https://doi.org/10.47108/jidhealth.Vol7.Iss3.348
Mijk KN, et al., Journal of Ideas in Health (2024); 7(3):1081-1086
Journal of Ideas in Health

Evaluation of first hospital entry and hospitalization related prescription polypharmacy targeting patients of fifty years old and more at a general hospital, Duhok, Iraq

Kadhim Naif Mijk[1], Khairya Haider Alyas[1], Majdal Hussien Haji[1], Wafaa Khalid Ali[1], Fouad Kasim Mohammad[2,3]

Abstract

Background: Polypharmacy is the intake of ≥ 5 medications. This study evaluates the prevalence of polypharmacy among elderly patients hospitalized during October 2023 at Azadi Hospital in Duhok, Iraq.

Methods: This was a retrospective cross-sectional study. The files of 373 patients aged ≥ 50 years were reviewed for the occurrence of polypharmacy (5 medications), major polypharmacy (6-9 medications) and excessive polypharmacy (≥ 10 medications) as well as their disease conditions.

Results: The 373 patients received 5 to 10 medications at first hospital entry, and during hospitalization (1-29 days), 220 (58.98%) of them received 5 to 12 medications. Cardiovascular disorders (44.04%) were the most encountered conditions in the hospitalized patients, followed by endocrine disorders (26.4%) and gastrointestinal disorders (8.14%). Polypharmacy occurred in 63 (16.89%) patients on the first day of hospital entry and in 73 (19.57%) during the hospitalization period. Major and excessive polypharmacy occurred among 90 (24.13%) and 2 (0.54%) of patients at the first entry and among 129 (34.58%) and 18 (4.83%) patients during the hospitalization, respectively. During hospitalization, polypharmacy significantly (Chi squared=22.655; df=1; p=1.9387*10-6) increased by 17.43% when compared to that of the first hospital entry. The most commonly used medications at the first hospital entry were paracetamol (17.18%) followed by antibiotics (11.8%). During hospitalization the most commonly used medications were antibiotics (13.52%) followed by proton pump inhibitors (11.43%).

Conclusion: The prevalence of polypharmacy was high among elderly hospitalized patients. This condition might increase the risk of potential drug-drug interaction and the intake of inappropriate medications. Alerting clinicians about the significance of polypharmacy is necessary in prescribing and deprescribing medications to hospitalized elderly patients.

Keywords: Polypharmacy, Drug Interaction, Elderly, Prescription Medications, Disease Conditions, Iraq

Correspondence: Fouad K. Mohammad (fouadmohammad@yahoo.com)
[2,3]Department of Physiology, Biochemistry and Pharmacology, College of Veterinary Medicine, University of Mosul, Mosul, Iraq

How to cite: Mijk KN, Alyas KH, Haji MH, Ali WK, Mohammad FK. Evaluation of first hospital entry and hospitalization related prescription polypharmacy targeting patients of fifty years old and more at a general hospital, Duhok, Iraq: Polypharmacy in elderly patients. Journal of Ideas in Health. 2024 Jun. 30 ;7(3):1081-1086 https://doi.org/10.47108/jidhealth.vol7.iss3.348

Article Info: (**Original Research**)
Received: 31 May 2024
Revised: 21 June 2024
Accepted: 25 June 2024
Published: 30 Junel 2024

