

# Detection and solving of drug therapy problems: a clinical pharmacist experience from a specialized nephrology clinic in Egypt

Dina A. Zaki<sup>a</sup>, Alaa M. Morsi<sup>a</sup>, Mohammed A. Abdel Gawad<sup>b</sup>, Mahmoud A. Ahmed<sup>c</sup>

<sup>a</sup>Clinical Pharmacist, Gawad Nephrology Clinic, Alexandria, Egypt, <sup>b</sup>Nephrology Consultant, Gawad Nephrology Clinic, Alexandria, Egypt, <sup>c</sup>Nephrology Specialist, Davita Kidney Care, Khobar, Saudi Arabia

Correspondence to Mohammed A. Abdel Gawad, MD, Gawad Nephrology Clinic, 237, Port Said Street, Cleopatra, Alexandria, Egypt. Tel: +20 120 223 0765; e-mail: drgawad@gmail.com, drgawad@gawadnephrologyclinic.com

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## Background

Clinical pharmacists (CPs) play a vital role in detecting and solving drug therapy problems (DTPs). This is a common practice in hospitals; however, it can be applicable for outpatient settings as well. Patients with chronic kidney disease (CKD) usually have multiple medication prescriptions and are at greater risk of medication errors (MEs) and/or DTPs.

## Objectives

The aim of this work is to assess the prevalence of DTPs among prescriptions for patients with CKD attending for outpatient nephrology consultation and to highlight the role of CPs team in outpatient settings.

## Patients and methods

This is a chart review study conducted at a private specialized nephrology clinic in Alexandria, Egypt. After taking informed consent from participants to use their medical data, CPs collected and evaluated 550 prescriptions for possible DTPs. Prescriptions were ordered by different health care providers for 49 adult patients with CKD who attended the clinic from April to November 2019. Data were classified and subcategorized accordingly. Statistical analysis was done, and results were expressed in numbers and percentages.

## Results and conclusion

Of 550 reviewed prescriptions, 122 (22.2%) DTPs were detected and solved. Dosage regimen ranked the top DTP 40 (32.8%), and it was mainly related to: (a) vitamins, minerals, and dietary supplements' prescriptions [23 (18.9%)], (b) antihypertensive medications [20 (16.40%)], and (c) circulatory enhancers [11 (9.02%)]. To conclude: suboptimal dosing regimens are common problems encountered by the CPs team during routine patient care. CPs provided direct outpatient patient care, solved DTPs, and prevented possible MEs.

## Keywords:

errors, medication, nephrology, pharmacist, problems, therapeutic

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## Introduction

Medication errors (MEs) are defined as 'failure in the treatment process that leads to (or has the potential to lead to) harm to the patient' [1]. Reviewing medication orders by the clinical pharmacist (CP) – in both inpatient and outpatient settings – helps identifying, solving, and preventing any unwanted incident related to medication therapy [i.e., drug therapeutic problems (DTPs)]. Patients with chronic kidney disease (CKD) require multiple medications and have complex medical problems; therefore, they might be at greater risk of MEs and/or DTPs [2–4].

## Patients and methods

This is a chart review study of clinical pharmacist interventions (CPI) to assess the prevalence of DTPs among external prescriptions (ordered by other health care providers) for patients with CKD

attending a private specialized outpatient nephrology clinic in Alexandria, Egypt. The clinic team consists of nephrology consultant, CPs, dietitian, and admin who work together to provide multidisciplinary care. Each nephrology consultation process includes an interview with the CP, who detects, records, and solves any DTPs.

The study included 49 adult patients with CKD who visited the clinic for outpatient nephrology consultation from April to November 2019. After taking informed consent from participants to use their medical data, CPs collected and evaluated

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prescriptions for possible DTPs. During this period, CPs collected and reviewed 550 prescriptions (a single patient could have more than one prescription and/or outpatient visit). Informed consent was taken from all participants to use their anonymous outpatient medical data for research purposes. The CPs' team designed a special electronic sheet to collect and record both clinical data and medications. The clinical data included the medical record number, demographic data, and medical history. The medication record included the number of medications, generic names, category, DTPs, and CPI. Detected DTPs were classified into seven categories: (a) indication, (b) selection, (c) dosing regimen, (d) drug interaction, (e) instructions for preparation and administration, (f) monitoring, and (g) adherence. Estimated glomerular filtration rate was calculated using Cockcroft–Gault and Salazar equations to adjust the renal doses [5]. All detected DTPs were adjusted, and medication reconciliation was provided to the patient or the caregiver.

Data were then analyzed, and the results were expressed in numbers and percentages. The statistical analysis was performed using IBM SPSS Statistics, version 25 (2017; SPSS Inc., Chicago, Illinois, USA).

