

Challenges in understanding dosing instructions among polypharmacy patients with chronic illnesses in Iraq

Saba Hameed Majeed ¹ and Deleen Abd Al-Wahab Hasoon ^{2,*}

¹ Department of Clinical Pharmacy, College of Pharmacy, Al-Nahrain University, Baghdad, Iraq.

² Department of Clinical Pharmacy, College of Pharmacy, Al-Mustansiriyah University, Baghdad, Iraq.

GSC Biological and Pharmaceutical Sciences, 2026, 35(02), 011-021

Publication history: Received on 25 March 2026; revised on 28 April 2026; accepted on 01 May 2026

Article DOI: <https://doi.org/10.30574/gscbps.2026.35.2.0156>

Abstract

Background: Patients with chronic conditions who are taking multiple medications often don't comprehend how to follow the dose schedule recommendations. Polypharmacy is becoming more common since there are more older people and more chronic conditions. Many patients depend on complicated pharmaceutical regimens that are recommended by more than one healthcare professional.

Objectives: The study sought to evaluate the extent of the misunderstanding regarding dose instructions among patients with chronic diseases undergoing a polypharmacy at the chronic outpatient pharmacy of the AL-Khadmyia teaching hospital in Baghdad, Iraq.

Methods: From September 2024 to August 2025, an institutional based a cross sectional survey took place at AL-Khadmyia Teaching Hospital in Baghdad, Iraq. The subjects in this study were chosen used a rigorous random sampling technique. Medscape and drug.com also looked at drug-drug and drug-food interactions to see how important they were. The distributions of variables were described using frequency, percentage, and mean standard deviation (SD). The Chi-square test was used to see if there was a link between the variables and the main outcome, with a p-value of less than 0.05.

Results: Out of 620 participants, (60.3) % were women, and their average age was 46.17 years old (± 17.09). The survey showed that almost half (80.6%) of the people who took part didn't understand at least one dose instruction, and around (18.9%) didn't understand how often to take the drug. About (92.4%) of patients were unaware of drug-drug interactions (DDIs). Sex ($X^2 = 16.605$; $P < 0.0001$), educational level ($X^2 = 21.565$; $P < 0.001$), Marital status ($X^2 = 32.971$; $P < 0.0001$), and duration of medicine use ($X^2 = 49.698$; $P < 0.0001$) were all strongly linked to not comprehending dose regimen instructions.

Conclusion: The study found that a considerable individual's proportion were unable to comprehend their pharmaceutical dosage regimen directions. To deal with these serious drug-related problems, healthcare providers should use interventions including giving patients written instructions and more counseling.

Keywords: Polypharmacy; Dosing instructions; Medication misunderstanding; Chronic diseases; Clinical pharmacy

1. Introduction

The misunderstanding of dosing regimen instructions is a serious concern among patients with chronic diseases receiving polypharmacy. Misunderstanding dosing instructions can lead to increased risk of hospitalization, medication

* Corresponding author: Deleen Abd Al-Wahab Hasoon

duplication, underdosing, and/or overdosing. Patients with chronic illnesses may have difficulty comprehending dosage frequency and administration, particularly if they are undergoing polypharmacy [1].

Polypharmacy is the concurrent use of multiple medications by a patient, which commonly emerges when a patient receives five or more medications. The prevalence of polypharmacy in several countries is rising due to the population aging as so as, chronic diseases chronic diseases was increased, such as hypertension and diabetes. Polypharmacy has associated with the negative consequences of the medication including a drug-drug, also drug-disease interactions, adverse drug reactions, medication non-adherence, as so as hence poor therapeutic outcomes [2].

Misunderstanding dosing regimen instructions can lead to the risk of hospitalization due to not following specific drug precautions, medication duplication, underdosing by misunderstanding on both the dose frequency and the number of medications, and/or overdosing by misunderstanding on dose frequency and/or number of medications. The misunderstanding of the instructions on most dosing regimen is common among most patients who has been receiving polypharmacy. That is indicated by the study of Azeez Ali al-Jumaili Ali *et al.* and Kim M. *et al.* [2. 3].

The understanding of dosing regimen instructions is closely associated with the effective quality use of medications. A drop of misunderstanding on dosing regimen instructions can positively influence the level of adherence to treatment among patients with chronic diseases. Reducing the misunderstanding of dosing regimen instructions might therefore facilitate the improvement of the quality use of medications among patients with chronic diseases [4]. Poor adherence to prescribed regimens for oral medications can exacerbate a patient's health condition, or can cause the amount of drug taken to exceed the therapeutic window, resulting in toxicity or overdose [5].

