Pharmacoeconomic evaluation of hospitalised pre-dialysis and dialysis patients: A comparative study

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RESEARCH

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ABSTRACT

Background
The progression of chronic kidney disease (CKD) can be attributed to various factors, including lack of medical services, delayed referral, lack of awareness about the disease, drugs, and financial support.

Aims
To compare the pharmacoeconomic-related direct medical and non-medical costs among hospitalised pre-dialysis and dialysis patients.

Methods
A prospective observational study was conducted on the inpatients admitted to the Department of Nephrology. Patients undergoing maintenance dialysis or initiated on renal replacement therapy were included in the dialysis patients group and other CKD patients in the pre-dialysis group. The data pertaining to the pharmacoeconomic-related direct medical and non-medical costs were collected from the patient records, medical bills, and other relevant sources.

Results
Out of 100 patients, 43 were in the pre-dialysis group and 57 were in the dialysis group. The median direct medical costs (INR 4,731.62, USD $76.47) for dialysis group patients were significantly higher than for the pre-dialysis group (INR 1,820.95, USD $29.43). The median direct non-medical costs (INR 550, USD $8.88) for pre-dialysis group patients were not significantly higher than for the dialysis group (INR 480, USD $7.75).

Conclusion
There was a significant difference in the median direct total costs between pre-dialysis and dialysis patients. The number of medications per prescription and length of hospital stay are the factors that influence the median direct total costs.

Key Words
Chronic kidney disease, dialysis, economics, cost, hospitalisation

What this study adds:

1. What is known about this subject?
Chronic kidney disease is a major public health issue and one of the leading causes of morbidity, mortality, and economic burden on patients in developing countries, including India.

2. What new information is offered in this study?
The exact cost of hospitalised CKD patients' treatment in India was not found in the literature. The present study aimed to assess the pharmacoeconomic-related direct

medical costs and direct non-medical costs among hospitalised pre-dialysis and dialysis patients.

3. What are the implications for research, policy, or practice?

Study results give insight into hospitalised CKD patient costs details for policy makers. In the future, multicentric studies should be conducted to better understand the economic aspects of CKD patients.

Background

Chronic kidney disease (CKD) is a major public health issue and leading cause of morbidity, mortality, and economic burden on patients in developing countries.[1–3] Worldwide, 50 million patients require treatment for CKD.[4] In India, there were 3.78 million deaths in 1990 due to CKD; this number is projected to rise to 7.73 million by 2020.[5] In India, it is reported that the progression of CKD can be attributed to various factors, including lack of medical services, delayed referral, lack of awareness about the disease, drugs, and financial support.[6]

According to the National Kidney Foundation (NKF) in the United States, CKD is classified into five stages based on the severity of the disease.[7–9] The CKD patients in stage 5 require renal replacement therapies (RRT), which is a very expensive treatment process. CKD enforces substantial economic consequences in terms of direct loss of gross domestic product.[10] As a result, patients invariably depend on family income and this has a negative effect on marital status, family, and social activities.[11] The exact cost of hospitalised CKD patients' treatment in India was not found in the literature. The objective of the study was to compare the pharmacoeconomic-related direct medical and non-medical costs among pre-dialysis and dialysis patients.

Method

Study design, setting, and patients

A prospective observational study was conducted for a period of three months (September to November 2014) at a tertiary care hospital in the Inpatient Nephrology Department. The study was approved by the Hospital Ethics Committee, Manipal, prior to the initiation of the study. Recruitment of patients was based on the selection criteria after obtaining informed consent from the patient or patient's relatives. The patients were divided into two groups: the pre-dialysis group and the dialysis group. Patients who were undergoing maintenance dialysis or initiated on renal replacement therapy were included in the dialysis group and other CKD patients were included in the pre-dialysis group. The patients who were diagnosed with CKD over 18 years of age and with more than 48 hours of hospital stay were included in the study. Patients with psychiatric problems or who died during hospitalisation and critically ill patients were excluded from the study.

