ORIGINAL ARTICLE

Socio-demographic and Health-System Profile of CKD and Hypertension Patients Attending a Tertiary Care Hospital in the Sub-Himalayan Area: A Cross-sectional Study under the NPCDCS Framework

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ABSTRACT

Background: Chronic kidney disease (CKD) and hypertension (HTN) represent interconnected spectrums of non-communicable diseases (NCDs) contributing significantly to India's morbidity and health expenditure. **Objectives**: To describe the socio-demographic and behavioural profiles of hypertensive and CKD patients on dialysis attending a tertiary care centre in the sub-Himalayan region. **Methodology:** A hospital-based cross-sectional study was conducted among adult patients attending medicine and dialysis units of a tertiary centre. Socio-demographic, clinical, and behavioural data were collected using a structured questionnaire and analysed using descriptive and comparative statistics. Findings were interpreted in the context of the National Programme for Prevention and Control of Non Communicable Diseases (NP NCD) and the Pradhan Mantri National Dialysis Programme (PMNDP). **Results**: CKD patients were predominantly from lower-income, rural backgrounds with higher unemployment and undernutrition compared to hypertensives. Health-insurance coverage was 76.7%, though nearly one-third of CKD patients remained uninsured. Most insured patients were covered under state schemes such as HIMCARE, with limited uptake of PM-JAY. **Conclusion**: CKD and hypertension reflect dual ends of India's NCD continuum, differing in socioeconomic vulnerability and health-system access. Strengthened integration of NP NCD screening with PMNDP services and unified insurance coverage is essential for equitable chronic disease care in difficult terrains.

KEYWORDS
chronic renal failure protein, human; hypertension; Insurance, health; Noncommunicable Diseases; Health programme, National; Renal dialysis; Himachal Pradesh, India

INTRODUCTION

Chronic kidney disease (CKD) and hypertension (HTN) represent sequential points along the continuum of non-communicable diseases (NCDs). Hypertension is one of the most prevalent modifiable NCDs globally, affecting over one billion adults, while nearly 850 million people live with kidney disease.[1] In India, recent evidence indicates a rising community-based CKD prevalence of 13.2% and persistently low hypertension control rates, underscoring the progression from early vascular dysfunction to advanced renal failure.[2] Although both conditions share behavioural and metabolic risk factors such as unhealthy diet, obesity, and physical inactivity their clinical trajectories represent distinct stages of NCD evolution, with CKD constituting a potential end-stage consequence of long-standing uncontrolled hypertension.

India's national NCD response, through the National Programme for Prevention and Control of Non Communicable Diseases (NP NCD) and the Pradhan Mantri National Dialysis Programme (PMNDP), attempts to address this entire continuum by screening hypertensive patients at NCD clinics and providing financial protection for dialysis at advanced disease stages.[3–4] However, little is known about how the socio-demographic and behavioural characteristics differ between patients presenting at the early outpatient stage of hypertension management and those already requiring dialysis, particularly in geographically challenging sub-Himalayan settings.

The present study therefore aims to describe the socio-demographic and behavioural profiles of hypertensive patients and CKD patients on dialysis, representing two ends of the NCD care continuum.

MATERIAL & METHODS

Study Type and Design: The study employed a hospital-based Observational, Cross-sectional Comparative Design. The study was conceptually aligned with the operational framework of India's National Programme for Prevention and Control of Non Communicable Diseases (NP NCD) and the Pradhan Mantri National Dialysis Programme (PMNDP), both of which emphasize integrated NCD screening, management, and financial protection.

Study Setting: Group 1 participants were recruited from the General Medicine- NCD Out Patient Department (OPD), reflecting the NPNCD NCD clinic model at tertiary-level care, while Group 2 participants were drawn from the Dialysis Unit/Nephrology Ward, representing tertiary-level care under the PMNDP framework.

Study Duration: Data collection was carried out over one month during the investigators' (Bachelor of Medicine and Surgery (MBBS) undergraduate students) elective posting in April 2024 at Dr Rajendra Prasad Government Medical College, Tanda at Kangra, Himachal Pradesh.

Study Population

All known patients attending the Hypertension OPD for follow-up and all patients receiving maintenance dialysis at the center were target population.

Sample Size: A total of 86 participants were enrolled through a non-probability Consecutive Sampling technique, divided into two distinct groups based on their clinical diagnosis and treatment location:

- Group 1 (HTN): 40 patients
- Group 2 (CKD - Dialysis): 46 patients

Inclusion Criteria

Hypertensives without Complications (HTN)

1. Patients aged ≥18 years.
2. Patients diagnosed with essential hypertension, attending the OPD for routine follow-up.
3. Patients with no clinically documented evidence of major hypertensive complications (e.g., stroke, myocardial infarction, established kidney disease/CKD).

