An educational intervention to improve the ability of community pharmacists in Sri Lanka to detect drug related problems

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Abstract

Background: Drug related problems (DRPs) in prescriptions could result in patient harm. **Objective:** To assess the effectiveness of an educational workshop on detecting DRPs in prescriptions by a cohort of community pharmacists. **Methods:** Pharmacists working in a large community pharmacy chain in Sri Lanka were invited for an educational workshop on detecting DRPs in prescriptions. Participants were asked to review three mock prescriptions containing hypothetical DRPs before the workshop. After an interactive teaching session, pharmacists were asked to review the same three prescriptions again. **Results:** All pharmacists who attended the workshop (N=58) participated. The mean score for detecting DRPs per pharmacist at pre-assessment was 5.3±2.1 which increased to 8.5±1.7 at post-assessment (*p*<0.001). **Conclusion:** An educational intervention improved the community pharmacists' ability to detect DRPs related to completeness and legality of prescriptions but failed to make a significant impact on detecting serious pharmacological issues like medicine duplications and interactions.

Introduction

Medicines are expected to give beneficial effects, however harmful effects may result if used inappropriately (Krähenbühl-Melcher *et al*., 2007; Mamunuwa & Dorabawila, 2014; Shanika *et al*., 2016). Pharmaceutical Care Network Europe (PCNE) classifies a drug related problem (DRP) as 'an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes' (PCNE, 2017). Studies have shown that DRPs are prevalent in prescriptions and cause serious harm to patients such as death, hospital admissions, permanent disabilities (Gandhi *et al*., 2003; Nicolas *et al*., 2013) and increased healthcare costs (Hammerlein,

Griese, & Schulz, 2007; Krähenbühl-Melcher *et al*., 2007; Kováčová & Ďurišová, 2016; Rathish *et al*., 2016; Kjeldsen, Nielsen, & Olesen, 2017). Furthermore, an interventional study conducted in a tertiary care hospital in Sri Lanka found that nearly 835 hospital bed days could be saved per year by preventing drug-related hospital readmissions by a clinical pharmacist, which in turn directly saves US$ 20,541 from the government expenditure (Shanika *et al*., 2018). Therefore detection and resolution of DRPs are essential to ensure patient safety and to reduce healthcare expenditure.

The joint International Pharmaceutical Federation (FIP) and WHO guidelines on Good Pharmacy Practice specify

that "pharmacists are healthcare professionals whose professional responsibilities and accountabilities include seeking to ensure that people derive maximum therapeutic benefits from their treatments with drugs" (WHO, 2011: p.313). Several studies have shown that community pharmacists can reduce DRPs in prescriptions through a preliminary prescription review before dispensing medicines (Currie *et al.*, 1997; Gandhi *et al.*, 2003; Blenkinsopp, Bond, & Raynor, 2012; Nicolas *et al.*, 2013; Kováčová & Ďurišová, 2016). A study from Pakistan showed that all community pharmacists had knowledge of DRPs and pharmaceutical care. Different types of DRPs were identified by them but only 41% of them reported these DRPs and only 37% intervened to reduce the incidences of DRPs (Jamal *et al.*, 2015). Reasons reported for this malpractice were lack of acceptance by society and other healthcare professionals, lack of a proper reporting system, lack of incentives, and lack of time, especially in the case of retail pharmacies (Jamal *et al.*, 2015). In Sri Lanka, some pharmacists work in the industry while a large majority work in hospitals and community pharmacies. There is no formal cadre for clinical pharmacists in state hospitals in Sri Lanka, but some aspects of pharmaceutical care are provided to patients attending clinics. A perspective article on the role of pharmacists in Sri Lanka describes the under-utilisation and missed opportunities of community pharmacy services which is particularly confined to traditional practices of dispensing with a business-oriented approach and limited emphasis on patient health and welfare (Sakeena, Bennett, & McLachlan, 2019). In Sri Lanka, there is very little published research reporting on DRPs and the few published are based on in-patients (Perera *et al.*, 2017; Thirumagal *et al.*, 2017 Shanika *et al.*, 2018) or specific hospital clinics (Mamunuwa *et al.*, 2016). Among these studies, Perera *et al.* (2017) reported a median of two preventable DRPs prevalent per patient indicating that there is a great opportunity for pharmacists to resolve DRPs in hospitalised patients in Sri Lanka. Although there is no solid evidence, it is believed that community pharmacists in Sri Lanka, seldom conduct a prescription review in routine practice possibly due to limitations such as large patient crowds, inadequate knowledge and skills, lack of pharmacists and restrictions in available facilities such as clinical decision support systems and drug interaction finders.

