



Original Article

Prevalence of Polypharmacy and its Financial Burden on Patients Undergoing Hemodialysis

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Abstract

Background: Polypharmacy is highly prevalent among patients with chronic kidney disease (CKD), due to the need for complex pharmacological management. The use of multiple medications increases the risk of financial burden. Data regarding the economic impact of polypharmacy among hemodialysis patients in Libya remain limited. **Objective:** To determine the prevalence of polypharmacy and evaluate its associated financial burden among patients undergoing maintenance hemodialysis at Zawia Renal Center, Libya. **Methods:** A cross-sectional study was conducted between August and December 2025 at Zawia Renal Center, Libya. Adult patients (≥ 18 years) receiving maintenance hemodialysis three times weekly were included. Data were collected using a standardized data collection form. Medication costs were calculated for each participant. Statistical analysis was performed using SPSS version 27. Descriptive statistics summarized the data, while Fisher's Exact test and one-way ANOVA were used to examine associations. A P-value < 0.05 was considered statistically significant. **Results:** A total of 139 patients were included (53.2% male; mean age predominantly ≥ 50 years). Polypharmacy (5–9 medications) was identified in 85.6% of participants, whereas 7.2% had hyperpolypharmacy (≥ 10 medications) and 7.2% used fewer than five medications. The overall mean number of medications was 6.55 ± 1.69 . Average monthly medication costs increased progressively with medication burden, from approximately 407 Libyan Dinars (LYD) among patients taking 1–4 medications to 735 LYD among those with polypharmacy and 1,141 LYD among patients with hyperpolypharmacy. Most participants belonged to low- or middle-income groups, and only 4.8% had health insurance coverage. **Conclusion:** Polypharmacy is highly prevalent among Libyan patients undergoing maintenance hemodialysis and is associated with a substantial increase in financial burden. These findings highlight the need for medication optimization strategies and reducing unnecessary polypharmacy among hemodialysis patients.

Keywords: Chronic kidney disease (CKD); Hemodialysis (HD); Polypharmacy; Hyperpolypharmacy; Medication cost; Financial burden; Libya.

Introduction

Chronic kidney disease (CKD) is becoming a major public health concern with its prevalence rising worldwide. Patients with chronic kidney disease frequently carry a high burden of comorbid conditions and often require multiple medications to slow disease progression, manage complications and to treat associated illness [1]. In addition, chronic kidney disease is associated with a higher risk of hospitalization, premature mortality and cardiovascular disease. This makes polypharmacy a part of their life. Polypharmacy is defined as concurrent use of 5–9 medications daily [2]. The use of at least 10 medications is particularly notable, representing a condition described in the Geriatrics and Pharmacology literature as hyperpolypharmacy [3]. Hyperpolypharmacy represents an

extreme version of polypharmacy—the condition of taking a high number of medications and is associated with a number of adverse outcomes, including disability, hospitalizations and mortality [4].

Individuals with CKD are highly vulnerable to polypharmacy due to underlying diseases and consequences of impaired kidney function; also, CKD risk factors such as hypertension, diabetes, cardiovascular disease (CVD), CKD-related bone and mineral disease and anaemia are more prevalent in this population (5). A significant proportion of their prescriptions are considered potentially inappropriate medications (PIMs) [6]. Polypharmacy is also associated with a broad range of adverse health outcomes, decreased quality of life,



Libyan Journal of Medical Research

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eISSN: 2413-6096

resulting in high costs to both the patient and the healthcare system [7].

The prevalence of polypharmacy in patients with CKD was over 80%, and highest in patients with a kidney transplant and those receiving dialysis. No causes of heterogeneity were identified, indicating that polypharmacy is an issue for all patients with CKD. Moreover, polypharmacy is associated with worse clinical outcomes, lower quality of life, and medication-related problems in patients with CKD [8]. The average annual cost of polypharmacy patients on hemodialysis (HD) or peritoneal dialysis in Alberta, Canada, was \$3831 [9]. Regarding hemodialysis itself, the cost of it in Libya is quite free as it is sponsored by the Ministry of Health. The medication is sometimes available free at the pharmacy of the renal centers across the country, but not always & not all the drugs are available. A study assessing the financial burden of HD treatment on patients at a Malaysian tertiary teaching hospital reported 52% with moderate financial burden [10]. The average annual cost of HD among patients with CKD in the Dar es Salaam region in Tanzania was \$3099, of which \$1523 was direct medical costs [11]. Polypharmacy & associated specific comorbidities were able to increase the risk of D-D interactions as well as side effects, which in turn increased the healthcare costs [12]. It is important to involve clinical pharmacists in hospitals to improve the care of patients [13] & therefore decrease drug-related problems, which in turn decreases the financial burden among CKD & HD patients. In Libya, a salary of under 1000 dinars per month is considered a low income, between 1000 & 3000 dinars is a moderate income, whereas >3000 dinars is a high income [14].