Data collection

Demographic details such as age, gender, diagnosis, comorbid conditions, length of hospital stay, and number of medications per prescription were obtained from patient medical records. The patients were observed until discharge from the hospital. The pharmacoeconomic-related direct medical costs (medicines, dialysis, surgical procedure, laboratory investigations, consultations, nursing services, and hospitalisation) and direct non-medical costs (transportation to the hospital and food) were collected from the patient records, medical bills, hospital accounts section, interviewing the patients or patient parties, and other relevant sources.[12]

Cost analysis

The median direct medical and non-medical costs for the hospitalised pre-dialysis and dialysis per patient were calculated by using SPSS 15 version (Bengaluru, India). The direct costs are the sum of the direct medical costs and direct non-medical costs.[12] The data of all the costs Indian Rupee (INR) were converted into US dollars (USD) at the rate of 1$ = 61.87 INR value in December 2014.

Statistical analysis

The normally distributed continuous variables were presented as mean ± standard deviation and skewed distribution variables were presented as median and interquartile range (Q1–Q3). The categorical variables were presented as frequency and percentage. Mann Whitney U Test was applied for drawing comparison between two groups and Spearman Correlation Test was used to assess the relationship between direct cost components and the age, number of medications per prescription, length of hospital stay, and the distance traveled for hospital visits among CKD patients. The Mann Whitney U Test and Pearson's Two-tailed Tests with $p < 0.05$ were considered statistically significant.

Results

A total of 100 patients were recruited during the study period. Out of 100, 43 patients were in the pre-dialysis group and 57 in the dialysis group. The median length of hospital stay for the dialysis group patients was significantly higher than the pre-dialysis group ($p < 0.001$), and the median distance traveled by the pre-dialysis group patients

to visit the hospital was significantly higher than the dialysis group (p<0.001). The demographic details are summarised in Table 1.

The median direct medical costs (INR 4,731.62, USD $76.47) in dialysis group patients were significantly higher than the pre-dialysis group (INR 1,820.95, USD $29.43), and the median direct non-medical costs (INR 550, USD $8.88) in pre-dialysis group patients were not higher than the dialysis group (INR 480, USD $7.75). The median direct medical and non-medical costs among CKD patients are summarised in Table 2. The percentages of direct cost components among pre-dialysis and dialysis patients are summarised in Figure 1. The median direct medical and non-medical costs per day among pre-dialysis and dialysis patients are summarised in Table 3.

The median number of medications per prescription and median length of hospital stay were significantly correlated with the median direct costs in both the pre-dialysis and dialysis patient groups (p<0.001). The correlation between the mean age, median number of medications per prescription, median length of hospital stay, and the median distance traveled to visit hospital, and direct cost components among the pre-dialysis group and the dialysis group patients are summarised in Tables 4 and 5.

Discussion

The costs associated with pre-dialysis and dialysis are mostly borne by diverse payers.[13] The present study was conducted taking into consideration the patient's perspective. The mean age of pre-dialysis patients (50.67 yrs) and dialysis patients (49.80 yrs) in the study was less when compared to the similar studies [pre-dialysis (59.3 yrs) and dialysis (53.3 yrs)]. The median length of hospital stay [pre-dialysis (five days) and dialysis (eight days)] was higher than the similar study[14] [pre-dialysis (four days) and dialysis (five day)]. These results were consistent with the study conducted by Satyavani et al.[14] The median cost of medications among dialysis patients were significantly higher than the pre-dialysis patients, which could be because of the higher median number of days of hospitalisation, and number of medications per prescription. Treatment of anemia of CKD in hemodialysis patients is very expensive. The previously conducted study revealed that the management of anemia among hemodialysis per patient per eight months in India is USD $2,216.06.[15]

The median direct cost is significantly higher in dialysis patients (INR 2,628.31, USD $42.48) in comparison to pre-dialysis patients (INR 1,143.02, USD $18.47). This could be because of the extra burden of dialysis (INR 3,100, USD $5.10), higher pill burden (INR 12,763.58, USD $206.29), and longer duration of hospital stay. But the direct non-medical costs for pre-dialysis patients were higher than for dialysis patients, which could be because of the higher travel costs to visit the hospital for the second opinion about the disease condition (median travel distance being 450km for the pre-dialysis group and 80km for the dialysis group). The direct non-medical cost is higher in developed countries when compared to that of developing countries due to the difference in GDP and the higher spending on health services in those countries.[16]

In the present study, it is observed there is a significant difference in the median length of hospitalisation among pre-dialysis and dialysis patients. Hence the cost (direct medical and non-medical) of hospitalisation has been computed per day to compare to both groups. The median direct medical, non-medical, and total costs were significantly different among pre-dialysis and dialysis patients. The previously conducted study has revealed that the annual healthcare costs per patient are significantly higher in dialysis patients (USD $56,988.50) than pre-dialysis patients (USD $11,790.10).[17]

The present study offers policy makers and stakeholders insight into medical and non-medical expenditures for hospitalised CKD patients. The study has also made an attempt to compare pharmacoeconomic aspects of hospitalised pre-dialysis and dialysis patients. In the future, multicentric studies should be undertaken for a better understanding of the economic aspects of the diverse CKD population. The main limitations of the study such as the sample size and the duration of the study is less.

