The Extent of Community Pharmacists' Involvement in Detecting and Resolving Drug Related Problems (DRPs) in Prescriptions - A Cross Sectional Study in a Community Pharmacy Setting From Sri Lanka

Tharmalinga Sharma Jegath Janani
University of Sri Jayewardenepura
Rafaideen Risla
University of Sri Jayewardenepura
Lelwala Guruge Thushani Shanika
University of Sri Jayewardenepura
Nithushi Rajitha Samaranayake (nithushi@sjp.ac.lk)
University of Sri Jayewardenepura

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Abstract

Background: Drug Related Problems (DRPs) in prescriptions could harm patients.

Purpose: To assess, the prevalence of DRPs in prescriptions, and the ability of community pharmacists to detect and correct DRPs in prescriptions dispensed in a selected community pharmacy.

Methods: A prospective, cross-sectional study was conducted in a selected community pharmacy in Colombo, Sri Lanka, where one researcher reviewed for DRPs in systematically selected prescriptions (N=400), and another directly observed the proportion of DRPs identified by community pharmacists in the same set of prescriptions. Actions taken by pharmacists on resolving DRPs were also documented. DRPs were classified according to a slightly modified version of Pharmaceutical Care Network Europe classification V8.01.

Results: Among 1986 drugs, 1211 DRPs were identified by researchers, and 441 by community pharmacists (N=24). Drug selection (N=15), dose selection (N=817), duration of treatment (N=128), incomplete prescriptions (N=128), and in-house classification such as outdated prescriptions, missing unit of measurements, and ambiguous names of medicines that cannot be read by both community pharmacists and researcher (N=122) were the most common DRPs identified by researchers, of which only 1 ($p<0.001$), 394 ($p<0.001$), 13 ($p=0.006$), 5 ($p<0.001$), and 27 ($p<0.001$) respectively were identified by pharmacists. DRP identification by researcher and pharmacist did not significantly differ for inappropriate drug form ($p=0.550$). Among 441 DRPs identified by pharmacists, 406 were corrected by them ($p=0.92$). Most DRPs were self-resolved by pharmacists themselves (366/406) ($p=0.90$), while patients were also sent back to prescriber (14/406) ($p=0.03$) and refused to dispense drugs (9/406) ($p=0.02$).

Conclusion: Among DRPs frequently observed in prescriptions in the community, pharmacists missed some, including incomplete prescriptions that had potential to harm. Pharmacist resolved most of the DRPs detected.

Background

Medicines are given to treat diseases, however inappropriate prescription could lead to Drug Related Problems (DRPs) [14,15,24]. DRPs are known to be a global issue [2,23]. DRPs can cause significant risks to patients and may adversely affect quality of life, increase mortality, morbidity rates, lead to permanent disabilities and life-threatening effects in patients [2,8,18,23,26]. DRPs could also have a great impact on healthcare costs [9,12,13,14,21]. The Pharmaceutical Care Network Europe (PCNE) classifies a DRP as “an event or circumstance involving drug treatment that actually or potentially interferes with the patients’ desired health outcomes” [7].

Several studies have shown that DRPs are prevalent in the community [9,18]. A study from USA reported that 25% of patients in the community experienced an adverse event within 4 weeks of receiving a prescription [8], while an Indian study revealed that DRPs were prevalent in a community pharmacy setting at a rate of 41.8%, where 10% were severe and 41% were moderately severe DRPs resulting in primary consultation and hospitalization [1].

Community pharmacists are the most accessible by the public and last accountable healthcare professionals who can identify and correct DRPs in outpatient prescriptions before a patient is harmed by them [28]. A study was done to observe the extent to which pharmacist can participate in reducing the incidences of DRPs in Lahore, Pakistan and found that although different types of DRPs were identified by pharmacists, only 37% of pharmacists intervened to reduce the incidence of DRPs. Most of the pharmacists were knowledgeable about DRPs but refrained from actively resolving DRPs due to their lack of acceptance by society and other healthcare professionals in this task, lack of a proper reporting system, lack of incentives, and lack of time due to administrative responsibilities especially in retail pharmacy[10]. These findings could be related to most countries in the South Asian region where pharmacists are submissive in challenging a problem detected in prescriptions.