Bridging the treatment gap created by doctors' prescriptive information is vital for public health, with prescriptive comprehension being central. While many studies have focused on patients' prescriptive literacy, few investigate chronic disease patients on polypharmacy. Misunderstandings regarding dosing regimens remain unclear. This study examines the nature of these misunderstandings and associated factors to help bridge this treatment gap [6]. Misunderstood regimens were grouped into six categories: "measurement unit," "frequency of medication," "timing of medication," "number of medications," "time point of medication," and "adjustment of dosage". Gender, age, and symptom duration were found to be significant factors associated with misunderstanding [7].

Chronic diseases are one of the most common health problems it is increasing treated level in pharmaceuticals. The burden of these diseases has wise different on the population by region around the globe. Chronic diseases have the characteristic of gradual development, long duration, and chronic course. Successful chronic disease management is essential to decrease morbidity and mortality globally [8]. The prevalent chronic diseases are mainly in a hypertension, a diabetes mellitus, also hyperlipidemia, a chronic obstructive pulmonary disease, a chronic renal failure, and asthma in Iraqi hospitals. Chronic diseases cause a highly concentrated treatment consumption in pharmaceuticals [9] on the contrary, chronic diseases can be, for the first time in world history, regarded as treatable by health system care, and considerable reasoned expanding in pharmaceutical industry in developed country. A chronic patient accepting treatment has also been risen. However, misunderstandings and misuses of dosing regimen instructions are commonly seen among the patients, worrying supine health system care [10,11]. There is still a lack of literature that focuses on aspects related to misunderstanding of dose regime instructions between patients with a chronic disease who were taken almost polypharmacy, in a context of Iraqi hospitals. The aim of this study, therefore, to assess the level of misunderstanding among dosing regimen instructions among patients with a chronic disease who were receiving a polypharmacy in Iraqi hospitals and to explore all the associated factors present.

2. Methods and materials

This cross-sectional survey study was carried out in AL-Khadmyia teaching hospital in Baghdad, Iraq during September 2024 to August 2025. Six hundred and Twenty patients with chronic disease. They were treated according to guideline, complication and consultant instruction., over a period of 11 consecutive months. The study targets patients who were on chronic medications for chronic non-communicable diseases conditions. Structural, social, and pharmaceutical information was collected, in addition to information about the chronic medications' classes and the knowledge about their dosing regimens.

2.1. Study participants and inclusion criteria:

Patients were eligible to participate in the study if they were aged ≥ 18 years, receiving ≥ 2 chronic medications for at least for 3 months prior to the study, able to communicate in Arabic language, suffering from at least one of the following chronic diseases: hypertension, hyperlipidemia, diabetes, chronic pain, chronic renal disease, asthma, or heart disease.

Patients with cognitive impairment or serious psychiatric illness, illiterate patients, as well as those whose drugs were delivered by healthcare professionals and patients who refuse to participate were excluded from the study.

2.2. Determination of Sample size and a sampling procedure:

Raosoftware® online software calculator was used to calculate the sample size. 98% a confidence interval, and through the maintain a 5% of the margins error were derived result established from the requirement. A sample size of 620 participants was considered to be suitable.

2.3. Data collection instruments, procedures and quality management:

English format prepared data was collected initially. A local language (Arabic) translated and then again translated to English to maintain consistency. In person interviews and a direct dispensed medications were observed through the data collection, with both a closed and open-ended questionnaire for interviews with a socio-demographic and addressing patients' variable to understanding the instructions of the dosage regimen. The Drug-drug interaction checker were prepared for a commonly used drugs in order to prepare the data collection stress-free.

2.4. Study design and setting:

This study was aimed at evaluating the misunderstandings of medications dosage regimen instructions by chronic disease patients receiving polypharmacy in AL-Khadmyia teaching hospital in Baghdad. The attached tool was designed to assess the following areas of patient understanding: Overall understanding of dosage regimen instructions (questions 1 to 3), Understanding of dosage by using volume and frequency (questions 4 to 6) and understanding of Special dosage instruction (questions 7 to 9). This validated tool can help hospital pharmacists to evaluate the dosing regimen instruction understanding of the medication among patients with a chronic diseases receiving a polypharmacy via face-to-face. Checker templates of the Drug-drug interaction were created for frequently utilized medications to facilitate data collection. The questionnaire was created following a literature assessment of analogous investigations [12,13,14]. Three clinical pharmacy experts looked at the survey to see if the questions were clear enough to be genuine. Forty-two participants then pre-tested the questionnaire for its content, design, readability, and understanding. The questionnaire was changed based on the results. Cronbach alpha test had been used to check the questionnaire's internal consistency, and it was ($\alpha = 0.929$). Changes were made depending on the answers. Consequently, the survey was easy to comprehend and respond to. The investigators also gave the data collectors feedback and revisions every day. We verified the collected data carefully on a regular basis to make sure it was complete, correct, and clear. The questionnaires were chosen at random for quality control and then verified again by an expert pharmacist. Also, the people who took part in the study were clearly told why they were being surveyed, which made the mood more amicable.