Conclusion

The median direct total cost for the pre-dialysis (INR 1,143.02, USD $18.47) and dialysis (INR 2,628.3, USD $42.48) patients differed significantly. The number of medications per prescription and length of hospitalisation had a significant impact on the median direct total costs among the pre-dialysis and dialysis patients.

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PEER REVIEW

Not commissioned. Externally peer reviewed.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

ETHICS COMMITTEE APPROVAL

The study was approved by the Institutional Ethics Committee (IEC/165/13), Kasturba Hospital, Manipal, India.

Table 1: Demographic details of the patients

Demographic details	Pre-dialysis patients (%) (n=43)	Haemodialysis patients (%) (n=57)	*p* value
Age (Mean±SD)	50.67 ± 11.87	49.80 ± 17.76	0.972
Gender			
Male	34 (79.1)	46 (80.7)	
Female	9 (20.9)	11 (19.3)	0.841
Comorbidity Conditions			
Hypertension	39 (90.7)	49 (86)	0.547
Diabetes	24 (55.8)	25 (43.9)	0.313
Cardiovascular problems	3 (7)	4 (7)	1.000
Hypothyroidism	3 (7)	8 (14)	0.343
Chronic Obstructive Pulmonary Disease (COPD)	2 (4.7)	1 (1.8)	0.576
Number of medications per prescription	12.55 ± 4.68	13.10 ± 4.86	0.701
Length of hospital stay in days Median (Interquartile range)	5 (3–7)	8 (5–11)	0.00
Distance travelled to visit hospital (km)	450 (100–600)	80 (28–225)	0.000

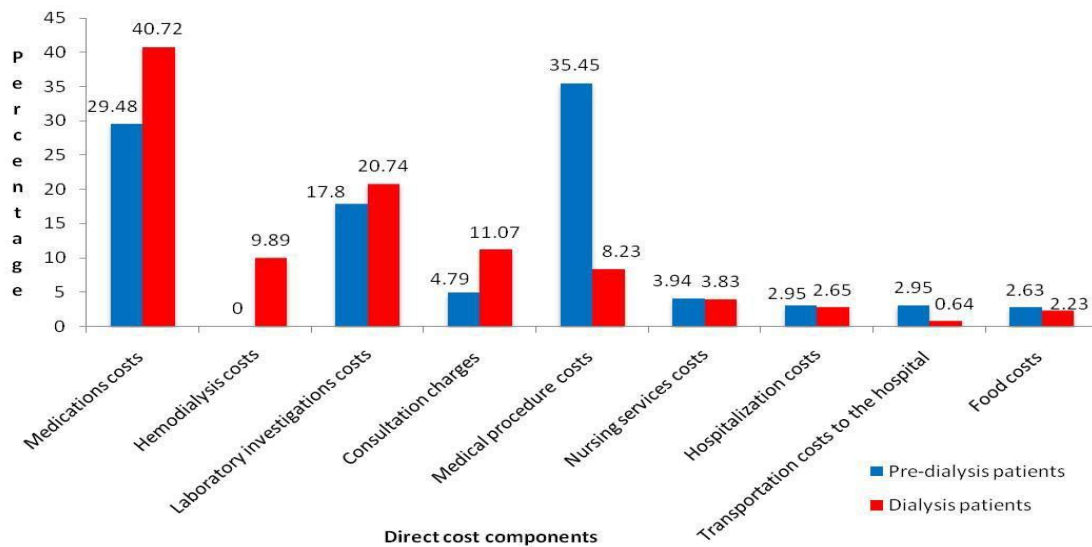**Figure 1: Percentage of direct cost components**

Table 2: The median direct medical and non-medical cost components (per patient) among CKD patients