Chronic Kidney Disease Patients on Dialysis (CKD)

1. Patients aged ≥18 years.

2. Patients diagnosed with End-Stage Renal Disease (ESRD) or CKD Stage 5, currently undergoing maintenance hemodialysis or peritoneal dialysis.

Exclusion Criteria (Both Groups)

1. Patients who were critically ill or unable to communicate coherently.
2. Patients with co-morbidities that may severely bias body mass index (BMI) or lifestyle factors (e.g., active cancer, severe debilitating chronic inflammatory disease).

Data Collection Tool and Procedure

Data was collected using a structured self-designed questionnaire developed specifically for the study. The questionnaire comprised two main sections:

1. Sociodemographic Profile**:** Included Age, Sex, Education level (e.g., Illiterate, Primary, High School, Graduate), Occupation, Monthly Family Income, and Health Insurance status/type.
2. Clinical/Lifestyle Factors**:** Included Self-reported history of family NCDs, Diabetes status, Smoking status, other tobacco product use, Alcohol consumption, and objective measurements like BMI.

Working definition: Alcohol user: A participant was classified as an alcohol user if they reported current consumption of alcohol (any amount) within the preceding 12 months, irrespective of frequency or quantity. Those who had never consumed alcohol or had abstained for more than one year were classified as non-users.

Tobacco user: A tobacco smoker was defined as a participant who currently smoked any smoked form of tobacco (cigarettes, bidis, hookah, or other local forms) at the time of the survey. Former smokers who had quit smoking for at least six months were classified as non-smokers.

Other tobacco products user (smokeless tobacco): Participants who reported current use of smokeless tobacco products such as gutkha, khaini, zarda, pan with tobacco, or chewing tobacco were categorized as other tobacco users, irrespective of frequency or duration.

Hypertension: Hypertension was defined as a self-reported physician diagnosis, current use of antihypertensive medication, or measured systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg, in accordance with NPNCD operational guidelines.

Diabetes mellitus: Diabetes was defined as a self-reported diagnosis by a physician, current use of anti-diabetic medication (oral hypoglycaemic agents or insulin), or documented medical records confirming diabetes mellitus.

Body Mass Index (BMI): BMI was calculated as weight (kg) divided by height squared (m^2) and classified using Asian cut-offs, as recommended for the Indian population as Underweight: <18.5 kg/m^2, Normal: 18.5–22.9 kg/m^2, Overweight: 23.0–24.9 kg/m^2 and Obese: ≥25.0 kg/m^2.

Health Insurance Coverage: Participants were considered insured if they were enrolled in any government- or privately funded health insurance scheme at the time of the study, including Ayushman Bharat–PMJAY or state-sponsored schemes; others were categorized as uninsured.

Strategy for Data collection: The study commenced only after obtaining formal approval from the Institutional Ethics Committee (IEC) of the tertiary care center. Eligible patients in the respective departments were approached by the medical student (investigator). The purpose, procedure, confidentiality, and voluntary nature of the study were explained, and written informed consent was obtained. The investigator administered the questionnaire through a face-to-face interview. Anthropometric parameters (weight, height for BMI calculation) were measured by the investigator, and other data (e.g., CKD/HTN diagnosis, Dialysis status, known diabetes status) were verified from the patient's medical records.

Data and Statistical Analysis: The collected data was entered into a spreadsheet program (e.g., Microsoft Excel) and analyzed using SPSS version 29 (IBM SPSS version 29). Descriptive statistics was conducted. Categorical variables were presented as Frequencies and Percentages. Standard error of difference in proportions was used to test difference in

distribution of variables in two groups of hypertension and chronic kidney disease. P value less than 0.05 was considered statistically significant.

