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RESEARCH ARTICLE

Evaluating categorisation and clinical relevance of drug-related problems in medication reviews

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Abstract *Objectives* We aimed to evaluate the categorisation and clinical relevance of DRPs identified by community pharmacists, and further, to assess the quality of interventions with the patients and the physicians as documented by the pharmacists. *Setting* 23 Norwegian community pharmacies. *Method* Patients with type 2 diabetes were recruited by 24 community pharmacists who performed structured medication reviews based on the patients' drug profiles and patient interviews. The DRPs identified were subsequently categorised. An evaluation group (EG) retrospectively evaluated the reviews. Clinical/practical relevance of each DRP and quality of community pharmacists' intervention with patients and physician were scored. Average agreement between the EG and the community pharmacists was calculated. Internal agreement in the EG was calculated using a modified version of Fleiss' Kappa coefficient. *Results* A total of 73 patients were included (mean age 62 years, 52% female, on average prescribed 8.7 drugs). The pharmacists identified 88 DRPs in 43 of the patients. The most common DRPs were adverse drug reactions (22%) and wrong drug or dose used by patient (14%). Anti-diabetic drugs and lipid modifying drugs were associated with the most DRPs. The EG agreed with detection and categorisation of DRPs in more than 80% of the cases. The clinical/practical relevance of the detected DRPs was scored by the EG to be high or medium in 87% of the cases. The quality of the follow-up with patients and physicians was scored to be good or satisfactory in 93 and 98% of the cases, respectively. *Conclusions* Pre-defined categories of DRPs supported by structured forms were reliable and valid tools for identifying DRPs. The evaluation demonstrated that community pharmacists were able to identify DRPs of high to medium clinical/practical relevance, and to perform follow-ups of the DRPs with the patients and the physicians with a good or satisfactory quality.

Keywords Community pharmacy · Drug-related problems · Evaluation · Medication review · PCNE DRP classification · Type 2 diabetes

Impact of findings on practice

- There is a high prevalence of DRPs amongst patients with type 2 diabetes.

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- A structured approach to identification and categorisation of DRPs assist community pharmacists to identify and solve valid DRPs in patients with type 2 diabetes.
- This study is adding evidence to the debate about interprofessional cooperation and professional roles in medication reviews in community pharmacy.

Introduction

Drug treatment is complex and attention has been given to medication reviews and patient interviews as areas where the pharmacists' expertise can improve drug treatment [1–3]. Medication reviews are important as basis for interprofessional cooperation when discussing drug treatment [4]. Patient interviews add value to the paper-based part of the medication review as additional drug-related problems (DRPs) are being identified [5]. Patient interviews in pharmacies imply a scheduled, structured dialogue between the patient and the pharmacist to increase understanding of the drug treatment, to improve compliance and to contribute to rational drug use. If problems are identified, the pharmacist should resolve the problem or, with patient consent, contact the prescriber to discuss the matters.

A DRP is defined as an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcome [6]. Many DRPs can be avoided or resolved by monitoring the effect of long term treatment and identifying patients at risk [1, 7]. A considerable number of studies demonstrate that medication reviews carried out by pharmacists are an effective way to determine DRPs for patients both in hospitals, nursing homes and pharmacies [5, 8–11].

Diabetes is associated with increased morbidity and mortality [12]. Diabetes care interventions delivered by pharmacists can improve medication adherence in diabetes, especially through providing patient education [3, 10]. Many patients with type 2 diabetes experience DRPs, which can be detected and solved through medication reviews and multidisciplinary cooperation DRPs [3, 13, 14].

It is important to evaluate whether methods for identification of DRPs, through systematic medication reviews and patient interviews, are reliable and valid, i.e. if the same problems can be identified by repetition and if objective relevant information is uncovered (face validity).

Aim of the study

In this study we developed a method addressing medicine use and DRPs for patients with type 2 diabetes in a community pharmacy setting.

We aimed to evaluate the categorisation and clinical relevance of DRPs identified by community pharmacist, and further, to assess the quality of interventions with patients and physicians as documented by the pharmacists.