## Results

In this study, we assessed 49 adult patients with CKD, comprising 25 (51%) males and 24 (49%) females, aged between 19 and 82, with a mean age of  $64.6 \pm 10.7$  years. Hypertension (83.7%) and diabetes mellitus (59.2%) were the two most common comorbidities among participants (Table 1).

Of 550 reviewed prescriptions, 122 (22.2%) DTPs were recorded. Among those DTPs, 23 (18.9%) errors were related to vitamins, minerals, and dietary supplements (DS), 20 (16.4%) DTPs were related to antihypertensive medications, and 11 (9%) DTPs were

found related to circulatory enhancers. DTPs related to both antidiabetic and lipid-lowering agents ranked the sixth (6.6%) for each, followed by DTPs related to antibiotics (5.7%) (Table 2).

Main DTPs were classified into seven categories listed in Table 3. The most prevalent one was 'wrong dosing regimen' found in 40 (32.8%) prescriptions, whereas the least was due to drug monitoring issue, counted as only one observation (0.82%). Drug interaction DTPs were reported in 13 (10.7%) prescriptions.

Figure 1 shows the distribution of DTPs reported among the different classes of medications. Antihypertensive medications expressed all types of DTPs, and the highest percentage was due to wrong dosing regimen followed by problems in instructions for preparation and administration (45 and 15%, respectively). Inappropriate dosing regimen and inappropriate indication were the most common types of DTPs reported among prescriptions of vitamins, minerals, and DS (52%), whereas, drug interactions were mostly observed in prescriptions including antiplatelets, anticoagulants (100%), antidysrhythmic/antianginal (50%), antihyperuricemia (44.4%), and

**Table 2 Prevalence of drug therapy problems among drug groups prescribed to the study population**

Medications	Frequency	% from total DTPs (N=122)	% from total prescriptions (N=550)
Vitamins, minerals, and DS	23	18.9	4.2
Antihypertensives	20	16.4	3.6
Circulatory enhancers	11	9.0	2.0
Antihyperuricemia	9	7.4	1.6
PPIs	9	7.4	1.6
Anti-diabetics	8	6.6	1.5
Lipid-lowering agents	8	6.6	1.5
Antibiotics	7	5.7	1.3
H2 blockers	7	5.7	1.3
Alkalinizers	5	4.1	0.9
Antiarrhythmic/antiangina	4	3.3	0.7
Diuretics	2	1.6	0.4
Prokinetics/antiemetics	2	1.6	0.4
NSAIDs	2	1.6	0.4
Phosphate binders	2	1.6	0.4
Antiplatelets/anticoagulants	1	0.8	0.2
Corticosteroids	1	0.8	0.2
Antioxidants	1	0.8	0.2
	122	100	22.2

DTP, drug therapy problem; PPI, protonpump inhibitors.

**Table 1 Demographic characteristics and comorbidities of the study participants**

	Males	Females	Total
Number of patients (%)	25 (51)	24 (49)	49
Age range (years)	37–82	40–78	37–82
Age (mean $\pm$ SD) (years)	64.6 $\pm 12.3$	64.6 $\pm$ 8.9	64.63 $\pm 10.73$
Creatinine clearance (ml/min)	35.2 $\pm 12.5$	32.0 $\pm 16.5$	33.7 $\pm 14.7$
Patients with hypertension (%)	18	23	41 (83.7)
Patients with diabetes mellitus (%)	15	14	29 (59.2)

antibiotics (14.1%). Wrong indication and dosing regimen also contributed the most common DTPs among antibiotic prescriptions (57%). The wrong indication was the only DTP found in antioxidants, corticosteroids, and phosphate-binder medications. Inappropriate selection of both proton pump inhibitors (PPIs) and NSAIDs was the only DTP encountered for these medication class.

**Discussion**

Physician ordering is a relatively common reported source of MEs and adverse drug reactions owing to inappropriate medication history taking at the time of the first visit [4]. In this work, we tried to overcome this by involving the CPs’ team in the consultation process. Our study showed that an average of 11 medications per order were prescribed for each patient with CKD. This indicates a high prevalence of polypharmacy in this group of patients. Several studies have shown that monitoring pharmacotherapy regimens can reduce the rates of MEs by up to 78%. Most of the DTPs occur during medication prescription and use processes. CPs

