RESEARCH

LONG-TERM MEDICATION USE AND POLYPHARMACY IN OLDER ADULTS

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Abstract

Introduction: In Turkey, long-term medication use reports help patients covered by universal health insurance to access drugs without having to make co-payments. Using these reports, the present study investigates the prevalence of polypharmacy and specifically, its relationship with age, gender, diagnosis, number of diseases, and various clinical branches.

Materials and Methods: In this descriptive retrospective study, anonymous data obtained from long-term medication use reports were analyzed using SPSS and Microsoft Excel.

Results: A total of 66,995 samples were examined, 60.7% of which were female patients. The average number of active substances was 2.78 ± 2.11, the rate of reports containing five or more active substances (polypharmacy) was 16.1% (10.757 samples), the distribution by gender was 62.7% female and 37.3% male. The distribution of polypharmacy by age groups was 60.1% in the 65-74 age group, 32.5% in the 74-85 age group, and 7.4% in the ≥85 age group. The most common diagnoses were diabetes mellitus (37.8%), hypertension (12.9%), and hyperlipidemia (8.2%). The clinical branches accounting for the highest rate of polypharmacy were internal medicine (65.1%), cardiology (10%), and chest diseases (6.1%). Acetylsalicylic acid was the most prescribed substance (12.3%) among 657 active substances.

Conclusion: The results of this study can be used by regulatory authorities and in clinical practice by physicians. Using a clinical decision system supported by guidelines can help clinicians to optimize drug therapy and reduce polypharmacy in older adults. To reduce inappropriate drug use, such as the Beers, STOPP-START, and TIME criteria were recommended to be used in decision support systems.

Keywords: Aged; Chronic Diseases; Multimorbidity; Polypharmacy; Prescriptions

INTRODUCTION

Life expectancy at birth has increased worldwide over the past 50 years owing to advances in the healthcare field and improved living standards. Consequently, the global population of older adults has also increased. In Turkey, individuals aged ≥ 65 years constituted 9.5% of the total population in 2020. Moreover, between 2000 and 2020, whereas the country's total population increased by 25%, the number of those aged ≥ 65 years increased by 42% (1). Chronic diseases are becoming increasingly prevalent owing to the aging population and lifestyle changes. Moreover, it is now common for individuals to have two or more co-occurring chronic medical conditions, also known as multimorbidity (2).

The use of multiple medications, or polypharmacy, is common in older adults. Although there is no standard definition, polypharmacy is often referred to as the daily use of ≥ 5 medications. This includes over-the-counter, prescription, and/or traditional and complementary medicines (3). The number of prescribed drugs is the most important predictor of inappropriate prescriptions or adverse medication events in older patients (4). Polypharmacy is associated with older age, multimorbidity, recent hospitalization, female sex, depression, and the number of physicians prescribing drugs (5). The issue of polypharmacy in older adults is becoming prevalent in most countries. This is a cause for concern given the observed association between polypharmacy and a broad spectrum of negative health outcomes, including drug-related problems, adverse medication events, physical and cognitive function decline, hospitalization, and increased mortality (6). Polypharmacy is one of the three key action areas of the third World Health Organization Global Patient Safety Challenge (7). It is imperative that patients adhere to the dosage and timing of their prescriptions and that costs are kept to a minimum for them to achieve the best results.