This study was designed to assess the prevalence of polypharmacy and its financial burden among haemodialysis patients at Zawia Renal Centre, Libya.

Materials and Methods

Study design

A cross-sectional study was carried out at Zawia Renal Centre, Zawia city, Libya. A purposive sampling technique was adopted in this study. The study population included patients in the HD unit with the following inclusion criteria: 1) CKD adult patients (18 years or older) undergoing HD and 2) who consented voluntarily to the study. Participants with severe complications, dementia, mental problems, altered state of consciousness, and communication problems were excluded from the study.

Data collection

The study was conducted from August 2025 to December 2025. A standardized data extraction sheet was used to

collect the relevant data from patients. **Data were collected** via comprehensive patient history interviews and the following data were obtained: age, gender, body weight, family and social histories, drug history, blood group, duration of dialysis, occupation, and the results of routine laboratory tests.

Comprehensive medication histories were obtained, with detailed drug profiles documented and categorized according to the standard therapeutic classification system. Concurrently, the individual cost of each pharmaceutical agent was recorded. All personal data, including name, contact details and investigation, remained confidential.

Ethical consideration: A letter of ethical clearance was obtained from the ethical review committee of Zawia University, Zawia, Libya. The investigators obtained official permission from the Zawia Renal Centre. Investigators evaluated all the prescribed drugs given in the patient's history that were included in the medical records.

Statistical analysis

The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS V27). Descriptive statistics were used to summarize the data, where categorical variables were presented as frequencies and percentages, while continuous variables were expressed as the mean and standard deviation. The prevalence and patterns of polypharmacy were described using descriptive measures, and the average medication cost was also calculated. To compare the mean number of medications among different age groups, one-way analysis of variance (ANOVA) was applied. Associations between the number of medications and demographic and clinical variables were assessed using Fisher's Exact test due to the small expected frequencies in some categories. A P value of less than 0.05 was considered statistically significant.

Results

The study sample was of patients undergoing hemodialysis. With regard to age distribution, the largest proportion of participants were aged 60 years and above (31.7%), followed by those aged 50–59 years (28.8%), while smaller proportions were aged 40–49 years (21.6%) and less than 40 years (18.0%). This indicates that the majority of the patients receiving hemodialysis in the present study were middle-aged and elderly individuals (Table 1).

Regarding gender, males constituted slightly more than half of the study sample (53.2%), whereas females represented 46.8%, suggesting a relatively balanced gender distribution with a slight predominance of male patients. In terms of medical history, most participants reported having



Libyan Journal of Medical Research

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eISSN: 2413-6096

a previous medical history (83.5%), while only 16.5% reported no prior medical conditions, indicating that comorbid diseases are common among patients undergoing hemodialysis.

Concerning family history, more than half of the participants (58.3%) reported a positive family history, whereas 41.7% had no such history. Regarding dialysis duration, more than half of the patients had been undergoing dialysis for less than five years (54.0%), followed by those with a duration of 5–9 years (28.0%), and a smaller proportion with a dialysis duration of ten years or more (18.0%).

Regarding blood group distribution, blood group O was the most common among participants (51.4%), followed by A (34.8%), while B (13.0%) and AB (0.7%) were less common. In terms of socioeconomic status, the majority of participants reported low (41.9%) or moderate (43.5%) income levels, whereas only 14.5% reported high income. Finally, the results revealed that the vast majority of participants did not have health insurance (95.2%), while only a small proportion reported having health insurance coverage (4.8%). These findings highlight the socioeconomic challenges faced by patients on hemodialysis, which may contribute to the financial burden associated with polypharmacy (Table 1).

