



## The extent of community pharmacists' involvement in detecting and resolving Drug Related Problems (DRPs) in prescriptions – A real time study from Sri Lanka



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### ABSTRACT

**Background:** Appropriate medication use is necessary to ensure patient safety. Drug Related Problems (DRPs) could result in patient harm.

**Purpose:** To assess the prevalence and types of DRPs in prescriptions, and the proportion of DRPs detected and resolved by community pharmacists during dispensation of prescriptions 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 frequency 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. Descriptive and comparative data analysis were performed using SPSS database V.21.  $P < 0.05$  was considered as significant.

**Results:** Among 1986 medications, a total of 1211 DRPs were identified by researchers, of which only 441 DRPs were detected by community pharmacists who participated in the study ( $N = 24$ ). DRPs identified by the researcher were related to medication selection ( $N = 15$ ), medication form ( $N = 1$ ), dose selection ( $N = 817$ ), duration of treatment ( $N = 128$ ), incomplete prescriptions ( $N = 128$ ), and other (outdated prescriptions, missing unit of measurements, and ambiguous names of medications that could not be read by both community pharmacists and researcher) ( $N = 122$ ) of which only one, one, 394, 13, five, and 27 were identified by pharmacists, respectively. Among 441 DRPs identified by pharmacists, 406 were resolved by them. Most DRPs were self-resolved by pharmacists themselves (367/406), while patients were also sent back to the prescriber (13/406), and some dispensation of medications to patients were refused (9/406).

**Conclusion:** Among the DRPs frequently observed in the sample of community prescriptions, the community pharmacists identified significantly fewer DRPs in relation to each type identified by the researcher, and pharmacists missed some, including incomplete prescriptions, that had potential to harm. Systematic and sustainable training of pharmacists on performing a preliminary prescription review and continuous education programs must be implemented to improve community pharmacist dispensing practices in this community.

### 1. Background

Drug-related problems (DRPs) are a global issue<sup>1–3</sup> and a major burden on the effectiveness and safety of the medication use process.<sup>4,5</sup> The Pharmaceutical Care Network Europe (PCNE) classifies a DRP as “an event or circumstance involving medication treatment that actually or potentially interferes with the patients' desired health outcomes”.<sup>6</sup> DRPs can cause significant risks to patients and may adversely affect quality of life, increase

mortality and morbidity rates, and lead to permanent disabilities and life-threatening effects in patients.<sup>1,2,7–9</sup> DRPs could also have a great impact on healthcare costs.<sup>3,4,10–13</sup> Several studies have reported that there was a large amount of money spent annually in USA and Australia to manage consequences of DRPs.<sup>14,15</sup> Therefore, detection and resolution of DRPs is a vital role to ensure patient safety and reduce healthcare expenditure.

There is a wealth of research on prevalence of DRPs in the inpatient, outpatient, or community settings all over the world. However, more is

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known about DRPs in the inpatient setting compared to the outpatient or community setting. Among these reported studies, a study from the USA identified that 25% of patients in the community experienced an adverse event within four weeks of receiving a prescription,<sup>7</sup> 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.<sup>16</sup>

A pharmacist's intervention is important for identifying and resolving DRPs. Studies have concluded that community pharmacists can minimize DRPs in prescriptions through a preliminary prescription review before dispensing medicines.<sup>7,8,12</sup> In outpatient care, the pharmacist when dispensing medication is the last safety barrier in the medication use process. DRPs can be identified, and corrected by pharmacists if they are adequately knowledgeable on medication therapies and appreciate the importance of screening for DRPs.<sup>17</sup> A survey observed the extent to which pharmacists participated in reducing the incidence of DRPs in Lahore, Pakistan; although different types of DRPs were identified by pharmacists, only 37% of pharmacists ( $N = 37$ ) intervened to reduce the incidence of DRPs.<sup>18</sup> However, there are barriers to maximizing interventions by pharmacists, particularly in Sri Lanka where pharmacist training is variable, and roles or responsibilities focus on dispensing rather than patient-centered care. In Sri Lanka, there are three avenues to qualify as a registered pharmacist<sup>1\*</sup>: a certificate course ('Certificate of Efficiency in Pharmacy') qualifies the registered pharmacist to practice only in the community. A diploma ('Certificate of Proficiency in Pharmacy') or degree in pharmacy qualifies pharmacists to practice in any healthcare setting including hospitals.<sup>19,20</sup>

