Original Article

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Evaluation of a Clinical Decision Support System for the Identification of Inappropriate Prescription Patterns in Elderly in the Community Pharmacy Setting

Toplum Eczanelerinde Yaşlılarda Uygun Olmayan Reçete Kalıplarının Belirlenmesi için Geliştirilmiş Bir Klinik Karar Destek Sisteminin Değerlendirilmesi

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ABSTRACT

Objective: This study aimed to design and evaluate a clinical decision support system (CDSS) identifying inappropriate prescription patterns in the elderly to be used at community pharmacies.

Methods: The study was carried out in 20 community pharmacies during a 6-month period on patients ≥65 years. A CDSS was developed and integrated into the pharmacy automation systems to automatically check the medications of the patients for the presence of any potentially inappropriate medications (PIMs). Depending on the preference of the pharmacist the recommendations were communicated with the prescriber or not. The number and characteristics of the PIMs, prescribers' acceptance status of the recommendations, and usability of the CDSS were recorded.

Results: During the 6-month period 1250 prescriptions each from an individual patient were evaluated. The median (interquartile range) age of the patients was 73 (63-81) years. The total number of PIMs was 1359 and 59% of the patients had at least one PIM. The most frequently identified PIMs involved proton pump inhibitors (16%) and selective beta-blockers (11.9%). The pharmacists communicated with the prescribers regarding 24.4% of the PIM-involving prescriptions and 85.8% of the prescribers accepted the recommendations. The usability of the CDSS was found to be good.

ÖZ

Amaç: Bu çalışmada toplum eczanelerinde yaşlılarda uygunsuz reçete kalıplarının belirlenmesine olanak sağlayan bir klinik karar destek sistemi (KKDS) tasarlanması ve değerlendirilmesi amaçlanmıştır.

Yöntemler: Çalışma, 6 aylık bir süre boyunca 20 toplum eczanesinde 65 yaş ve üstü hastalarda yürütülmüştür. Yaşlı hastaların reçetelerinin potansiyel uygunsuz ilaçlar (PUİ) varlığı açısından otomatik olarak kontrol edilmesine olanak sağlayan bir KKDS geliştirilmiş ve eczane otomasyon sistemlerine entegre edilmiştir. Eczacının tercihine bağlı olarak öneriler reçeteyi yazan doktora iletilmiş ya da iletilmemiştir. PUİ'lerin sayısı ve özellikleri, reçete yazan doktorların önerileri kabul etme durumu ve KKDS'nin kullanılabilirliği kaydedilmiştir.

Bulgular: Altı aylık dönem boyunca her biri ayrı bir hastaya ait 1250 reçete değerlendirilmiştir. Hastaların medyan (çeyrekler arası aralık) yaşı 73 (63-81) idi. Hastaların %59'unun en az bir PUİ'ye sahip olduğu ve toplam PUİ sayısının 1359 olduğu tespit edilmiştir. En sık karşılaşılan PUİ'ler proton pompası inhibitörleri (%16) ve selektif beta-blokerlerdir (%11,9). Eczacılar, PUİ içeren reçetelerin %24,4'ü ile ilgili olarak reçeteyi yazan doktorla iletişim kurmuş ve önerilerin %85,8'i doktorlar tarafından kabul etmiştir. KKDS'nin kullanılabilirliği iyi olarak bulunmuştur.

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ABSTRACT

Conclusion: It is anticipated that the widespread use of this product would prevent drug-related adverse events, hospitalizations, morbidities, and mortalities; thus, would improve patients' health and quality of life, as well as lead to better clinical, humanistic, and economic outcomes.

Keywords: Clinical decision support system, community pharmacy, elderly, geriatric, potentially inappropriate medication

ÖZ

Sonuç: Bu ürünün yaygın kullanımının ilaca bağlı advers olayları, hastaneye yatışları, morbiditeleri ve mortaliteleri önleyeceği; böylece hem hastaların sağlık ve yaşam kalitesinde, hem de sağlık çıktılarının klinik, insani ve ekonomik düzeylerinde iyileşmelere yol açacağı öngörülmektedir.