Cost Components	Pre-dialysis patients Median Costs (INR, $) and IQR (INR) (n=43)	Dialysis patients Median Costs (INR, $) and IQR (INR) (n=57)	*p* value
Direct medical cost components			
Medications costs	INR 4,489.75, USD $72.56 (INR 1,821.67–INR 8,074.49)	INR 12,763.58,USD $206.29 (INR 4992.18–INR 19,446.57)	0.000
Dialysis costs	–	INR 3,100, UD $5.10 (INR 2,300-INR 4,500)	–
Laboratory Investigations costs	INR 2,710, USD $43.80 (INR 1,717.5–INR 5773.75)	INR 6,500, USD $105.05 (INR 3,232.50–INR 10,302.50)	0.000
Consultation charges	INR 730, USD $11.79 (INR 425–INR 2635)	INR 3,469.20, USD $56.07 (INR 1745–INR 5482.50)	0.000
Surgical procedure costs	INR 5,400, USD $87.27 (INR 157.50–INR 5.437.50)	INR 2,580, USD $41.70 USD (INR 1,000–INR 6,400)	0.764
Nursing services costs	INR 600, USD $9.69 (INR 300–INR 900)	INR 1200, 1 USD $9.39 (INR 750–INR 1,650)	0.000
Hospitalization costs	INR 450, USD $7.27 (INR 350–INR 830)	INR 830, 1 USD $3.41 (INR 555–INR 1,290)	0.000
Direct non-medical costs			
Transportation costs to the hospital	INR 450, USD $7.27 (INR 100–INR 600)	INR 200, USD $3.23 (INR 200–INR 600)	0.375
Food costs	INR 400, USD $6.46 (INR 300–INR 700)	INR 700, USD $11.31 (INR 400–INR 1,000)	0.014
Median total direct costs	INR 1,143.02, USD $18.47 (INR 745.98–INR 2,059.90)	INR 2,628.31, USD $42.48 (INR 1,537.17–INR 3,861)	0.000

IQR- Interquartile range

Table 3: Median per day length of direct medical and non-medical costs (per patients) among CKD patients

Cost Components	Pre-dialysis patients Median Costs (INR, USD $) and IQR (INR) (n=43)	Dialysis patients Median Costs (INR, USD $) and IQR (INR) (n=57)	*p* value
Direct medical costs	INR 405.90, USD $6.56 (INR 337.21–INR 579.80)	INR 573.11, USD $9.26 (INR 448.70–INR 810.03)	0.003
Direct non-medical costs	INR 95.83, USD $1.54 (INR 63.63– INR 140)	INR 67.50, USD $1.09 (INR 51.66–INR 89.44)	0.006
Median total direct costs	INR 264.74, USD $4.27 (INR 206.74–INR 349.10)	INR 327.36, USD $5.29 (INR 260.28–INR 429.64)	0.019

Table 4: Correlation between direct cost components and the age, number of medications per prescription, length of hospital stay, and distance travelled to visit hospital among pre-dialysis patients

Direct Cost Components	Age *p* (r)	Number of medications per prescription *p* (r)	Length of hospital stay *p* (r)	Distance travelled to visit hospital *p* (r)
Direct medical costs	0.323 (0.154)	0.002 (0.464)**	0.000 (0.699)**	0.480 (−0.111)
Direct non-medical costs	0.178 (−0.209)	0.002 (0.464)**	0.007 (0.404)**	0.000 (0.610)**
Median total direct costs	0.343 (0.148)	0.001 (0.497)**	0.000 (0.688)**	0.939 (−0.012)

r = Spearman's rho Correlation Coefficient

** Correlation is significant at the 0.01 level

Table 5: Correlation between direct cost components and the age, number of medications per prescription, length of hospital stay, and distance travelled to visit hospital among dialysis patients

Direct Cost Components	Age p (r)	Number of medications per prescription p (r)	Length of hospital stay p (r)	Distance travelled to visit hospital p (r)
Direct medical costs	0.141 (0.197)	0.000 (0.494)**	0.000 (0.692)**	0.067 (−0.245)
Direct non-medical costs	0.288 (−0.143)	0.164 (0.187)	0.000 (0.516)**	0.000 (0.609)**
Median total direct costs	0.191 (0.176)	0.000 (0.508)**	0.000 (0.715)**	0.196 (−0.174)

r = Spearman's rho Correlation Coefficient

** Correlation is significant at the 0.01 level