Improving the pharmacists' knowledge on prescription review will lead to greater detection of DRPs which in turn will reduce the medication-related health harm in patients (Paulino *et al.*, 2004; Krähenbühl-Melcher *et al.*, 2007). There are published studies on the effectiveness of educational programmes on detecting DRPs by

pharmacists, but most are from developed countries (Kimberlin *et al.*, 1993; Currie *et al.*, 1997; Zekan, 2020) where the training of pharmacists and facilities available may be considerably different to that of a developing country with limited resources. Even the few reported from developing countries used simple yes/no questions without directly assessing pharmacists' competencies on the prescription review (Amaka *et al.*, 2015; Jamal *et al.*, 2015). To address this research gap this study assessed the ability of community pharmacists to detect hypothetical DRPs in mock prescriptions and the effectiveness of an educational intervention to improve this skill.

Methods

Study design and settings

A cross-sectional, prospective quasi-experiment study was conducted among invited community pharmacists working in a state-owned community pharmacy chain in Sri Lanka. There are 33 community pharmacy outlets in this chain spread over 20 districts. This study was conducted on the 19th January, 2018.

Study participants

Community pharmacists registered as pharmacists in Sri Lanka, and working in study pharmacies were invited through the parent office to take part in a workshop on preliminary prescription review, DRP identification and medication safety. The workshop was advertised through the parent office of the organisation and participants were granted a full day's leave to attend this programme.

Sample size calculation

An online sample size calculator was used to calculate the minimum sample of community pharmacists needed to ensure the validity of this study (Kohn & Senyak, 2018). The required sample size was 31 community pharmacists for pre- and post-assessments, considering a significance level of 5%, Type II error rate of 0.2, effect size of 0.5, and a standard deviation of 1.

Study instruments

Two academic pharmacists prepared three mock prescriptions containing hypothetical DRPs that assessed areas discussed in the lectures. These hypothetical cases were aimed at assessing pharmacists' ability to identify DRPs; largely declarative knowledge than decision-making and problem-solving ability (i.e. procedural knowledge).

The mock prescriptions contained 16 DRPs and identification of a DRP scored one point each.

Study process

The educational workshop titled 'Medication safety for pharmacists' was a half-day programme conducted from 8.30a.m. to 1.30p.m. in two phases (pre-assessment and post-assessment). During the pre-assessment, pharmacists were asked to review the three mock prescriptions (elaborated in study instruments) within 15 minutes in order to evaluate their baseline ability to detect potential DRPs. This activity was followed by two teaching sessions on basic concepts of medication safety and preliminary prescription review conducted by a senior clinical pharmacologist and a senior academic pharmacist, respectively. The teaching activities included both one-way lecturing and interactive discussions to highlight key steps of a preliminary prescription review, DRP identification, prioritisation of identified DRPs, and recommended action to resolve problems (Appendix A).

The titles of presentations were 'Introduction to the basic concepts of medication safety and its global impact' and 'Preliminary prescription review and drug-related problems' which were delivered as interactive discussions supplemented with Powerpoint slides. The duration of each presentation was about 1 hour and 15 minutes.

