Pharmaceutical Care Practice –

Drug-related Problems and Opportunities for New Services

Inauguraldissertation

zur

Erlangung der Würde eines Doktors der Philosophie

vorgelegt der

Philosophisch-Naturwissenschaftlichen Fakultät

der Universität Basel

von

Patrick Marc Eichenberger

aus Lenzburg (AG)

Basel, 2010

Genehmigt von der Philosophisch-Naturwissenschaftlichen Fakultät
auf Antrag von

Prof. Dr. Kurt Hersberger
Prof. Dr. Dr. Stephan Krähenbühl

Basel, den 27. April 2010

Prof. Dr. Eberhard Parlow
Dekan

creative commons

Namensnennung-Keine kommerzielle Nutzung-Keine Bearbeitung 2.5 Schweiz

---

Sie dürfen:

das Werk vervielfältigen, verbreiten und öffentlich zugänglich machen

Zu den folgenden Bedingungen:

Namensnennung. Sie müssen den Namen des Autors/Rechteinhabers in der von ihm festgelegten Weise nennen (wodurch aber nicht der Eindruck entstehen darf, Sie oder die Nutzung des Werkes durch Sie würden entlohnt).

Keine kommerzielle Nutzung. Dieses Werk darf nicht für kommerzielle Zwecke verwendet werden.

Keine Bearbeitung. Dieses Werk darf nicht bearbeitet oder in anderer Weise verändert werden.

- Im Falle einer Verbreitung müssen Sie anderen die Lizenzbedingungen, unter welche dieses Werk fällt, mitteilen. Am Einfachsten ist es, einen Link auf diese Seite einzubinden.
- Jede der vorgenannten Bedingungen kann aufgehoben werden, sofern Sie die Einwilligung des Rechteinhabers dazu erhalten.
- Diese Lizenz lässt die Urheberpersönlichkeitsrechte unberührt.

Quelle: http://creativecommons.org/licenses/by-nc-nd/2.5/ch/ Datum: 3.4.2009

To my family

Acknowledgements

This work was carried out at the Pharmaceutical Care Research Group at the University of Basel and was supervised by Prof. Dr. sc. nat. Kurt E. Hersberger and Prof. Dr. med. Dr. pharm. Stephan Krähenbühl.

My thanks belong to all the people who had contributed in any way to the accomplishment of this thesis.

First of all, I would like to thank sincerely Prof. Dr. Kurt E. Hersberger for his unrestricted support, his enthusiasm and helpfulness during the whole thesis. I am very grateful for all the interesting and inspiring discussions, his valuable ideas and his untiring dedication.

I wish to express my gratitude to Prof. Dr. Dr. Stephan Krähenbühl for supporting this thesis and for assuming the co-reference. His helpful suggestions contributed to the accomplishment of this thesis.

Many thanks belong to Dr. phil. Markus Lampert and to Dr. med. Manuel Haschke for their support in several projects and to Prof. Dr. med. Rudolf Bruppacher for his support in analysis and for his helpful inspirations in the framework of the seminar in clinical pharmacy.

My thanks go to Prof. Dr. Christoph Meier for accepting the function of representative of the Faculty.

I would like to thank Senglet Foundation (Basel, Switzerland) and Förderinitiative Pharmazeutische Betreuung e.V. (c/o ABDA, Bundesvereinigung Deutscher Apothekerverbände) for the financial support.

Many thanks go to all colleagues of the Pharmaceutical Care Research Group, especially to Seraina Mengiardi, Dr. Jörg Indermitte, Philipp Walter, Fabienne Böni,

Esther Spinatsch, Dr. Vera Bernhardt, and Dr. Isabelle Arnet as well as to all colleagues of the Pharmacoepidemiology Unit and the Clinical Pharmacology and Toxicology, especially to Patrick Imfeld, Dr. Yolanda Brauchli, Dr. Birk Poller, Dr. Felix Hammann, Dr. Sabin Egger, Dr. Alexandra Rätz Bravo, Peter Mullen, Carmen Franz, Dr. Marcel Bruggisser, Cornelia Schneider, and Julia Spöndlin.

I would like to thank Flavia Gregorini, Barbara Slejska and Romina Caluori for their excellent work in the framework of their master theses in our team.

