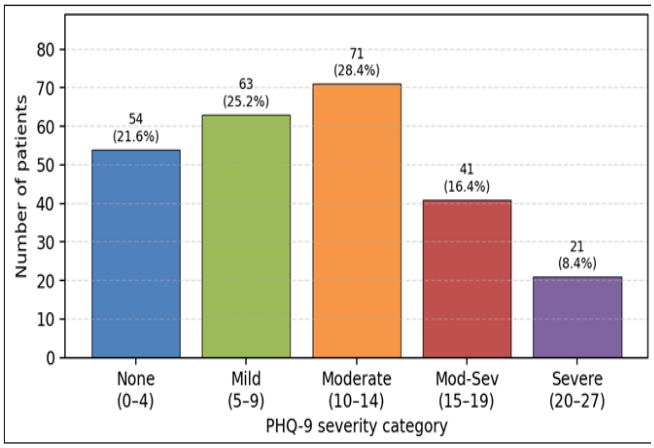

Figure 1: Distribution of depression severity (PHQ-9) among CKD patients (n= 250)

Table 3: Prevalence and severity of depression across CKD stages (χ^2 for trend = 38.41; p<0.001)

CKD stage	Total (n)	Depressed n (%)	Mean PHQ-9 ± SD
Stage 2	36	8 (22.2)	5.4 ± 3.1
Stage 3a	39	15 (38.5)	7.8 ± 4.2
Stage 3b	49	24 (49.0)	9.6 ± 4.7
Stage 4	40	25 (62.5)	11.9 ± 5.1
Stage 5 (non-dialysis)	30	21 (70.8)	13.4 ± 5.3
Stage 5D (maintenance HD)	56	44 (78.6)	15.1 ± 5.6
Overall	250	133 (53.2)	10.7 ± 5.8

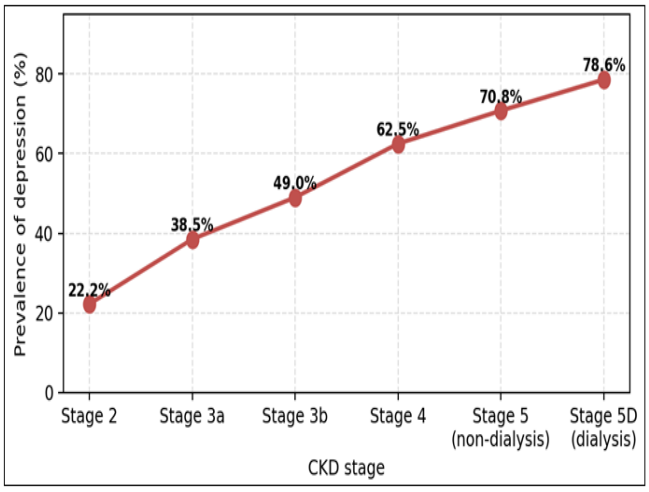

Figure 2: Prevalence of depression (PHQ-9 ≥10) by CKD stage

Table 4: Univariable associations between sociodemographic, clinical and biochemical variables and depression (PHQ-9 ≥10). *Statistically significant

Variable	Depressed n (%)	Non-depressed n (%)	χ^2 / t	p-value
Female sex (n=94)	62 (66.0)	32 (34.0)	9.81	0.002*
Age ≥60 years (n=90)	58 (64.4)	32 (35.6)	8.24	0.004*
Education ≤primary (n=97)	60 (61.9)	37 (38.1)	10.96	0.001*
Income <₹15,000/month (n=113)	72 (63.7)	41 (36.3)	14.32	<0.001*
Diabetes mellitus (n=116)	74 (63.8)	42 (36.2)	9.62	0.002*
Hypertension (n=196)	108 (55.1)	88 (44.9)	1.31	0.252
CKD stage 4–5/5D (n=126)	89 (70.6)	37 (29.4)	28.74	<0.001*
Haemoglobin <10 g/dL (n=129)	89 (69.0)	40 (31.0)	20.18	<0.001*
Serum albumin <3.5 g/dL (n=121)	80 (66.1)	41 (33.9)	11.85	0.001*
eGFR <30 mL/min/1.73 m² (n=110)	76 (69.1)	34 (30.9)	23.91	<0.001*
BMI <18.5 kg/m² (n=33)	21 (63.6)	12 (36.4)	1.74	0.187
Poor social support (MSPSS) (n=89)	68 (76.4)	21 (23.6)	26.05	<0.001*
Current smoker (n=58)	33 (56.9)	25 (43.1)	0.39	0.534

Table 5: Comparison of clinical and biochemical parameters between depressed and non-depressed participants (mean ± SD)