The first session focused on introducing the concept of medication safety including the nature and types of medication errors that occur, with a greater emphasis on dispensing errors. Definitions, characteristics, occurrences, and causes of medication errors including dispensing errors were explained. Concepts of look-alike sound-alike (LASA) medicines, inappropriate use of abbreviations in prescriptions, and dangers of dispensing illegible prescriptions were introduced using real cases. This session was concluded by emphasising the role of the pharmacist in minimising medication errors.

The second session was on guiding pharmacists to conduct a preliminary prescription review before dispensing medicines. Pharmacists were taught to assess the legality, completeness, and appropriateness (limited to available information) of the prescription. The main types of DRPs that should be checked for by pharmacists including wrong patient errors, wrong drug errors, wrong dose errors, wrong duration errors, wrong route errors, potential drug interaction, unintentional omissions and drug duplication were explained. In addition, potential issues such as use of 'Do Not Use' abbreviations and brand names in prescriptions that need to be dealt with caution

were highlighted. Further, pharmacists were guided on prioritising DRPs identified with a special emphasis on DRPs that require clarification from prescribers before dispensing. Pharmacists were discouraged on guessing ambiguous prescriptions whenever potential threat to patient safety were anticipated.

After the educational intervention, pharmacists were asked to re-visit the same three mock prescriptions (within 15 minutes) again to evaluate the post-assessment knowledge on detecting DRPs. Later, DRPs in the prescriptions were discussed in detail with explanations on prioritising DRPs for necessary action. During pre- and post-assessments, pharmacists were monitored closely and were advised to respond to assessments without assistance from colleagues or any reference sources. Basic demographic information of participants was also obtained at the beginning of the study.

Consent and confidentiality

At the beginning of the workshop, 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.

Ethics approval

The Ethics Review Committee, Faculty of Medical Sciences, University of Sri Jayewardenepura approved the 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 and the workshop.

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. Mean scores of study participants in the pre- and post-assessments were compared using the non-parametric test, Wilcoxon Signed Rank Test. For descriptive data, continuous variables were expressed as mean ± standard deviations (SD) and frequencies (numbers and %). The Spearman correlation test was used to correlate assessment scores with age. 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 pharmacists giving correct responses in pre- and post-assessments.

Results

Fifty-eight community pharmacists employed at outlets of the selected pharmacy chain participated in the workshop. This represents approximately one-third of all community pharmacists working in this pharmacy chain in Sri Lanka. The mean age of participants was 36.9±6.3 years and 60.3% were women. Table I shows demographic data of community pharmacists who participated in the educational workshop.

Table I: Demographics of community pharmacists in study pharmacies

Characteristics	Outcomes
Gender, N (%)	
Men	23 (39.7)
Women	35 (60.3)
Mean age ± SD*	36.9±6.3
Age groups in years, N (%)	
21-40	37 (63.7)
41-60	17 (29.3)
Not given	4 (7.0)
Median number of prescriptions dispensed per day#	62.5
Minimum and maximum number of prescriptions dispensed per day#	Min-20 Max-600
Mean number of years of working as a registered pharmacist ± SD*	8.5±5.9

* SD = Standard Deviation

self-reported by pharmacists

Participating pharmacists had a pre-assessment mean score of 5.3±2.1, and post-assessment mean score of 8.5±1.7. The scores on detecting DRPs had significantly improved after the educational intervention ($p<0.001$).

Table II shows the number of pharmacists who correctly identified DRPs present in the three mock prescriptions during pre- and post-assessments. In general, the overall ability to detect missing essential legal information in prescriptions (including name and age of the patient, date, and Sri Lanka Medical Council registration number of prescribers) ($p<0.001$) and missing duration of medicines increased significantly after the lectures ($p<0.05$ for all relevant comparisons). There were three instances of using error-prone abbreviations and notations such as 'q.d', 'mcg', and a trailing zero. The ability to detect error-prone abbreviations increased significantly ($p<0.05$ for all relevant comparisons).