Methods

Training of community pharmacists

A 2 day post graduate course for community pharmacist was held in May 2006 in performing medication reviews aimed at identifying and solving DRPs in patients with type 2 diabetes. The participating pharmacists received lectures about diabetes and practical training in medication reviews and the use of the DRP-categorisation system with simulated patients [15]. Real medication reviews were performed subsequently in a 3 month period in the participants' respective pharmacies throughout Norway, and an appraisal meeting with experience exchange was held in September 2006.

The medication reviews were based on structured questionnaires, previously piloted on five pharmacy customers with type 2 diabetes. The medication review process consists of three steps. Later on, an evaluation group (EG) retrospectively assessed the categorisation and clinical relevance of the identified DRPs, see below.

I. Patient recruitment

From May to September 2006, 24 pharmacists from 23 pharmacies enrolled 73 patients with type 2 diabetes for a medication review. The inclusion criteria were patients of both genders aged 18 or above, prescribed medicines or medical equipment for type 2 diabetes. Patients were invited to take part by the pharmacists as they handed in prescriptions. They received both written and oral information about the study before written consent was obtained. The patients as such represent a 'convenience sample' of pharmacy customers. Non-responders were not recorded. The study was approved by the Norwegian Social Science Data Services (NSD) and the Regional Committee for Medical Research Ethics.

II. Medication review

The pharmacists performed structured medication reviews based on the patients' drug profiles and patient interviews. In Norway, pharmacies have drug profiles of a patient's dispensed prescriptions the preceding year, or even longer. Pharmacy records are not linked, so if a patient use two or more pharmacies, the drug profiles are not complete. Patient notes from physicians were not available.

Drug profile. The pharmacist constructed a drug profile based on the pharmacy electronic medication records prior to the patient interview and completed this with information from the patient at the interview. The drugs were classified according to the ATC-classification system [16].

Patient interview. A dialogue technique was used in the pre-planned patient interviews, which were supported by an interview guide addressing medicine use, compliance issues, and identification and documentation of potential DRPs.

III. DRPs and contact with the prescriber

The categorisation of DRPs was based on the Pharmaceutical Care Network Europe (PCNE) system, further adjusted by a Norwegian group for use in the Norwegian health care system [6, 17], adapted by the project group to suit pharmacy practice research (Table 1). Moreover, pharmacists noted their advice to the patient on a separate form and a copy was provided for the patient. Patients were advised to contact their general practitioner (GP) or pharmacist if they had further queries after the patient interview. For DRPs were prescriber involvement was deemed necessary, the pharmacist would prepare suggestions of possible solutions before the prescriber was contacted. All changes in prescribing were performed by prescribers, and the responses of the informed prescriber were documented. After the interviews the patients were handed an anonymous evaluation form to be mailed to the authors.

IV. Evaluating the categorisation and relevance of drug-related problems

A group (hereafter called the evaluation group, EG) consisting of one consultant in internal medicine and endocrinology (KB), two hospital-based clinical pharmacists (HSB and KKV), and one community pharmacist (AK), retrospectively evaluated the medication reviews and the DRPs identified by the community pharmacists. A standardised form was used for this evaluation.

The EG held two meetings, in February and August 2007. The purpose of the first meeting was to achieve a mutual understanding of the concept of categorisation of DRPs. The principles were presented and discussed, and demonstrated by applying them on three DRPs from two different patients. Between the meetings, the EG independently evaluated the remaining medication reviews. In addition to evaluating the documented DRPs, the EG was asked to identify *additional DRPs* not documented by the community pharmacists. At the second meeting the results were discussed.

Questions 1–6 below formed the basis for the evaluation. Question 1 was constructed by considering whether one or more DRPs, or no DRP, was identified in each of the 71 reviews. Questions 2–6 were actually posed to the EG members:

For each of the medication reviews ($n = 71$):

1. Do you agree with the community pharmacist on whether or not the patient had at least one DRP? (yes/no)

Table 1 Categorised drug-related problems modified after the PCNE for use in community pharmacies [6, 16]