In developed countries, the community pharmacists' role is integrated into the healthcare system and well recognized by the public.<sup>19</sup> However, in Sri Lanka, a perspective article described the underutilization and missed opportunities of community pharmacy services which is particularly in line with traditional practices of dispensing with a business-oriented approach and limited emphasis on patient healthcare.<sup>19</sup> Further, 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 is very little published literature regarding DRPs and the few reported are based on in-patients<sup>3,9</sup> or specific clinics in Sri Lanka.<sup>21</sup> Although these studies have contributed some evidence on the DRPs prevalent in Sri Lanka, little is known about community prescriptions and the involvement of community pharmacists in detecting and resolving DRPs in prescriptions. To bridge this gap, the following study was conducted to assess the nature and frequency of DRPs present in prescriptions dispensed, the proportion of DRPs identified, and the types of actions taken to resolve these, by community pharmacists in prescriptions dispensed at a selected community pharmacy in the Colombo District.

## 2. Methods

### 2.1. Study design and settings

A prospective, cross-sectional study was conducted in one community pharmacy in the Colombo District, selected through convenience sampling as the study setting, an outlet of the state-owned pharmacy chain in Sri Lanka. The selected community pharmacy operated 24 h a day for

<sup>1</sup> \* A diploma (termed as the 'Certificate of Proficiency in Pharmacy') consists of a two-year training programme involving one and half years of academic taught course at government institutions, followed by six months of internship in a medical care institution.<sup>35</sup> No training course is offered by government institutions for the 'Certificate of Efficiency in Pharmacy' which consists of 'on the job training' for two years as an apprentice pharmacist under a master pharmacist.<sup>36</sup> Both categories must undergo final evaluation by the Ceylon Medical College Council and after successful completion they will be awarded the certificate and are suitable to be considered for registration under the Sri Lanka Medical Council to practice as a pharmacist.<sup>36,37</sup>

365 days of the year and served around 275,000 patients a year (<https://www.spc.lk/spc-services.php>). The study pharmacy received prescriptions from about 10 public and private hospitals situated in the vicinity. The study was conducted over a period of four months (November 2017 to March 2018).

### 2.2. 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.

### 2.3. Sample size calculation

The number of prescriptions to be reviewed was calculated using an on-line sample size calculator ([www.raosoft.com](http://www.raosoft.com)) considering a 95% confidence level, 5% significance level and 50% response distribution. Although the calculated sample size of prescriptions was 384, a total of 400 prescriptions were selected for review in this study.

### 2.4. 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.<sup>6</sup> 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 medication missing, and ambiguously written names of medicine that cannot be read by pharmacists and researchers). 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 piloting results.

### 2.5. Study process

Some specific demographic details of community pharmacists such as, age, gender and the number of years work experience as community pharmacists were documented using an inquiry form before commencing the direct observation study.

Two researchers visited the pharmacy on four days a week (every second day, during the week or weekends) and selected to observe the dispensing process of every fifth prescription until the 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.

The researchers directly observed the complete dispensing cycle of the selected prescriptions and monitored whether the pharmacists were able to identify any DRPs. The researchers also observed action taken by pharmacists to correct the problem when DRPs were detected. This information was transferred on to the predetermined data collection sheet.

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)<sup>22</sup> - 70, Australian Medicines Handbook (AMH)<sup>23</sup> - 2011 and Medscape Pharmacists<sup>24</sup> were used to identify DRPs. All DRPs identified were endorsed by two senior academic pharmacists.

### 2.6. 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 DRPs detected by them with pharmacists and patients, but DRPs with potentially serious harm to

patients were informed to research supervisors for necessary action. The study supervisors, who were senior academic pharmacists, if informed of harmful DRPs missed by community pharmacists, were to notify the pharmacy manager for necessary corrective action as researchers did not interfere in correcting DRPs.

### 2.7. Ethics approval

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

### 2.8. 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. Descriptive statistics such as frequencies (Numbers and %), mean  $\pm$  standard deviation, and median and interquartile ranges (IQR) were used to describe the data. For all tests, a  $P < 0.05$  was considered to be statistically significant. Two sample proportion test in Minitab 14 was used only to compare proportions of DRPs identified by researchers and community pharmacists.