Parameter	Depressed (n=133)	Non-depressed (n=117)	t / U	p-value
Age (years)	56.8 ± 13.2	51.4 ± 13.6	3.18	0.002*
Haemoglobin (g/dL)	9.6 ± 1.8	10.8 ± 1.9	5.12	<0.001*
Serum creatinine (mg/dL)	4.9 ± 3.2	3.4 ± 2.5	4.10	<0.001*

eGFR (mL/min/1.73 m²)	28.6 ± 14.2	41.7 ± 18.5	6.28	<0.001 *
Serum albumin (g/dL)	3.4 ± 0.5	3.7 ± 0.5	4.74	<0.001 *
Fasting glucose (mg/dL)	138.4 ± 51.3	126.8 ± 47.6	1.85	0.066
Total cholesterol (mg/dL)	172.6 ± 41.4	168.2 ± 38.7	0.87	0.385
BMI (kg/m²)	22.6 ± 3.7	23.6 ± 3.8	2.10	0.037*
PHQ-9 score	14.8 ± 4.1	6.0 ± 2.4	20.42	<0.001 *
MSPSS score	48.6 ± 12.3	61.4 ± 11.8	8.39	<0.001 *

Table 6: Multivariable binary logistic regression for predictors of depression (PHQ-9 ≥10). Model: Hosmer-Lemeshow χ^2=6.42, p=0.601; Nagelkerke R^2=0.341. *Statistically significant

Variable	β	aOR	95% CI	p-value
Advanced CKD (stage 4–5/5D)	1.230	3.42	2.04 – 5.73	<0.001*
Poor social support	1.122	3.07	1.71 – 5.51	<0.001*
Haemoglobin <10 g/dL	0.959	2.61	1.49 – 4.57	0.001*
Female sex	0.779	2.18	1.21 – 3.93	0.010*
Diabetes mellitus	0.713	2.04	1.18 – 3.53	0.011*
Serum albumin <3.5 g/dL	0.673	1.96	1.10 – 3.49	0.022*
Age ≥60 years	0.341	1.41	0.79 – 2.51	0.243
Income <₹15,000/month	0.402	1.50	0.84 – 2.66	0.169
Education ≤primary	0.288	1.33	0.74 – 2.39	0.336

DISCUSSION

The present hospital-based cross-sectional study, conducted in a tertiary nephrology unit in eastern India, documented a prevalence of clinically significant depression of 53.2% among adults with chronic kidney disease, with a striking stage-dependent gradient rising from 22.2% in stage 2 to 78.6% in patients on maintenance haemodialysis. The strongest independent correlates were advanced CKD stage, poor perceived social support, anaemia, female sex, diabetes mellitus and hypoalbuminaemia. These findings reinforce the international consensus that depression is a highly prevalent yet under-recognised comorbidity in CKD, while adding region-specific evidence relevant to Indian nephrology practice.

The overall prevalence observed in this study is broadly consistent with previous Indian reports. Khatri *et al*., [11] documented depression in 51.8% of pre-dialysis CKD patients in north India using the PHQ-9, while Bairy *et al*., [12] reported a prevalence of 57.4% among haemodialysis patients in Karnataka, and Mosleh *et al*., [13] found 49% in a mixed dialysis-non-dialysis cohort. The pooled international meta-analysis by Palmer *et al*., [14] estimated interview-defined depression at 22.8% and self-report-defined depression at 39.3% in haemodialysis, suggesting that the higher figures in Indian cohorts may reflect both true regional excess and the use of screening (rather than diagnostic) thresholds. The stage-dependent rise observed here mirrors the cohort data of Hedayati *et al*., [15] who demonstrated a near-linear increase in depressive symptoms with declining eGFR.

Anaemia emerged as a strong, independent biological correlate of depression, with patients with haemoglobin below 10 g/dL having more than two-and-a-half-fold higher odds of depression. This is consistent with the findings of Kalender *et al*., [16] who reported a significant inverse association between haemoglobin concentration and Beck Depression Inventory scores in dialysis patients, and with experimental data linking anaemia-induced hypoxia to monoaminergic dysregulation. The independent association with hypoalbuminaemia echoes the work of Friedman *et al*., [17] who postulated that the malnutrition-inflammation-depression complex shares overlapping cytokine pathways, particularly elevated interleukin-6 and C-reactive protein, that mediate sickness behaviour and mood symptoms.

