

A Scoping Review on Estimation of Economic Burden of Chronic Kidney Diseases in India

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Abstract— Objective: To study the expenses of Chronic Kidney Disease (CKD) stages III, IV and V, haemodialysis, peritoneal dialysis and kidney transplantation among Indian population.

Background: Chronic Kidney Disease (CKD) has become a leading cause of morbidity and mortality around the world. It's an ailment in which kidney function gradually deteriorates over time. Between 2000 and 2025, the number of people with hypertension is predicted to double. As a result, India will become a CKD reservoir. Treatment for CKD depends on the stage of kidney disease. Treatment for CKD is expensive especially in the later stages of the disease. There are no government reimbursements for dialysis or transplantation in India, and only a small number of End Stage Renal Disease (ESRD) patients have employer sponsors or health insurance that covers RRT.

Methods: A systematic scoping review undertaken by carrying out a literature search in different databases with relevant keywords to assess the nature, scope, and range of the existing literature on the CKD, and to produce a comprehensive synthesis of the available evidence on the economic burden of CKD in India. It focuses on evidence that can be easily put into practice and employ a wide range of evidence to address a broad review issue. A total of 14 articles were analysed for this study and the data was subjected to descriptive analysis.

Results: By government health schemes some patients can afford the access to the ESRD treatments. As the subsidies are income based, the amount is not enough to create an impact on every patient's treatment. The overall annual cost of illness was calculated to be \$308 on average. Direct expenditures accounted for 79.9% of total treatment costs. Medicines were the most expensive part of the direct cost, followed by laboratory fees and transportation. The annual average costs of treatment for patients on medication only and patients

on haemodialysis plus medication were Rs 25,836 (US \$386) and Rs 2,13,144 (US \$3181), respectively. The total cost per session was found to be around Rs.4500, out of which direct medical costs was 56%, direct non-medical cost was 20% and indirect costs was 24%. The prevalence of catastrophic health expenditure on ESRD patients was 95% and that of distress financing was 70%.

Conclusion: CKD is a worldwide public health problem. Patients, more commonly those from the low-income strata, have difficulties in availing the health care services because of the costs involved in the diagnostic and curative procedures. Even though cost of care is low in public hospitals, patient had to bear out-of-pocket expenditure (OOPE) on the direct and indirect costs, which further impoverish them and only the upper or upper middle-class patients can undergo haemodialysis regularly. This is a concern for nation's health policy, to address the cost, quality and accessibility of health care. As the societal demands for health care equity is growing, balancing the societal and personal costs of treatment for chronic disease will be a continuous learning curve for policy makers, health systems, communities, families and patients.

Index Terms: CKD, Disease Burden, Pharmacoeconomic Outcome, Out-of-Pocket Expenditure.

INTRODUCTION

Chronic kidney disease has become a leading cause of morbidity and mortality around the world. Chronic kidney disease, commonly known as chronic renal disease or CKD, is an ailment in which kidney function gradually deteriorates over time. It includes conditions that damage kidneys and decrease their ability to keep the person healthy by filtering wastes from blood. If the kidney disease worsens, the waste

can build up to high levels in blood, making the patient feel sick. (1)

Diabetes, high blood pressure, heart disease, and a family history of kidney failure are the key risk factors for renal disease, in which diabetes and high blood pressure are being the most common causes. Patients with these diseases must get tested regularly for early diagnosis the kidney diseases. (2)

The Glomerular Filtration Rate (GFR) indicates the health of the kidneys. It is very challenging to obtain an accurate GFR level because measured GFR (mGFR) is a lengthy and complicated process and impractical for both clinicians and patients. Therefore, health professionals use a formula to estimate GFR (eGFR), which is important in identifying the kidney diseases. A simple test that measures the creatinine levels is the standard way to obtain eGFR. According to national kidney foundation, eGFR of 90 or higher is in the normal range, eGFR of 60 -89 means early kidney disease, eGFR of 15 -59 may mean kidney disease and eGFR below 15 may mean kidney failure.(3)