Table II: Comparison of proportion of community pharmacists who correctly identified DRPs during pre and post-assessments

DRPs in three mock prescriptions	Number of community pharmacists who correctly identified DRPs		p-value
	Pre-assessment (N=58)	Post-assessment (N=58)	
	Frequency (%)	Frequency (%)	
Prescription 1			
1 Age of the patient missing	28 (48.3)	54 (93.1)	**<0.001**
2 Registration number of prescriber and date of prescription missing	21 (36.2)	52 (89.7)	**<0.001**
3 Ipratropium dose written as 400 micrograms instead of 40 micrograms	40 (69.0)	39 (67.2)	0.842
4 'Microgram' written as 'mcg' (error prone abbreviation)	0 (0.0)	5 (8.6)	**0.019**
6 Duplication of 'salmeterol' with 'salmeterol' and 'fluticasone' combination	39 (67.2)	43 (74.1)	0.413
7 Dosage form missing for 'salmeterol' and 'fluticasone' combination	14 (24.1)	23 (39.7)	0.069
Prescription 2			
8 Digoxin dose unit incorrectly written as 'mg' instead of micrograms	46 (79.3)	50 (86.2)	0.323
9 Interaction between clarithromycin and warfarin	8 (13.8)	10 (17.2)	0.608
10 Warfarin dose administration timing missing	6 (10.3)	8 (13.8)	0.568
11 Duration of all medication missing	36 (62.1)	50 (86.2)	**0.002**
Prescription 3			
12 Name and age of patient missing	33 (56.9)	57 (98.3)	**<0.001**
13 Duplication of anti-histamines, 'cetirizine' and 'fexofenadine'	8 (13.8)	17 (29.3)	**0.039**
14 A trailing zero when writing the dose of 'warfarin 5.0 mg'	0 (0.0)	13 (22.4)	**<0.001**
15 'Once a day' medication frequency for 'warfarin' written as 'q.d' (error prone abbreviation)	3 (5.2)	28 (48.3)	**<0.001**
16 Duration of all medication missing	23 (39.7)	43 (74.1)	**<0.001**

The overall ability to detect medicine duplications increased, but not significantly, after the workshop ($p=0.085$). However, a sub-analysis revealed that ability to detect the duplication between 'cetirizine' and 'fexofenadine' increased significantly (p-value=0.039). Ability to detect the medicine interaction between 'warfarin' and 'clarithromycin' ($p=0.608$), missing dosage form of 'salmeterol', and 'fluticasone' combination ($p=0.069$) and missing dose administration timing of warfarin ($p=0.568$) increased at post-assessment but not significantly.

There was also a negative correlation in the pre- and post-assessments scores and age (pre-assessment (Spearman r=-0.281, n=54, *p*=0.039; post-assessment: Spearman r=-0.303, n=54, *p*=0.026).

Discussion

A community pharmacist needs to review prescriptions for accuracy, completeness, and legality before dispensing any medicines to patients. The community pharmacist is the last person in the healthcare chain who will directly communicate with outpatients, and he/she plays an important role in identifying and addressing the actual and potential DRPs in prescriptions. As Sri Lanka is a developing country, there is limited access to novel technologies such as Computerised Decision Support Systems that helps detect and alert DRPs automatically. Pharmacists are compelled to engage in manual reviewing of prescriptions and thus must possess adequate skills to conduct at least a preliminary prescription review.

For this educational intervention, 58 pharmacists representing 14 districts in Sri Lanka participated which is about one-third of all pharmacists attached to this pharmacy chain. According to the results, the mean score for detecting DRPs per community pharmacist increased by 60% during the post-assessment compared to the pre-assessment (*p*<0.001). The results are compatible with previous studies (Kimberlin *et al*., 1993; Cunningham *et al.,* 1997; Currie *et al*., 1997; Zekanetal, 2020). Zekan *et al*. (2020) in their before and after survey study showed that a three-day educational workshop on clinical pharmacy increased the community pharmacist's ability to identify, resolve, and evaluate DRPs by 14.5%. Furthermore, Currie and colleagues (1997) showed that a 40-hour training programme in pharmaceutical care significantly improved pharmacists' skill on identifying DRPs, and led to improved patient outcomes.