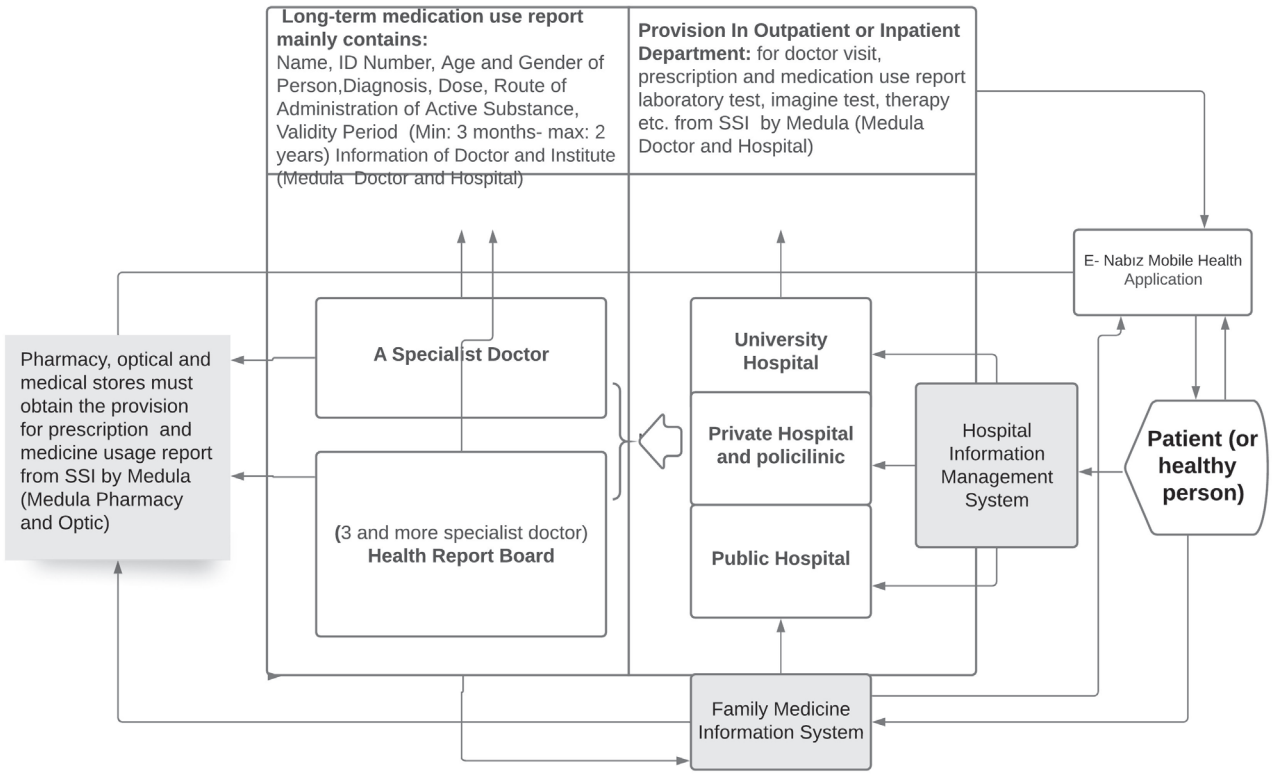
According to the Organisation for Economic Co-operation and Development's (OECD) Health at a Glance 2019 report, which considers data from 14 countries, the polypharmacy rates in older adults vary widely (as much as elevenfold). Turkey reports the lowest rates and Luxembourg the highest. The wide variation can partially be explained through the launch of targeted polypharmacy initiatives in some countries, including related policies on reimbursement and prescriptions (8).

Long-term Medication Use Report System

Long-term medication use reports prepared electronically by a specialist physician or board are transferred to the pharmacy using information and communication technologies and followed by the pharmacist. These reports are valid up to a maximum of two years and include details regarding the active substances, the amount of each active substance in the medication, and the daily dosages. The electronic prescription and drug report provisioning system operate as part of the web services of the Ministry of Health and the Social Security Institute in Turkey (9,10).

Electronic medical records obtained from health services provided within the scope of universal health insurance are recorded in an electronic database called the Medula system. There are four basic sub-modules in the Medula system: Medula pharmacy, Medula optics, Medula doctor, and Medula hospital (10). E-pulse is a personal health record system through which all health information can be centrally managed and accessed. Physicians can access a patient's previous electronic medical records via the E-pulse mobile application after the patient's permission. The physician from the relevant clinical branch can prescribe the medicines included in the long-term medication use report. Further, family physicians can re-prescribe the medicines for a maximum of 3 months using the Family Medicine Information System (Figure 1).