With an estimated 57.2 million cases of diabetes in 2025, India has the world's highest diabetes population. Between 2000 and 2025, the number of people with hypertension is predicted to double. As a result, India will become a CKD reservoir. As the treatment of CKD and ESRD is very expensive, it is not reachable for more than 90% of the patients in India. Between the developed and developing countries there's a difference in the annual incidence of ESRD reports, 34 – 240 per million population to 98 – 198 per million population, respectively. As India lacks a comprehensive renal registry, exact data on the prevalence of CKD is uncertain. In 2006, the "Screening and Early Evaluation of Kidney Disease" (SEEK) study began to find out the prevalence of kidney disease in India's rural and urban populations, as well as the key causes and complications. This study found a very high prevalence of CKD (17.4%) among 5,623 participants, with 1.6 percent of those in Stages 4 and 5 of the disease. Only 1.6 percent of the 17.4 percent with CKD were in Stages 4 and 5, whereas 7 percent were in Stage 1, 4.3 percent were in Stage 2 and 4, and 5 percent were in Stage 3.

Table 1: Summary of data from studies of CKD burden from India (Dabhi, 2010)

Author	Geographical area	Method of study	No of subjects	Criteria for CKD	Prevalence
Mani 2003	South India	Domiciliary	20,986	MDRD GFR < 80 ml/min/1.73 m ²	8.6/thousand (0.86%)
Mani 2005	South India	Domiciliary	6,100	MDRD GFR < 80 ml/min/1.73 m ²	13.9/thousand (1.4%)
Agarwal et al. 2005	North India	Screening camp module	4,712	Serum creatinine > 1.8 mg/dl	7.85/thousand (0.785%)
SEEK study	India	Domiciliary, community-based camps, hospital-based camps	5,623	MDRD-III, GFR < 60 ml/min/1.73 m ² or urine albumin ≥ 1+	17.4% CKD Stage 3 – 5: 6%

Treatment for CKD can help in relieving the symptoms and prevent the disease from getting worse, but there's no cure. Treatment depends on the stage of kidney disease. The main treatments are:

- LIFESTYLE CHANGES**
 - To help stay as healthy as possible
- MEDICINES**
 - To control high blood pressure, blood sugar and high cholesterol
- DIALYSIS**
 - Method of removing waste products from the blood
- KIDNEY TRANSPLANT**
 - A surgical procedure to place a healthy kidney from a donor

There are some lifestyle changes that are usually recommended for patients with kidney disease, which includes:(4)

Quitting smoking
Managing alcohol consumption of not more than the recommended limit of 14 units of alcohol/week
Restricting the salt intake of < 6g/day
Maintaining a healthy balanced diet
Doing regular exercise of at least 150 minutes/week
Weight loss if overweight or obese
Avoiding over-the-counter (OTC) Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) (like Ibuprofen) until advised by a medical professional

Treatment for CKD is expensive especially in the later stages of the disease. The prevailing economic conditions, the political-social structure, overall health care facilities, and the health care funding strategies of the country will impact the availability and quality of dialysis programs. The enormous costs of the treatment will limit the treatment continuation in most patients with ESRD leading to short-term patient survival. There are no government reimbursements for dialysis or transplantation in India, and only a small number of ESRD patients have employer sponsors or health insurance that

covers Renal Replacement Therapy (RRT) (Kher, 2018).