Journal Home page: https://www.jidhealth.com
e ISSN: 2645-9248

Background

According to the World Health Organization, polypharmacy refers to the use of five or more medications that might include prescription, over-the-counter and/or complementary medicines by the patient [1]. Polypharmacy could be a major (6-9 medications) or an excessive (> 10 medications) type [2]. Aging which is usually associated with comorbidities are subjected to treatments with multiple medications leading to polypharmacy [3,4]. Polypharmacy, which might also include non-essential drug prescription, potentially predisposes elderly patients to drug-drug interactions, adverse drug reactions/events, medication noncompliance and even missing the therapeutic goal [2,3,5,6]. More complications arise because of the polypharmacy when comorbidities are diagnosed in the elderly patients [7,8]. As the frailty and polypharmacy are often seen in the elderly, their interaction is highly associated with the overexpression of poor health outcomes [9,10]. The demographic transition in Iraq is expectedly continuing [11] and the elderly population (age 60 years or more) is projected to increase from 2 million (5.1% country's population) to 7.5 million (10.6%) [12]. As elderly people are more prone to polypharmacy medications [3-5], it is also expected that older Iraqi population will suffer from such a condition. One study demonstrated that polypharmacy (45.5%) with 8% excessive polypharmacy existed in elderly patients recruited in Baghdad, Iraq [13]. To this end, the information on

polypharmacy in hospitalized Iraqi elderly patients and their comorbidities are rather limited [13-15]. The purpose of the present study was to assess the occurrence of polypharmacy in elderly hospitalized patients during October 2023 at the Azadi Hospital, Duhok, Kurdistan Region, Iraq, taking into account concurrent comorbidities and medications administered at the first entry to the hospital and during the hospitalization period, since such information is scarce in this region.

Methods

Study design and participants

A cross section observational retrospective study was conducted at Azadi Hospital, and the data were collected from the statistical unit of the hospital.

Sample size

Considering the margin of error between 5%, a confidence level of 95%, and a 50% response distribution the sample size 373 was reached using the following formula: $N= [Za^2 \times P \times Q / (M.E.)^2]$.

Inclusion and exclusion criteria

The inclusion criteria were patients of both genders aged ≥ 50 years and were hospitalized during October 2023. This time period was considered for the study because the study was a pilot one, in taking into account polypharmacy difference at the first hospital entry vs. during the hospitalization period. The exclusion criteria were any patient with missing demographic or medication data and patients < 50 years old, or those having surgical procedures. Other patients who were not hospitalized during October 2023 were excluded.

Procedure

A modified questionnaire was designed to collect data. The questionnaire included three sections; first Procedure

Data concerning drugs used for each patient at the first hospital entry and during hospitalization period, which included the gender, age, duration of hospitalization and diagnoses were extracted from records of 373 eligible patients who were hospitalized during October, 2023 at the Azadi Hospital, Duhok, Iraq. The data were tabulated according to medications prescribed to patients and disease conditions diagnosed. The occurrence of polypharmacy was categorized into polypharmacy (5 medications), major polypharmacy (6-9 medications) and excessive polypharmacy (≥ 10 medications) [2,15]..

Statistical analysis

Descriptive statistics were used to characterize the data using the statistical software PAST4.15 (https://www.nhm.uio.no/english/research/resources/past/).

Mann-Whitney-U-test was used to analyze differences in the number and frequency of medications between the first hospital entry and during the hospitalization period. Chi squared analysis was performed to analyze polypharmacy at the first hospital entry compared to that of the hospitalization period. The level of significance was at $p \leq 0.05$.

Results

Table 1 shows the demographic data of 373 hospitalized elderly patients; 201 (53.89%) were females and 172 (46.11%) were males. Their ages ranged from 50 to 97 years (mean ± SD= 67.21 ± 11.16), and the most frequently hospitalized patients during October, 2023 were in the age group 50-60 years (33.51%) and the least one (9.38%) was the group of ≥ 81 years (Table 1).