In developed countries, community pharmacists’ role is integrated into the healthcare system and well recognised by the public [22]. In Sri Lanka, community pharmacists dispense prescriptions prescribed by medical practitioners working in different levels of care including general practitioners and specialized consultants, in both State and private hospitals. Given this responsibility, community pharmacists should be able to identify the diverse and frequent occurrences of DRPs in prescriptions and be assertive in resolving them. There are very little published research findings reported regarding DRPs and the few reported are based on in-patients [25,26] or specific clinics in Sri Lanka [16]. Although these studies have contributed some evidence on DRPs prevalent in Sri Lanka, little is known on community prescriptions and the involvement of community pharmacists in detecting and resolving DRPs in prescriptions.

To bridge this gap, we conducted the following study to assess the nature and frequency of DRPs present in prescriptions dispensed, the proportion of DRPs identified by community pharmacists and the types of corrective action taken by community pharmacists when DRPs were detected in prescriptions dispensed at a selected community pharmacy in the Colombo district.

Methods

Study Design and Settings

A prospective, cross-sectional study was conducted in a selected community pharmacy in the Colombo District over a period of four months (November 29, 2017 to March 30,2018). The selected community pharmacy is an outlet of the only State-owned pharmacy chain in Sri Lanka which operates 24 hours a day for 365 days of the year and serves around 600 patients a day. The study pharmacy receives prescriptions from about 10 public and private hospitals situated in the vicinity.

Study Participants

All community pharmacists registered at the Sri Lanka Medical Council (SLMC) and working at the study setting were observed while training pharmacists were excluded from the study.

Sample Size Calculation

The number of prescriptions to be reviewed was calculated using an online sample size calculator (www.raosoft.com) considering a 95% confidence level, 5% significance level and 50% response distribution. The calculated number of prescriptions was 384 but 400 prescriptions were selected considering a 10% drop-out of prescriptions during analysis.

Study Instruments

Prescription review and direct observation methods were used in this study. All the DRPs were classified according to a slightly modified version of the PCNE classification V8.01 (Additional file 1). The in-house modification to the PCNE classification included, addition of two sub-sections under 'causes'; "Incomplete essential information in prescriptions"; (Necessary information not provided including age of the patient, date, and SLMC registration number of prescriber) and "Other cause"; (Outdated prescription, unit of strength of the drug missing, and ambiguously written names of medicine that cannot be read by pharmacists).

A pilot study was conducted among 10 prescriptions after obtaining ethics approval and permission from the relevant study pharmacy. The pre-determined data collection format was fine-tuned according to the pilot study.

Study Process

Two researchers visited the pharmacy every four days of a week (during week or weekends) and selected to observe the dispensing process of every 5th prescription until the calculated sample size was achieved. If the selected prescription did not have at least one oral medicine, the prescription next in line was observed. This prescription information was transferred on to the predetermined data collection sheet (Additional file 2).

We directly observed the complete dispensing cycle of the selected prescriptions and monitored whether the pharmacists were able to identify any DRPs. We also observed the actions taken by pharmacists to correct the problem when DRPs were detected. This information was transferred on to the predetermined data collection sheet (Additional file 3).

Two researchers retrospectively reviewed the same set of prescriptions in order to assess DRPs actually present in them. Standard references such as the, British National Formulary (BNF) -70 [11], Australian Medicines Handbook (AMH) – 2011 [4], Medscape Pharmacists [17] were used to identify the DRPs. All DRPs identified were endorsed by two senior academic pharmacists. Study process is shown in Figure I.

Consent and Confidentiality

At the beginning of the study, pharmacists were informed about the intentions of the study, and written informed consent was obtained. The respondents were assured about the confidentiality of data and personal identifiers. Researchers refrained from discussing about DRPs detected by them with pharmacist and patients but DRPs with potential to harm patients were informed to supervisors for necessary action.

Ethics Approval

The Ethics Review Committee, Faculty of Medical Sciences, University of Sri Jayewardenepura approved this study (Reference number: B.Pharm/08/17, Date: 20th of November 2017). Approval was also obtained from the Head office of the community pharmacy chain to conduct this study.