In India, the average prevalence values for treated ESRD (not diagnosed ESRD); dialysis and transplant patients were 70, 60 and 10 ppm, respectively. This number is increasing globally at a rate of 7% every year. It is estimated that only 10–20% of ESRD patients in India continue long-term Renal Replacement Therapy (RRT). It is estimated that in India in 1 year, there are 3,500 new renal transplants + 3,000 new continuous ambulatory peritoneal dialysis (CAPD) initiation + 15,000 new maintenance haemodialysis (MHD) patients. Availability and affordability of the treatment are the two important issues for any disease treatment. Lack of nephrologists, haemodialysis (HD) units, unequal distribution of nephrology service availability and the treatment cost are leading to treatment inaccessibility for most of the patients. The government sponsored programs in the South Indian states like Rajiv Arogyasri in Andhra Pradesh (AP) and Chief Ministers' Health Insurance Scheme in Tamil Nadu (TN) provide free dialysis and transplantation for the poor patients. Few Nongovernment Organization (NGOs) like the Tanker Foundation in TN and Kerala offer subsidized treatment for the poor. Improving the government hospital's infrastructure would be the only way to provide equity of treatment, accessibility and to reduce the cost of treatment in the long run. Majority of India lives in small towns and villages and most of the maintenance haemodialysis (MHD) units are located in the cities. As most of the patients travel long distances to reach a MHD facility, money and time is lost. Since 2003, the peritoneal dialysis (PD) program in India has been expanded due to the "once-in-a-lifetime payment" scheme for patients paid to the manufacturing industry for PD supplies. The lifetime scheme currently costs Rs. 7,00,000 payable as a single payment or three instalments over 3 years. In 2010, a medical insurance company introduced PD 'Suraksha' insurance for peritonitis, which covers everything a patient needs during an episode of peritonitis (Ilangovan Veerappan, 2013). The goal of this review is to study the expenses of CKD stages III, IV, and V, haemodialysis, peritoneal dialysis, as well as kidney transplantation in Indian populations.

METHODS

A systematic scoping review was undertaken to assess the nature, scope, and range of the existing literature on the CKD, and to produce a comprehensive synthesis of the available evidence. The literature search was carried out in PubMed, Cochrane, Science Direct, Google, and Google Scholar, combining Mesh terms and Boolean terms and key words to identify papers published in English related to economic burden of CKD treatment. Scoping reviews focus on evidence that can be easily put into practise and employ a wide range of evidence to address a broad review issue. The publications were abstracted to include information on the expenditures associated with CKD in India. The data was subjected to a descriptive analysis. The keywords used were "chronic kidney disease", "dialysis", "economic burden", "expenditure", "financial burden", "burden", "treatment", "scoping review" and "India". Studies were excluded if they had no criteria for economic aspect of CKD. The search yielded 241 articles, out of which 103 were excluded as title or abstract was not relevant and 92 were excluded as duplicates. 46 studies were full text assessed and 32 were excluded as non-relevant. All the 14 articles used for this study for review are cited in the references.

RESULTS

As the middle-class population increases, the rates of obesity, hypertension, diabetes and CKD also increases and the societal demands for health care equity grows. Some patients can afford the access to the ESRD treatments by government health insurance schemes. These schemes provide haemodialysis twice weekly, peritoneal dialysis or transplantation for the underprivileged and that's a boon for the beneficiaries. But the subsidies are income based and the amount is not enough to create an impact (Krishnan, The Importance of Considering Total Patient Economics for Haemodialysis, 2019).

According to a cross-sectional study of 150 patients conducted at a renal clinic of medicine in the outpatient department of the Government Hospital, Chandigarh, India, the annual average costs of treatment for patients on medication only and patients on haemodialysis plus medication were Rs 25,836 (US \$386) and Rs 2,13,144 (US \$3181), respectively.

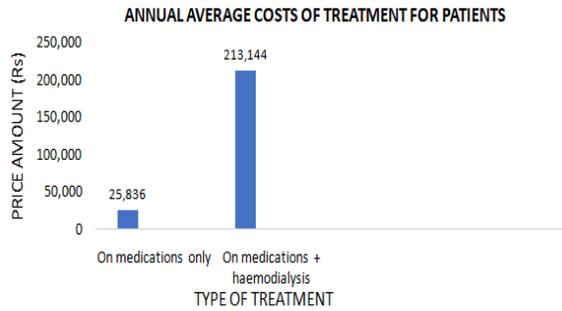


Figure 1: The annual average costs of treatment for patients on medication only and patients on medication plus haemodialysis

The average out-of-pocket expenditure (OOPE) was found to be significantly higher, Rs 65,664, than when the treatment was funded by the employer, Rs 48,600. Also, the OOPE was found to be significantly different in stage 5 CKD than with patients in stages 2 to 4, because most of the patients in CKD stage 5 stage were on dialysis and required erythropoietin in addition to other medications. Due to high cost and low income of patients in lower socioeconomic status, they are unable to afford the treatment, and this remains to be one of the most common reasons for nonadherence to dialysis among CKD patients (Rajiv Ahlawat MPharm, 2017).