Anahtar Sözcükler: Klinik karar destek sistemi, toplum eczanesi, yaşlı, geriatrik, potansiyel uygunsuz ilaç

Introduction

The number of elderly people is increasing worldwide. In Europe, the rate of elderly people over 65 years old, which was 17.4% in 2010 is expected to increase to 29.5% in 2060 (1). Türkiye's population is aging, too. In Türkiye, the rate of the elderly population, which was 9.9% in 2022, is expected to be 12.9% in 2030, 16.3% in 2040, 22.6% in 2060, and 25.6% in 2080 (2).

Increasing life expectancy brings new challenges for effective patient care. Factors such as multimorbidity, polypharmacy, and frailty challenge the provision of safe and effective drug therapy for older adults. Multimorbidity, which is the presence of at least two chronic health conditions (3), results in polypharmacy, which is often defined as the routine use of at least five medications. The prevalence of prescription drug use increases with age; 36% of older adults regularly take at least five prescription drugs (4).

Polypharmacy increases the medication error rate as reported by Avery et al. (5), who found that the medication error rate was 30.1% in patients taking five or more medications and 47% in patients receiving 10 or more medications.

Polypharmacy is also associated with a higher risk of "potentially inappropriate prescribing (PIP)" (6). PIP is defined as prescribing medication therapies that do not comply with accepted medical standards and, therefore, may cause significant harm to elderly patients. PIP can either be in the form of "potentially inappropriate medications (PIMs)", which is prescribing a medication that may not produce benefit relative to its harm, or "potential prescription omissions", which is, not prescribing recommended medications.

Inappropriate prescribing can cause adverse drug events in the elderly (7). With a prevalence ranging from 22.6% for community-dwelling older persons (8) to 43.2% for nursing home residents (9), PIPs were associated with lower quality of life as well as increased adverse drug events, hospitalizations, and healthcare costs (7).

PIMs are classified as a category of drug-related problems (DRPs), and elderly patients have a high risk of DRPs (10). While clinical medication review, including patient interviews, is an important tool in identifying and resolving DRPs (10), this process seems to be quite time-consuming for the elderly due to polypharmacy. Therefore, it is necessary to standardize and facilitate the clinical medication review process to use the limited workforce, time, and other resources in the most effective way (10).

Various tools such as the medication appropriateness index, the American Geriatrics Society (AGS) Beers Criteria® (AGS Beers Criteria®) for PIM Use in Older Adults, Screening Tool of Older People's Prescriptions (STOPP) and Screening Tool to Alert to Right Treatment (START) Criteria for PIP in older people (STOPP/START criteria), and Turkish Inappropriate Medication Use in the Elderly (TIME) Criteria to Improve Prescribing in Older Adults: TIME-to-STOP and TIME-to-START have been developed to make the identification of DRPs easier during the medication review process. These tools can be integrated into clinical decision support systems (CDSSs) which are computer programs that generate alerts aimed at helping healthcare professionals improve the quality and safety the of medication therapy they provide (11-14). CDSSs can provide automated, near-real-time monitoring, alerting, analysis, and reporting (15). PIPs can be prevented by the use of CDSSs at the time of prescribing.

CDSSs are generally designed to support physicians when prescribing (16). Only a small number of studies evaluated the use of CDSSs in pharmacy practice (17-21), helping to increase the DRP identification rate during the medication evaluation process (17).

Currently, there isn't any CDSS developed particularly to be used for elderly patients in the community pharmacy setting in Türkiye. Community pharmacists' knowledge of medications, including over-the-counter medications, combined with the availability of electronic medication registration systems puts pharmacists in an ideal position to identify PIPs.

This study aimed to design a CDSSs to identify inappropriate prescription patterns in the elderly and to evaluate the use of this digital system at community pharmacies.

Methods

This study was granted ethical approval by the Ethics Committee of Marmara University (approval no: 115, date: 15.04.2019).