Adverse reactions (To be addressed at the patient interview)
Drug choice problem (To be addressed before the patient interview)
The need for additional drug
Unnecessary drug
Inappropriate drug selection
Dosing problem (To be addressed before the patient interview)
Dosage too high
Dosage too low
Non-optimal dosing schedule
Formulation not optimal
Drug use problem (To be addressed at the patient interview)
Dispensing error in the pharmacy
Wrong drug or dose used by patient
Non-optimal dosing schedule by patient
Practical problems (e.g. opening packages, swallowing, unpractical dosage schedules)
Communication issues (dosage instructions misunderstood, need for additional information)
Drug interactions (To be addressed *before* the patient interview)
Other drug-related problems (To be addressed at the patient interview, e.g. lacking understanding of need for drug treatment)

For each DRP identified by the community pharmacists ($n = 85$):

2. Do you agree that it was a DRP? (yes/no)
3. If yes, do you agree with the DRP category? (yes/no)
4. How do you score the clinical/practical relevance of the DRP? (high, medium, low)
5. How do you score the quality of the community pharmacist's intervention with the patient? (good, satisfactory, not satisfactory)
6. How do you score the quality of the intervention with the physician? (good, satisfactory, not satisfactory)

The outcome of questions 1–6 were registered and analysed in Excel. The statistical analysis was performed in "A language and environment for statistical computing-R" [18].

Statistical method

Average agreement between the EG and the community pharmacists on identification and categorisation of DRPs was calculated. The agreement within the EG may for the questions 1–3 take any of three levels: Two, three or four of the EG members may have the same score. For the last three questions there are more possibilities as the difference between high and low relevance/quality is larger than between high and medium relevance/quality. We have chosen to simplify this: If at least three in the EG agreed, or if two agreed, and one or none of the extremes (1 or 3) was represented, this was defined as a "good/satisfactory" agreement. Other instances were defined as a "not satisfactory" agreement.

To measure the internal agreement in the EG, the Fleiss' Kappa coefficient was used as a starting point [19]. This coefficient is defined as the achieved agreement above chance divided by attainable agreement above chance so that $\kappa \approx 0$ with coincidental agreement, and $\kappa = 1$ with total agreement. In our material, there are far more positive evaluations (agreements with the community pharmacists) than negative ones. In such skewed distributions κ may be much lower than seems intuitively reasonable. We have therefore used a modified version (κ') where observed agreement is compared with expected agreement if each EG member responds to question 1–6 completely at random.

The modified version is defined as:

$$\kappa' = \frac{1}{n}\sum_{i=1}^{n} \kappa_i', \kappa_i' = \frac{A_{i,obs} - A_{i,e}}{A_{i,\max} - A_{i,e}} = \frac{P_{i,obs} - P_{i,e}}{1 - P_{i,e}}, \quad (1)$$

where the Ps are defined by dividing the corresponding As with $A_{i,\max}$For questions 1–3, $A_{i,\text{obs}}$ is the number of internal agreements (EG members giving the same response) in medication review i, $A_{i,\max}$ is the number of responses, and $A_{i,e}$ is the expected number of internal agreements if the probability of agreeing with the community pharmacists is 50% for each member of the group. For questions 4–6, $A_{i,\text{obs}}$ equals 0 (not satisfactory) or 1 (good/satisfactory), $A_{i,max} = 1$ and $A_{i,e}$ is the expected agreement if each group member answers either 1, 2 or 3 with the same degree of probability. Confidence intervals were calculated by bootstrapping the medication reviews [20].

Results

Medication reviews

Table 2 presents descriptive information for the study sample of 73 patients who received medication reviews, of whom 38 were women (52%). The average number of prescribed drugs was 8.7 (range 2–19), and 85% ($n = 62$) of the patients were prescribed six or more drugs. The pharmacists' median time for preparation and consultation was 60 min and median follow-up time was 30 min.

Table 3 presents the number of DRPs identified and whether the prescriber was contacted by the community pharmacist or not. A total of 88 DRPs were identified for 43 of the 73 patients, an average of 1.2 (range 0–6) DRP per patient. For 30 patients, no DRP was identified. There were no statistical differences between those with identified DRPs and those without DRPs regarding age ($p = 0.418$) and gender ($p = 0.769$). The most commonly reported DRPs were adverse drug reactions (22%), wrong drug or dose (14%), and the need for additional drug treatment (10%) (Table 3). In 34% of the DRPs, the pharmacists were in contact with the prescriber, however it was not recorded whether the DRPs were solved or not. Oral and/or written advice was given to the patient in relation to 92% of the DRPs.