RESULTS

Table 1: Socio demographic profile of Hypertensive patients and Chronic Kidney disease patients

	HTN N (%)	CKD N (%)	Total N (%)	P value*
Total	40 (100)	46 (100%)	86 (100%)	
Sex				
Female	13 (32.5)	23 (50.0)	36 (41.9)	0.10
Male	27 (67.5)	23 (50.0)	50 (58.1)	
Education				
Professional degree	-	1 (2.2)	1 (1.2)	0.35
Graduate	6 (15.0)	3 (6.5)	9 (10.5)	0.20
Diploma /senior secondary	4 (10.0)	12 (26.1)	16 (18.6)	0.06
High school	13 (32.5)	13 (28.3)	26 (30.2)	0.67
Middle	6 (15.0)	5 (10.9)	11 (12.8)	0.57
Primary	4 (10.0)	9 (19.6)	13 (15.1)	0.22
Illiterate	7 (17.5)	3 (6.5)	10 (11.6)	0.11
Occupation				
Professional	-	6 (13.0)	6 (7.0)	0.02
Semi professional	5 (12.5)	4 (8.7)	9 (10.5)	0.57
Clerical /shop/farm	2 (5.0)	8 (17.4)	10 (11.6)	0.07
Semi skilled worker	10 (25.0)	9 (19.6)	19 (22.1)	0.55
Skilled worker	4 (10.0)	7 (15.2)	11 (12.8)	0.47
Un skilled worker	6 (15.0)	-	6 (7.0)	0.01
Unemployed	13 (32.5)	12 (26.1)	25 (29.1)	0.52
Income in INR				
< 9,307	14 (35.0)	22 (47.8)	36 (41.9)	0.23
9,308-27,882	13 (32.5)	13 (28.3)	26 (30.2)	0.67
27,883-46,474	12 (30.0)	5 (10.9)	17 (19.8)	0.03
46,475-69,534	1 (2.5)	3 (6.5)	4 (4.7)	0.38
92,951-1,85,895	-	1 (2.2)	1 (1.2)	0.35
> 1,85,895	-	2 (4.3)	2 (2.3)	0.19
Insurance				
No	6 (15.0)	14 (30.4)	20 (23.3)	0.09
Yes	34 (85.0)	32 (69.6)	66 (76.7)	
Type				
Ayushmaan Bharat Pradhan Mantri Jan Arogya Yojana	3 (7.5)	2 (4.3)	5 (5.8)	0.53
Corporate insurance	1 (2.5)	-	1 (1.2)	0.28
Government contributory	6 (15.0)	2 (4.3)	8 (9.3)	0.09
Him care (State government scheme)	24 (60.0)	24 (52.2)	48 (55.8)	0.47
None	6 (15.0)	14 (30.4)	20 (23.3)	0.09
Private	-	4 (8.7)	4 (4.7)	0.06

*standard error of difference in proportions

Table 2: Behavioural and clinical profile

	HTN N (%)	CKD N (%)	Total N (%)	P value*
Total	40 (100)	46 (100%)	86 (100%)	
Tobacco Smoking				
No	31 (77.5)	46 (100)	77 (89.5)	<0.01
Yes	9 (22.5)	-	9 (10.5)	
Other tobacco products				
No	38 (95.0)	45 (97.8)	83 (96.5)	0.48
Yes	2 (5.0)	1 (2.2)	3 (3.5)	

	HTN N (%)	CKD N (%)	Total N (%)	P value*
Alcohol				
Past user	1 (2.5)	18 (39.1)	19 (22.1)	<0.001
Non user	32 (80.0)	28 (60.9)	60 (69.8)	0.06
Current user	7 (17.5)	-	7 (8.1)	0.003
BMI				
Underweight	2 (5.1)	17 (37.0)	19 (22.4)	<0.01
Normal	15 (38.5)	22 (47.8)	37 (43.5)	0.39
Overweight	7 (17.9)	3 (6.5)	10 (11.7)	0.10
Obesity	15 (38.5)	4 (8.7)	19 (22.4)	0.001
Family H/O NCD				
No	23 (57.5)	41 (89.1)	64 (74.4)	<0.01
Yes	17 (42.5)	5 (10.9)	22 (25.6)	
Diabetes				
Yes	18 (45.0)	15 (32.6)	33 (38.4)	0.24
No	22 (55.0)	31 (67.4)	53 (61.1)	

**standard error of difference in proportions*

The HTN group is predominantly male (67.5%), the CKD group exhibits an equal gender distribution (50.0% male, 50.0% female). Economically, the CKD group had a higher burden of low income, with nearly half (47.8%) falling into the lowest income bracket (< 9,307 INR), compared to 35.0% in the HTN group. The HTN group is more represented in the higher-middle income brackets (30.0% earning 27,883–46,474 INR, compared to 10.9% of the CKD group). In terms of insurance coverage, a greater proportion of the CKD cohort reported having no insurance (30.4%) compared to the HTN cohort (15.0%). (Table 1)