Development of the CDSS

A CDSS to be used in community pharmacies aiming to detect inappropriate medication prescriptions in elderly patients and provide relevant solutions was developed by the authors who

were clinical pharmacy scholars (Ş.A., B.T.) in collaboration with a software developer.

While establishing CDSS algorithms, three criterion sets were taken into consideration: the 2019 Updated AGS Beers Criteria®, the STOPP/START Version 2 Criteria, and the TIME Criteria. Among these criterion sets the most appropriate criteria that could be used in the community pharmacy setting was chosen by the authors and included in the CDSS.

The CDSS consisted of 78 criteria. Fortythree from the 2019 Updated AGS Beers Criteria®, 43 from the STOPP/START Version 2 Criteria, and 56 from the TIME Criteria. Similar criteria from these three criterion sets were merged accordingly.

This CDSS was structured to work as follows:

- First, the CDSS was integrated into the pharmacy automation systems of pharmacies that volunteered to participate in the study.

- The "pharmacy automation system" prompts the CDSS whenever the pharmacist attempts to process a prescription of an elderly (≥65 years) patient.

- The CDSS processes not only the medications listed in the most recent prescription to be filled but also all of the recorded medications the patient seems to be currently using and checks for the presence of any inappropriate prescription pattern.

- If any inappropriate prescription pattern is encountered, the CDSS generates an "alert" through a pop-up screen. An "alert" contains at least one item of warning regarding inappropriate prescription pattern(s) identified for that specific patient. Multiple warnings are generated when more than one inappropriate prescription pattern (hereafter referred to as "PIM") is encountered.

- The warning also includes detailed information about the rationale for the inappropriateness and/or recommendations for appropriate approaches (Figure 1).

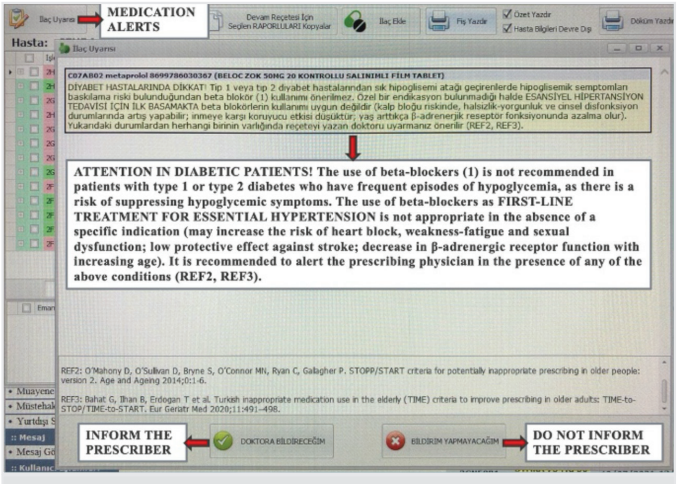

Figure 1. Example of an alert pop-up screen

- At the bottom of the pop-up screen two decision buttons are located, guiding the pharmacist on whether or not to inform the prescriber about the recommendations.

- Pharmacists are considered to decide between two choices: "to inform" or "not to inform" the prescriber. This decision was entirely at the discretion of the pharmacist.

Implementation

The study was conducted in 20 community pharmacies run by qualified pharmacists who had received clinical pharmacy training through MSc studies or certified courses. Patients aged 65 and over who visited the study pharmacies to have their prescriptions filled throughout the study period (1st March-1st September 2021) were invited to the study. The study was conducted on patients who agreed to participate.

First, the CDSS was installed on the computers of the pharmacies and integrated with the pharmacy automation systems. Pharmacists were authorized to sign in to the system using their confidential passwords. Entering the social security ID number of the patient in the system allowed the pharmacist access to the list of currently registered medications of that individual patient.

The pharmacy automation system prompted the CDSS if the patient's age was ≥65 years, and the CDSS checked the medications of the patient for any inappropriate prescription patterns.