## 3. Results

Four hundred prescriptions containing 1986 medications were analyzed. The researchers identified 54 (13.5%, 54/400) prescriptions with no DRPs and 346 (86.5%, 346/400) prescriptions with at least one DRP. A median number of five (IQR  $\pm$  12) medications per prescription was prescribed with a minimum of one and a maximum of 13 medications per prescription. In the 346 prescriptions with DRPs, and 54 prescriptions without DRPs, the range of medications prescribed were 1–13 and 1–5 respectively.

Twenty-four community pharmacists employed at the outlet of the selected pharmacy chain participated in the study. The mean age of participants was  $36.7 \pm 9.1$  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.

Among the 1986 medications analyzed (400 prescriptions), a total of 1211 DRPs were detected by researchers whereas only 441 (36.4%) DRPs were detected by community pharmacists. Categories, subcategories and examples of DRPs, as well as proportions of DRPs identified by researcher and community pharmacists were compared, and shown in Table 3.

### 3.1. Types of DRPs which were not identified by community pharmacists

Fourteen out of 15 medication selection errors identified by researchers were missed by pharmacists. There were ten duplications of medications identified by researchers of which only one duplication was identified by community pharmacists. Among dose selection errors, wrong/unclear/

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

Characteristics	Outcome
Mean age $\pm$ SD	56.5 $\pm$ 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 where prescriptions were obtained from, N (%)	Outcome
Private hospital	215 (53.8)
State hospital	134 (33.5)
General practitioners (Private practitioners)	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 $\pm$ SD	36.7 $\pm$ 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 $\pm$ SD	8.3 $\pm$ 6.3

SD standard deviation.

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 medication missing was the highest DRP sub-type missed by community pharmacists ( $N = 214$ ).

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

Among 441 DRPs identified by community pharmacists, actions were taken for 406 DRPs. Most of the DRPs were corrected by community pharmacists themselves (i.e. self-resolved) without resorting to the prescriber (90.3%;  $N = 367/406$ ). The next most frequent corrective action taken were: sending the patient back to the prescriber to clarify the detected problem (3.2%;  $N = 13/406$ ) and refusing to dispense the medication (2.2%;  $N = 9/406$ ). Patients were sent back to the prescriber to clarify DRPs, mostly when they encountered ambiguous names of medicines that were illegible (1.4%;  $N = 6$ ), when frequencies of medicines were missing (0.7%;  $N = 3$ ), when too high medication doses were prescribed (0.4%;  $N = 2$ ) and strength of the medications were missing (0.4%;  $N = 2$ ). Pharmacists refused to dispense medications on nine occasions (2.2%;  $N = 9$ ) which were mostly related to outdated prescriptions, and missing prescriber credentials on prescriptions. Pharmacists resolved issues by discussing with patients (1.9%;  $N = 8$ ), checking recent written medical histories of patients (0.9%;  $N = 4$ ), and through discussion with fellow pharmacists (1.2%;  $N = 5$ ). A summary of corrective action taken by community pharmacists for DRPs identified by them are shown in Fig. 1, and types of corrective action categorized by the types of DRPs are shown in Table 4.

## 4. Discussion

This study highlights a considerable issue, both in terms of patient safety and medication costs, which may have harmful consequences if ignored. In Sri Lanka, which is a lower middle-income country with limited resources, community pharmacies are the main source of medicines,<sup>20</sup> and dispensing in the community is mostly undertaken by apprentice pharmacists.<sup>20,21</sup> Studies have shown that inappropriate dispensing labelling, insufficient patient information, dispensing without prescriptions, and absence of qualified pharmacists have been an ongoing challenge at community pharmacies in Sri Lanka.<sup>20,21,25,26</sup>

This study found that the rate of DRPs that exist in prescriptions dispensed in the community is 86.5% and is within the range of other studies conducted internationally on examining DRP rates.<sup>8,12,15,27,28</sup> However, it is difficult to directly compare findings of this study with other international studies due to the explicit DRP definitions used (in this study) to capture even trivial issues in prescriptions. It should be noted that the number of identified DRPs depend on multiple factors including study design, type of setting, study population, classification system used, and the denominator used for statistical analysis. Although most DRPs may not result in immediate clinical consequences, they could lead to poor compliance and sub-therapeutic effects in the long run.