Of the 637 prescribed drugs, 24.3% were drugs used in diabetes (ATC-group A10), 8.8% were drugs acting on the renin-angiotensin system (ATC-group C09), 8.6% antithrombotic agents (ATC-group B01), 7.7% lipid modifying agents (ATC-group C10) and 5.5% were beta blockers (ATC-group C07). Statins were prescribed to 49 of the patients (67). The majority (95% of the patients) were prescribed cardiovascular drugs. The ATC groups causing the most DRPs were drugs used in diabetes (ATC-group A10), lipid modifying agents (ATC-group C10) and beta blockers (ATC-group C07). See Table 4 for examples of DRPs for the different ATC groups.

Three in four patients reported to be satisfied or very satisfied with their drug treatment. Still, 23% felt their medicines could have worked better. Experiences with adverse drug reactions/discomfort were common (>40%),

Table 2 Age, gender, smokers, and drug prescribing patters for medication review patients. $N = 73$

		Percentage
Patient characteristics		
Female, *n*	38	52
Average age (SD)	62.4 (10.2)	N/A
Years since diagnoses (range)	10 (0–30)	N/A
Average number of prescription drugs (range)	8.7 (2–19)	N/A
Self reported HbA1c, (range)	7.4 (4.6–10)	N/A
Smokers, *n*	18	25
Member of the Norwegian Diabetes Society, *n*	37	50.7
Patient perception of drug use	**Yes**	
Do you think your medicines could have worked better?	16	22.5
Do you sometimes have adverse drug reactions/discomfort due to your drugs?	31	43.7
Do you have practical problems taking your medicines?	7	9.7
Do you use all the medicines prescribed to you?	64	87.7
Do you take less/more of the medicines than prescribed by your physician ?	19	26.8
Drug use in relation to type 2 diabetes (ATC-classification)	***N***	
Oral anti-diabetics only (A10B)	37	51
Insulin only (A10A)	9	12
Combined use of insulin and orale anti-diabetics(A10A and A10B)	27	37
Lipid modifying drugs (C10)	49	67
Other cardiovascular drugs (C except C10)	68	93

Table 3 Frequency of DRPs and prescriber contact[a], and additional DRPs to the ones identified by the community pharmacists, detected by more than one in the evaluation group (EG)

Categorised drug-related problems	Total DRP	Prescriber contacted	Prescriber not contacted	DRPs additional to the ones identified by the community pharmacists,
Adverse drug reactions	19	3	16	7
Wrong drug or dose used by patient	12	2	10	0
The need for additional drug	9	3	6	0
Inappropriate drug selection	7	5	2	4
Non-optimal dosing schedule	7	3	4	1
Drug interactions	7	3	4	3
Dosage too low	6	3	3	0
Other drug-related problems	6	3	3	1
Practical problems	5	0	5	2
Dosage too high	4	2	2	0
Communication issues	3	0	3	1
Formulation not optimal	2	2	0	0
Non-optimal dosing schedule	1	1	0	0
Unnecessary drug				1
Total	88	30	58	20

N/A non applicable

[a] It was not recorded whether the DRPs were solved or not during prescriber contact

a quarter of the patients were at times non-compliant (taking more/less, or in a different manner), and 12.3% reported not having used all medicines prescribed.

Fifty-three patients (73%) returned the evaluation form after the patient interview, and all except one reported to have good or very good benefit of the medication review. About 50% reported to have learned something new about their medicines, and 32% reported to have changed the way they took medicines as a result of the review. In the future, 81% would accept the offer of a similar medication review.