The duration of hospitalization of the patients ranged from one to 29 days (Table 2). The hospitalization most frequently occurred for two days (21.72%), followed by one day (21.18%), whereas the least one (2.14%) was 9 days (Table 3). During the hospitalization period that extended from 10 to 29 days, 14 patients (3.75%) were hospitalized. The most frequently diagnosed disease conditions among the patients were two (32.17%), followed by three (29.76%) and the least one was five (1.34%) (Table 3). The categories of disease conditions diagnosed among the hospitalized patients are presented in table 4. Cardiovascular disorders (44.04%) were the most encountered conditions among them, followed by endocrine disorders (26.40%) and gastrointestinal disorders (8.14%). The occurrence of other disease conditions ranged from 0.60 (eye disorders) to 6.94 (neurological disorders) (Table 4). Table 5 presents the number of medications (1-12), median (5.5 vs. 6.5) and their frequencies (median= 21.5 vs. 28) given to patients at the first hospital entry and during hospitalization, respectively. There were no statistically significant differences between them. The number of patients who received one to four medications (no polypharmacy) at the first hospital entry was 218 (58.45%), and it was reduced to 153 (41.02%) during hospitalization (Table 5). In contrast, the rest of the patients had polypharmacy at the first hospital entry with 5 to 10 medications (155 patients, 41.55%), and this was increased to 220 patients (58.98%) during hospitalization, with 5 to 12 medications (Table 6). Further analysis of the polypharmacy type delineated differences according to definitions we employed. Among 373 elderly patients, polypharmacy (5 medications) occurred in 63 (16.89%) patients on the first day of hospital entry and in 73 (19.57%) during the hospitalization period that extended from one to 29 days (Table 6). Major (6-9 medications) and excessive (≥ 10 medications) polypharmacy occurred among 90 (24.13%) and 2 (0.54%) of patients at the first hospital entry and among 129 (34.58%) and 18 (4.83%) patients during the hospitalization, respectively (Table 6). As revealed by the Chi squared analysis, there was a significant difference between the occurrences of polypharmacy at the first hospital entry compared to that of the hospitalization period (Table 7). During hospitalization, polypharmacy significantly ($p<0.05$) increased by 17.43% when compared to that of the first entry. Medications prescribed for the elderly patients are presented in table 8. The most commonly used medications at the first hospital entry were paracetamol (17.17%) followed by antibiotics (11.79%) and the least ones were acyclovir, ipratropium, betahistine, atropine, carbamazepine and H1 and H2 antihistamines (0.07% each). This pattern changed during hospitalization, as the most commonly used medications were antibiotics (13.52%) followed by proton pump inhibitors (11.43%) and the least ones were lactulose, H1 and H2 antihistamines, atropine, carbamazepine, rivaroxaban, ipratropium and betahistine (0.06%-0.17%). The mean and median numbers of medications at the first hospital entry (40.94 and 18) increased during hospitalization (49.23 and 29) of the patients, respectively (Table 8).

Table 1. The demographic data of 373 elderly hospitalized patients during October 2023 at the Azadi Hospital, Duhok, Iraq

Variable	n	%	Age, years (mean ± SD)
Females	201	53.89	68.2±11.61
Males	172	46.11	66.06±10.53
Total	373	100	67.21±11.16
Age ranges of the patients			
Age range (years)	Females, n (%)	Males, n (%)	Total, n (%)
50-60	66 (17.69%)	59 (15.82%)	125 (33.51%)
61-70	62 (16.62%)	56 (15.01%)	118 (31.64%)
71-80	50 (13.40%)	45 (12.06%)	95 (25.47%)
≥ 81	23 (6.17%)	12 (3.22%)	35 (9.38%)

n= Number of patients. SD= Standard deviation.

Table 2: Duration of hospitalization of 373 elderly patients

Duration of hospitalization (days)	N	%
1	79	21.18
2	81	21.72
3	58	15.55
4	39	10.46
5	28	7.51
6	29	7.77
7	20	5.36
8	17	4.56
9	8	2.14
10-29	14	3.75

Table 3: The frequency and percentage of disease conditions diagnosed among 373 elderly hospitalized patients

Number of diagnosed diseases	N	%
1	106	28.42
2	120	32.17
3	111	29.76
4	31	8.31
5	5	1.34

Table 4: Categories of disease conditions diagnosed among 373 elderly hospitalized patients

Category	N	%
Cardiovascular disorders	292	44.04
Endocrine disorders	175	26.40
Gastrointestinal disorders	54	8.14
Neurological disorders	46	6.94
Renal disorders	36	5.43
Pulmonary disorders	35	5.28
Musculoskeletal disorders	14	2.11
Hematological disorders	7	1.06
Eye disorders	4	0.60
Total	663	100