At this point I would like to express my gratefulness to my parents Silvia und Eugen and to my brother Reto for their great sympathy, always motivating encouragement and for giving me the opportunity to do these studies but above all for their deep love and incredible everlasting support.

Abbreviations

ABDA	Confederation of German pharmacists' associations
ADE	Adverse drug event
ADR	Adverse drug reaction
AFS	Automated forms processing
ANOVA	Analysis of variance
ASHP	American Society of Hospital Pharmacy
BP	Blood pressure
BPCS	Behavioural pharmaceutical care scale
cDUR	Concurrent drug utilization review
CH	Switzerland (Confoederatio Helvetica)
CHD	Coronary heart disease
CI	Confidence interval
CMR	Clinical medication review
CPCF	Community pharmacy contractual framework
CPD	Continuing professional development
CPS	Cognitive pharmaceutical service
CV(D)	Cardiovascular (disease)
DDI	Drug-drug interaction
DFI	Drug-food interaction
DK	Denmark
DMMR	Domiciliary medication management review
DRP	Drug-related problem
DRR	Drug regimen review
DUE	Drug use evaluation
DUR	Drug utilization review
EKBB	Ethics Committee of Basel
EQ-5D™	EuroQol 5D
FVC	Forced vital capacity
GER	Germany
GP	General practitioner

HF	Heart failure
HV	Home visit
HMR	Home medicines review
IQR	Interquartile range
MRR	Medication regimen review
MRRF	Medication-related risk factor
MTM	Medication therapy management
MUR	Medicines use review
NCCP-MERP	National coordinating council for medication error reporting and prevention
NHS	National Health Service
OTC	Over-the-counter
PAS®	Problems, assessment, and solutions
PBM	Pharmacy benefit manager
PC	Pharmaceutical care
PCNE	Pharmaceutical Care Network Europe
pDUR	Prospective drug utilization review
PI-Doc®	Problem-Intervention-Documentation
PIE	Problem, Intervention, Ergebnis (Outcome)
PMC	Polymedication check
POM	Prescription-only medicine
PQ	Postgraduate qualification
QC	Quality circle
rDUR	Retrospective drug utilization review
RCT	Randomized controlled trial
RMMR	Residential medication management review
SD	Standard deviation
SF-36	Short Form 36
SHB-SEP	The Health Base Foundation – subjective/objective, evaluation, plan
SOEP	Subjective, objective, evaluation, plan
UK	United Kingdom
US	United States
V	Version

Table of contents

Summary

Within the last decades, the role of the pharmacist and of pharmacy practice have moved from that of drug manufacturing and technical dispensing to a more cognitive role with patient orientation. The concept of pharmaceutical care focuses on the process of ‘using a drug’, bearing in mind that the dispensing of a drug is neither the beginning nor the end of this process. Pharmaceutical care is based on a relationship between the patient and the pharmacist who accepts responsibility for the patient. The concept implies the active participation of the patient in making decisions regarding his/her pharmacotherapy. Assessment of drug-related problems (DRPs), development of a care plan and its evaluation, as well as a continuous follow-up are important steps of the pharmaceutical care process. However, much of the impetus for pharmaceutical care provision has been driven by academics, and only limited published data on the extent to which pharmaceutical care has been adopted and implemented are available. This is particularly true for community pharmacy practice, at a national as well as international level.

Drug-related problems are very common in primary care and in hospital settings. To evaluate the benefit of pharmaceutical care, we need tools to describe DRPs and measure their impact on patient outcomes. Pharmaceutical care practitioners need to be aware of common pattern of inappropriate care and the associated risk for adverse outcomes when they want to manage drug therapy successfully. In turn, our knowledge about the nature, prevalence, and causes of drug-related morbidity has to derive from practice. The classification of identified DRPs is useful to simplify the analysis, documentation, and prevention of further problems. However, no accepted standard tool for classification and documentation of DRPs has been made available so far.

Clinical pharmacy is a commonly used term in pharmacy practice and pharmacy literature. The term includes all services performed by pharmacists practising in hospitals, community pharmacies, nursing homes, home-based care services, clinics, and any other setting where medicines are prescribed and used. The term ‘clinical’ does not necessarily imply an activity implemented in a hospital setting. A community

pharmacist as well as a hospital practitioner may perform clinical activities. Clinical pharmacists' activities aim at maximising the clinical effect of medicines, minimising the risk of treatment-induced adverse events, and minimising the expenditures for pharmacological treatments. Medication reviews on individual patient level form a central part of this process. Although recent studies indicated that pharmacist-led medication reviews and home visits are potentially beneficial, it is still an open question if tailored medication reviews are needed.