Table 4 Examples of DRPs categories of according to 2nd level ATC groups

Drugs (ATC-groups 2nd level)	Number of DRPs	Example of DRPs (number of patients in brackets)
A10: Drugs used in diabetes	31	Adverse drug reaction (6), dosage too low (5), dosage too low (3), Wrong drug or dose used by patient (3)
C10: Lipid modifying agents	12	Need for additional drug (3), non-optimal dosing schedule (2), adverse drug reaction (2), communication issues (2)
C07: Beta blocking agents	7	Adverse drug reaction (3), interaction (1), inappropriate drug selection (1), dosage too low (1)
C03: Diuretics	6	Need for additional drug (2), non-optimal dosing schedule(1), wrong drug or dose used by patient (1), formulation not optimal (1), adverse drug reaction (1)
C09: Agents acting on the rennin- angiotensin system	6	Adverse drug reaction (4), inappropriate drug selection (1), wrong drug or dose used by patient (1)
B01: Antithrombotic agents	5	Interactions (4), need for additional drug (1)

Evaluation group agreement

After the meeting aiming to achieve a mutual understanding of the concept of categorisation of DRPs by applying them on three DRPs from two different patients, the EG independently evaluated the remaining 71 medication reviews. In total, community pharmacists uncovered at least one DRP in 42 of the 71 medication reviews, a total of 85 DRPs. In 39 (92%) of these 42 reviews three or more of the EG members agreed with the community pharmacists in that there was at least one DRP present in the review. A total of 26 (30%) of the 85 DRPs identified by the community pharmacists were regarded by at least one of the EG members to belong to another DRP category. However, in only six of these cases, more than one EG member coincided in their choice of re-categorisation.

With regard to questions 1–3 (detection and categorisation of DRPs), the EG agreed with the community pharmacists in more than 80% of the cases (Table 5). The clinical/practical relevance of the detected DRPs (question 4) was scored to be high or medium in 87% of the cases, and the quality of the follow up of patients and physicians (questions 5 and 6) was scored as good or satisfactory in 93 and 98% of the cases, respectively (Table 6). The internal agreement in the EG was in general relatively high, ranging from $\kappa' = 0.50$ for question 4 (relevance) to $\kappa' = 0.81$ for question 6 (intervention in relation to physician). Measured by the unmodified κ for questions 1–3, it was considerably lower.

Both in the medication reviews where the community pharmacists identified a DRP, and in those where no DRP was identified, the EG suggested *additional DRPs*, a total of 76. However, only 20 DRPs were revealed by more than one member of the EG, the most common being adverse drug reactions, inappropriate drug selection and drug interactions (Table 3). Fourteen of the 20 were identified in the reviews where the community pharmacists had not identified any DRP.

Discussion

Medication reviews

A medication review including a patient interview with a pharmacist can shed light on problems of which prescribers are unaware or uninformed [21]. Prescriptions for chronic diseases are usually issued for 1 year, however pharmacies

Table 5 Evaluation of 85 DRPs identified by the community pharmacists

	n	Fraction of individual evaluation group's (EG) evaluations agreeing with the community pharmacists	Confidence interval (95%)	*N*	Agreement within the EG[a]	Confidence interval (95%)
1. Agreement on whether or not the medical review had one or more DRP	71	0.87	[0.82–0.91]	282	0.60 (0.09)	[0.47–0.72] ([0.00–0.18])
2. Agreement on the presence of a DRP	85	0.82	[0.78–0.87]	335	0.55 (0.14)	[0.45–0.68] ([0.01–0.25])
3. Agreement on the categorisation of the DRP	79	0.87	[0.83–0.90]	261	0.72 (0.34)	[0.57–0.82] ([0.21–0.52])

n = number of medication reviews (question 1) or DRPs (question 2 and 3) where at least two of the EG members contributed, *N* = number of DRP evaluations performed by the EG

[a] Modified Fleiss κ' (unmodified κ in parenthesis) calculated from the n DRPs; 0 = coincidental agreement, 1 = full agreement

Table 6 Evaluation of clinical/practical relevance and quality of the interventions made by the community pharmacists

	n	Evaluation of relevance and quality[a]	*N*	Agreement within the EG[b]	Confidence interval (95%)
1.Clinical/practical relevance of detected DRP[c]	80	0.62, 0.25, 0.13	279	0.50	[0.30–0.70]
2.Quality of intervention with the patient[d]	80	0.73, 0.20, 0.07	283	0.64	[0.50–0.79]
3.Quality of intervention with the physician[d]	36	0.69, 0.29, 0.02	106	0.81	[0.65–0.96]

N = number of DRP evaluations performed by the evaluation group (EG), *n* = number of DRPs where at least two of the EG-members contributed