Table 1: Demographic and Clinical Characteristics of the Sample

Variable	Categories	Count	%
Age	< 40	25	18.0
	40-49	30	21.6
	50-59	40	28.8
	60+	44	31.7
Gender	Male	75	53.2
	Female	65	46.8
Medical history	Yes	116	83.5
	No	23	16.5
Family history	Yes	81	58.3
	No	58	41.7
Dialysis duration	< 5 years	75	54.0
	5-9 years	39	28.0
	≥ 10 years	25	18.0
Blood group	O	71	51.4
	A	48	34.8
	B	18	13.0
	AB	1	0.7
Income	Low	52	41.9
	Moderate	54	43.5
	High	18	14.5
Health insurance	Yes	6	4.8
	No	118	95.2

The patterns of polypharmacy and the associated medication costs among the study participants undergoing hemodialysis. The results show that the majority of participants were taking between 5 and 9 medications, representing 85.6% of the sample, with a mean number of medications of 6.50 and a standard deviation of 1.227. In contrast, a smaller proportion of participants were taking 1–4 medications (7.2%), with a mean of 3.60 and a standard deviation of 0.516, while an equal proportion

(7.2%) were taking 10 or more medications, with a mean of 10.10 and a standard deviation of 0.316.

Furthermore, the results indicate a clear increase in medication costs with the increase in the number of prescribed drugs. Participants taking 1–4 medications had an average cost of approximately 407 LYD, whereas those taking 5–9 medications had a higher average cost of about 735 LYD. The highest financial burden was observed among participants taking 10 or more medications, with an



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eISSN: 2413-6096

average cost reaching 1141 LYD. Overall, the mean number of medications used among participants was 6.55 with a standard deviation of 1.690, and the overall average medication cost was approximately 740. These findings

suggest that polypharmacy is highly prevalent among patients on hemodialysis and is associated with a substantial increase in medication-related financial burden (Table 2).

Table 2: Polypharmacy Patterns and Associated Costs in Participants

Polypharmacy	Count	%	Mean $\pm$ SD	Average cost
1-4	10	7.2	3.60 $\pm$ 0.516	407 LYD
5-9	119	85.6	6.50 $\pm$ 1.227	735 LYD
10+	10	7.2	10.10 $\pm$ 0.316	1141 LYD
Total	139	100.0	Overall (6.55 $\pm$ 1.690)	740 LYD

Association of Medication Number with Demographic Variables:(Table 3)

Regarding age groups, the majority of participants in all age categories were taking between 5 and 9 medications. Among patients aged 20–39 years, 16.5% were taking 5–9 medications, while only 0.7% were taking 0–4 medications and 0.7% were taking 10 or more medications. Similarly, in the 40–49 age group, 18.7% were taking 5–9 medications and 2.9% were taking 0–4 medications, with In contrast, a statistically significant association was observed between gender and the number of medications used (Fisher's Exact test = 10.597, P = 0.004). The majority of male participants (42.4%) and female participants (43.2%) were taking 5–9 medications. However, all participants taking 0–4 medications were males (7.2%), while none of the females fell into this category. Additionally, an equal proportion of males and females (3.6% each) were taking 10 or more medications.

With respect to income level, the daily consumption of 5–9 medications was the most common frequency across all

none using 10 or more medications. In the 50–59 age group, 25.2% were taking 5–9 medications, compared with 1.4% taking 0–4 medications and 2.2% taking 10 or more medications. Among those aged 60 years and above, 25.2% were using 5–9 medications, while 2.2% were using 0–4 medications and 4.3% were taking 10 or more medications. However, the association between age and medication number was not statistically significant (Fisher's Exact test = 6.753, P = 0.312).

categories, observed in 37.1% of low-income, 36.3% of moderate-income, and 12.1% of high-income participants."

Smaller proportions were observed in the categories of 0–4 medications and 10 or more medications. Nevertheless, the association between income level and medication number was not statistically significant (Fisher's Exact test = 4.455, P = 0.313). These findings suggest that gender may play a role in the distribution of medication use among patients on hemodialysis.