Both groups have their largest single segment reporting 'High school' as their highest educational level (32.5% for HTN, 28.3% for CKD). However, the HTN group has a notably higher percentage of illiterate individuals (17.5% vs. 6.5% for CKD). The occupational data shows the largest portion of both groups are unemployed (HTN: 32.5%, CKD: 26.1%). The 'Unskilled workers' were absent in the CKD group (0.0% vs. 15.0% in the HTN group), and higher proportion in the CKD group for 'Clerical/shop/farm' (17.4% vs. 5.0%) and 'Professional' roles (13.0% vs. 0.0%). (Table 1)

The CKD group reported no current smokers (p<0.01), alcohol users and 22.5% of the HTN group reported smoking and 17.5% reported current alcohol consumption (p:0.003). A high percentage of CKD patients (39.1%) report having 'Left' alcohol consumption (p<0.001). The HTN group has high rates of Overweight (17.9%) (p:0.10) and Obesity (38.5%) (p:0.001). The CKD group, shows a large proportion classified as Underweight (37.0% vs. 5.1% in HTN, p<0.01) and Normal weight (47.8%). The CKD group reported a significant lower prevalence of a family history of non-communicable diseases (NCDs) (10.9%) compared to the HTN group (42.5%). (Table 2)

Discussion

The present study from a sub-Himalayan tertiary centre provides an overview of the clinico-epidemiological spectrum of patients with chronic kidney disease (CKD) on dialysis and hypertension (HTN), two interlinked entities within India's growing non-communicable disease (NCD) burden. Findings of equal gender distribution among CKD patients and male predominance in hypertensives align with regional and national data showing higher male hypertension prevalence and earlier disease onset, but similar CKD risk between sexes due to shared metabolic and environmental exposures. Our findings of high prevalence of low BMI, and absence of alcohol or tobacco use among CKD patients on dialysis reflect disease chronicity and advanced-stage catabolism. These results mirror those from Karnataka and Central India, where CKD is recognized as a major regional public health issue, often emerging independent of classical causes such as diabetes or hypertension.[5,6]

The systematic review by Talukdar et al. (2025) estimated the national community-based CKD prevalence at 13.24%, comparable to global

averages and highlighting a rising trend from 11% (2011–2017) to 16% (2018–2023).[2] This uptrend parallels the increased burden of diabetes and hypertension under the National Programme for Prevention and Control of Non Communicable Diseases (NP NCD). Within NP NCD, CKD is recognized as a critical end-stage complication of uncontrolled HTN and diabetes conditions now responsible for >60% of all NCD deaths in India.[3]

Hypertension, observed as both a cause and consequence of CKD in this cohort, remains the most common comorbidity across CKD studies. The Mumbai and Western India series reported that poor adherence to therapy, high LDL cholesterol, and infrequent medical check-ups were major determinants of hypertensive crises.[7] Similar behavioural and systemic factors may contribute to CKD progression in our population, emphasizing the need for integrated follow-up and adherence counselling under the NPNCD platform.

One striking finding of this study is that while 76.7% of participants reported some form of health insurance, nearly one-third of CKD patients (30.4%) remained uninsured, compared with only 15% among hypertensive patients. The Mukhya Mantri HIMCARE Scheme is the Himachal Pradesh State Government's insurance initiative. The eligible families can avail cashless treatment coverage of up to Rs. 5.00 lakh per year per family in empaneled hospitals.[8] In current analysis it covered over half (52.2%) of CKD patients, while only 4.3% benefited from the Ayushman Bharat-PMJAY, reflecting state-centric rather than national scheme utilization. This pattern highlights two policy insights; PMNDP, though designed to provide free haemodialysis under the NHM, may still be underutilized in peripheral regions due to limited district-level dialysis infrastructure or awareness, the coexistence of multiple small-scale insurance schemes (HIMCARE, PMJAY, Government Contributory) can lead to fragmentation and gaps in coverage, especially for chronic, high-cost conditions like CKD.

The NPCDCS framework emphasizes financial risk protection as a critical pillar of NCD management. However, our findings suggest that despite widespread insurance coverage, out-of-pocket expenditure for dialysis and transportation may remain significant in mountainous regions issues echoed in studies from other low-resource zones such as Central India and Raichur.[5,6]

Similar health financing inequities were reported internationally: a study from Somalia and Sudan demonstrated that low socioeconomic status, inadequate insurance, and irregular medical follow-up were strongly associated with hypertension complications and poor disease control.[9,10] These parallels reinforce the global need for integrated insurance and NCD service delivery, particularly in low-income, rural populations.