Depending on the preference of the pharmacist the recommendations were communicated with the prescriber or not. While communicating with the prescriber, pharmacists explained the rationale for and recommendations about the identified PIM. No information about the presence and/or structure of any inappropriate prescription pattern was shared with the patient.

Usability of the CDSS

The usability of the CDSS was assessed by the system usability scale (SUS), which is a ten-item scale reflecting a global view of subjective assessment of usability. SUS is scored using a 5-point Likert scale (from 1 to 5) ranging from "strongly disagree" to "strongly agree". SUS scores are calculated as described in the work of Brooke (22). The overall SUS score ranges from 0 to 100. The SUS score of 68 represents the 50th percentile (median) corresponding to the center of the range for an average grade (C), while a SUS score between 77.2-78.8 represents the 80th-84th percentile corresponding to a grade of B+, and a SUS score between 84.1-100 represents the 96th-100th percentile corresponding to a grade of A+. A SUS score above 68 indicates average performance, while a score below 68 is considered below average (23).

Other Data

Data regarding the pharmacies (location, number of prescriptions filled per month), the pharmacists (age, gender, experience), patients (age, gender, number of medications, number of chronic diseases, number of PIMs, presence of polypharmacy, i.e.,

simultaneous use of ≥5 medications), and the alerts (number of alerts communicated with the prescribers, the prescribers' reply) were also collected.

The main outcome measures were as follows:

- Descriptive features of inappropriate prescription patterns detected by the CDSS,

- Descriptive features of prescribers' acceptance status of the CDSS-generated recommendations communicated with them,

- Opinions and attitudes of pharmacists regarding CDSS use.

Statistical Analysis

The SPSS 11.5 (SPSS Inc., Chicago, IL) was used for the statistical analysis. Kolmogorov-Smirnov and Shapiro-Wilk normality tests were used to determine the distribution characteristics of the data. Frequency data was expressed as n (%), while data with non-normal distribution were expressed as the median and interquartile range (IQR). Statistical significance was considered as $p<0.05$.

Results

The characteristics of the study pharmacies and the pharmacists (n=20) who participated in the study are presented in Table 1. The typical study pharmacist was a 35-year-old woman with 9.5 years of professional experience. The most common (50%) pharmacy location was "near a local general practitioner (GP) office".

Table 1. Characteristics of the study pharmacies and pharmacists (n=20)

Pharmacist	n (%)
Age (year); median (IQR)	35.00 (30.00-52.75)
Experience (year); median (IQR)	9.50 (5.25-29.00)
Female/male	14 (70)/6 (30)
Location of the pharmacy	
Near a local GP office	10 (50)
Pharmacy in a residential area	6 (30)
Near hospital	3 (15)
On a shopping street	1 (5)
Number of monthly prescriptions	
301-600	4 (20)
601-900	2 (10)
901-1200	4 (20)
1201-1500	4 (20)
>1500	6 (30)
Number of monthly geriatric prescriptions	
0-100	3 (15)
101-200	4 (20)
201-300	6 (30)
301-400	2 (10)
401-500	3 (15)
>500	2 (10)

GP: General practitioner, IQR: Interquartile range

From 20 pharmacies, 1250 patients participated in the study. The median (IQR) age of the patients was 73 (68-81) years, and 60.2% of them were female; 660 (52.8%) lived with their spouses and 24.2% with their children. The median (IQR) number of chronic diseases and number of medications for individual patients were 3 (2-4) and 5 (3-8), respectively. Polypharmacy was present in 56.6% of the patients. Detailed patient characteristics are presented in Table 2.

The prescriptions of more than half of the patients (59.04%; n=738/1250) resulted in inappropriate prescription pattern alerts containing a total of 1359 PIMs. The most frequently encountered PIMs involved medications listed in Table 3.

The pharmacists decided "not to inform the prescriber" for 75.6% of the 738 alert-generated prescriptions. Pharmacists' reasons for not communicating the warnings and recommendations with the prescriber are shown in Table 4. Only 10% (n=2/20) of the pharmacists made referrals to the prescribers. These two pharmacists communicated with the prescribers regarding 317 PIMs in 180 prescriptions, while no recommendation was made to the prescriber regarding 1042 PIMs. Prescribers' acceptance status of the recommendations made to them (n=317) was as shown in Table 5.