Table 3: Association of Medication Number with Demographic Variables

Variables	Medication number			Fisher Exact test	P value
	0-4 N (%)	5-9 N (%)	+10 N (%)		
age					
20-39	1 (0.7)	23 (16.5)	1 (0.7)	6.753	0.312
40-49	4 (2.9)	26 (18.7)	0 (0.0)		
50-59	2 (1.4)	35 (25.2)	3 (2.2)		
60+	3 (2.2)	35 (25.2)	6 (4.3)		
Gender					
Male	10 (7.2)	59 (42.4)	5 (3.6)	10.597	0.004
Female	0 (0.0)	60 (43.2)	5 (3.6)		
Income					
Low	3 (2.4)	46 (37.1)	3 (2.4)	4.455	0.313
Moderate	3 (2.4)	45 (36.3)	6 (4.8)		
High	3 (2.4)	15 (12.1)	0 (0.0)		



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eISSN: 2413-6096

Discussion

In this analysis with 139 patients on haemodialysis, we gained insight into haemodialysis patients' experiences with polypharmacy and its economic burden. We found that the vast majority of haemodialysis patients were prescribed a median of six separate drug categories, and almost all met the criteria for polypharmacy. It was clear that the prevalence of polypharmacy slightly increased in middle-aged and elderly haemodialysis patients. It is reported in the literature that female gender is associated with a higher risk of polypharmacy because of low educational attainment and socioeconomic status [9]. In our study, gender was a significant risk factor for polypharmacy in haemodialysis patients. This may be due to these individuals being part of a hospital-based research study where multimorbidity was an inclusion requirement. Future research should examine gender differences by drug classes contributing to polypharmacy in haemodialysis patients.

For the purposes of this study, the Libyan population was segmented into low, middle, and high-income tiers, corresponding to monthly earnings of under 1,000 LYD, 1,000 to 3,000 LYD, and above 3,000 LYD, respectively. Most participants across all income categories were also taking 5–9 medications, including 37.1% of those with low income, 36.3% with moderate income, and 12.1% with high income. Overall, polypharmacy suggesting a prescribing cascade tended to be more frequent in the lower- and moderate-income groups relative to the higher income patients. Lower- and moderate-income patients have been associated with greater use of potentially inappropriate drugs, possibly related to factors including less access to health and drug information, and in some cases to receiving inferior quality of health care [10].

Although our study only included haemodialysis patients from a single centre, it shows that the financial burden of polypharmacy can be substantial and overwhelming when correlated with socioeconomic status. This study demonstrates that the average cost for polypharmacy in haemodialysis patients is approximately 735 Libyan dinars per month and is about 1140 Libyan dinars per month for hyperpolypharmacy, whereas non-polypharmacy costs around 400 Libyan dinars per month. These findings indicate that haemodialysis patients with polypharmacy face a twofold increase in financial burden compared with haemodialysis patients with non-polypharmacy. Although haemodialysis is free for Libyan patients in public hospitals, they do not receive sufficient government support to pay for their medications. Only 6% of the

participants in this study reported that their health insurance covers their medication costs; thus, they may not have faced a financial burden. The vast majority of haemodialysis patients has reported that they do not have health insurance and 25% of the patients are unemployed. Therefore, making life-changing decisions about affording medications and managing life can be difficult for these patients.

The Libyan dialysis population is growing, particularly among low- and middle-income patients. As a result, hundreds of patients may die each year from kidney failure, often without receiving adequate supportive care. Taking into consideration that Libya's economy has been at its worst since 2014 because of a political and financial crisis. The financial burden can have an impact on patients' access to medical care. A haemodialysis patient, for example, may exhibit medication non-adherence such as omitting doses or rationing prescriptions as a coping mechanism to mitigate severe financial strain. As a result, it is important for the health workers at dialysis centres to assess the patient's financial capabilities for medical treatment costs in follow-up visits.

This study sends a clear message to Libyan health policymakers that significant efforts are required to optimizing medication affordability for individuals undergoing dialysis. Further research is required to confirm the financial issues that haemodialysis patients are facing and what are consequences of financial strains on the patient's health. In addition, there are a number of limitations to the study. For starters, only haemodialysis patients in one setting were included for practical reasons, which may not represent the entire picture of Libya's household financial burden and low-income impacts of haemodialysis treatment. Second, due to a lack of local data, it is not possible to compare the results of this study to those of other contexts.

Conclusion

Evidence shows a significant percentage of Libyan patients receiving haemodialysis treatment came from low-income demographics. The results demonstrate that the financial burden of polypharmacy can impact haemodialysis patients and is associated with employment status, salary, and income class. Consequently, the capacity to identify the precise financial needs of the haemodialysis population is critical for healthcare policymakers, enabling them to allocate sufficient economic support and resources effectively.

Conflict of interest

The authors declare no conflict of interest.



Libyan Journal of Medical Research

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eISSN: 2413-6096

Funding

No external funding was received for this study.

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