The sub-Himalayan belt, with its unique climatic and occupational exposures, presents emerging parallels with CKD clusters described in Raichur (Karnataka) and Central India (Chhattisgarh and Odisha) regions where CKD of unknown etiology has been increasingly reported.[5,6] In these areas, dehydration, pesticide contact, and possible water contamination were linked with nephrotoxicity in non-diabetic, non-hypertensive populations. Our data, though hospital-based, point towards similar environmental and occupational factors requiring further exploration through community-based surveillance within the NPNCD district NCD clinics.

Manual workers demonstrated a higher proportion of advanced CKD requiring dialysis, whereas hypertensive patients engaged in sedentary occupations more frequently reported long-standing hypertension with associated metabolic comorbidities. Similar findings were reported from SEEK study.[9] Unemployment was also observed in more than one fourth of population in both groups. Lakshmi et al., in their analysis on dialysis patients reported high proportion of unemployment (>60%) before initiation of dialysis.[10]

The Pradhan Mantri National Dialysis Programme (PMNDP), launched in 2016 under the NHM, aims to ensure free haemodialysis for BPL patients in district hospitals. Our findings of significant representation of low-income, uninsured patients with CKD underscore the relevance of PMNDP in

ensuring equity of renal care in geographically difficult sub-Himalayan terrains. However, dialysis dependence also reflects delayed detection an area where NPNCD can intervene through CKD screening at NCD clinics using serum creatinine and urine dipstick testing in all hypertensive and diabetic patients; integration of referral pathways between PHCs, NCD clinics, and PMNDP dialysis units for continuity of care; and community awareness campaigns for early reporting of urinary or hypertensive symptoms.

The CKD prevalence pattern in India is consistent with global trends but exhibits regional heterogeneity from 7% in northern states to >15% in southern zones.[2] Studies from Somalia and Sudan have shown similar associations between poor medical follow-up, male sex, and hypertensive complications, emphasizing the universality of these risk factors across developing nations.[11,12] These observations affirm that early intervention through population-level screening and lifestyle modification is more impactful than tertiary management alone.

CONCLUSION

The study underscores the dual burden of CKD and hypertension as intertwined NCDs in the sub-Himalayan population, shaped by socioeconomic vulnerabilities, poor healthcare access, and late-stage presentation. The paradoxical behavioural and anthropometric divergence between the two groups in form of obesity and active tobacco/alcohol use clustering in hypertensives, while underweight status and complete cessation of substance use dominating the dialysis cohort illustrates how risk-factor profiles shift dramatically as CKD advances, a transition seldom quantified in Indian hospital-based data.

RECOMMENDATION

The integration of NPNCD-based screening with PMNDP's dialysis coverage can provide a continuum of prevention and care. Further multicentric research and registry-based monitoring are warranted to identify regional etiologies, improve early detection, and guide resource allocation for CKD control in India's high-altitude and resource-limited regions.

LIMITATION OF THE STUDY

The present study has several limitations that should be acknowledged. Being a hospital-based cross-sectional study, it may not fully represent the community-level burden of CKD and hypertension in the sub-Himalayan population. Our sample (n=86) was selected by consecutive sampling from a single tertiary centre and was not powered for detecting moderate differences between groups. The cross-sectional design precludes causal inference between clinical variables and disease outcomes.

RELEVANCE OF THE STUDY

Hypertension and dialysis dependent chronic kidney disease are two ends of single NCD continuum. Through this study the gap in profiling of these diseases is addressed. The fragmentation in financial protection for chronic kidney care that has not been previously highlighted for the sub-Himalayan region. The findings strongly recommend early CKD screening at NCD clinics, strengthened referral linkages between PHCs and dialysis units, and unification of insurance pathways for programme managers working in geographically challenging terrains.

AUTHORS CONTRIBUTION

Conceptualization: AM; Methodology: VK, SS; Software: MS; Validation: AR, MK; Formal analysis: MS; Investigation: VK,SS; Resources: AM; Data Curation: MS; Writing (original draft): MS, AM; Writing (review & editing): AR, MK ; Visualization: AM; Supervision: AR,MK; Project administration: AM

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CONFLICT OF INTEREST

There are no conflicts of interest.

DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors used AI tool, Open AI-ChatGPT 5.0 in order to paraphrase and refine the language of the Introduction, Discussion, and Relevance

sections to improve clarity and readability. The tool was not used to generate scientific content, data, analysis, or references. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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