As the patient's age increased, the number of diseases ($r=0.116$, $p<0.01$), the number of medications used ($r=0.079$, $p<0.01$), and the number of PIMs ($r=0.155$, $p<0.01$) increased significantly.

The number of PIMs increased significantly as the number of chronic diseases ($r=0.401$, $p<0.01$) and the number of medications used ($r=0.612$, $p<0.01$) increased.

The number of medications used increased as the number of chronic diseases increased ($r=0.564$, $p<0.01$); patients with polypharmacy were older ($p=0.025$), had a higher number of chronic diseases ($p<0.001$) and had a higher number of PIMs in their prescriptions ($p<0.001$).

The overall median SUS score of the study CDSS was 77.25. SUS item scores are shown in Table 6.

Discussion

Twenty pharmacists who received clinical pharmacy training through MSc studies or certified courses participated in this study. The typical pharmacist in the study was a 35-year-old woman with 9.5 years of professional experience. The most common location (50%) of pharmacies was "near a local GP office".

The study included 1250 patients from 20 pharmacies. The patients' median age was 73 years, and 60.2% were female. Studies on geriatric patients in the literature included patients of similar age, with a median age ranging from 73.3 to 78.7 years (10,20,24-26).

The median number of chronic diseases and medications per patient was 3 and 5, respectively, in accordance with those reported from similar other studies where patients' median number of diseases and medications ranged from 2 to 11 (10,20,24-27), and from 3 to 10 (10,24-27), respectively.

The most prevalent chronic condition in our study was cardiovascular diseases, followed by diabetes. The pattern of chronic diseases aligned with the local data reported in the study of Zoghi et al. (28) which was conducted on more than 5,000 geriatric patients in Türkiye and with the global data indicating that cardiovascular conditions, arthritis, and diabetes were the most prevalent long-term conditions among geriatric patients (20,29).

More than half (56.6%) of our patients had polypharmacy as anticipated from the geriatric population, where polypharmacy prevalence was reported to range from 4% to 96.5% (30).

The CDSS used in this study was developed based on the 2019 Updated AGS Beers Criteria®, STOPP/START Version 2 Criteria, and TIME Criteria. Only the most appropriate criteria to be used in the community pharmacy setting were chosen; therefore, the START criteria, which are to be used by the prescribers, were not included in the study. The studies in the literature commonly used different versions of Beers criteria (10,20,24,31), STOPP/START criteria (10,20,31-33), and PRISCUS list (20) to detect PIMs in older patients. In addition to these criterion sets, we also used a local criterion set (TIME Criteria) to include the local expert opinion.

In this study, at least one PIM at more than half (59%, n=738/1250) of the prescriptions was identified by the CDSS. The mean number of PIMs per patient was 1.09 (n=1359/1250). Different PIM prevalence rates were reported from both local and international studies depending on the study design, sample size, setting, the criterion sets used, and patient characteristics. Studies on elderly patients in Türkiye revealed a prevalence of PIM ranging from 10.9% to 80.6% (34-41), while similar rates ranging from 7.87% to 57.6% (24,26,42,43) and even higher rates up to 81% for patients residing at residential care facilities (44,45) were recorded in international studies.

A local study using the TIME, Beers 2019, and STOPPv2 criteria revealed a PIM prevalence rate of 46.1%, 30.6%, and 26.2%, respectively, while a higher (46.9%) PIM rate was reported

Table 2. Characteristics of the patients (n=1250)

Patients	n (%)
Age; median (IQR)	73.00 (68.00-81.00)
Female/male	753 (60.2)/497 (39.8)
Chronic diseases	
Hypertension	955 (76.4)
Diabetes	486 (38.9)
Coronary artery disease	357 (28.6)
Dyslipidemia	414 (33.1)
Arrhythmia	151 (12.1)
With whom does the patient live?	
At a nursing home	145 (11.6)
Alone	129 (10.3)
Spouse	660 (52.8)
Children	302 (24.2)
Caretaker	7 (0.6)
Other	7 (0.6)
Number of medications; median (IQR)	5.00 (3.00-8.00)
Polypharmacy	707 (56.6)