A retrospective study of 200 End Stage Renal Disease patients admitted in nephrology wards in SKIMS calculated both direct medical charges and direct non-medical charges. The calculated charges in the form of average annual and average monthly expenditure per patient in rupees are: (Abas Khan, Economic Burden of End Stage Renal Disease: A Study from India, 2020)

Table 1: The calculated charges in the form of average monthly and average annual expenditure per patient

CHARGES	AVERAGE MONTHLY EXPENDITURE PER PATIENT (in Rupees)	AVERAGE ANNUAL EXPENDITURE PER PATIENT (in Rupees)
Hospitalization	570.22	6,842.67 ± 1,046.53
Drugs	4,874.42	58,493.12 ± 13,845.47
Investigation	2,305.02	27,660.35 ± 9,545.43
Haemodialysis	10,764.60	1,29,175.24 ± 12,448.44
Pentoneal dialysis	416.67	5,000.00 ± 804.48
Transplantation	8,419.54	1,01,034.56 ± 15,048.67
Transportation	1,454.35	17,452.31 ± 3,265.08
Lodging	1,107.09	13,285.16 ± 1,025.27
Miscellaneous	462.08	5,545.00 ± 1,045.43
TOTAL	30,374.00	3,64,488.41 ± 51,040.48

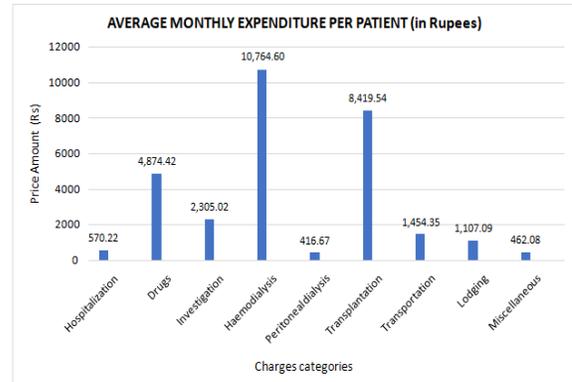


Figure 2: The calculated charges in the form of average monthly expenditure per patient

The same retrospective study in SKIMS found that the prevalence of catastrophic health expenditure on ESRD patients was 95% and that of distress financing was 70% (Abas Khan, Prevalence of Distress Financing and Catastrophic Health Expenditure among End Stage Renal Disease Patients Attending A Tertiary Care Teaching Hospital of North India, 2020).

In the study of 60 participants surveyed in Kerala, it was estimated that the average cost per session in person was Rs 1,028.3, around Rs 12,339.6 per month. According to Suja A et al. report, average cost of dialysis was Rs.4500, out of which direct medical costs was 56%, direct non-medical cost was 20% and indirect costs was 24%. According to another study of Fathima et al., the average median direct medical cost was Rs 85,999 and the non-medical cost was Rs 14,437 (Manjula MJ, 2021).