Social Sciences (SPSS) at version 26 Statistical Package for are statistical analysis uses, with significance level at p of 0.05. chi-square test has been used to found any association between the outcome of variables and the different independent variables. A result had been presented in a table and a figure as necessary.

General characteristics of the patients were assessed with descriptive statistics (simple frequencies and percentages) for categorical variables and descriptive statistics (means and standard deviation) for continuous variables. Associations between the demographic characteristics of patients and correct understanding of dosage regimen were analyzed by Chi-square test.

2.5. Ethics approval and consent to participate

The research proposal of the present study and data collected techniques was administer to the "College of Pharmacy, AL-Nahrain University" and an approval has been obtained from a Scientific and the Ethical Committee (approval registration number: nah.coh.pha.H8). also, consent is obtained from all students participate in this study.

3. Results

3.1. Demographics

Out of 620 participants, (60.3) % were women, and their average age was 46.17 years old (± 17.09). More than half (68.7) % of the participants residence was live in Urban area and approximately (21.9) % of the respondents, were unable to read or write (Table 1).

3.2. Rate of misunderstanding of the recommended instructions

The study found that over a half (80.6%) for a 620 patients did not comprehend at least a one instruction about the dose, and approximately (71.3%) frequently missed a dose. About 92.4% of patients didn't know about drug-drug interactions (DDIs). But the other recommendations were more correct than wrong (Table 2).

3.3. Misunderstanding of dosing regimen directions categorized by sociodemographic factors:

Based on a socio-demographic characteristics of the patients' respondents were occupied had been correlated significantly with a dose instruction misunderstanding ($X^2 = 15.553$; $P < 0.049$), the frequency ($X^2 = 16.196$; $P < 0.003$), and the duration of the treatment ($X^2 = 22.114$; $P < 0.036$). The sex of the participants was significantly and highly significant association with the misunderstanding of the dose ($X^2 = 25.911$; $P < 0.011$), frequency equal ($X^2 = 24.614$; $P < 0.0001$), also the duration of the treatment ($X^2 = 54.505$; $P < 0.0001$) respectively (Table 3).

3.4. Misunderstand for dosage regimen instructions distribution:

Distribution of pharmaceuticals for dose regimen instructions was (278) of the total (1161) drugs given out were not comprehended by those participating in this study. The vast majority (119) of this misunderstanding were due to not understanding the suggested frequency to take the drugs, and the least one were due to not understanding how to follow the dosing regimen recommendations (72). Antidiabetic medicines (48) were the most common type of drug that people didn't understand how long they would need to take them (Table 4).

3.5. Number of prescription medications and prevalence of drug-drug interactions:

The majority of those participating in the research (53.4%) had received three medications (Fig 1). Regarding DDIs, (62.8%) of the respondents experienced a moderate level of DDIs (Fig 2).

Table 1 Sociodemographic characteristics among Iraqi patients with chronic disease (N = 620)

Frequency (%)	Categories	
149(24)	18-27	Age
74(11.9)	28-37	
45(7.3)	38-47	
175(28.2)	48-57	
105(16.9)	58-67	
72(11.6)	≥ 68	
246(39.7)	Male	Sex
374(60.3)	Female	
136(21.9)	Cannot read and write	Educational status
109(17.6)	Primary school	
164(26.5)	Secondary school	
211(34)	diploma and above	
450(72.6)	Married	marital status
170(27.4)	Unmarried	
188(30.3)	Rural	Residence
432(68.7)	Urban	
117(18.9)	self-employee	Occupation
139(22.4)	Governmental-employee	
39(6.3)	Retired	

81(13.1)	Other	
244(39.4)	Housewife	
227(36.6)	1 -6 months	Duration of medication use
75(12.1)	7-12months	
59(9.5)	1-4 years	
259(41.8)	5 and more years	

Table 2 Proportion of the study participants with respective understanding level of dosage regimen instructions (N = 620)

Incorrect understanding n (%)	Correct understanding n (%)	Instructions
500(80.6)	120(19.4)	Instructions for one or more dosing regimens
72(11.6)	448(88.4)	Amount of dose administered
117(18.9)	503(81.1)	Frequency of dose administration
87(14)	533(86)	Duration of treatment
500(80.6)	120(19.4)	Multiple treatment
442(71.3)	178(28.7)	missed dose
573(92.4)	47(7.6)	Drug-drug interaction
593(95.6)	27(4.4)	Food-drug interaction

Table 3 Misunderstanding of dosage regimen instructions stratified by socio-demographic characteristics