Figure 1. Schematic of Prescription and Long-term Medication Use Report Provisioning System*



*(schematized by the authors)

The long-term medication use report system facilitates access to prescription medicines, as a significant proportion of the Turkish population is covered by social security. The Communiqué on the Healthcare Practices determines the payment methods for these drugs, with corresponding payment rules being created in the Medula information system. Additionally, there are no co-payments under the long-term medication use report system.

This study aims to generate insights for regulatory institutions by analyzing the number of drugs and diagnoses and their details in these reports. By ensuring that the reports are prepared based on scientific foundations and guidelines, it will be possible to prevent polypharmacy and inappropriate medicine use.

MATERIALS AND METHODS

This study retrospectively analyzed 2015–2016 data on the age, sex, diagnoses, and active substances, as available from the long-term medication use reports prepared by specialist physicians or health committees, for patients aged ≥65 years. The analysis was conducted using the decision support feature of Istanbul's Region IV Public Hospitals Union's hospital information management system. Long-term medication use reports with similar content and for the same person were not included in the study results. Data from the reports were anonymized and examined after ethical approval was obtained from the İstanbul Prof. Dr. Cemil Taşcioglu City Hospital Clinical Research Ethics Committee (Approval number: 2020/572).

Statistical analyses and calculations were performed using SPSS Statistics 26.0 (IBM Corp., Armonk, NY, USA) and Microsoft Excel 2013 (Microsoft Corp., Redmond, Washington, USA).

While evaluating the study data, frequencies (number, percentage) were used for categorical variables, and descriptive statistics (mean, standard deviation (SD), median (IQR-interquartile range)) for numerical variables. The differences between two independent groups were analyzed using the independent samples t-test.

Differences between more than two independent groups were analyzed using one-way analysis of variance (ANOVA). Tukey multiple comparison tests were used in cases where the one-way ANOVA revealed a difference in group means. The relationships between independent numerical variables were checked with the Pearson correlation coefficient, while the relationships between categorical variables were checked using chi-square analysis. Statistical significance in the analysis was interpreted at the level of 0.05.

RESULTS

The baseline data collected on each participant consisted of age, gender, all drugs (prescribed) with an ATC (anatomic therapeutic chemical) code fifth level, all diagnoses (using the international classification of diseases, 10th revision (ICD-10) codes), relevant clinical branches, report date, report creator (specialist physician or board), and hospital name.

A total of 66,995 long-term medication use reports were analyzed, 60.7% of which concerned female patients. The average age in the reports was 74.22 ± 6.96 years. The mean age was 74.37 ± 7.10 years in the reports of female patients and 73.98 ± 6.71 years in the reports of male patients. The age data, which are continuous in nature, were grouped as follows: 65– 74, 75–84, and 85+. We also found that 60.0% of the reports for patients between the ages of 65–74 or 75–84, and 67.8% of the reports for individuals aged ≥85 years, were for women. There was a statistically significant difference ($x^2 = 140.121$, $p < 0.001$) between age groups in terms of gender.

The average number of diseases overall was 2.88±1.87. The average number of diseases for females was 2.84±1.92, and that for males was 2.93±1.76. The average number of diseases was 2.86±1.86 for patients aged 65–74 years, 2.90±1.86 for patients aged 75–84, and 2.90±1.86 for patients aged ≥85 years. The proportion of individuals with multimorbidity (two or more diseases) was 67.3% across all age groups. Distribution of patients with multimorbidity by gender, 55.9% for women and 44.1% for men; The distribution by age groups is 56.1% for 65-74 years, 34.8% for 75-84 years, 9.1% for 85 years and over (Table 1). A statistically significant difference was found between diagnosis groups according to age groups and gender $x^2 =_{age\ groups} 27.043$, $p = 0.001$, $x^2 =_{gender} 2721.577$, $p < 0.001$).