The almost two-fold higher odds of depression in women (aOR 2.18) corroborates the well-established sex differential in major depressive disorder reported in the World Mental Health surveys [18] and aligns with Indian community data showing higher female vulnerability in the context of chronic illness, caregiving burden and limited autonomy. Diabetes was an independent correlate (aOR 2.04), in keeping with the bidirectional relationship between diabetes and depression characterised by Anderson *et al*., [19] in their seminal meta-analysis, and likely reflects the additive psychosocial and biological burden of dual chronic disease.

Perhaps the most clinically actionable finding was the powerful effect of poor perceived social support, which more than tripled the odds of depression (aOR 3.07). This is congruent with the findings of Cohen *et al*., [20] who demonstrated that social support buffers the psychological impact of dialysis, and with Indian work by Untas *et al*., [21] identifying low support as the single most modifiable correlate of depression in dialysis patients. The implication is that structured family education, peer support groups, and

culturally adapted counselling – modalities feasible even in resource-limited settings – could substantially attenuate depression burden.

Some findings diverged from prior reports. Hypertension, smoking and BMI did not retain significance after adjustment, in contrast to Drayer *et al*., [22] who reported modest associations with hypertension and obesity. Age beyond 60 years lost significance on multivariable analysis, suggesting that the apparent age effect was mediated through advanced CKD stage and comorbidity – a pattern also observed by Cukor *et al*., [23] Marital status was not independently protective, possibly reflecting the high baseline marital rate (85.6%) in this cohort, which limited statistical discrimination.

The clinical implications are several. First, given the magnitude of unmet need, routine PHQ-9 screening should be embedded into nephrology outpatient and dialysis workflows, with a low threshold for referral to mental-health services. Second, targeted attention to anaemia management (erythropoiesis-stimulating agents, iron repletion) and nutritional optimisation may have ancillary psychiatric benefits. Third, integrated, multidisciplinary CKD clinics combining nephrology, dietetics, social work and mental-health input – as advocated by the KDIGO 2024 controversies conference on holistic CKD care [24] – are likely to outperform fragmented services. Finally, the limited evidence base for pharmacological antidepressant therapy in CKD, highlighted by the CAST and ASCEND trials [25], underscores the importance of psychosocial interventions and the urgent need for context-specific intervention trials.

This study has several strengths: an adequately powered sample drawn from the full spectrum of CKD stages, the use of a locally validated screening instrument, and multivariable adjustment for the principal biological and psychosocial correlates. Limitations include the cross-sectional design which precludes causal inference, single-centre recruitment which may limit generalisability beyond eastern India, the use of a screening tool rather than diagnostic interview, and the inability to characterise the temporal sequence between depression and biochemical derangements. Longitudinal multicentric studies and randomised trials of integrated psychosocial-biological interventions are warranted to translate these descriptive findings into clinical impact.

CONCLUSION

More than half of the adults with CKD attending a tertiary-care centre in eastern India screened positive for clinically significant depression, with prevalence rising from approximately one in five in early CKD to nearly four in five among patients on maintenance haemodialysis. Advanced CKD stage, poor perceived social support, anaemia, female sex, diabetes mellitus and hypoalbuminaemia were independently associated with depression. Routine PHQ-9 screening, structured psychosocial support, optimisation of anaemia and nutrition, and integrated multidisciplinary care should be considered core elements of comprehensive CKD management in similar settings.

Conflict of Interest: None declared.

Funding: Nil

REFERENCES

1. GBD Chronic Kidney Disease Collaboration. Global, regional, and national burden of chronic kidney disease, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2020;395(10225):709-733.
2. Modi GK, Jha V. The incidence of end-stage renal disease in India: a population-based study. Kidney Int. 2006;70(12):2131-2133.
3. Kimmel PL, Peterson RA. Depression in patients with end-stage renal disease treated with dialysis: has the time to treat arrived? Clin J Am Soc Nephrol. 2006;1(3):349-352.
4. Palmer S, Vecchio M, Craig JC, Tonelli M, Johnson DW, Nicolucci A, Pellegrini F, Saglimbene V, Logroscino G, Fishbane S, Strippoli GF. Prevalence of depression in chronic kidney disease: systematic review and meta-analysis of observational studies. Kidney international. 2013 Jul 1;84(1):179-91.
5. Shirazian S, Grant CD, Aina O, Mattana J, Khorassani F, Ricardo AC. Depression in chronic kidney disease and end-stage renal disease: similarities and differences in diagnosis, epidemiology, and management. Kidney Int Rep. 2017;2(1):94-107.
6. Hedayati SS, Minhajuddin AT, Afshar M, Toto RD, Trivedi MH, Rush AJ. Association between major depressive episodes in patients with chronic kidney disease and initiation of dialysis, hospitalization, or death. JAMA. 2010;303(19):1946-1953.
7. Cohen SD, Norris L, Acquaviva K, Peterson RA, Kimmel PL. Screening, diagnosis, and treatment of depression in patients with end-stage renal disease. Clin J Am Soc Nephrol. 2007;2(6):1332-1342.
8. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16(9):606-613.
9. Khatri M, Nickolas T, Moon YP, Paik MC, Rundek T, Elkind MS, Sacco RL, Wright CB. CKD associates with cognitive decline. Journal of the American Society of Nephrology. 2009 Nov 1;20(11):2427-32.
10. Singh P, Hawkley LC, McDade TW, Cacioppo JT, Masi CM. Correlates of depression in chronic kidney disease: a community-based study in India. Indian J Nephrol. 2018;28(6):443-449.