Medication selection was the significant problem identified in this study, of which 10 medication duplications and five inappropriate

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

DRP categories and subcategories	DRPs identified by				P value*	Examples
	Researchers (N = 1211)		Community pharmacists (N = 441)			
	N	(%)	N	(%)		
Medication selection	15	1.2	1	0.2	0.010	
Inappropriate combination of medications	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
Medication form	1	0.08	1	0.2	0.550	
Inappropriate medication 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	
Medication dose too high						
1. Medication 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)
2. Medication dose too high because the wrong dose unit was written by a prescriber	2	0.1	2	0.5	0.397	Thyroxine 50 mg prescribed instead of Thyroxine 50 micrograms
Dosage regimen too frequent	23	1.9	0	0	<0.001	Losartan prescribed in three divided doses per day
Dose timing instructions wrong, unclear or missing	525	43.3	365	82.7	<0.001	Thyroxine, alendronate administration timing was missing
Strength of the medication missing	217	17.9	3	0.7	<0.001	'Losartan 1-tab bd' was written on prescription
Frequency of the medication administration missing	47	3.8	21	4.8	0.446	Only 'captopril 25mg' was written on prescription
Duration of treatment too long	12	0.9	4	0.9	0.875	Duration was written as one year for amlodipine, prazosin, bisoprolol, metformin, glimepiride, sitagliptin and isophane insulin in a prescription
Duration of treatment missing	116	9.5	9	2.0	<0.001	Duration was not written for clarithromycin and amoxicillin
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 medication strength missing	79	6.5	1	0.2	<0.001	
Ambiguous name of medication that cannot be read by both community pharmacists and researcher	9	0.7	9	2.0	0.070	

\* Comparison of proportions of DRPs identified by researcher and pharmacist.

combinations were potentially harmful and could directly impact patient safety. This finding is similar to previous studies which reported that medication selection issues, medication-medication interactions, and duplications accounted for a substantial amount of potential DRPs.<sup>8,10,17,28,29</sup> Anti-histamines and nonsteroidal anti-inflammatory medications (NSAIDs) ( $N = 8$ ) were the groups mostly associated with medication duplications in this study. Also, atorvastatin with rosuvastatin ( $N = 1$ ), and nifedipine with diltiazem ( $N = 1$ ) were prescribed in the same prescription. In this study, the most likely reason for medication duplications was prescribing in brand names, especially NSAIDs. Pharmacists need to be continuously educated on identification of DRPs, even minor issues that could result in harm, and on prioritizing for corrective action.

Another interesting finding under dose selection was that the community pharmacist resolved to dispense the lowest strength available in 17.9% of medications where the strength was not indicated on the prescriptions and was prescribed as '1 tab' or '2 tabs'. This is compatible with the literature found in a systematic review involving Southeast Asian countries, where the most common prescribing error was related to wrong dose.<sup>2</sup> Dose selection error was reported as the most frequently identified DRP in other literature as well.<sup>30-32</sup> 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.

Several reports have discussed the potential for community pharmacists to significantly add value to the care of patients.<sup>10,18</sup> There has been much interest in interventions that may result in early detection and prevention of DRPs, to decrease the associated morbidity and mortality. Community pharmacists must be well placed to detect, and either prevent or resolve DRPs during the course of routine dispensing and counselling.<sup>29</sup>

Community pharmacists in this study identified and resolved some of them (36.4%, and 33.5%) respectively; they identified wrong doses, frequencies, dosage forms, and durations of medications written on prescriptions. However, community pharmacists overlooked DRPs related to missing information, medication duplications, and medication interactions. In the 'medication selection' category, 10 medication duplications, and five inappropriate medication combinations, were detected by the researchers. However, only one medication duplication where atorvastatin and rosuvastatin was written on the same prescription, was detected by pharmacists. DRPs identified in this category are clinically significant which may lead to over-usage of medication and could be prevented if pharmacists were vigilant of DRPs. Pharmacists may have known of inappropriate duplications and inappropriate combinations; however, they may be lacking the clinical knowledge to appropriately assess and resolve these problems. Detection of DRPs relies on the type of pharmacy education and the extent of clinical training together with recall memory.<sup>19,33,34</sup> The community pharmacists in this study may have had limited clinical training on identifying and resolving DRPs which may have influenced the practice observed. This factor was not assessable as the level of training and qualifications obtained by participating pharmacists were not documented at the beginning of the study.