The most common diagnoses were hypertension (18.8%), diabetes mellitus (14.8%), hyperlipidemia (6%), cancer (5%), psychiatric disorders (4.4%), heart diseases (4.4%), and chronic obstructive pulmonary disease (3.3%). The proportion of females was significantly higher in all diagnosis groups, except for cancer (57.3%, n=1,915) and chronic ischemic heart disease (52.1%, n=558), which were more prevalent among males.

The average number of active substances overall was 2.78±2.11. The prevalence of polypharmacy overall was 16.1% (n = 10,757). The average number of active substances for females was 2.80±2.06, and that for males was 2.74±2.17. The distribution of polypharmacy by gender was 62.7% female and 37.3% male. There was a statistically significant difference between men and women regarding the average number of active substances, based on the independent samples t-test ($t = -3.909$, $p < 0.001$) (Table 2).

The average number of active substances was 2.85±2.16 in the 65-74 year age group, 2.72±2.06 in the 75-84 year age group, and 2.54±1.95 in the ≥85

Table 1. Age Groups, Sex, and Number of Diagnoses in Long-term Medication Use Reports

Age groups & Gender	Percent and Number of Diagnosis					
	1 n (%)	2 n (%)	3 n (%)	4 n (%)	≥5 n (%)	Total n%
65-74						
Female	8,861 (39.1)	2,623 (11.6)	4,068 (17.9)	2,363 (10.4)	4,754 (21.0)	22,669 (100.0)
Male	3,657 (24.2)	3,881 (25.7)	2,996 (19.8)	1,503 (9.9)	3,079 (20.4)	15,116 (100.0)
Total	12,518 (33.1)	6,504 (17.2)	7,064 (18.7)	3,866 (10.3)	7,833(20.7)	37,785 (100.0)
75-84						
Female	5,123 (36.9)	1,668 (12.0)	2,479 (17.9)	1,598 (11.5)	3,010 (21.7)	13,878 (100.0)
Male	2,291 (24.9)	2,351 (25.5)	1,782 (19.3)	899 (9.8)	1,894 (20.5)	9,217 (100.0)
Total	7,414 (32.2)	4,019 (17.4)	4,261 (18.4)	2,497 (10.8)	4,904 (21.2)	23,095 (100.0)
≥85						
Female	1,525 (36.8)	494 (11.9)	751 (18.1)	482 (11.7)	893 (21.5)	4,145 (100.0)
Male	469 (23.8)	474 (24.1)	408 (20.7)	233 (11.8)	386 (19.6)	1,970 (100.0)
Total	1,994 (32.6)	968 (15.8)	1,159 (19.0)	715 (11.7)	1,279 (20.9)	6,115 (100.0)
Total Female	15,509 (38.1)	4,785 (11.8)	7,298 (17.9)	4,443 (10.9)	8,657 (21.3)	40,692 (100.0)
Total Male	6,417 (24.4)	6,706 (25.5)	5,186 (19.7)	2,635 (10.0)	5,359 (20.4)	26,303 (100.0)
Total	21,926 (32.7)	11,491 (17.2)	12,484 (18.6)	7,078 (10.6)	14,016 (20.9)	66,995 (100.0)

year age group. As a result of the one-way analysis of variance (ANOVA) applied, the average active substance according to age groups was showed a statistically significant difference ($F = 71.801$, $p < 0.001$). Polypharmacy was found in 60.1% of the cases in the 65–74 age group, 32.5% of the cases in the 75–84 age group, and 7.4% of the cases in the ≥85 age group. The use of ≥ 5 active substances was most prevalent in the 65-74 year age group (Table 2). The active ingredient average was 2.84 ± 2.24 in 1 disease, 2.74 ± 2.05 in 2 diseases, 2.72 ± 2.04 in 3 diseases, 2.72 ± 1.96 in 4 diseases, and 2.79 ± 2.06 in ≥5 diseases. As a result of the one-way analysis of variance (ANOVA) applied, the average active substance according to the number of diseases was showed a statistically significant difference ($F = 65.659$, $p < 0.001$). According to the number of diseases, the rate of polypharmacy is 34.1% in 1 disease, 15.9% in 2 diseases, 18.1% in 3 diseases, 10.6% in 4 diseases, and 21.3% in ≥ 5 diseases (Table 2).