Discussion

In the present study polypharmacy (≥ 5 medications) was encountered in elderly hospitalized patients at the first entry (41.55%), and thereafter it was increased to 58.98% during the hospitalization stay. These results are within the ranges reported by other studies in the elderly in Iraq [13,15] and other countries such as Saudi Arabia [3,7], Bahrain [4], USA [5] and Australia [16]. Polypharmacy is a global problem frequently encountered in elderly hospitalized patients [1,3-5,15-17]. Its prevalence could reach 90% and more, and it is often associated with increased hospitalizations and high economic costs of healthcare [1]. However, the percentages of occurrence of polypharmacy may vary according to definitions employed in categorizing it [16,17]. In a review article, after classifying polypharmacy according to the number of medications taken (≥ 5, 9 or 10), the polypharmacy prevalence encountered among the patients was up to 91%, 74%, and 65%, respectively [16]. In the present study, the percentage of hospitalized patients with polypharmacy was 58.98% in spite of the fact that the median values of the number of medications at the first hospital entry (5.5) vs. during the hospitalization (6.5) were not significant different (Table 5). However, following the polypharmacy definition pattern we employed, this percentage during hospitalization became 19.57% in polypharmacy of only 5 medications, 34.58% in major polypharmacy (6-9 medications) and 4.83% when it was excessive (≥ 10 medications). This system of defining polypharmacy has the advantages of dealing with polypharmacy related outcomes, comorbidity assessment, evaluating the quality of life and hospital discharge of the patients [1,2,15-17].

The number of medications prescribed for the patients depend largely among other factors on the diagnosis outcome, comorbidities, age of the individual [5,8]. The hospital of concern in the present study, however, is a general one with limited specialized services. To this end several factors affect polypharmacy and its classification and prevalence. These include but not limited to major disease conditions, diagnosis outcome, comorbidities, aging, self -medication and duration of the hospitalization [1-5,7-10,16]. The disease conditions encountered in the present study ranged from one to five per patient. They mainly involved the cardiovascular system, endocrine disorders and gastrointestinal disorders. These conditions and others presented in table 4 required multiple therapeutic applications, paving the way to polypharmacy [6,7,16,17]. The polypharmacy report in the present study further ascertains the existence of polypharmacy in patients with severe disease conditions recorded in Duhok hospitals [15]. Comorbidities with the need for multiple therapies might have contributed to the polypharmacy we identified in the present study. Aging and comorbidities are risk factors that increase the likelihood of occurrence of polypharmacy and exacerbate it in the elderly, because of the requirements for multiple medications for the treatment or prophylaxis, as is the case with diabetes, hypertension, heart failure, and gastrointestinal ailments [3-5,16-18].

Table 5: Number of medications taken by 373 elderly hospitalized patients

Number of medications	First hospital entry		During hospitalization	
	Frequency	%	Frequency	%
1	16	4.29	11	2.95
2	57	15.28	27	7.24
3	79	21.18	63	16.89
4	66	17.69	52	13.94
5	63	16.89	73	19.57
6	47	12.60	47	12.60
7	27	7.24	41	10.99
8	10	2.68	29	7.77
9	6	1.61	12	3.22
10	2	0.54	12	3.22
11	0	0	3	0.80
12	0	0	3	0.80
Total	373	100	373	100
Summary statistics				
Number of medications				
Results	First hospital entry		During hospitalization	
Median	5.5		6.5	
25 percentiles	2.75		3.25	
75 percentiles	8.25		9.75	
Frequency of 1-12 medications taken by the patients				
Median	21.5		28	
25 percentiles	3		11.25	
75 percentiles	61.5		50.75	

Table 6: The occurrence of polypharmacy among 373 elderly hospitalized patients

Type of polypharmacy	First hospital entry		During hospitalization	
	Frequency	%	Frequency	%
No polypharmacy	218	58.45	153	41.02
Polypharmacy	63	16.89	73	19.57
Major polypharmacy	90	24.13	129	34.58
Excessive polypharmacy	2	0.54	18	4.83
Total of polypharmacy types	155	41.55	220	58.98