Misunderstanding dosage regimen instructions			socio-demographic characteristics.	
Duration of treatment n (%)	Frequency of administration n (%)	Dose n (%)		
12(8.1)	43(28.9)	28(18.8)	18-27	Age
16(21.6)	1013.5)	13(17.6)	28-37	
4(8.9)	15(33.3)	5(11.1)	38-47	
33(18.9)	29(16.6)	18(10.3)	48-57	
12(12.4)	11(22.8)	5(5.2)	58-67	
10(13.9)	9(12.5)	3(4.2)	≥ 68	
X ² =54.505 P<0.0001	X ² =24.614 P<0.0001	X ² =25.911 P<0.011	Association	
25(10.2)	27(11)	23(9.3)	Male	Sex
62(16.6)	90(24.1)	49(13.1)	Female	
X ² =12.932 P<0.005	X ² =16.605 P<0.0001	X ² =3.424 P<0.181		
8(5.9)	16(11.8)	10(7.4)	Cannot read and write	Educational status

22(20)	16(14.7)	5(4.6)	Primary school	
21(12.8)	48(29.3)	26(15.9)	Secondary school	
36(17.1)	37(17.5)	31(14.7)	diploma and above	
$X^2=29.871$ $P<0.0001$	$X^2=17.563$ $P<0.001$	$X^2=21.565$ $P<0.001$		
58(12.9)	68(15.1)	32(7.1)	Married	Marital status
29(17.1)	49(28.8)	40(23.5)	Unmarried	
$X^2=11.390$ $P<0.01$	$X^2=15.154$ $P<0.0001$	$X^2=32.971$ $P<0.0001$		
27(14.4)	36(19.1)	14(7.4)	Rural	Residence
60(13.9)	81(18.8)	58(13.4)	Urban	
$X^2=2.983$ $P<0.394$	$X^2=0.014$ $P<0.911$	$X^2=5.520$ $P<0.063$		
20(17.1)	24(20.5)	18(15.4)	self-employee	Occupation
22(15.8)	11(7.9)	10(7.2)	Governmental-employee	
7(17.9)	6(15.4)	3(7.7)	Retired	
7(8.6)	21(25.9)	17(21)	Other	
31(12.7)	55(22.5)	24(9.8)	Housewife	
$X^2=22.114$ $P<0.036$	$X^2=16.196$ $P<0.003$	$X^2=15.553$ $P<0.049$		
32(15.46)	53(25.63)	28(13.5)	1 -6 months	Duration of medication use
10(13.3)	9(12)	9(12)	7-12months	
3(5.1)	13(22)	6(10.2)	1-4 years	
42(16.5)	42(16.7)	29(11.5)	5 and more years	
$X^2=24.542$ $P<0.138$	$X^2=49.698$ $P<0.0001$	$X^2=18.897$ $P<0.091$		

Table 4 Distribution of misunderstood medications by study participants for dosage regimen instructions.

Class of drugs Number of medications misunderstood			Class of drugs
Duration of treatment N (%)	Frequency of administration N (%)	Dose N (%)	
1(5.6)	4(22.2)	3(16.7)	Arthritis
14(30)	10(20)	16(38.1)	Cancer
1(16.7)	1(16.7)	0(0)	Cerebrovascular disease
1(16.7)	0(0)	3(50)	chronic lung disease
31(24.2)	48(37.5)	11(8.6)	Antidiabetic
0(0)	1(0.5)	0(0)	Dyslipidemia
1(16.7)	3(50)	3(50)	Antidepressant

0(0)	1(1.3)	0(0)	Endocrine disease
1(4.5)	6(27.3)	0(0)	Cardiovascular disease
12(7.9)	16(10.9)	4(2.6)	Hypertension
12(21.8)	14(25.5)	25(45.5)	Asthma
13(17.1)	15(19.7)	7(9.2)	Others