Missing demographics (name and age) of the patient, date, treatment duration, and prescriber's registration number were not identified by most pharmacists at pre-assessment but significantly improved at post-assessment. This finding indicates that educational programmes helped to improve pharmacists' vigilance on evaluating the legality and completeness of prescriptions. Two prescriptions contained two different drug duplications. Identification of duplications by pharmacists improved at post-assessment although the results were not significant in one of them where the brand name was used. It could be that some pharmacists did not know the generic medicine of this brand or confused it with another

brand name resulting in poor ability to detect the duplication. Overall, the ability to detect essential prescription issues and obvious pharmacological issues that did not need much recall memory were tackled through this educational intervention.

Identification of error-prone abbreviations such as 'q.d', 'mcg', trailing zero were correctly detected by only three pharmacists at pre-assessment which increased to forty-six pharmacists at post-assessment. It could be that pharmacists were unaware of error-prone abbreviations which were effectively addressed by the workshop. Another important finding was that pharmacists (N=45) misread the abbreviation 'q.d' as 'four times a day' (q.i.d) highlighting the inherent dangers of using such abbreviation. In general, this educational intervention was also successful in updating pharmacists' knowledge of recent developments in medication safety.

The ability to detect drug interactions did not change significantly at post-assessment. This may be due to lack of knowledge on the mechanism of drug action, pharmacodynamics and pharmacokinetic principles. Detecting drug interactions needs considerable recall memory and is best supported by electronic resources. Most community pharmacists in Sri Lanka do not have access to required electronic reference sources during the dispensing process, which makes this task very challenging. This also highlights the importance of continuous educational programmes for community pharmacists to improve their knowledge on pharmacological aspects.

Further, there was one instance where a reduction in correct responses in the post-assessment was observed related to ipratropium dose, but this difference was insignificant (*p*=0.842), and likely to be due to chance.

There was a significant negative correlation between age and total scores of correctly detecting DRPs in both pre- and post-assessment. The result is compatible with the findings of Amaka *et al*. (2015) who reported that younger pharmacists had more knowledge on identifying and resolving DRPs than older pharmacists. The implication is that practices such as preliminary prescription review should be introduced at a younger age, possibly during undergraduate level for it to be accepted as an essential step in the dispensing process. It is also important to update pharmacists' knowledge with continuing education programmes to keep abreast of new developments in healthcare.

Strengths and limitations of this study should be acknowledged. This study recruited pharmacists from all over the country, which is a more representative sample

than a cohort of pharmacists confined to one district. However, the limited sample size must be acknowledged. Secondly, the same mock prescriptions were used in the pre-assessment and post-assessment which could add some biases. It is possible that pharmacists referred up on some of the DRPs on the mock prescription or engaged in discussions with colleagues in-between the pre- and post-assessment which may have affected the improved post-assessment result. This limitation could have been addressed by asking pharmacists to review a few additional prescriptions (with similar issues) to ensure whether they had grasped the intended learning points. Thirdly, these findings may not reflect the actual practice of pharmacists as mock cases where used. However, it is a better approach than asking pharmacists questions using self-administered 'yes/no' questionnaires as was done in most other studies (Westerlund, Almarsdóttir, & Melander, 1999; Amaka *et al.*, 2015). Fourthly, the sum mean scores were approximately 33% (5.3/16) and 53% (8.5/16) for pre- and post-assessment respectively, which is low compared to the normal pass marks of 60% to 80% generally used in pharmacy education. Although the sum mean scores improved after the workshop, this improvement may not be significant enough to be meaningful. Continuous education on basic concepts such as reviewing prescriptions, introduction to evolving concepts in pharmacy, and assessment-based promotion schemes in workplaces could yield better outcomes than one-off workshops like this which are not continuous. However, this study is evidence that interactive training can motivate pharmacists to improve dispensing safety.