Table 7: Chi squared analysis of occurrence of polypharmacy among 373 elderly hospitalized patients according to first hospital entry and during hospitalization

Measurement	Polypharmacy	%	No polypharmacy	%
First entry	155	41.55	218	58.45
Hospitalization	220	58.98	153	41.02

Chi squared= 22.655; df =1; p= 1.9387×10-6

The most widely administered medications in the present study were paracetamol, antibiotics, proton pump inhibitors, aspirin and statins at first entry and during hospitalization the most common medications were antibiotics, paracetamol, proton pump inhibitors, aspirin and statins. The differences in the medications used at the first hospital entry compared to those during hospitalization could be attributed to the progress of the disease conditions during hospitalization that needed additional or different drug therapy. Furthermore, the mean and median numbers of medications among the patients at the first hospital entry (40.94 and 18) increased during hospitalization (49.23 and 29), respectively. These findings call for additional in-depth exploration of diseases diagnosed and medications prescribed to the elderly in order to avoid unnecessary polypharmacy and thereafter potential drug-drug interactions [5-10]. The fragile elderly patients, who are vulnerable to adverse drug events, need continuous monitoring of medication intake with a focus on disease diagnosis and prescribing necessary medications only. If not, then deprescription is needed to reduce the number of drugs involved in polypharmacy [6,8,10,18]. The data of polypharmacy in the present study showed that its occurrence increased in the hospitalized patients compared to the first hospital entry by 17.43%. This might increase the possibility of potential drug-drug interactions during hospitalization. It is well known that polypharmacy predisposes patients to drug-drug interactions [2,3,5,6,19]. It is possible that non-essential medications are included within the polypharmacy drug count. Such a condition, which is often complicated with hospitalization and comorbidities, predisposes elderly patients under multi-therapeutics to adverse drug reactions and drug-drug interactions in a manner that would compromise the main therapeutic goal [2,6,7,19].

Table 8: Medications prescribed for 373 elderly hospitalized patients

Medications	First hospital entry		Hospitalization	
	Frequency	%	Frequency	%
Paracetamol	246	17.17	165	9.58
Antibiotics	169	11.79	233	13.52
Proton pump inhibitors	133	9.28	197	11.43
Aspirin	125	8.72	148	8.59
Statins	112	7.82	142	8.24
Clopidogril	97	6.77	114	6.62
Diuretics	89	6.21	100	5.80
Heparin	85	5.93	132	7.66
Ondansetron	68	4.75	48	2.79
Metoclopramide	35	2.44	43	2.50
Tramadol	33	2.30	29	1.68
Insulin	30	2.09	53	3.08
Nitrates	30	2.09	37	2.15
Steroids	27	1.88	42	2.44
Beta blockers	25	1.74	41	2.38
Calcium channel blockers	22	1.54	36	2.09
Angiotensin receptor blockers	18	1.26	31	1.80
Salbutamol	18	1.26	30	1.74
Angiotensin converting enzyme inhibitors	17	1.19	11	0.64
Prochlorperazine	10	0.70	4	0.23
Citicoline	10	0.70	14	0.81
Diazepam	7	0.49	6	0.35
Bromohexine	6	0.42	18	1.04
Digoxin	4	0.28	8	0.46
Amiodarone	3	0.21	12	0.70
Lactulose	3	0.21	1	0.06
Rivaroxaban	2	0.14	2	0.12
Levitriacetame	2	0.14	8	0.46
Acyclovir	1	0.07	8	0.46
H1 antihistamines	1	0.07	3	0.17
Ipratropium	1	0.07	2	0.12
Betahistine	1	0.07	2	0.12
H2 antihistamines	1	0.07	1	0.06
Atropine	1	0.07	1	0.06
Carbamazepine	1	0.07	1	0.06
Total	1433	100.00	1723	100.00
Statistics of frequencies of medications				
	First entry		Hospitalization	
Mean	40.94		49.23	
Median	18		29	
25 percentiles	2		4	
75 percentiles	62		53	