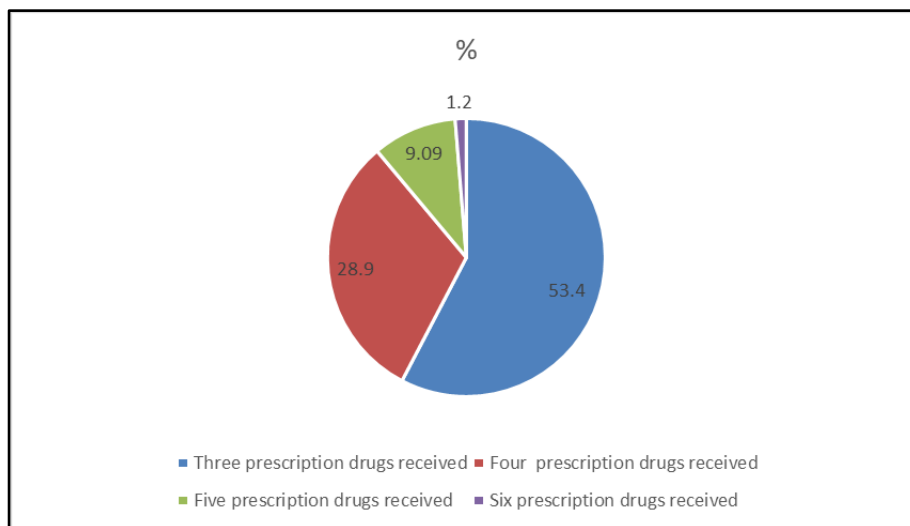


Figure 1 The percentage of participants receiving a specific number of dispensed prescriptions among chronic disease patients at Al-Khadmyia Teaching Hospital in Baghdad, Iraq

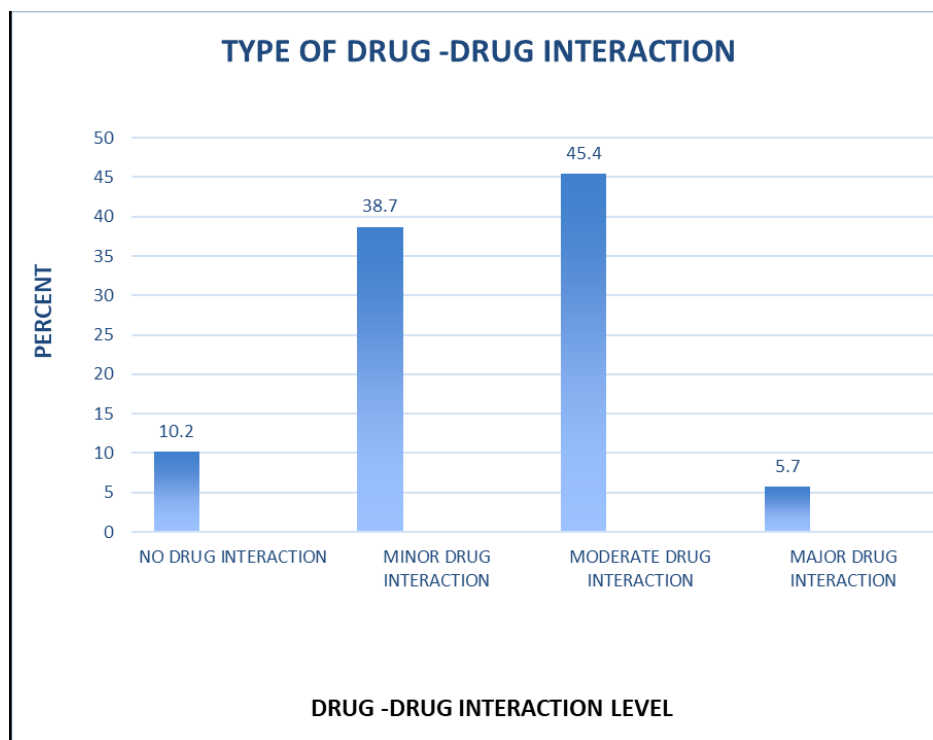


Figure 2 The extent of drug-drug interactions among the study participants

4. Discussion

Misunderstanding dosage regimen instructions is a common medication error that could result in unanticipated adverse events. Patients receiving polypharmacy and having chronic health problems have been well-documented to be at great risk of misunderstanding their medications. Issues about patient understanding of dosing regimen instructions lack specific consideration in developing countries, particularly in Iraq, which has the highest polypharmacy risk in Asian countries [15,16]. This study aimed to present an information source and tool for assessing patient understanding of the dosing regimen instructions in Iraq, developing countries, and beyond. The study showed that over a half (80.6%) from 620 participants did not comprehend at least one of the dosage instructions. This is actually very similar to other studies like a 72.4% in the Nekemte referral hospital [17], and 77.3% on Wollega [18], also 77.3% in Dessie [19]. The finding, on the other hand, is higher than what was found in a study done in the US (46.3%). The disparity may stem from differing pharmaceutical counseling policies between the two countries, as well as variations in the health literacy levels of the research population. [20] and Brazil (38.2%) The disparity may stem from differing pharmaceutical counseling policies between the two countries, as well as variations in a literacy of health levels on a research population [21]. In this study, (71.3%) of participants misinterpreted the frequency of drug administration, which is marginally lower than the 79% reported in a previous study in the USA, when patients indicated taking all TID doses within (12) hours [6] and higher than findings from other studies in a Dessie Referral Hospital (51.3%) [19] and the Shambu Primary Hospital, at Southwest in Ethiopia (66%) also Nekemte, at Southwest in Ethiopia, 67.6% [17,18]. The tool is expected to be a valuable means for screening the instructions misunderstanding of a dosage regimen so the pharmacists can offer tailored reasons for each misunderstanding, minimize misunderstanding occurrences, and thus maximize patient medication safety. About (21.9%) of the people in this research didn't understand their daily dose instructions correctly because they Cannot read and write. A considerable proportion of respondents lacking literacy skills misinterpreted the dosage directions. This study's number was a little higher than the one done at Nekemte referral hospital [17]. Another study revealed that most patients who had a low literacy skill, patients are unable to reading or writing, should not indicate the quantity of medicines to be taken daily [22, 23].