Based on these results the authors recommend that the community pharmacies in Sri Lanka should be equipped with evidence-based resources, such as British National Formularies, interaction finders (either online or hard copies) as some pharmacies rarely have these basic resources. Community pharmacists must be encouraged to enrol for continuous professional development programmes through offering incentives and credit-based promotions, in order to enhance their knowledge, competencies, and skills related to work. It is also important to establish good communication links with prescribers which facilitates rapid information exchange. Good documentation practices must be a mandatory requirement in pharmacies.

Conclusions

It was evident that community pharmacists needed more knowledge and training on detecting DRPs in prescriptions and this study assessed if a simple educational intervention could improve the ability to identify and resolve DRPs in prescriptions. This educational intervention improved the community pharmacists' ability to detect DRPs related to completeness and legality of prescriptions but failed to make a significant impact on detecting advanced pharmacological issues such as medicine duplications and medicine interactions that needed recall memory. While it is important to introduce concepts such as 'preliminary prescription review' at an early stage of pharmacy education, it is recommended to organise regular educational programmes on pharmacology and to facilitate continuous professional development for pharmacists.

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Appendix A

Medication Safety For Pharmacists

Title	Duration
1. Introduction for the workshop	10 minutes
2. Pre-assessment activities	15 minutes
3. Introduction to the basic concepts of medication safety and its global impact (Lecture)	1.5 hours
a) The nature and types of medication errors, with a greater emphasis on dispensing errors	
b) Definitions, characteristics, occurrences, and causes of medication errors	
c) Concepts of look-alike sound-alike (LASA) medicines,	
d) Inappropriate use of abbreviations in prescriptions	
e) Dangers of dispensing illegible prescriptions were introduced using real cases.	
f) Emphasizing the role of the pharmacist in minimizing medication errors	

4. Preliminary prescription review and drug-related problems (Lecture)	1.5 hours

a) Goals of Prescription review
b) Discussing the three main types of prescription review i.e.
   Type 1- Preliminary prescription review
   Type 2 - Concordance and compliance review
   Type 3 - Clinical medication review
c) Describing the steps in the preliminary prescription review
d) Explaining how to assess the legality and the completeness of the prescription
e) Introducing the term DRPs and explaining each type of DRPs with examples e.g. wrong patient errors, wrong drug errors, wrong dose errors, wrong duration errors, wrong route errors, potential drug interaction, unintentional omissions and drug duplication
f) Explaining the strategies to prioritize the identified DRPs with a special emphasis on DRPs that require clarification from prescribers before dispensing
g) Describe the approaches need to correct the DRPs
h) Explain the importance of effective communication and assertive speaking in discussing the DRPs with the healthcare professionals.

5. Post-assessment and Discussion	1.5 hours

The three mock prescriptions used in the pre- and post-assessments

Registration No: ……………………………………

Please identify prescription related problems (DRPs) in the following prescriptions.

Prescription 1

℞   Mrs. Perera
                                     19/01/2018

Salbutamol 100 micrograms MDI 1 puff sos
Ipratropium bromide 400 mcg MDI 2 puffs tds   1/12
Salmeterol 50 micrograms bd
Seroflo 250 mcg bd

Dr. D Somasiri
MBBS (SL)

Prescription 2

℞   Mrs. Perera
                                     19/01/2018

Salbutamol 100 micrograms MDI 1 puff sos
Ipratropium bromide 400 mcg MDI 2 puffs tds
Salmeterol 50 micrograms bd
Seroflo 250 mcg bd

Dr. D Somasiri
MBBS (SL)

Prescription 3

19/01/2018

Propranolol 30 mg tds
Cetirizine 10 mg nocte
Warfarin 5.0 mg q.d.
Fexofenadine 120 mg q.d.

Dr. D Somasiri
MBBS (SL)
Reg No: 1658