Data Analysis

All the data were fed into a database using SPSS, V.21 (IBM, Chicago, USA), and cleaned to assure the quality of the entered data. For descriptive data, continuous variables were expressed as mean ± standard deviations (SD) and frequencies (Numbers and %). For all tests, a $p<0.05$ was considered to be statistically significant. Sample proportion tests in Minitab 14 was used to compare proportions of DRPs identified by researchers and community pharmacists.

Results

Four hundred prescriptions containing 1986 drugs were analysed. The researchers identified 14 (13.5%, 14/400) prescriptions with no DRPs and 346 (86.5 %, 346/400) prescriptions with at least one DRP. A mean number of 5.0 (±2.6) drugs per prescription was prescribed with a minimum of one and a maximum of 13 drugs per prescription.

Twenty-four community pharmacists employed at the outlet of the selected pharmacy chain participated in the study. The mean age of participants was 36.7± 9.1 years and 66.7% were women. Demographics of patients owning the prescription are shown in Table 1 and demographics of participating pharmacists are shown in Table 2.

Table 1 Demographic characteristics of patients owning the prescriptions (N=400)

Characteristics	Outcome
Mean age (SD)	56.5 (±18.2)
Age groups in years, N (%)	
<20	19 (4.8)
21-40	34 (8.5)
41-60	110 (27.5)
61-80	144 (36)
>80	16 (4.0)
Institution prescriptions obtained from, N (%)	**Outcome**
Private hospital	215 (53.8)
State hospital	134 (33.5)
General practitioners (Private practitioner)	51 (12.8)

SD standard deviation

Table 2 Demographic characteristics of community pharmacists (N=24)

Characteristics	Outcome
Gender, N (%)	
Men	8 (33.3)
Women	16 (66.7)
Mean age (SD)	36.7 (± 9.1)
Age groups in years, N (%)	
21-40	15 (62.5)
41-60	9 (37.5)
61-80	-
Mean number of years working as a registered pharmacist (SD)	8.3 (±6.3)

SD standard deviation

Among 1986 drugs analysed (400 prescriptions), a total of 1211 DRPs were detected by researchers whereas only 441 (36.4%, 441/1211) DRPs were detected by community pharmacists. Proportions of DRPs identified by researcher and community pharmacists were compared and is shown in Table 3. Categories, subcategories, and examples for DRPs are also shown in Table 3.

Types of DRPs which were not identified by community pharmacists

Fourteen out of 15 drug selection errors identified by researchers were missed by pharmacists. There were ten duplications of medicines identified by researchers of which only one duplication was identified by community pharmacists. Among dose selection errors, wrong/unclear/missing dose timing errors were the highest DRP sub-type identified by researchers (N=525) of which 160 were missed by community pharmacists. However, strength of the drug missing was the highest DRP sub type missed by community pharmacists (N=214).

Different types of corrective action taken by community pharmacists to resolve identified DRPs

Among 441 DRPs identified by community pharmacists, 406 were corrected. Most of the DRPs were corrected by community pharmacists themselves without resorting to the prescriber (self-resolved) (N=366/406; 90.1%). The next most frequent corrective actions taken were, sending the patient back to the prescriber to clarify the detected problem (N=14/406; 3.4%), and refusing to dispense the drug (N=9/406; 2.2%). A summary of corrective actions taken by community pharmacists for DRPs identified by them are shown in Figure 2 and types of corrective action taken by community pharmacists categorized by the types of DRPs are also shown in Table 4.

Table 3 Categories and subcategories of drug related problems (DRPs) identified by researchers and community pharmacists