IQR: Interquartile range

Table 3. The most frequently encountered potentially inappropriate medications

PIMs	n (%)
Proton pump inhibitors	217 (16.0)
Selective beta-blockers	162 (11.9)
Betahistine, trimetazidine, dimenhydrinate	75 (5.5)
Non-steroidal anti-inflammatory drugs	72 (5.3)
Acetylcholinesterase inhibitors	70 (5.2)

PIM: Potentially inappropriate medication

Table 4. Pharmacists' reasons for not communicating the recommendations with the prescriber (n=20)

Comments	n (%)
The pharmacist thought that the prescriber would not care	10 (50.0)
The pharmacist thought that the prescriber would not trust the information provided by the pharmacist	11 (55.0)
The pharmacist hesitated to contact the prescriber as he/she did not know him/her in person	15 (75.0)
Communication issues	18 (90.0)
Lack of time	19 (95.0)

The question might have more than one answer

Table 5. Acceptance status of the recommendations (n=317)

	n (%)
The recommendation was accepted	
The recommendation was accepted and implemented	158 (49.8)
The recommendation was accepted but not implemented	77 (24.3)
The recommendation was accepted, not implemented, but followed up	37 (11.7)
The recommendation was not accepted	
The recommendation was not accepted; no agreement was reached	3 (0.9)
The recommendation was not accepted; reason is unknown	24 (7.6)
Other	
Recommendation made, acceptance status unknown	18 (5.7)

when all three criterion sets were considered (36). In another study, number of patients with at least one PIM identified by the TIME-to-STOP criteria and Beers 2019 was 33% and 10.9%, respectively (34). Different rates were also reported from another study depending on the criteria set used: as 80.6% (Beers 2019), 59.7% (STOPPv2), and 48.2% [EU(7)-PIM] (35). The PIM rate according to TIME-to-STOP criteria among the elderly attending geriatric outpatient clinics was between 21.5-38%, whereas this rate was 11.7% for those receiving palliative care (34,39-41), and 48.2% for intensive care patients (35). Other studies from Türkiye reported similar rates of patients who had at least one PIM as 45.1% (37) and 41.4% (38).

In the systematic review and meta-analysis of 132 studies, including more than 370 million geriatric patients from 17 countries, conducted by Tian et al. (46), PIM prevalence was reported to be 36.7%. Sub-group analysis of that study showed that PIM prevalence in Türkiye was 39.6% depending on the six studies included and 56.3% in low-income countries (according to the World Bank classification) (46).

OPERAM (OPtimising thERapy to prevent Avoidable hospital admissions in the Multimorbid elderly) study, aiming to optimize the existing therapy among the elderly population aged ≥75 years by the use of a CDSS reported a rate of inappropriate prescribing for 86.1% of the participants (33).

The rate (59%) of patients with at least one PIM in our study was higher than many of those reported in the literature. The reasons for that might be that unlike the other studies we used a combination of three criterion sets instead of one, and as the intervention we used a CDSS instead of medication review; both approaches together might have prevented missing PIMs and helped identify a higher rate of PIMs.

In this study, PIM alerts were mostly generated for PPIs. Similarly, in the systematic review and meta-analysis of Tian et al. (46), benzodiazepines, non-steroidal anti-inflammatory drugs, and proton pump inhibitors were the first three medication classes that generated PIM alerts. The high prevalence of PPI-related PIMs may be due to several factors. As PPIs are known to be gastroprotective agents, most patients tend to continue these medications infinitely, and they might put pressure on their GPs to prescribe a PPI. Also, in elderly patients, bleeding problems may be more prevalent due to the increased number of medications and be more detrimental due to the existing comorbidities. Therefore, prescribers might have preferred a defensive approach and continued PPIs beyond the indicated period. Another factor might be the prescribers' lack of knowledge regarding the adverse effects of PPIs on the elderly.