This thesis aimed to focus on different aspects of pharmaceutical care, i.e.

- to investigate the provision of pharmaceutical care by community pharmacists across Europe and to closely examine the factors that could affect its implementation in Switzerland and Germany,
- to explore the occurrence, nature, and the pharmacist's management of DRPs with new prescriptions and to determine patients' knowledge about newly prescribed medication shortly after the pharmacy visit,
- to gain first experience with home visits of chronically ill patients.

The concept of pharmaceutical care has been adopted by professional pharmacy associations and academic training programmes throughout the world and has redirected the focus of the pharmacist's role within community practice from a traditional dispensing role to a more outcome-oriented, patient-centred practice. The aim of **project A** was to evaluate the current provision of pharmaceutical care by community pharmacists across 13 European countries and the impact of a range of factors that could affect its implementation. For this study, the behavioural pharmaceutical care scale (BPCS) was used. A total of 4,696 questionnaires were obtained (overall response rate of 25.3%). The mean total BPCS scores ranged from 50.6 (Denmark) to 83.5 (Ireland). Ireland had significantly higher total scores than other countries. Denmark had the lowest mean total score, followed by Sweden. In general, pharmacists scored less well on 'direct patient care activities' (means ranged from 17.9% to 43.8% of the maximum achievable score) than on the 'referral and consultation' (means ranged from 39.4% to 70.1%) or the 'instrumental activities' dimension (means ranged from 50.6% to 70.3%). In England and Ireland, the provision of pharmaceutical care was more extensive if more pharmacists were

employed by a certain pharmacy. Furthermore, ‘referral and consultation activities’ in both countries increased with increasing number of employed pharmacists. The latter situation was also true for Switzerland and Belgium. In Sweden and Portugal, the total number of full-time pharmacists had a positive impact on the score obtained for ‘direct patient care activities’ which specifically seeks to capture pharmacists’ efforts to provide pharmaceutical care.

The results of project A suggest that the provision of pharmaceutical care in a comprehensive fashion is still limited within Europe. Pharmacists rarely documented activities related to patient care and did not often evaluated patients’ perceived status or engaged in implementing therapeutic objectives and monitoring plans.

Because of the different healthcare systems in Germany (GER) and Switzerland (CH; several regions with dispensing doctors [DDs] in Switzerland), we used the opportunity to amend the BPCS questionnaire with specific questions. Our aim was to perform an in-depth analysis in **project B** and to compare these results with a sample of specialised quality circle (QC) pharmacists. After completion of our surveys among these three samples, we realised with surprise that Denmark (DK) had scored lowest although several pharmaceutical care services had already been implemented there. With this study, we aimed to explore differences between standard pharmacists, pharmacists participating in quality circles, and Danish pharmacists. Moreover, differences between Swiss pharmacists in regions with or without DDs were of interest, as well as discussion of the BPCS’ reliability and applicability as a research tool for pharmacy practice. Response rates ranged from 10.1% (GER) to 59.9% (QC). The mean total score achieved by community pharmacists, expressed as a percentage of the total score achievable, ranged from 31.6% (DK) to 45.8% (CH). The specialised QC and Danish pharmacists reached significantly lower scores in some dimensions and domains than Swiss and German pharmacists (e.g. dimension: direct patient care activities; domains: documentation, patient record screening, discussion of drug therapy, or verification of patient understanding).

Our results show that pharmacies in all regions are adequately equipped to provide pharmaceutical care. However, the provision of pharmaceutical care mainly occured

when pharmacists were supported by their computer system, while individual patient approaches seem to be less frequent. Surprisingly, specialised QC pharmacists had lower scores than standard community pharmacies. This result casts doubt on the results of the whole BPCS study, and the question arises if the BPCS is a sensitive scale to enable a conclusion about the extent to which pharmaceutical care is provided to patients.