It is encouraging to note that community pharmacists in this study had taken corrective action for 92% of the DRPs detected by them, a higher proportion compared to previous research reported by Sell et al., (72.2%).<sup>28</sup> Pharmacists also resolved most of the DRPs identified using self-judgement. Patients were sent back to the prescriber and refused dispensation in some cases. Other published studies indicate that counselling and reassuring patients, followed by practical instructions, were by far the

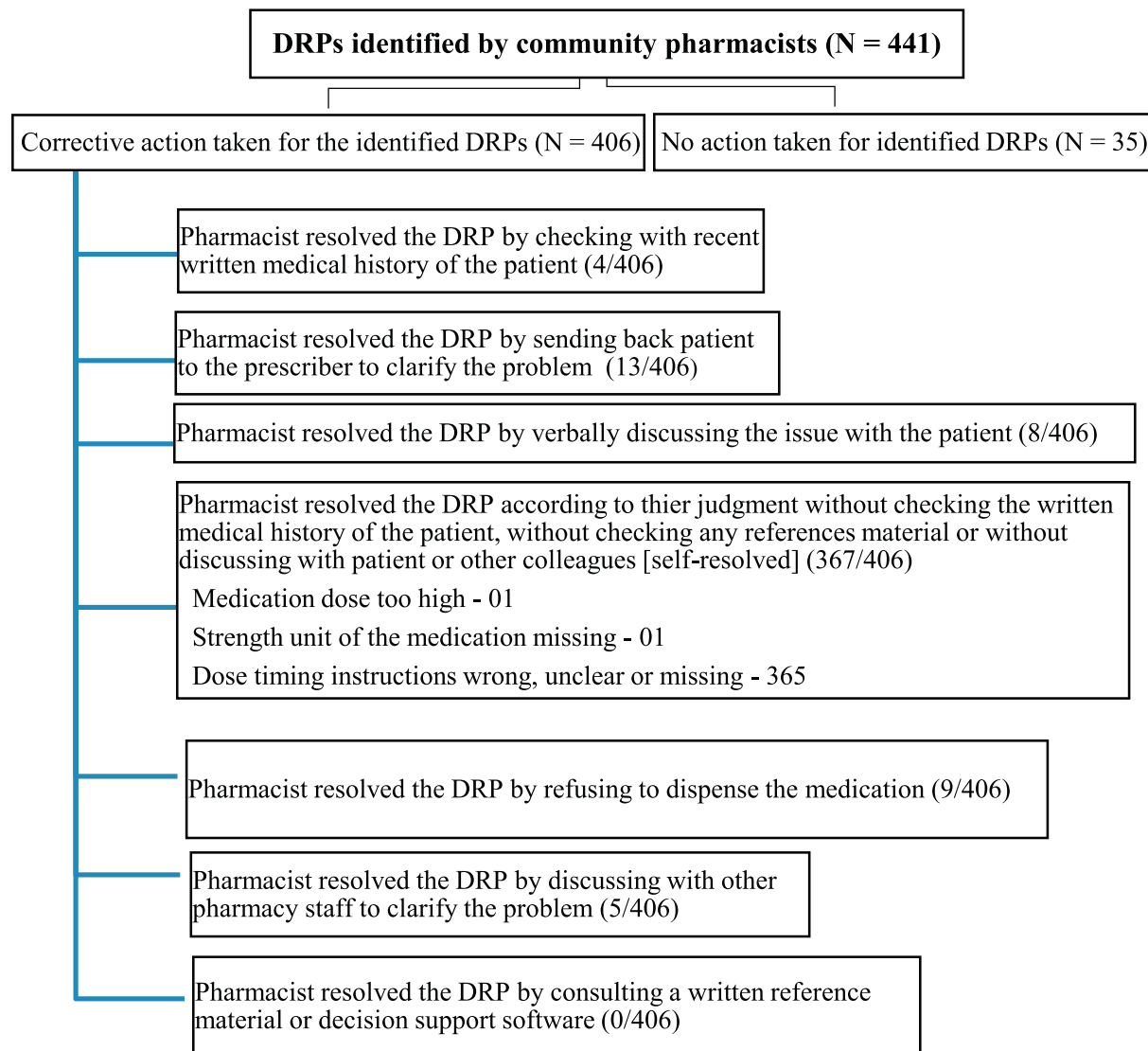


Fig. 1. Summary of corrective actions taken by community pharmacists for DRPs identified by them.