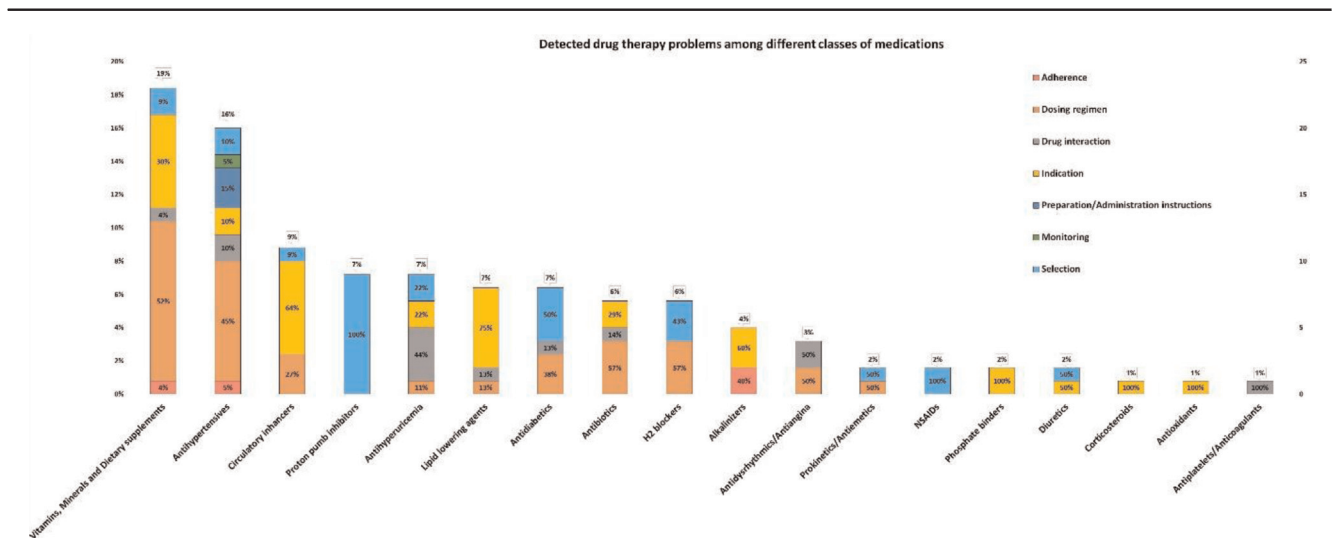
involvement could greatly improve the quality of medication prescription and administration processes. Reviewing the prescription orders for all patients with CKD is an essential practice to detect and resolve MEs and improve the quality of care [6–8].

NSAIDs and PPIs were ordered to more than one-third of adult patients with CKD according to the Center for Kidney Disease Research, Education, and Hope (CURE-CKD) registry published in 2019 [9]. The present study revealed that most of the DTPs were observed among vitamins, minerals, and DS (18.9%); antihypertensive medications (16.4%); antibiotics (5.8%); NSAIDs (1.6%); and PPIs (7.4%). It is worth noting that the recent Joint Commission’s National Patient Safety Goals require documenting the patient’s DS usage and over-the-counter drugs, just like any other medication. Failure to document these supplements creates opportunities for potential complications owing to either DS per se or its interactions with other prescribed medications [10]. Looking at our data from a different perspective, we found that 6.6% of the reviewed medications had no real indication. The National Health and Nutrition Examination Study of the Centers for Disease Control and Prevention in the United States revealed that 34% of participants – representing 72 million people in the United States – were taking some kind of DS in addition to a prescription medication. Although many people consume supplements to ensure an adequate intake of essential nutrients, DS should not replace good food choices and healthy diet [11]. Overall, 22% of the reviewed prescriptions in the current work were found to have one or more DTP that requires CPI. Dosage regimen issues were the

**Table 3 Categories of drug therapy problems detected by clinical pharmacists during the study duration**

Categories	Frequency	Percentage
Dosing regimen	40	32.8
Indication	34	27.9
Selection	27	22.1
Drug interaction	13	10.7
Adherence	4	3.3
Administration/preparation instructions	3	2.5
Monitoring	1	0.8
Total	122	100.0

**Figure 1**



Detected drug therapy problems among different classes of medications.

most common DTP (32.8%). This result is supported by a retrospective analysis conducted by Saleem and Masood [12] to predict dosing errors in patients with CKD that showed that dosage adjustments were required in 34% of the drugs prescribed. An additional study stated that drug–drug interaction was the most frequent DTP observed among medication orders to patients with CKD (46%) [13]. Incorrect dosing was the most detected DTP among antibiotics prescriptions in our research (10%). Similar findings were reported in alternative studies conducted in Indonesia and Palestine [14,15].

## Conclusion

DTPs are relatively common among patients with CKD attending outpatient settings, especially inappropriate dosage. Close monitoring and early detection of DTPs may help improve therapeutic outcomes and decrease unnecessary health care-related morbidity. CPs, working in close liaison with other health care teams, can promote sustained patient safety.

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## Conflicts of interest

There are no conflicts of interest.

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