Many studies have shown DRPs to be very common in primary care and hospital settings. Patients with at least one new prescribed drug represent a relevant population for the study of DRPs, especially for studying the applicability of a comprehensive classification system which includes technical DRPs.

The aims of **project C** were to explore the occurrence of DRPs with new prescriptions and to analyse differences between primary care and hospital discharge as well as between electronically printed and handwritten prescriptions. Furthermore, we aimed to evaluate the applicability of a modified classification system. Prescriptions of 616 patients were analysed. The patients received a median of 3 (range 2−19) different drugs. In 121 (19.6%) prescriptions, 141 clinical DRPs were detected. The most frequent clinical DRPs were potential drug-drug interactions (DDIs; 37.6%), drug choice (24.8%), and drug use problems (15.6%). These clinical DRPs led to a total of 299 interventions. There were 222 prescriptions (36.0%) that contained 278 technical DRPs, resulting in a total of 417 interventions. The most frequent technical DRPs were missing or unclear package size or therapy duration (32.7%) and missing or unclear dosing/application instructions (30.9%).
The results of this study showed that clinical and technical DRPs were frequently observed and that the number of prescribed drugs was the only factor with an influence on the frequency. The modified Pharmaceutical Care Network Europe (PCNE) classification system, especially the amendment with a technical DRP category, proved to be useful and allowed the classification of all DRPs.

To get insight into the patients' medication management and to identify DRPs, it may be useful to visit patients at home. Medication review has been shown to be an effective service to identify DRPs although some randomised controlled trials failed to prove effectiveness. With **project D** – a pilot study – we set the goal to explore

patients' knowledge about newly prescribed medication and to gain first experiences in performing home visits. We conducted 70 phone interviews with patients who received newly prescribed medications some days ago. Only 35% of drug names could be given by patients (10% of gastrointestinal and 20% of cardiovascular drugs). However, 92% of all stated purposes of drugs were correct (60% of cardiovascular drug purposes were known). Patients knew the duration of intake in 89% of cases, frequency or timing in 96% of cases, and the number of tablets of all drugs in 84% of cases.

Out of 70 interviewed patients, 20 agreed to be visited at their home. The mean (SD) age of patients was 59.2 (16.2) years. The mean (SD) duration of a visit was 42.9 min (24.3), ranging from 15 to 125 min. We recorded a mean (SD) number of 4.6 (2.5) drugs per patient. Seventeen (85.0%) patients got their drugs from a single pharmacy. Two (10.0%) patients had drug use problems (e.g. big tablets), seven (35.0%) suffered from adverse drug events (e.g. gastro-intestinal problems, headache). No patient used a medicine cupboard. Seven (35%) patients experienced moderate or severe interactions.

The patients' knowledge a few days after receiving newly prescribed drugs was rather good (except for drug names and potential adverse effects). Home visits showed to be a feasible service, presumably also for community pharmacists.

The structured interview guide for home visits developed for project D proved to be a useful tool. This pilot study gave important information on potential improvements of the interview guide, which were incorporated in the subsequent main study. In **project E,** we analysed the number and pattern of DRPs and assessed the patients' knowledge. We also explored opportunities for pharmaceutical care at the patients' home. Two investigators visited 54 diabetes type 2 (DM) and 22 solid organ transplant (Tx) patients in their homes, using a structured interview guide specifically developed for this study. We identified a mean of 7.4 ± 2.4 DRPs per visited patient, with significant differences between Tx and DM patients (6.3 ± 1.7 vs. 7.8 ± 2.5; p=0.010). All patients had at least one DRP. The most relevant DRPs in Tx and DM patients were uncertainty about one or multiple purposes or justification of drugs (36.4% and 48.1%), uncertainty about potential adverse effects (31.8 and 50.0%), no

basic knowledge about potential interactions such as with grapefruit, St. John's wort, and/or beta-blockers (18.2% and 61.1%), no medication administration routine (36.4% and 37.0%), confusion of generic and trade names (27.3% and 74.1%), and risk for non-adherence (77.3% and 61.1%). In the case of a missed dose, 27.3% (Tx) and 61.1% (DM) of patients would 'just ignore it'. The mean number of drugs was 12.5 ± 4.4 (Tx) and 13.9 ± 5.4 (DM). Among all patients, 11 (14.5%) reported to have problems with their drugs (e.g. swallowing, opening of a bottle, use of a pipette). If interviews had been conducted at the pharmacies rather than the patient homes, we most probably would have detected only 3.6 ± 1.5 (48.6%) DRPs. Thus, we reason that 51.4% of all DRPs were only identified because we performed visits at the patient's home.