Assessments of misunderstanding among chronic diseases patients receiving polypharmacy in hospitals are shown by subsequent studies. Findings of these studies imply that misunderstanding the instructions of dosage regimen which was a common issue associated with knowledge loss about educational offers among chronic disease patients receiving polypharmacy in the hospitals. Hospital pharmacists must address certain recommendations and offer follow-ups to rectify the misunderstandings [24]. Polypharmacy is a chronic condition often accompanied by multiple health issues, typically including hypertension, diabetes, and hyperlipidaemia. These diseases hinder adherence to diet and exercise, prompting the introduction of new therapies that increase the burden of prescriptions. Patients with chronic illnesses may struggle to understand dosage frequency and administration [14,25,26]. Despite the lack of substantial changes in our study regarding the impact of residence on dosage, frequency, and duration of therapy, this can be attributed to the influence of the healthcare system in Iraq. The healthcare systems in Iraq possess a rich legacy, with the inception of primary health care services occurring in 1969, with service grievances emerging post-2011. The first medical school was established in Iraq in 1927, and several medical schools were subsequently established in other governorates in Iraq. However, the successive wars in Iraq proved significant damage to the health system, and there was a breakdown of the curative service system. With more than two decades of economic sanctions, the Iraqi health system had deteriorated, and the public sector was unable to provide a reasonable level of care. Currently, there is a huge disparity in expenditure on health by the public sector between urban and rural areas [2,27] . In 2013, the Iraqi Ministry of Health commenced an initiative to establish a comprehensive health system based on a family health care model, with the ultimate aim of monitoring results on health indicators in marginalized areas. The health services in Iraq could be over-all grouped into two sectors: the public health sector, which is managed by the Ministry of Health, and the private health sector. Public health is free of charge for all citizens. The hospitals, medical polyclinics, and community health facilities comprise this sector. The private health sector is comprised of establishments founded and managed by the general public. Since 2001, the private health sector has been expanded enormously across the villages. [15, 16]. Understanding the dosing regimen instructions of the medications is essential for the successful regimen implementation to attain the desired drug therapy benefit. Failure to appropriately follow the dosing instructions of prescribed medications is a common problem in patients with chronic illnesses, which partly explains the growing rate of poor clinical outcomes observed [28] . Adherence to prescribed medications and understanding/dosing regimen instructions by the patients is one of the goals of pharmaceutical care that has been neglected. Consequently, medication non-adherence, wastage, and avoidable drug-related morbidities/mortalities are rising in chronic disease patients. Hence, assessing the level of understanding of the dosing instructions of scheduled medications and the associated factors among users of polypharmacy patients with chronic diseases will help health care professionals develop a targeted intervention to improve patient understanding of dosing regimens. This will enhance patients' compliance with the dosing regimen instructions of prescribed medications, which in turn improves health outcomes/consequences [10,29,30]

5. Conclusion

Benefiting from the latest available knowledge, patients with chronic diseases on polypharmacy are a particular group of medication users and often experience the highest burden of medication use. Many patients simultaneously managing the multiple medications using is because of an increasing prevalence of polypharmacy and chronic diseases worldwide. But besides, different patient factors, such as the age, poor of the health literacy, and mental health issues, can contribute to ongoing misunderstanding of dosing regimen instructions.

These results speak against patients' assumed competence to manage their own medication. Considering the negative outcomes of misunderstanding dosing regimen information, it is essential to invest additional time in deciding the appropriateness of the prescribed medication regimen, communicating medication information, and appointing duplication monitoring when indicated, to ensure that patients with chronic diseases on polypharmacy that communicate low understanding of dosing regimen information can self-manage their own medication accurately. This first insight should stimulate more research on misunderstanding medication information in general, and more rigorous research designs should be used to further elucidate the generalizability of these results to Iraqi patients' sub-groups. In doing so, health care professionals can eventually be helped in further tailoring their care based on this patient groups' specific needs.