Table 2. Age Groups, Gender, Number of Diseases, and the Prevalence of Polypharmacy (* p <0.05)

Baseline characteristics	Number of Drugs			Polypharmacy (≥ 5 drugs)	
	Mean ± SD	Median (IQR)	Statistical Test	N	%
Total	2.78±2.11	2.0 (3.0)		10,757	16.1%
Gender					
Men	2.74±2.17	2.0 (2.0)	t=-3.909 **p=0.000***	4,017	15.3%
Women	2.80±2.06	2.0 (3.0)		6.740	16.6%
Age Groups					
65-74	2.85±2.16	2.0 (3.0)	F=71.801 **p=0.000***	6,460	17.1%
74-85	2.72±2.06	2.0 (2.0)		3,496	15.1%
≥85	2.54±1.95	2.0 (2.0)		801	13.1%
Number of Diseases					
1	2.84±2.24	2.0 (3.0)	F=65.659 **p=0.000***	3,664	16.7%
2	2.74±2.05	2.0 (2.0)		1,713	14.9%
3	2.72±2.04	2.0 (3.0)		1,948	15.6%
4	2.72±1.96	2.0 (3.0)		1,140	16.1%
≥ 5	2.79±2.06	2.0 (3.0)		2,292	16.3%

Specialists from 15 different departments made the diagnoses. A majority of the long-term medication use reports were prepared by the department of internal medicine, at 39.3% (n=26,345); followed by cardiology at 11.1% (n=7,443) and neurology at 10.6% (n=7,078). The average number of active substances in the reports prepared by the departments of medical oncology, internal medicine, and radiation oncology was 4.91±4.98, 3.40±2.40, and 3.24±3.33 respectively. The reports prepared by these departments had higher average numbers of active substances than those prepared by the other clinical branches. In Table 3, the results of the one-way ANOVA revealed that there was a statistically significant difference in the average number of active substances in reports prepared by each clinical branch (F = 593.269, p <0.001). The three most common branches in those with polypharmacy are Internal Medicine (65.1%), Cardiology (10.0%), and Chest Diseases (6.1%).

When Table 4 is examined, the average number of active substances in patients with diabetes mellitus, cancer, and hyperlipidemia was 4.25±2.35, 3.64±3.98, and 3.11±1.90, respectively. A one-way

Table 3. Clinical Branches and Prevalence of Polypharmacy (* p <0.05)

Clinical Branches	Number of Drugs			Polypharmacy (≥ 5 drugs)	
	Mean ± SD	Median (IQR)	Statistical Test	N	%
1. Internal Medicine	3.40±2.40	3.0 (3.0)	F=593.269 p=**0.000***	6,999	65.1%
2. Cardiology	2.66±1.64	2.0 (3.0)		1,071	10.0%
3. Chest Diseases	3.07±1.54	3.0 (2.0)		660	6.1%
4. Neurology	2.14±1.42	2.0 (2.0)		463	4.3%
5. Medical Oncology	4.91±4.98	2.0 (6.0)		381	3.5%
6. Physical Treatment&Rehabilitation	2.54±1.31	2.0 (1.0)		299	2.8%
7. Radiation Oncology	3.24±3.33	2.0 (3.0)		187	1.7%
8. Orthopedics & Traumatology	2.23±1.29	2.0 (1.0)		130	1.2%
9. Family Medicine	2.32±1.71	2.0 (2.0)		94	0.9%
10. Cardiovascular Surgery	2.07±1.48	1.0 (2.0)		91	0.8%
11. General Surgery	1.98±1.57	1.0 (1.0)		65	0.6%
12. Psychiatry	1.90±0.91	2.0 (1.0)		33	0.3%
13. Ophthalmology	1.85±0.74	2.0 (1.0)		19	0.2%
14. Urology	1.54±0.68	1.0 (1.0)		14	0.1%
15. Other	2.54±2.04	2.0 (2.0)		251	2.3%

ANOVA revealed a statistically significant difference in the average number of active substances according to the diagnoses (F = 579.872, p <0.001), (Table 4). The most prevalent diagnoses in individuals with ≥ 5 active substances were diabetes mellitus (37.8%), hypertension (12.9%), and hyperlipidemia (8.2%).