Limited time period (one month) was used in the present study. Nevertheless, the specific aim of detecting difference in polypharmacy encountered at the first hospital entry vs. the hospitalization was achieved. The presented study did not elaborate more on possible drug-drug interaction among the medications of the polypharmacy. Albeit, future studies would address this notion. Polypharmacy among patients with specific disease condition, though would be interesting to examine, was beyond the scope of the study.

Conclusion

Polypharmacy in the elderly is a significant concern due to its association with adverse health outcomes. In this study the prevalence of polypharmacy was high among elderly hospitalized patients, a condition that might lead to an increased risk of potential drug-drug interaction and inappropriate medications. To further address this serious health issue, a cautious approach is necessary in prescribing and deprescribing medications to hospitalized elderly patients within the framework of maintaining satisfaction and improving the quality of life. Alerting clinicians to potential risks of polypharmacy is a necessary step within this context.

Abbreviation

Declaration

Acknowledgment

The authors thank the College of Pharmacy, University of Duhok and the Azadi Hospital, Duhok, Kurdistan Region, Iraq for support and facilities provided. This study is the graduation project of the first four authors submitted to the College of Pharmacy, University of Duhok for the year 2023-2024.

Funding

The authors received no financial support for their research, authorship, and/or publication of this article.

Availability of data and materials

Data will be available by emailing kadhimmijk@gmail.com

Authors' contributions

KNM, KHA, MHH and WKA: Data acquisition, calculations, statistics, writing; FKM: Concept, design, statistics, supervision and drafting the manuscript. All authors have read, reviewed, and approved the final manuscript.

Ethics approval and consent to participate

We conducted the research following the declaration of Helsinki. This study was approved by the Council of the College of Pharmacy, University of Duhok, Iraq (No. 153, March 6, 2024) and it was considered a graduation research project of the 5th year students. The location of the research was at the Azadi Hospital, Duhok, Iraq after obtaining permission from the administration, and identity of all the patients was kept confidential.

Consent for publication

Not applicable

Competing interest

The authors declare that they have no competing interests.

Author Details

[1]College of Pharmacy, University of Duhok, Duhok, Kurdistan Region, Iraq. [2]Department of Physiology, Biochemistry, and Pharmacology, College of Veterinary Medicine, University of Mosul, Mosul, Iraq. [3]College of Nursing, The American University of Kurdistan, Duhok, Kurdistan Region, Iraq.