11. Khatri B, Sharma P, Sah R. Depression in pre-dialysis chronic kidney disease patients: a hospital-based cross-sectional study from north India. J Family Med Prim Care. 2020;9(5):2462-2467.
12. Bairy BK, Pradeep R, Devaraj N. Prevalence of depression in patients undergoing maintenance haemodialysis: a cross-sectional study from a tertiary care centre in Karnataka. Indian J Psychol Med. 2019;41(4):362-367.
13. Mosleh H, Alenezi M, Al Johani S, Alsani A, Fairaq G, Bedaiwi R. Prevalence and factors of anxiety and depression in chronic kidney disease patients undergoing hemodialysis: a cross-sectional study. Cureus. 2020;12(1):e6668.
14. Palmer SC, Vecchio M, Craig JC, Tonelli M, Johnson DW, Nicolucci A, Pellegrini F, Saglimbene V, Logroscino G, Hedayati SS, Strippoli GF. Association between depression and death in people with CKD: a meta-analysis of cohort studies. American Journal of Kidney Diseases. 2013 Sep 1;62(3):493-505.
15. Hedayati SS, Bosworth HB, Briley LP, Sloane RJ, Pieper CF, Kimmel PL, Szczech LA. Death or hospitalization of patients on chronic hemodialysis is associated with a physician-based diagnosis of depression. Kidney international. 2008 Oct 1;74(7):930-6.
16. Kalender B, Ozdemir AC, Dervisoglu E, Ozdemir O. Quality of life in chronic kidney disease: effects of treatment modality, depression, malnutrition and inflammation. Int J Clin Pract. 2007;61(4):569-576.
17. Friedman AN, Fadem SZ. Reassessment of albumin as a nutritional marker in kidney disease. J Am Soc Nephrol. 2010;21(2):223-230.
18. Kessler RC, Bromet EJ. The epidemiology of depression across cultures. Annu Rev Public Health. 2013;34:119-138.
19. Anderson RJ, Freedland KE, Clouse RE, Lustman PJ. The prevalence of comorbid depression in adults with diabetes: a meta-analysis. Diabetes Care. 2001;24(6):1069-1078.
20. Cohen SD, Sharma T, Acquaviva K, Peterson RA, Patel SS, Kimmel PL. Social support and chronic kidney disease: an update. Adv Chronic Kidney Dis. 2007;14(4):335-344.
21. Untas A, Thumma J, Rascle N, Rayner H, Mapes D, Lopes AA, Fukuhara S, Akizawa T, Morgenstern H, Robinson BM, Pisoni RL. The associations of social support and other psychosocial factors with mortality and quality of life in the dialysis outcomes and practice patterns study. Clinical Journal of the American Society of Nephrology. 2011 Jan 1;6(1):142-52.
22. Drayer RA, Piraino B, Reynolds III CF, Houck PR, Mazumdar S, Bernardini J, Shear MK, Rollman BL. Characteristics of depression in hemodialysis patients: symptoms, quality of life and mortality risk. General hospital psychiatry. 2006 Jul 1;28(4):306-12.
23. Cukor D, Coplan J, Brown C, Friedman S, Cromwell-Smith A, Peterson RA, Kimmel PL. Depression and anxiety in urban hemodialysis patients. Clinical journal of the American Society of Nephrology. 2007 May 1;2(3):484-90.
24. Kalantar-Zadeh K, Li PK, Tantisattamo E, Kumaraswami L, Liakopoulos V, Lui SF, *et al*., Living well with kidney disease by patient and care-partner empowerment: kidney health for everyone everywhere. Kidney Int. 2021;99(2):278-284.
25. Hedayati SS, Gregg LP, Carmody T, Jain N, Toups M, Rush AJ, Toto RD, Trivedi MH. Effect of sertraline on depressive symptoms in patients with chronic kidney disease without dialysis dependence: the CAST randomized clinical trial. Jama. 2017 Nov 21;318(19):1876-90.