most common types of interventions used by pharmacists when resolving DRPs.<sup>27,32</sup> This practice was not frequently seen in this study but self-resolving of DRPs was frequently observed instead. It is important to give clear instructions to patients on dose timing and strength, for medications like thyroxine, warfarin, alendronate, methotrexate, proton pump inhibitors, and anti-diabetes medications which are often associated with significant medication- medication and food- medication interactions. It was observed that most of these instructions were not clearly indicated in prescriptions. However, often important medication related instructions which were missing on the prescription were added on to the dispensing label by pharmacists themselves (categorized in the results section as 'self-resolved by pharmacist'; 89.9%;  $N = 365$ ). Also, pharmacists resolved some other DRPs by checking recently written medical histories of patients (0.9%;  $N = 4$ ), and through discussion with fellow pharmacists (1.2%;  $N = 5$ ) which is acceptable if DRPs are resolvable beyond doubt through these measures.

However, there are some limitations in this study which need to be considered. This study was carried out only in one community pharmacy in Sri Lanka. Therefore, this sample does not represent the total study population of this country. Another limitation may be the younger age of the community pharmacists. It could be that more experienced pharmacists would have detected a larger number of potential DRPs. It should also be acknowledged that the researchers failed to keep records of prescriptions which

were excluded from the study, and thus were unable to discuss the nature of the excluded prescriptions to detect any biases. A direct observation was done to assess if pharmacists identified and took corrective action for DRPs, however it is possible that there was a 'Hawthorne effect'. The fact that researchers selected a community pharmacy which is one of the largest and busiest outlets in the chain which operates 24 h a day and 365 days of the year may have led to a reduced Hawthorn effect, as pharmacists were very busy with the dispensing process. Also, the direct observation was carried out for a period of four months to allow pharmacists to get used to being observed.

## 5. Recommendations

As this study was conducted using a convenience sample, findings may not reflect the pattern in the whole country. It is recommended that similar multi-centered, rigorous studies with more sensitive and specific outcome measures be conducted to obtain more generalized findings.

It is also recommended that systematic and sustainable measures must be implemented to improve the dispensing practice in the community pharmacy setting. This can be achieved in many ways such as training pharmacists on performing preliminary prescription reviews, and to identify and resolve DRPs before dispensing prescriptions. Continuous education programs to train pharmacists off-site on prescription reviewing and

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

	Duplication of medications	Inappropriate medication form	Medication dose too high	Duration missing	Duration of treatment too long	Strength of medication missing	Frequency of medication missing	Prescriber credentials missing	Outdated prescription	Strength unit of medication missing	Ambiguous name of medication that cannot be read by pharmacists	Dose timing instructions wrong, unclear, or missing
Checking the recent medical history of the patient							4					
Sending back the patient to prescriber			2			2	3				6	
Discussing the issue with a patient to clarify a DRP (verbally)	1						6				1	
Self-resolved without checking any related references			1							1		365
Refusing to dispense the medication			1					4	3		1	
Discussing with other staff to clarify the problem		1				1			1		1	
Consulting a written reference material or decision support software				9	4		8	1	13			
No action taken												

evaluating the impact of training using hypothetical prescriptions which contain DRPs would be helpful.<sup>33</sup> Furthermore, awareness programs on new trends and practices on medication safety must be conducted periodically to update pharmacists of related improper practices and interventions to resolve these problems.

Pharmacists must be encouraged to upgrade their qualification with a professional degree in pharmacy (B.Pharm) which is now available in higher education institutes in Sri Lanka. A more clinical oriented training could then be received by them to enhance their practice. Furthermore, pharmacists must especially be trained to assertively communicate with prescribers, and information transfer and communication should be more accessible for pharmacists to resolve harmful DRPs instead of speculating possibilities from ambiguous prescriptions. Lastly, dispensing pharmacists must be provided with software to check for medication interactions, and with decision support systems where possible as these resources are currently not available for pharmacists, especially in the government sector.