The results of this study indicated that home visits allowed to identify more DRPs than would have been detected with a medication review in the pharmacy and that more tailored interview guides for different diseases would enable more efficient home visits.

In **conclusion** this thesis showed the following:

- The provision of pharmaceutical care in a comprehensive fashion is still limited within Europe. Pharmacists routinely screened patient records and verified patient understanding but rarely documented activities related to patient care, evaluated patients' perceived status, engaged in implementing therapeutic objectives and monitoring plans, or self-evaluated their performance in providing pharmaceutical care on regular basis. There is substantial room for improvements.

- Pharmacies are adequately equipped to provide pharmaceutical care. However, the provision of pharmaceutical care mainly occured when pharmacists were supported by their computer system. If the results are presented in detail, they are much more meaningful than when aggregated in domains and dimensions. However, the question arises if the BPCS scale is sensitive enough to enable a conclusion about the extent to which pharmaceutical care is provided to patients. Thus, further efforts are needed to

develop valid assessment tools including indicators for pharmaceutical care activities.

- Clinical and technical DRPs are frequently observed in new primary care and in hospital discharge prescriptions. Their occurrence was only influenced by the number of prescribed drugs. Therefore, management of DRPs in community pharmacies is a very important activity. The modified PCNE classification system proved to be useful and allowed the classification of all DRPs, but remained rather complicated to apply in pharmacy practice.

- The patients' knowledge a few days after receiving newly prescribed drugs was rather good (except for drug names and potential adverse effects), indicating that patients obtaining their drugs from a pharmacy were well informed. Home visits of such patients showed to be a feasible service, presumably also for community pharmacists.

- Home visits of chronically ill patients allowed assessing more DRPs than would have been detected with an interview at the pharmacy. Transplant patients showed significantly less DRPs than diabetes patients who were often confused about generic and trade names, hoarded drugs, and had gaps in knowledge about interactions and purpose of drugs. These aspects represent important opportunities for pharmaceutical care. The interview guide developed specifically for the purpose of this study proved useful in the selected patient population. More tailored interview guides for different diseases would enable more efficient home visits.

1 General introduction

1.1 Pharmaceutical care

1.1.1 Development of pharmaceutical care

Within the last decades, the role of the pharmacist and of pharmacy practice have moved from that of drug manufacturing and technical dispensing to a more cognitive role with patient orientation [1]. Pharmaceutical care was first defined by Mikeal et al. in 1975 [2] as “the care that a given patient requires and receives which assures safe and rational drug usage”. The concept of pharmaceutical care focuses on the process of ‘using a drug’, bearing in mind that the dispensing of a drug is neither the beginning nor the end of this process [3, 4]. According to the definition of Hepler and Strand [5, 6], pharmaceutical care is “the responsible provision of medicine therapy for the purpose of definite outcomes that improve a patient’s quality of life”.

Pharmaceutical care is based on a relationship between the patient and the pharmacist who accepts responsibility for the patient. The concept implies the active participation of the patient in making decisions regarding his/her pharmacotherapy and the interdisciplinary cooperation of healthcare providers, and gives priority to the direct benefit of the patient. Assessment of drug-related problems (DRPs), development of a care plan and its evaluation, as well as a continuous follow-up are important steps of the pharmaceutical care process [4, 7]. Patient expectations and desired quality of life are important factors to ensure the best possible medication outcome, and to possibly prevent recurrence of disease. Pharmaceutical care is an indispensable element of patient centred healthcare and requires a change of traditional professional attitudes, a re-engineering of the pharmacy environment, the use of new technologies, and the acquisition of knowledge as well as skills in the areas of patient assessment, clinical information, communication, adult teaching, and psychosocial aspects of care [4].

The term ‘pharmaceutical care’ has established itself as a philosophy of practice, with the patient and the community as the primary beneficiaries of the pharmacist’s actions. The concept is particularly relevant to special groups such as the elderly,

mothers and children, and chronically ill patients. The model of pharmaceutical care is perhaps most advanced in the United Kingdom (UK) as evidenced by the new National Health Service (NHS) contractual frameworks for community pharmacy (CPCF) [8].