[a] From left to right: fraction of high/good, medium/satisfactory and low/not satisfactory ratings

[b] Modified Fleiss κ' calculated from the n DRPs; 0 = coincidental agreement, 1 = full agreement

[c] Categorised as high, medium, or low

[d] Categorised as good, satisfactory, or not satisfactory

in Norway dispense medicines for a 3 month period and therefore sometimes have more regular contact with the patients than the prescribers. Pharmacists can therefore reveal intended or non-intended non-compliance, potentially disclosed for the prescriber due to long intervals between the patients' consultations [22]. Based on pharmacy dispensing records and the patients drug dosages, pharmacists should in concordance with the patient intervene to improve adherence to medication [3].

Studies have shown pharmacists' impact on medication use and adherence in diabetes care services [3, 11], and in some models cooperation between pharmacists and physicians have resulted in improved clinical values such as blood pressure and HbA1c [3, 21, 23]. We found that community pharmacists identified many DRPs related to the need for additional drugs. In particular, drugs for diabetes and lipid modifying drugs were not prescribed according to current clinical guidelines for treatment of type 2 diabetes. This is in line with other studies pinpointing the need for additional drugs in diabetic patients [1, 13]. The pharmacists in our study further identified inappropriate drug selection, too low doses and non-optimal dosing schedule, which potentially may reduce the effect of the drug or cause adverse drug reactions.

It is debatable if the pre-defined DRPs categories and the interview guide in our study, helped the pharmacists to identify valid DRPs, or, if the pharmacists identified DRPs and then merely tried to classify them. A recent study [24] suggests that a systematic approach to conducting medication reviews, somewhat similar to our approach, improved pharmacists' ability to identify important drug-related problems during medication reviews.

Medication reviews are now offered to patients as an established service in some Norwegian community pharmacies [25]. However, the number of reviews performed, time spent, methodology used and patient outcomes are not recorded at a national level. The service has no remuneration but some pharmacy chains charge about 20 € for 30 min consultations.

Communication with prescribers about DRPs

The value of good cooperation and effective communication between the prescriber and the pharmacist regarding DRPs and clinical problems is recognised [1, 7, 26]. In our study the pharmacist contacted the prescriber in one of three DRPs (Table 3). Pharmacist did only to a small degree contact the prescriber if patients had practical drug problems, compliance related problems such as taking the wrong drug or dose, or when patients needed information and counselling. They rather solved problems through direct dialogue with the patient, an approach also observed in other studies [2, 27]. The lack of communication in general between pharmacists and prescribers about DRPs can be related to difficulties of finding suitable ways of communication in busy general practice settings and likewise busy pharmacies [28]. In Norway, GPs and pharmacists have reported varying management of the pharmacists' prescription interventions whereby both expect the other profession to file these interventions. Also, GPs want more feedback than actually provided by the pharmacists [29].

Patients' experiences with patient interviews

Similar to other studies [21, 30] patients were satisfied with the service, and half of the patients reported to have learnt something new about their medicines. Whether the medication review altered compliance was not investigated. Research supports that inter-professional interventions are the most effective in that respect [23].

Methodological aspects of categorising DRPs

It is likely that the EG, in light of background and experiences in using categorised DRPs, had relevant qualifications to evaluate the cases from the community pharmacists working with practical patient counselling. The EG was small, but comparable to corresponding groups in other studies [2, 21, 31].

The Fleiss' κ is often used for evaluating within-group agreement, and has also been used in other research in the field of medication reviews and DRPs [32]. We have used the modified version κ'. The motivation for this was that in situations where the two outcomes (agreements and disagreements) are unequally distributed (we had about 80-90% agreements), the κ-coefficient may appear counter-intuitive. For example, if all of the EG members agreed with the community pharmacists in 81 out of 85 DRPs, and one disagreed in each of the four last ones, one would intuitively say that the within-group agreement was high, and the use of categorised DRPs on standardised forms would have been deemed a success. This would not be reflected by κ, which would be as low as -0.01. One should be aware, though, that a high average agreement with the community pharmacists leads to a high modified κ ($=\kappa'$). Thus κ', which reflects a combination of the within-group agreement and the average agreement with the community pharmacists, is a more stand-alone measure than κ, which should only be interpreted in light of the average agreement with the community pharmacists.