There were 183,667 active substances mentioned in the reports. The reports also included non-pharmaceutical materials used in chronic disease management, such as needle tips and blood-sugar measuring sticks. Only prescription drugs specified in the Social Security Institution payment list were included in this study, yielding a total of 657 active substances. The most prescribed active substance was acetylsalicylic acid (prescribed 8,245 times), followed by biguanides (6,589), beta-blocking agents (6,267), HMG CoA reductase inhibitors (statins; 6,115), calcium channel blockers (3,868), and angiotensin-converting enzyme (ACE) inhibitors (3,294).

Table 4. Diagnoses and Prevalence of Polypharmacy (* p <0.05)

Diagnoses	Number of Drugs			Polypharmacy (≥ 5 drugs)	
	Mean ± SD	Median (IQR)	Statistical Test	N	%
1. Diabetes Mellitus	4.25±2.35	4.0 (4.0)	F=579,872 **p=0.000***	4,064	37.8%
2. Hypertension	2.48±1.71	2.0 (2.0)		1,388	12.9%
3. Hyperlipidemia	3.11±1.90	3.0 (3.0)		884	8.2%
4. Cancer	3.64±3.98	2.0 (3.0)		706	6.6%
5. Atrial fibrillation and flutter	2.47±1.85	2.0 (2.0)		284	2.6%
6. Chronic obstructive lung disease	2.37±1.93	2.0 (2.0)		280	2.6%
7. Depressive episode	2.40±1.46	2.0 (2.0)		178	1.7%
8. Chronic ischemic heart disease	2.18±1.75	1.0 (2.0)		114	1.1%
9. Glaucoma	2.25±1.63	2.0 (2.0)		108	1.0%
10. Retinal deterioration	2.39±1.68	2.0 (2.0)		92	0.9%
11. Anxiety disorders	2.52±1.38	2.0 (1.0)		48	0.4%
12. Asthma	1.97±1.42	2.0 (1.0)		41	0.4%
12. Dementia in Alzheimer's Disease	1.95±1.04	2.0 (1.0)		17	0.2%
14. Nonorganic psychosis	1.86±1.09	2.0 (2.0)		10	0.1%
15. Other	2.40±1.72	2.0 (2.0)		2,543	23.6%

DISCUSSION

A previous study of 17 European countries and Israel used data for participants aged ≥65 years from Wave 6 of the Survey of Health, Aging, and Retirement in Europe database. In that study, the prevalence of polypharmacy in each country ranged from 26.3% to 39.9%. Polypharmacy prevalence was lower in Switzerland (26.3%), Croatia (27.3%), and Slovenia (28.1%), and higher in Portugal (36.9%), Israel (37.5%), and the Czech Republic (39.9%) (11). OTC drugs, vitamins, and minerals were included in this study, conducted with 10,989 people aged ≥65 years. It is noteworthy that the polypharmacy rate in Turkey is remarkably lower than in OECD countries (8). In terms of multiple medication use, 16.1% of the patients in this study used ≥ 5 medications, it is seen that the prevalence of polypharmacy is quite low compared to European countries. The exclusion of OTC and similar food supplements plays an important role in our study.