**6. Conclusions**

Among the DRPs frequently observed in the sample of community prescriptions, the community pharmacists identified significantly fewer DRPs in relation to each type identified by the researcher, and pharmacists missed some, including incomplete prescriptions, that had potential to harm. Systematic and sustainable training of pharmacists on performing a preliminary prescription review and continuous education programs must be implemented periodically to improve community pharmacist dispensing practices in this community.

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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.

**Declaration of Competing Interest**

The authors declare that they have no competing interests.

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**References**

1. Alsulami Z, Conroy S, Choonara I. Medication errors in the Middle East countries: a systematic review of the literature. *Eur J Clin Pharmacol* 2013;69(4):995-1008.
2. Salmasi S, Khan TM, Hong YH, Ming LC, Wong TW. Medication errors in the southeast Asian countries: a systematic review. *PLoS One* 2015 Sep 4;10(9), e0136545.
3. Shanika LGT, Jayamanne S, Wijekoon CN, Coombes J, Perera D, Mohamed F. Ward-based clinical pharmacists and hospital readmission: a non-randomized controlled trial in Sri Lanka. *Bull World Health Organ* 2018;96(3):155-164.
4. Krähenbühl-Melcher A, Schlienger R, Lampert M, Haschke M, Drewe J, Krähenbühl S. Drug related problems in hospitals. A review of the recent literature. *Drug Saf* 2007;30(5):379-407.
5. Shanika LGT, Jayamanne S, Coombes J, Coombes I, Wijekoon CN. Adverse drug reactions and associated factors in a cohort of Sri Lankan patients with non-communicable chronic diseases. *Pharmaceut J Sri Lanka* 2016;6:2-8.