Limitations of the Study

Strength and The Limitations of the Study

To the best of an our knowledge, this study was the first of its type about misunderstanding of the dosing regimen instructions among patients with chronic diseases taking multiple medications. It highlighted "misunderstanding" of the dosing regimen instructions include all patients with chronic diseases who were receiving polypharmacy in Iraqi hospitals. The strengthening points of this study included the use of a validated questionnaire as the data collection tool. Another strength was that the sampling showed diversity with regard to patients' demographics and health status. The limitation of this study was the cross-sectional self-reporting design, meaning that causal inferences cannot be made. Besides, there may still be unaddressed confounding factors within the control of the researcher. Moreover, the survey was conducted in public hospitals only. Private hospitals may have a different view of the problem, so the ability to generalize the study conclusions and recommendations to private hospitals is limited. Also, the representativeness of all patients with chronic diseases taking polypharmacy who come to Iraqi hospitals is limited. Consequently, multi-national and multi-center studies with larger sample sizes are recommended to address these limiting factors.

Recommendations

It is important to promote optimal medication-taking behavior among patients with chronic diseases receiving polypharmacy, as it can improve treatment outcomes Measures may involve both individual and systemic actions. To start with, patients should be provided with educational booklet containing easy-to-understand information on the general principles of medication-taking behavior while being counseled to read it thoroughly to clarify any misunderstandings. Family members should also be educated as this may help the patients in their medication-taking behavior. Use of supplemental measures such as reminders and alarms may help enhance the effectiveness of educational inputs. Pharmacists and nurses are also able to provide osmotic health education regarding prescribed medications. In addition, non-pharmacological treatment should be introduced for chronic diseases that warrants health education delivery.

Compliance with ethical standards

Acknowledgments

We would like to acknowledge AL-Khadmyia teaching hospital in Baghdad, for supporting us during conducting this study.

Disclosure of conflict of interest

All authors had none to declaring.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

Author Contribution

The authors were contribution as follows: the study conception and a design; the data collection: first author; draft manuscript preparation: first and second author. Both authors had been reviewed and approved a results of the final manuscript.

References

- [1] Amorim WW, Passos LC, Gama RS, Souza RM, Oliveira MG. Factors associated with older patients' misunderstandings of medication dosage regimen instructions after consultation in primary care in Brazil. *Journal of Evaluation in Clinical Practice*. 2021 Aug;27(4):817-25. [HTML]
- [2] AZEEZ ALI AL-JUMAILI ALI, M. Jabri A, D. Al-Rekabi M, K. Abbood S et al. Physician Acceptance of Pharmacist Recommendations about Medication Prescribing Errors in Iraqi Hospitals. 2016. [PDF]
- [3] Kim M, Suh D, Barone JA, Jung SY, Wu W, Suh DC. Health literacy level and comprehension of prescription and nonprescription drug information. *International journal of environmental research and public health*. 2022 May 30;19(11):6665. mdpi.com
- [4] Julien C, Hache G, Dulac M, Dubrou C, Castelnovo G, Giordana C, Azulay JP, Fluchère F. The clinical meaning of levodopa equivalent daily dose in Parkinson's disease. *Fundamental & Clinical Pharmacology*. 2021 Jun;35(3):620-30. [HTML]
- [5] Belachew EA, Sendekie AK, Wondm SA, Ayele EM, Netere AK. Misunderstanding of dosing regimen instructions among patients with chronic diseases receiving polypharmacy at the University of Gondar comprehensive specialized hospital. *Plos one*. 2023 Jan 12;18(1):e0280204. plos.org
- [6] Tang J, Wang K, Yang K, Jiang D, Fang X, Su S, Lin Y, Chen S, Gu H, Li P, Yan S. A combination of Beers and STOPP criteria better detects potentially inappropriate medications use among older hospitalized patients with chronic diseases and polypharmacy: a multicenter cross-sectional study. *BMC geriatrics*. 2023 Jan 25;23(1):44. springer.com
- [7] IU H, MY M, GP. Patients' knowledge about medicines improves when provided with written compared to verbal information in their native language. *PLoS One*. 2022. plos.org
- [8] F L, N. Lutfiyya M, Cha I, El-Khabiry E. Results of chart reviews conducted to evaluate primary care patients seen by second and third year family medicine residents for potential adverse polypharmacy. 2007. ncbi.nlm.nih.gov
- [9] Ibrahim RH. Hypertension Among People with Diabetes Mellitus: Prospective Study. *International journal of health sciences*. . [HTML]
- [10] Gudeta T, Mechal D. Patient Knowledge of Correct Dosage Regimen; The Need for Good Dispensing Practice. 2019. ncbi.nlm.nih.gov
- [11] Russell AM, Opsasnick L, Weiner-Light S, Bailey SC, O'Brien M, Wolf MS. Medication Dosing Schedules, Medication Knowledge, and Dosing Errors of Adults Taking Complex Drug Regimens. *Journal of health care for the poor and underserved*. 2023;34(1):192-207. nih.gov
- [12] Belachew EA, Sendekie AK, Wondm SA, Ayele EM, Netere AK. Misunderstanding of dosing regimen instructions among patients with chronic diseases receiving polypharmacy at the University of Gondar comprehensive specialized hospital. *PLoS One*. 2023 Jan 12;18(1):e0280204. doi: 10.1371/journal.pone.0280204. PMID: 36634103; PMCID: PMC9836283.
- [13] Mengesha, Yohannes and Eskedar Amare. "Assessment of Patients Misunderstanding of Dosing Instructions Among Outpatients in Dessie Referral Hospital, Northeast Ethiopia." *Risk Management and Healthcare Policy* 13 (2020): 3079 - 3085.
- [14] Desta, Desilu Mahari et al. "Exit-Knowledge About Dispensed Medications and Associated Factors Among Ambulatory Patients Attending Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia." *Patient preference and adherence* 14 (2020): 1523 - 1531.
- [15] Rambhade S, Chakarborty A, Shrivastava A, K. Patil U et al. A Survey on Polypharmacy and Use of Inappropriate Medications. 2012. ncbi.nlm.nih.gov
- [16] Saad R, Hallit S, Chahine B. Evaluation of renal drug dosing adjustment in chronic kidney disease patients at two university hospitals in Lebanon. 2019. ncbi.nlm.nih.gov