DRP categories and subcategories	DRPs identified by					Examples
	Researchers (N=1211)		Community pharmacists (N=441)		P value*	
	N	(%)	N	(%)		
Drug selection	**15**	**1.2**	**1**	**0.2**	**0.010**	
Inappropriate combination of drugs	5	0.4	0	0	**0.025**	Atenolol and verapamil Theophylline and clarithromycin
Inappropriate duplication of therapeutic group or active ingredient	10	0.8	1	0.2	0.082	Celecoxib and etoricoxib Atorvastatin and rosuvastatin
Drug form	**1**	**0.08**	**1**	**0.2**	0.550	
Inappropriate drug form	1	0.08	1	0.2	0.550	Capsule amoxicillin prescribed instead of syrup amoxicillin for a three-month-old baby
Dose selection	**817**	**67.4**	**394**	**89.3**	**<0.001**	
Drug dose too high						
1. Drug dose too high because the wrong dose was written by a prescriber	3	0.2	3	0.7	0.299	Sertraline 125 mg prescribed instead of sertraline 12.5 mg (previously taking a dose of 12.5 mg) Thyroxine 50mg prescribed instead of Thyroxine 50 micrograms
2. Drug dose too high because the wrong dose unit was written by a prescriber	2	0.1	2	0.5	0.397	Losartan prescribed in three divided doses per day
Dosage regimen too frequent						Thyroxine, alendronate administration timing was missing 'Losartan 1-tab bd' was written on prescription
Dose timing instructions wrong, unclear or missing	23	1.9	0	0	**<0.001**	Only 'captopril 25mg' was written on prescription
Strength of the drug missing	525	43.3	365	82.7	**<0.001**	
Frequency of the drug administration missing						
Treatment duration	217	17.9	3	0.7	**<0.001**	Duration was written as one year for amlodipine, prazosin, bisoprolol, metformin, gliclazide, sitagliptin and isophane insulin in a prescription
Duration of treatment too long	47	3.8	21	4.8	0.446	Duration was not written for clarithromycin and amoxicillin
	128	**10.5**	**13**	**2.9**	**<0.001**	
Duration of treatment missing	12	0.9	4	0.9	0.875	
	116	9.5	9	2.0	**<0.001**	

Incomplete essential information in prescriptions (in-house)	**128**	**10.5**	**5**	**1.1**	**<0.001**
Necessary information not provided (includes the age of patient, date, and Sri Lanka Medical Council registration number of prescriber)	128	10.5	5	1.1	**<0.001**
Other (in-house)	**122**	**10.0**	**27**	**6.1**	**0.006**
Outdated prescription	34	2.8	17	3.8	0.310
Unit of drug strength missing	79	6.5	1	2.0	**<0.001**
Ambiguous name of medicine that cannot be read by both community pharmacists and researcher	9	0.7	9	0.2	0.070

*Comparison of proportions of DRPs identified by researcher and pharmacist

Table 4 Types of corrective action taken by community pharmacists categorized by types of DRPs

	Duplication of drugs	Inappropriate drug form	Drug dose too high	Duration missing	Duration of treatment too long	Strength of the drug missing	Frequency of drug missing	Reg. no of prescriber missing	Outdated prescription	Strength unit of the drug missing	Ambiguous name of medicine that cannot be read by pharmacis
Checking the recent medical history of the patient							4				
Sending back the patient to prescriber			2			1	3				8
Discussing the issue with a patient to clarify a DRP (verbally)	1						6				1
Self-resolved without checking any related references			1							1	
Refusing to dispense the drug			1					4	3		1
Discussing with other staff to clarify the problem		1	1			1			1		1
Consulting a written reference material or decision support software											
No action taken				9	4		8	1	13		

Discussion

This study found that DRPs exist in prescriptions dispensed in the community (86.5%, 346/400) and community pharmacists identified and resolved some of them (36.4%, 441/1211, and 33.5%, 406/1211 respectively). Community pharmacists identified wrong doses, frequencies, dosage forms and durations of drugs written on prescriptions. However, they overlooked DRPs related to missing information, drug duplications, and drug interactions. Pharmacists also resolved most of the DRPs identified (406/441) using self-judgement (366/406). Patients were sent back to prescriber (14/406) and refused dispensation (9/406) in some cases.

During the study period, we reported a DRP rate of 86.5% which is considerably higher than DRPs reported in other studies. Although most DRPs may not end up in immediate clinical consequences, they could lead to poor compliance and sub-therapeutic effects in the long run. In a study done in Europe: Austria, Denmark, Germany, The Netherlands, Portugal and Spain, Paulino et al., reported a total of 451 DRPs in 277 (out of 435) prescriptions (63.7%) [19] and a study conducted in India reported 90 DRPs among 215 prescriptions (41.8%) [1]. It is difficult to directly compare findings of this study with other international studies due to the explicit DRP definitions we used to capture even trivial issues in prescriptions. However, the fact that more than 80% of prescriptions had at least one DRP is similar to results reported from the West (18% to 88% of patients) [13]. However, it should be noted that the number of identified DRPs depend on multiple factors including study design, type of settings, study population, classification system used and the denominator used for statistical analysis.