References

1. World Health Organization. Medication safety in polypharmacy. Geneva: World Health Organization; 2019 (WHO/UHC/SDS/2019.11).
2. Masnoon N, Shakib S, Kalisch-Ellett L, Caughey GE. What is polypharmacy? A systematic review of definitions. BMC Geriatr. 2017 Oct 10;17(1):230. doi: 10.1186/s12877-017-0621-2.
3. Alsuwaidan A, Almedlej N, Alsabti S, Daftardar O, Al Deaji F, Al Amri A, et al. Comprehensive overview of polypharmacy in elderly patients in Saudi Arabia. Geriatrics (Basel). 2019 May 15;4(2):36. doi: 10.3390/geriatrics4020036.
4. Alawainati M, Habib F, Ateya E, Dakheel E, Al-Buainain M. Prevalence, characteristics and determinants of polypharmacy among elderly patients attending primary healthcare centres in Bahrain: A cross-sectional study. Sultan Qaboos Univ Med J. 2024 Feb;24(1):63-69. doi: 10.18295/squmj.9.2023.052.
5. Nguyen K, Subramanya V, Kulshreshtha A. Risk factors associated with polypharmacy and potentially inappropriate medication use in ambulatory care among the elderly in the United States: a cross-sectional study. Drugs Real World Outcomes. 2023 Sep;10(3):357-362. doi: 10.1007/s40801-023-00358-2.
6. Hughes C. Appropriate and inappropriate polypharmacy-choosing the right strategy. Br J Clin Pharmacol. 2021 Jan;87(1):84-86. doi: 10.1111/bcp.14589.
7. Alharbi SA, Alfadl AA, Almogbel Y. Polypharmacy and inappropriate prescribing in elderly patients: a retrospective study at Buriadah Central Hospital, Saudi Arabia. Eur Rev Med Pharmacol Sci. 2022 May;26(9):3325-3333. doi: 10.26355/eurrev_202205_28752.
8. Cross AJ, Elliott RA, Petrie K, Kuruvilla L, George J. Interventions for improving medication-taking ability and adherence in older adults prescribed multiple medications. Cochrane Database Syst Rev. 2020 May 8;5(5):CD012419. doi: 10.1002/14651858.CD012419.pub2.
9. Khezrian M, McNeil CJ, Murray AD, Myint PK. An overview of prevalence, determinants and health outcomes of polypharmacy. Ther Adv Drug Saf. 2020 Jun 12;11:2042098620933741. doi: 10.1177/2042098620933741.
10. Hoel RW, Giddings Connolly RM, Takahashi PY. Polypharmacy Management in Older Patients. Mayo Clin Proc. 2021 Jan;96(1):242-256. doi: 10.1016/j.mayocp.2020.06.012.
11. Mohsin LA. The demographic reality of Iraq's older people and their spatial difference. Diyala J. 2020; 1(83): 385-416. https://www.iasj.net/iasj/article/223614
12. The rights and wellbeing of older persons in Iraq. [Internet]. Accessed May 26, 2024. https://arabstates.unfpa.org/en/publications/rights-and-wellbeing-older-persons-iraq
13. Talib H, Anwer ZM. Prevalence of polypharmacy among older adult patients in Baghdad: A descriptive study. AIP Conf. Proc. 2977, 040008 (2023). doi.org/10.1063/5.0181861
14. Collett GA, Song K, Jaramillo CA, Potter JS, Finley EP, Pugh MJ. Prevalence of Central Nervous system polypharmacy and associations with overdose and suicide-related behaviors in Iraq and Afghanistan war veterans in VA Care 2010-2011. Drugs Real World Outcomes. 2016 Mar;3(1):45-52. doi: 10.1007/s40801-015-0055-0.
15. Raouf GA, Mohammad FK, Merza MA. polypharmacy and the in silico prediction of potential body proteins targeted by these drugs among hospitalized COVID-19 patients with cytokine storm. Cureus. 2023 Nov 15;15(11):e48834. doi: 10.7759/cureus.48834.
16. Jokanovic N, Tan EC, Dooley MJ, Kirkpatrick CM, Bell JS. Prevalence and factors associated with polypharmacy in long-term care facilities: a systematic review. J Am Med Dir Assoc. 2015 Jun 1;16(6):535.e1-12. doi: 10.1016/j.jamda.2015.03.003.
17. Hsu HF, Chen KM, Belcastro F, Chen YF. Polypharmacy and pattern of medication use in community-dwelling older adults: a systematic review. J Clin Nurs. 2021 Apr;30(7-8):918-928. doi: 10.1111/jocn.15595.
18. Thorell K, Midlöv P, Fastbom J, Halling A. Use of potentially inappropriate medication and polypharmacy in older adults: a repeated cross-sectional study. BMC Geriatr. 2020 Feb 19;20(1):73. doi: 10.1186/s12877-020-1476-5.
19. Dagnew SB, Tadesse TY, Zeleke MM, Yiblet TG, Addis GT, Mekonnen GB, Agegnew Wondm S, Negash EA. Drug-drug interactions among hospitalized elderly in patients at medical wards of Northwest Ethiopia's Comprehensive specialized hospitals: a multicenter observational study. SAGE Open Med. 2022 Nov 8;10:20503121221135874. doi: 10.1177/20503121221135874.