- [17] Diriba G., Alemkere G., and Gedamu M.J.J.F.M., Assessment of patients misunderstanding regarding dosage regimen instructions at nekemte referral hospital, Ethiopia. 2018. 5(5): p. 1153.
- [18] Terefe A. and Chanie T.J.I.J.P.S.R., Assessment of patients misunderstanding of dosage regimen instructions among adolescent and adult outpatients in ethiopia: the case of a primary hospital. 2014. 5: p. 446–453.
- [19] Mengesha Y., Amare E.J.R.M., and Policy H., Assessment of Patients Misunderstanding of Dosing Instructions Among Outpatients in Dessie Referral Hospital, Northeast Ethiopia. 2020. 13: p. 3079.
- [20] Davis T.C., et al., Improving patient understanding of prescription drug label instructions. 2009. 24(1): p. 57–62. <https://doi.org/10.1007/s11606-008-0833-4> PMID: 18979142
- [21] Welma WA L.C., Romana SG, Renato MS, Marcio GO., Factors associated with older patients' misunderstandings of medication dosage regimen instructions after consultation in primary care in Brazil. *J Eval Clin Pract.*, 2020: p. 1–9.
- [22] Davis T.C., et al., Improving patient understanding of prescription drug label instructions. 2009. 24(1): p. 57–62. <https://doi.org/10.1007/s11606-008-0833-4> PMID: 18979142
- [23] Remington J.P., Remington: the science and practice of pharmacy. Vol. 1. 2006: Lippincott Williams&Wilkins.
- [24] Higano CS, Hafron J. Adherence with oral anticancer therapies: clinical trial vs real-world experiences with a focus on prostate cancer. *Journal of Urology*. 2023. [lww.com](http://www.lww.com)
- [25] Higano CS, Hafron J. Adherence with oral anticancer therapies: clinical trial vs real-world experiences with a focus on prostate cancer. *Journal of Urology*. 2023. [lww.com](http://www.lww.com)
- [26] Junaid Patel M, Shoaib Khan M, Ali F, Kazmi Z et al. Patients' Insight of Interpreting Prescriptions and Drug Labels - A Cross Sectional Study. 2013. ncbi.nlm.nih.gov
- [27] Ibrahim Albaroodi KA. Pharmacist knowledge, attitude, and practice regarding pharmacy code of practice and ethics in Iraq. *Journal of Public Health Research*. 2024. sagepub.com
- [28] Baryakova TH, Pogostin BH, Langer R, McHugh KJ. Overcoming barriers to patient adherence: the case for developing innovative drug delivery systems. *Nature Reviews Drug Discovery*. 2023 May;22(5):387-409. nih.gov
- [29] Rosano GM, Moura B, Metra M, Böhm M, Bauersachs J, Ben Gal T, Adamopoulos S, Abdelhamid M, Bistola V, Čelutkienė J, Chioncel O. Patient profiling in heart failure for tailoring medical therapy. A consensus document of the Heart Failure Association of the European Society of Cardiology. *European journal of heart failure*. 2021 Jun;23(6):872-81. wiley.com
- [30] Banerji A, Wickner PG, Saff R, Stone Jr CA, Robinson LB, Long AA, Wolfson AR, Williams P, Khan DA, Phillips E, Blumenthal KG. mRNA vaccines to prevent COVID-19 disease and reported allergic reactions: current evidence and suggested approach. *The Journal of Allergy and Clinical Immunology: In Practice*. 2021 Apr 1;9(4):1423-37. jaci-inpractice.org