A previous study in Germany included patients aged over 60 years who had made at least one visit to any of the 1,010 general practitioners between January to June 2017—yielding a sample of 564,352 patients for analysis. Of these patients, 85% of males and 86% of females showed multimorbidity. Simultaneously, 38% of males and 37% of females met the criteria for polypharmacy. The mean number of chronic diseases was 5.3 (SD=4.4) in males and 5.7 (SD=4.6) in females. The mean number of prescribed medications was 4.2 (SD=2.7) in both males and females (12). By contrast, our study found that the average number of chronic diseases in Turkish patients aged ≥65 years was overall 2.88±1.86 and multimorbidity was found overall 67.3%. The average number of active substances used by females was 2.80±2.06, whereas the number was 2.74±2.17 for males. The prevalence of polypharmacy in the primary care study in Germany was much higher than in our study.

Data obtained from the Irish Longitudinal Study on Aging showed that 27% of the ≥54 year age group used ≥ 5 medications (13). Similarly, in Sweden, out of 1,742,336 individuals aged ≥65 years who were included at baseline in a prospective cohort study, 44% were exposed to polypharmacy (≥5 medications) and used 4.6 different drugs on average (14). Thus, the prevalence of polypharmacy is high among older adults in Ireland and Sweden. Contrastingly, 16.1% of the patients used ≥ 5 medications and the average number of active substances was 2.78±2.11 in Turkey.

In another survey in Spain of 164,513 patients with multimorbidity and aged >65 years, the 65–79 year age group was prescribed a median of four medications. The 80–94 years age group was prescribed a median of six medications. At least 45.9% of the 65–79 year age group and 61.8% of the 80–94 year age group were prescribed ≥ 5 medications (15). In our study, the average number of active substances was 2.85±2.16 in the 65–74 years age group, 2.72±2.06 in the 75–84 years age group, and 2.54±1.95 in the ≥85 years age group.

In a study of 1,003 patients in France, polypharmacy (5 to 9 medications) and excessive polypharmacy (≥10 medications) were reported in 42.9% and 27.4% of the study cohort, respectively (16). The prevalence of polypharmacy overall was 16.1% (n = 10,757) in our study. Thus, the prevalence of polypharmacy in France is almost three times higher than in this study.

A study conducted by Qato et al. used cross-sectional data from a nationally representative of 2,206 United States citizens. The mean age was 71.4 years, and 51.6% of the sample consisted of females. That study found that nearly 87.7% of the subjects used at least one prescription medicine, while 35.8% simultaneously used five or more prescription medications. The use of multiple medications increased from 2005 to 2011, particularly the use of statins (33.8% to 46.2%), acetylsalicylic acid (30.2% to 40.2%), and proton pump inhibitors (15.7% to 18.5%). The use of antihypertensives increased slightly (60.9% to 65.1%), primarily driven by increases in the use of angiotensin-converting enzyme inhibitors (24.5% to 30.4%), which are commonly used as diuretics (29.5%) and [illegible]-blockers (31.2%) (17). In the present study, only 16.1% of the patients aged ≥65 years received prescriptions containing ≥5 drugs. The most commonly prescribed drugs in our study were similar to those in the USA. Acetylsalicylic acid (12.3%) was the most prescribed active substance, followed by biguanides (9.8%), beta-blocking agents (9.3%), statins (9.1%), calcium channel blockers (5.7%), and ACE inhibitors (4.9%).

One Canadian study found that, in 2016, approximately one-third (35.3%) of Canadian older adults were chronically using ≥ 5 medications from different medication classes, and 1 out of 18 (5.5%) were chronically using medications from 10 or more different medication classes. Statins were the most common medication class used by nearly half of all older adults (46.6%). The next most commonly used medication classes were ACE inhibitors—used to

treat high blood pressure and heart failure—and proton pump inhibitors—used to treat gastroesophageal reflux and peptic ulcer disease—used by 28.2% and 26.9% of older adults, respectively (18). In terms of multiple medication use, 16.1% of patients were using ≥ 5 medications in our study. Based on these findings, it can be concluded that, compared to our study, polypharmacy in Canada and the USA are twice as high and the most common medications are generally similar to those covered in Canada and USA studies.