Evaluation group agreement

In total, the EG expressed a high degree of agreement with the community pharmacists on the existence of a DRP, and also with the community pharmacists' categorisation of DRPs. Agreement within the EG as measured by κ' was high. This indicates that the use of pre-defined categories of DRPs on a standardised form can contribute to detect valid DRPs.

There were several suggestions for alternative categorisations, 26 in total. Within the EG, however, there was little consistency in the suggestions of re-categorisation. This could be due to the members' different clinical background and the evaluations being performed retrospectively. Agreement within the EG was largest when assessing the community pharmacists' categorisation of a specific DRP (question 3) and somewhat lower regarding whether an identified DRP actually constituted a DRP (question 2). The EG, in other words, in some instances disagreed as to whether there was a DRP present, but when they seconded the community pharmacist's opinion, they largely agreed with the chosen category.

Clinical/practical relevance

Clinical/practical relevance of the DRPs (question 4) was scored as high in most of the cases. The agreement within the EG was lower with regard to this, which probably can be explained by the different occupations, experiences and workplaces of the EG members and the retrospective approach.

The community pharmacists' follow-up of the patient (question 5) was evaluated as good/satisfactory, and there was a relatively high degree of agreement within the EG. The total number of documented follow-ups with the physician was low, presumably due to the fact that many DRPs were clarified at the pharmacy without need of contacting the physician. This corresponds to a finding in another study of pharmacist–physician communication in pharmacies [27]. In the cases where the physician was contacted, there was a high agreement within the EG regarding the quality of the follow-up (question 6).

Additional DRPs identified by the evaluation group

In spite of the retrospective review, the EG identified DRPs in addition to those found by the community pharmacists, both in patients where DRPs were identified and in those where no DRPs were recorded. A possible explanation for some of the additional DRPs is that they were identified in the dialogues at the pharmacies, but immediately recognised as unproblematic and thus not regarded as a DRP. An example would be that the pharmacist had anticipated or recorded gastrointestinal adverse drug reactions related to metformin use, but during the patient interview she/he had clarified this issue with the patient and as such this was not recorded as a DRP.

There was a relatively low degree of agreement in the EG regarding the additional DRPs. A total of 20 DRPs were identified by more than one member of the EG. Of these, adverse drug reactions (ADRs) represented seven cases.

Limitations of the study

The pharmacists received the same course in how to perform medication reviews and documenting findings. The number of medication reviews performed and the frequency of detected DRPs varied significantly between participants, from six to one medication reviews and from six to none identified DRPs per medication review. The pharmacists had different backgrounds for detecting DRPs as reflected in different level of education, experience, communication skills, motivation, work situation and patients selected. A different choice of protocol to detect DRPs might have led to other DRPs being documented [33].

This study enrolled patients consenting to take part at the point of having prescriptions dispensed in the pharmacy. A selection bias in both recruiting pharmacists (signing up for the course) and patients (convenience sample of patients) can have affected the findings. The findings as such are therefore based on patients with time and interest in a medication review, and generalisation may thus be limited.

The EG's possibility to identify and categorize DRPs was limited by the retrospective approach, as the documentation delivered by the community pharmacists represented second-hand information of varying quantity and quality.

Future studies

Further research on how to support pharmacists in using DRP categories in medication reviews and patient interviews should be performed to improve the quality of medication reviews and promote systems for inter-professional cooperation.

Conclusion

Many patients have drug-related problems which can be identified through medication reviews including patient interviews, and solved based on pharmaceutical judgement. The most frequent DRP was adverse drug reactions, and the prescribed drugs connected to DRPs were drugs used for treatment of the patient's type 2 diabetes. The prescriber was contacted on every third DRPs, and the EG scored the follow up of patients and the contact with the physicians to be good or satisfactory.

The EG reported high agreement with the community pharmacists in finding and categorising of DRPs, and as such, the pre-defined categories of DRPs supported by an interview guide can contribute to the identification of DRPs. Furthermore, the evaluation demonstrated that community pharmacists were able to identify DRPs of high or medium clinical/practical relevance.

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