There were 17.9% (217/1211) of drugs where the strength was not indicated on the prescriptions and was prescribed as ‘1 tab’ or ‘2 tab’ and the community pharmacist resolved to dispense the lowest strength available. Although unnecessary overdosing and toxicities may be avoided, selecting the lowest strength

option could result in therapeutic failure if the prescriber had intended a higher dose. Drug selection was the next most common problem identified in this study of which 10 out of 15 inappropriate combinations and drug duplications identified were potentially harmful. A previous prospective, cohort study conducted in two Sri Lankan medical wards to evaluate medication appropriateness, also reported a rate of 1.7% drug duplications [20]. In this study the most likely reason for drug duplications was prescribing in brand names. Pharmacists need to be advocated on identification of DRPs, even the potential issues that could result in harm, and on prioritizing for corrective actions.

There were inappropriate abbreviations observed in this sample of prescriptions, but these were not included as DRPs in the analysis. Inappropriate abbreviations were used to indicate frequency ('d' to denote daily, 'm' to denote mane, 'n' to denote nocte), drug name (HCT to denote hydrochlorothiazide, CBZ to denote carbamazepine and HCQ to denote hydroxychloroquine) and dose units of drugs (mcg to denote microgram and IU to denote International Unit). Previous studies too have reported the prevalence of non-standard abbreviations and incomplete units used in Sri Lankan prescriptions [6].

It is encouraging to note that, community pharmacists in this study had taken corrective actions for 92% of the DRPs detected by them. Other published studies indicate that, counselling and reassuring patients, followed by practical instructions, were by far the most common types of interventions used by pharmacists when resolving DRPs [19,27]. This practice was not frequently seen in our study but self-resolving of DRP was frequently observed instead. It is important to give clear instructions to patients on dose timing and strength, for drugs like thyroxine, warfarin, alendronate, methotrexate, proton pump inhibitors and anti-diabetes drugs are often associated with significant drug-drug and food-drug interactions. We observed that most of these instructions were not clearly indicated in prescriptions. Often important drug related instructions were given on the dispensing label even if it was missing in the prescription (n=364; 89.6%). Patients were sent back to prescriber to clarify DRPs (n=14; 3.4%) in a few instances, mostly when they encountered ambiguous names of medicines that were illegible (n=8; 1.9%), when frequencies of medicines were missing (n=3; 0.7%), and when too high drug doses were prescribed (n=3; 0.7%). Pharmacists refused to dispense drugs on nine occasions (n=9; 2.2%) which were related to outdated prescriptions, and missing prescriber credentials on prescription. Pharmacists also made every effort to resolve issues by discussing with patients (n=8; 1.9%), checking with recent written medical histories of patients (n=4; 0.9%), and through discussion with fellow pharmacists (n=5; 1.2%) which is acceptable if DRPs are resolvable beyond doubt through these measures. It is noteworthy that none of the community pharmacists consulted written references or decision support software in this study possibly due to the unavailability of such resources. Ezeuko et al., too reported this observation in resource limiting settings [3].

To our knowledge, there are no studies that have focused on the prevalence of a wide-range of DRPs in prescriptions brought for dispensation to community pharmacies, the ability of the community pharmacists to detect such DRPs, and their practices when resolving these DRPs using prescription review and direct observation methods as in our study. However, there are some limitations to our study which needs to be considered. We carried out the study only in one community pharmacy in Sri Lanka. Therefore, our sample does not represent the total study population of this country. However, this study provides evidence on a very important but seldom researched area. A direct observation was done to assess if pharmacists identified and took corrective action for DRPs, but it is possible that a 'Hawthorne Effect'. Nevertheless, it is concluded that behavior of observes are seldom affected by direct observation [5].

Conclusions And Recommendations

This study found that DRPs exist in prescriptions dispensed in outpatient prescriptions and community pharmacists were able to identify and resolve some of them. Community pharmacists identified drug duplication, and wrong doses, frequencies, dosage forms and durations of drugs written on prescriptions. However, they overlooked DRPs related to missing information and drug interactions. Pharmacists also resolved most DRPs using self-judgement. Patients were sent back to prescriber to clarify DRPs mostly when drug names were not clear, when frequencies of drugs were missing, and when too high drug doses were prescribed. Pharmacists also refused to dispense drugs for outdated prescription, and when prescriber details were missing. Pharmacists were also observed discussing with patients, checking on recent written patient histories, and consulting fellow pharmacists to resolve DRPs. Unfortunately, references material or decision support software were unavailable for pharmacists to refer.