A previous study examined the electronic prescriptions prepared in 2018 by family physicians across Turkey for geriatric patients (aged ≥65 years), based on the prescription information system. In this geriatric cohort, 6,104,798 individuals (85.0%) had at least one prescription. Moreover, 14.3% of the patients were chronically prescribed ≥ 5 medications. Additionally, the percentage of those with polypharmacy ranged between 16.4% and 20.7%. Each prescription contained an average of 2.9 individual drug items, and each medication was prescribed in 2.7 boxes on average (19). The prevalence of polypharmacy in this study, which was conducted with the data obtained from the family medicine information system, was found to be very close to the findings of our study. There was a difference between the drugs prescribed to patients examined in primary care and the long-term drug use reports in our study.

Polypharmacy in older adults requires more attention because of age-related changes in pharmacokinetics and pharmacodynamics, exclusion of these patients from clinical studies, inadequate representation in guidelines, excessive morbidity, the effect of dementia on the course and management of diseases, and poor communication. In the case of such patients, other chronic conditions and their medication use must be thoroughly assessed when taking their medical history (anamnesis), because a detailed evaluation can reduce the number of medications used. When medication is prescribed, interaction with other existing medications and aging-related factors must be considered.

There are several ways to prevent polypharmacy. Two major approaches to minimize the adverse outcomes of multiple medication use are i) using computerized doctor prescriptions that feature clinical decision support systems based primarily on guidelines on the prescribing process and interventions, and ii) establishing examination processes after computer-assisted or non-computer-assisted prescriptions (20). Bates et al. defined computerized decision support systems as computer-based systems providing "passive and active referential information as well as reminders, alerts, and guidelines" (21). Automated decision support system tools consistently reduce the number of potentially inappropriate prescriptions started and the mean number of potentially inappropriate prescriptions per patient. These tools also increase potentially inappropriate prescription discontinuation and medication appropriateness (22).

The Screening Tool of Older Persons' Prescriptions (STOPP) and the Screening Tool to Alert to Right Treatment (START) are explicit criteria that facilitate medication review in multimorbid older adults in most clinical settings. Electronic deployment of the STOPP/START criteria is a significant technical challenge; however, recent clinical trials of software prototypes have demonstrated their feasibility (23). The SENATOR and OPERAM trials are ongoing multicenter randomized controlled trials currently being conducted across Europe. These trials employ computerized versions of STOPP and START in their interventions (24).

Prescribing habits and locally available medications vary considerably between countries, and the evidence on appropriate prescriptions for older persons continues to evolve. Within this context, the Turkish Inappropriate Medication Use in the Elderly (TIME) criteria set (TIME-to-STOP/ TIME-to-START)—produced under the leadership of the Rational Drug Use Working Group of the Turkish Aca-

demic Geriatrics Society—provides a guide tailored to the specific needs of the Turkish people as well as an explicit screening tool (25).

Computerized interventions have been suggested as an effective strategy to improve prescription appropriateness for hospitalized older adults. In the hospital setting, the electronic prescribing and computerized physician order entry (CPOE) systems have reduced prescribing errors and help prevent adverse drug events (24). A long-term medication use report system designed similarly, with international medicine usage instructions such as the Beers, STOPP-START, and TIME criteria, would encourage rational medicine use. Future research should continue to focus on evaluating the use of Medula and clinical decision-making system to reduce inappropriate prescribing and polypharmacy in older people.

The study's main limitation was that only long-term medication use reports by specialist physicians or boards were analyzed. Thus, prescriptions without reports written by specialist physicians and family physicians, as well as OTC medications and dietary supplements obtained from pharmacies without a prescription, were not included in this study.

Re-prescribed data with similar content for the same person in long-term drug use reports were not included in the study results. On the other hand, data from the same person with different diagnoses from different clinical branches were included.

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Conflict of Interest

The authors declare no potential conflicts of interest concerning the research, authorship, or publication of this article.

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