6. Europe PCN. Classification for drug related problems. The PCNE classification V8. 01. Disponible en: <http://www.pcne.eu>. 2017, June 15.
7. Gandhi TK, Weingart SN, Borus J, Seger AC, Peterson J, Burdick E. Adverse drug events in ambulatory care. *N Engl J Med* 2003;348(16):1556–1564.
8. Nicolas A, Eickhoff C, Griese-Mammen N, Schulz M. Drug related problems in prescribed medicines in Germany at the time of dispensing. *Int J Clin Pharm* 2013;35(3):476–482.
9. Thirumagal M, Ahamedbari MAR, Samaranyake NR, Wanigatunge CA. Pattern of medication errors among inpatients in a resource-limited hospital setting. *Postgrad Med J* 2017;93(1105):686–690.
10. Hammerlein A, Griese N, Schulz M. Survey of drug related problems identified by community pharmacies. *Ann Pharmacother* 2007;41(11):1825–1832.
11. Kjeldsen LJ, Nielsen TRH, Olesen C. Investigating the relative significance of drug-related problem categories. *Pharmacy* 2017;5(2):31.
12. Kováčová B, Ďurišová A. Drug-related problems identified by pharmacist-led medication review in Slovak hospitalised patients. *Die Pharm* 2016;71(9):548–551.
13. Rathish D, Bahini S, Sivakumar T, Thiranyagama T, Abarajithan T, Wijerathne B. Drug utilization, prescription errors and potential drug-drug interactions: an experience in rural Sri Lanka. *BMC Pharmacol Toxicol* 2016;17(1):27.
14. Easton KL, Chapman CB, Brien JA. Frequency and characteristics of hospital admissions associated with drug-related problems in paediatrics. *Br J Clin Pharmacol* 2004 May;57(5):611–615.
15. Johnson JA, Bootman JL. Drug-related morbidity and mortality: a cost-of-illness model. *Archiv Int Med* 1995;155:1949–1956.
16. Adepu R, Adusumilli PK. Assessment of drug-related problems in patients with chronic diseases through health status survey in a south Indian rural community setting. *Indian J Pharm Sci* 2016;78(4):537–542.
17. WHO [World Health Organization]. The role of the pharmacist in the health care system; Report of a WHO Consultative group, New Delhi, India 1988 and Report of a WHO meeting, Tokyo, Japan 1993. [online] Available at: <http://apps.who.int/medicinedocs/en/d/Jh2995e/1994>. (Accessed on 12th May 2018).
18. Jamal I, Amin F, Jamal A, Saeed A. Pharmacist's interventions in reducing the incidences of drug related problems in any practice setting. *Int Curr Pharm J* 2015;4(2):347–352.
19. Sakeena MHF, Bennett AA, McLachlan AJ. The need to strengthen the role of the pharmacist in Sri Lanka: perspectives. *Pharmacy* 2019;7(2):54.
20. Zawahir S, Lekamwasam S, Aslani P. Antibiotic dispensing practice in Sri Lankan community pharmacies: a simulated client study. *Res Soc Adm Pharm* 2019 May;15(5):584–590.
21. Mamunuwa N, Jayamanne S, Coombes J, De Silva A, Lynch C, Wickramasinghe D. *Drug related problems among patients with diabetes; a descriptive analysis of data from an urban hospital in Sri Lanka. Paper presented at the 17th International postgraduate research conference, Colombo, Sri Lanka; 2016, December 8–9.* [online] Available at: <http://repository.kln.ac.lk/handle/123456789/16176>.
22. Joint Formulary Committee. *British national formulary 70*. London: BMJ Group and Pharmaceutical Press. September 2015–March 2016.
23. Australian medicines handbook. Adelaide: Australian Medicines Handbook Pty Ltd. 2011.
24. Medscape pharmacists. Available from: <https://www.medscape.com/pharmacists> 2021.
25. Manchanayake MGCA, Bandara GRWSK, Samaranyake NR. Patients' ability to read and understand dosing instructions of their own medicines-a cross sectional study in a hospital and community pharmacy setting. *BMC Health Serv Res* 2018 Jun 7;18(1):425.
26. Athuraliya N, Walkom EJ, Dharmaratne S, Robertson J. Assessing medication packaging and labelling appropriateness in Sri Lanka. *J Pharm Policy Pract* 2016 Nov 25;9:38.
27. Paulino EI, Bouvy ML, Gastelurrutia MA, Guerreiro M, Buurma H. Drug related problems identified by European community pharmacists in patients discharged from hospital. *Pharm World Sci* 2004;26(6):353–360.
28. Sell R, Schaefer M. Prevalence and risk factors of drug-related problems identified in pharmacy-based medication reviews. *Int J Clin Pharm* 2020 Apr;42(2):588–597.
29. Williams M, Peterson GM, Tenni PC, Bindoff IK, Stafford AC. "DOCUMENT": a system for classifying drug-related problems in community pharmacy. *Int J Clin Pharm* 2012;34(1):43–52.
30. Perera DMP, Coombes JA, Shanika LGT, Dawson A, Lynch C, Mohamed F. Opportunities for pharmacists to optimise quality use of medicines in a Sri Lankan hospital: an observational, prospective, cohort study. *J Pharm Pract Res* 2017;47(2):121–130.
31. De Silva KIM, Parakramawansa KPRC, Sudeshika SHT, Gunawardhana CB, Sakeena MHF. Investigation of medication errors: a prescription survey from Sri Lanka. *Trop J Pharm Res* 2015;14(11):2115–2120.
32. Westerlund T, Almarsdóttir AB, Melander A. Drug-related problems and pharmacy interventions in community practice. *Int J Pharm Pract* 1999;7(1):40–50.
33. Janani TSJ, Rislal R, Shanika LGT, Galappathay P, Samaranyake NR. An educational intervention to improve the ability of community pharmacists in Sri Lanka to detect drug related problems. *Pharm Educ* 2020;20(1):357–364.
34. Sakeena MHF, Bennett AA, Carter SJ, McLachlan AJ. A comparative study regarding antibiotic consumption and knowledge of antimicrobial resistance among pharmacy students in Australia and Sri Lanka. *PLoS One* 2019;14(3), e0213520.
35. University of Colombo, Faculty of Medicine, Department of Pharmacology. Accessed from: <https://med.cmb.ac.lk/wp-content/uploads/2018/03/certificate-of-proficiency-as-a-pharmacist.pdf> 26.06.2021.
36. University of Colombo, Faculty of Medicine, Department of Pharmacology. Accessed from: <https://med.cmb.ac.lk/wp-content/uploads/2018/03/certificate-of-efficiency-as-a-pharmacists.pdf> 26.06.2021.