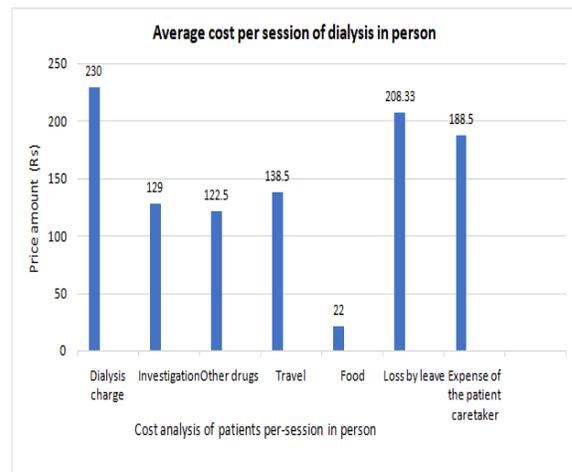


Figure 3: Average cost per session of dialysis in person

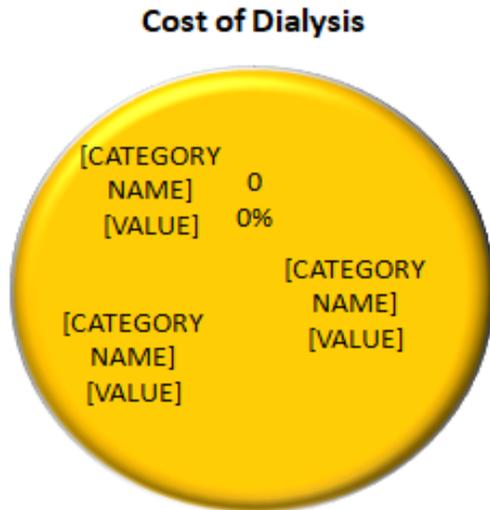


Figure 4: Different aspects of total cost of dialysis
A study was undertaken to understand the household financial burden in the care of patients with predialysis CKD in rural communities in Uddanam, enrolled 221 patients of average age 57.5 years, with 51.6% females. The overall annual cost of illness was calculated to be \$308 on average. Direct expenditures accounted for 79.9% of total treatment costs. Medicines were the most expensive part of the direct cost, followed by laboratory fees and transportation. About 57% of the patients obtained treatment from private hospitals/clinics, 23% from government hospitals and 19.9% from both private and government hospitals/clinics. Around 67.4 % of the patients faced catastrophic costs and 39% of the patients were engaged in distress financing. Patients seeking care from private facilities experience catastrophic expenditure and distress financing (Balaji Gummid, 2022).

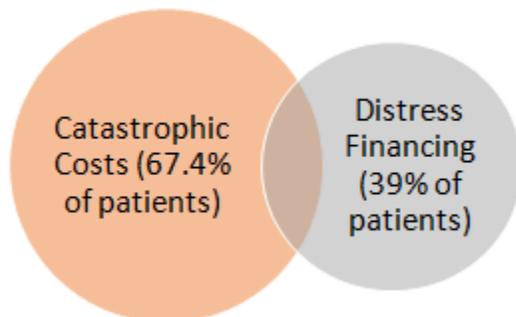


Figure 5: Economic burden of CKD treatment for the patients

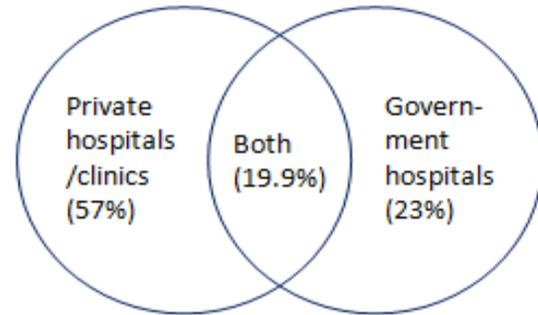


Figure 6: Place of seeking CKD treatment by the patients

CONCLUSION

CKD is a worldwide public health problem. Patients, more commonly those from the low-income strata, have difficulties in availing the healthcare services because of the costs involved in the diagnostic and curative procedures. Even though cost of care is low in public hospitals, patient had to bear out-of-pocket expenditure on the direct and indirect costs, which further impoverish them. Since the patients are paying from their own pocket, only the upper or upper middle-class patients can undergo haemodialysis regularly. With this, patients requiring tertiary care often go untreated, even if they are aware of the availability of high-quality treatment services, delaying the diagnostic and curative procedures, or even causes thousands of poor patients' death. This is a concern for nation's health policy, to address the cost, quality and accessibility of health care. Most patients with CKD can be managed by prevention and early detection of CKD by their primary physicians with timely nephrology referrals which mandates involvement of physicians at all levels (Grill, 2018). As the societal demands for health care equity is growing, balancing the societal and personal costs of treatment for chronic disease will be a continuous learning curve for policy makers, health systems, communities, families and patients (Krishnan, The Importance of Considering Total Patient Economic for Haemodialysis, 2019). Some initiatives such as governmental provision of affordable and easily accessible treatment of ESRD, reduction in cost of transplantation and increasing transplant donors are improving the care of ESRD patients.

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