It is recommended that pharmacists are continuously trained on conducting a preliminary prescription review before dispensing of prescriptions to identify DRPs which may potentially harm patients. They should also be trained to assertively communicate with prescribers to resolve harmful DRPs instead of speculating possibilities of ambiguous prescriptions. Dispensing pharmacists must be provided at least with software to check for drug interactions, and with decision support systems where possible. Given the high prevalence of DRPs in prescriptions, these recommendations will help ensure patient safety.

Abbreviations

PCNE: The Pharmaceutical Care Network Europe; USA: United State of America; SLMC: Sri Lanka Medical Council; SPSS: Statistical Package for the Social Sciences

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Ethics Review Committee of the University of Sri Jayewardenepura (Ref: B.Pharm/08/17). Approval was also obtained from the Head office of the community pharmacy chain to conduct this study. Written informed consent was obtained from study participants.

Consent for publication

All authors consent for publication.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contribution

TSJ Janani: Data curation, Formal analysis, Writing - original draft

R Risla: Data curation, Formal analysis

LGT Shanika: Conceptualization, Formal analysis, Methodology, Supervision, Writing - original draft, reviewing, and editing

N.R Samaranayake: Conceptualization, Formal analysis, Methodology, Supervision, Writing -reviewing, and editing

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Figures

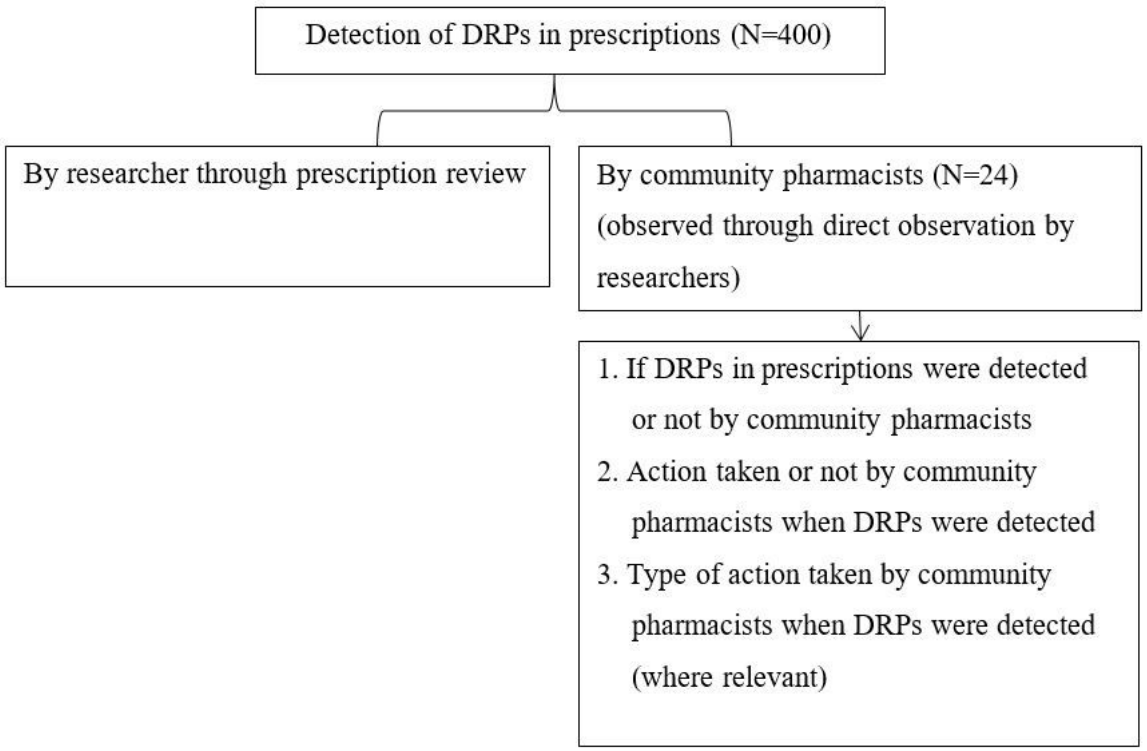

Figure 1

Study process

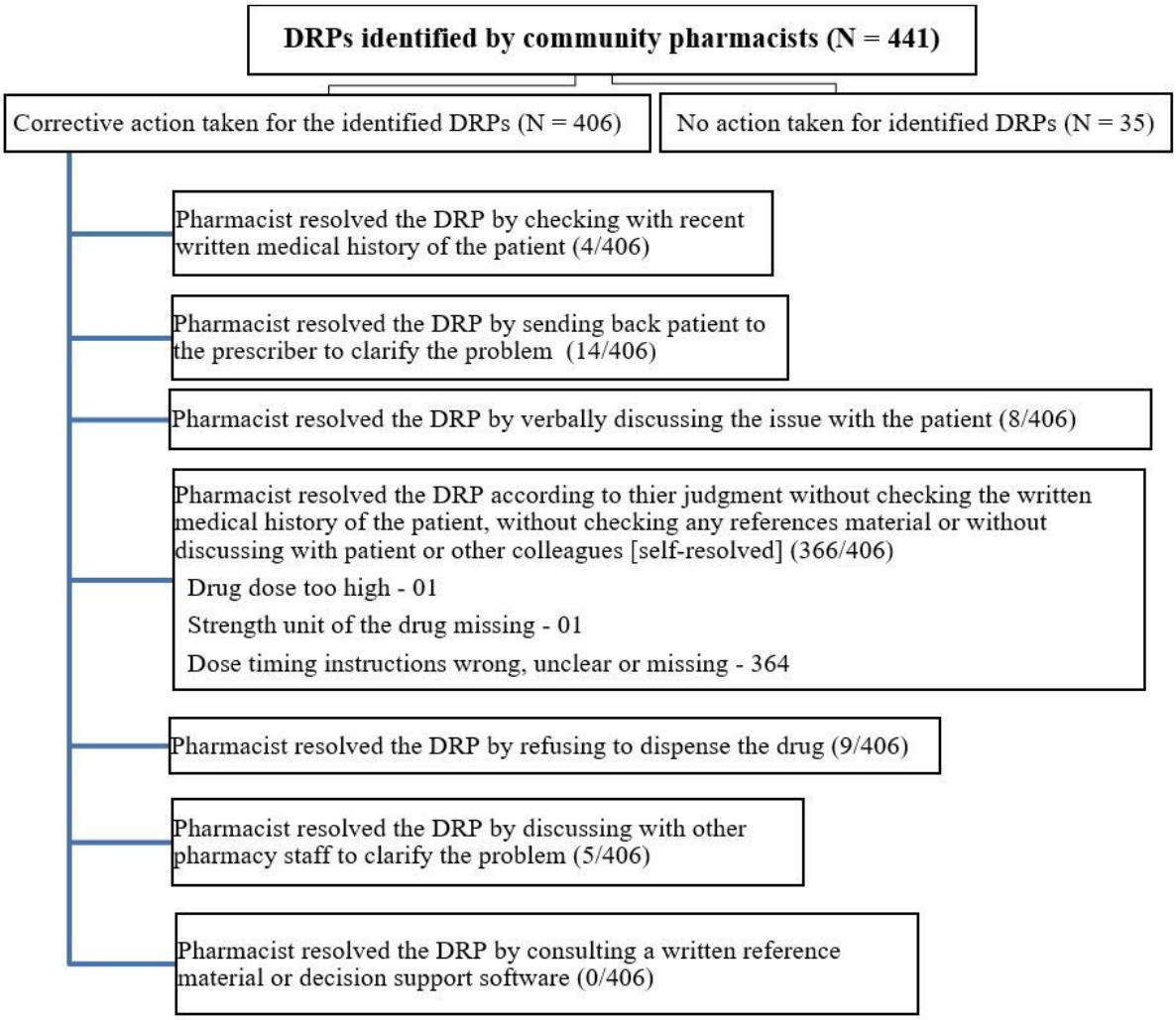

Figure 2

Summary of corrective actions taken by community pharmacists for DRPs identified by them

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