The pharmacists in our study communicated with the prescribers regarding 24.4% of the prescriptions. The majority (85.8%) of the prescribers accepted the recommendations generated through the CDSS and communicated by the pharmacist. The prescriber acceptance rate of the pharmacist's interventions was similar to the higher rates reported in the literature, which ranged from 61.8% to 93.2% (47-50). The acceptance rate was high because only the pharmacists who felt comfortable communicating with the specific prescriber with whom they already had strong professional communication proposed interventions to the prescribers. Therefore, due to the mutual professional trust, the acceptance rate was high. The rate of pharmacists who felt comfortable communicating with the prescribers was very low (10%). Lack of time and communication issues were the major reasons for almost all of the pharmacists who did not communicate with the prescribers. A professional relationship between a pharmacist and a physician is crucial for the success of a CDSS (18) as demonstrated in our study, where only the pharmacists with a good relationship with the prescribers communicated with them and this communication yielded a high pharmacist intervention acceptance rate.

Table 6. System usability scale item scores (n=20)

System usability scale items	Strongly disagree, n (%)	Disagree, n (%)	Neither agree nor disagree, n (%)	Agree, n (%)	Strongly agree, n (%)
I think that I would like to use this system frequently	0 (0)	0 (0)	3 (15)	9 (45)	8 (40)
I found the system unnecessarily complex	5 (25)	14 (70)	0 (0)	1 (5)	0 (0)
I thought the system was easy to use	0 (0)	0 (0)	2 (10)	8 (40)	10 (50)
I think that I would need the support of a technical person tobe able to use this system	1 (5)	14 (70)	3 (15)	0 (0)	2 (10)
I found the various functions in this system were well integrated	0 (0)	0 (0)	8 (40)	9 (45)	3 (15)
I thought there was too much inconsistency in this system	3 (15)	15 (75)	2 (10)	0 (0)	0 (0)
I would imagine that most people would learn to use this systemvery quickly	0 (0)	0 (0)	2 (10)	14 (70)	4 (20)
I found the system very cumbersome to use	8 (40)	12 (60)	0 (0)	0 (0)	0 (0)
I felt very confident using the system	0 (0)	0 (0)	1 (5)	11 (55)	8 (40)
I needed to learn a lot of things before I could get going with this system	0 (0)	17 (85)	3 (15)	0 (0)	0 (0)

The CDSS used in this study had a SUS score corresponding to a grade of B+ (23) indicating the good usability of the system. Poor usability may increase workload and cause alert fatigue while decreasing the system's acceptability and effectiveness.

Study Limitations

While being a novel research on the use of a CDSS in the community pharmacy setting, our study has several limitations. One of the limitations was that only pharmacists with an established good relationship with individual prescribers communicated with them regarding the PIMs. Therefore, this raised a bias resulting in a high recommendation acceptance rate, which might not be the case in daily practice. Another limitation was that although the calculated SUS score indicated good usability of the system, due to the small sample size, it is hard to anticipate the real usability in daily practice.

Conclusion

This study showed that inappropriate medication prescription patterns in the elderly can be identified comprehensively in the community pharmacy setting by the use of a diligently developed clinical decision support system. It is anticipated that the widespread use of this product would prevent medication-related adverse events and related hospitalizations, morbidities, and mortalities, thus help improving patients' health and quality of life as well as leading to better clinical, humanistic, and economic outcomes.

Ethics

Ethics Committee Approval: This study was granted ethical approval by the Ethics Committee of Marmara University (approval no: 115, date: 15.04.2019).

Informed Consent: The patients included in this study were those who granted their consent after being informed about and invited to the study.

Authorship Contributions

Concept: Ş.A., Design: B.T., Ş.A., Data Collection or Processing: B.T., Analysis or Interpretation: B.T., Ş.A., Literature Search: B.T., Ş.A., Writing: B.T., Ş.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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