Clinical pharmacy is a commonly used term in pharmacy practice and in pharmacy literature. It is a health specialty which describes the activities and services of the clinical pharmacist to develop and promote the rational and appropriate use of medicinal products and devices [9]. The term includes all services performed by pharmacists practising in hospitals, community pharmacies, nursing homes, home-based care services, clinics, and any other setting where medicines are prescribed and used. The term ‘clinical’ does not necessarily imply an activity implemented in a hospital setting. A community pharmacist as well as a hospital practitioner may perform clinical activities. Clinical pharmacists’ activities aim at maximising the clinical effect of medicines (i.e. using the most effective treatment for each type of patient), minimising the risk of treatment-induced adverse events (i.e. monitoring the therapy course and the patient’s compliance with therapy), and minimising the expenditures for pharmacological treatments [9] driven by the national healthcare systems and the patients (i.e. trying to provide the best treatment for the greatest number of patients). Medication reviews on individual patient level form a central part of this process. A literature review found that clinical pharmacy interventions in inpatient medical care contribute to improved patient outcomes [10]. A number of studies have demonstrated the clinical and economic benefits of clinical pharmacy interventions in hospital and primary care settings [11-15].

The World Health Organization (WHO) and others consider community pharmacists to be ideally positioned to play important roles in facilitating improved patient adherence by, among others, providing patients with cognitive pharmaceutical services (CPS) that include the provision of appropriate health-related information and counselling to promote self-care and the correct use of medicines [16-19]. There is ample evidence that pharmaceutical care and CPS have been successfully applied by pharmacists across a range of disease entities and in different pharmacy practice settings [20-25]. Comprehensive or cognitive pharmacy services involve activities both to secure good health and to avoid ill-health in the population. When ill-health is

treated, it is necessary to assure quality in the process of using medicines in order to achieve maximum therapeutic benefit and avoid untoward side-effects. This presupposes the acceptance by pharmacists of shared responsibility with other professionals and with patients for the outcome of therapy [1].

1.1.2 Effectiveness of pharmaceutical care

We found four reviews covering the period up to the end of 2003: a Cochrane review included 25 studies between 1966 and 1999 with more than 16,000 patients and was published in 2006 [26]. They compared 1. pharmacist services targeted at patients vs. services delivered by other health professionals; 2. pharmacist services targeted at patients vs. the delivery of no comparable service; 3. pharmacist services targeted at health professionals vs. services delivered by other health professionals; 4. pharmacist services targeted at health professionals vs. the delivery of no comparable service. Comparison 1: scheduled service utilisation was slightly increased, whereas hospital admissions and emergency room admissions were decreased. Comparison 2: pharmacist services reduced the use of health services, the number of specialty physician visits, or the number and costs of drugs, compared to control patients. Improvements in the targeted patient condition were reported in 10 of 13 studies that measured patient outcomes, but patients' quality of life did not seem to change. Comparison 3: the intervention delivered by the pharmacist was less successful than that delivered by physician counsellors in decreasing inappropriate prescribing. Comparison 4: all studies demonstrated that pharmacist interventions produced the intended effects on physicians prescribing practices. The authors concluded that only two studies compared pharmacist services with other health professional services. Both had some bias and did not allow drawing conclusions about comparisons 1 and 3.

An evidence report issued in 2004 by the Danish College of Pharmacy Practice (Pharmakon) [27] about the follow-up on outcomes of drug therapy (Pharmaceutical Care) covered 44 studies between 1990 and October 2003 [28]. This report showed strong evidence that pharmaceutical care can positively influence clinical parameters (blood pressure [BP], blood sugar, and cholesterol) and that there is a positive influence on health-related quality of life of asthma patients and patients with

elevated cholesterol levels, hypertension, and diabetes. However, three out of five studies in elderly patients showed no difference between intervention and control groups. There is a tendency that programmes for the elderly do not affect drug use, and the authors found evidence for the cost effectiveness of pharmaceutical care programmes, patient satisfaction, and increased adherence (but not among the elderly), but evidence of improved knowledge was inconsistent. They concluded that pharmaceutical care programmes can contribute to solving DRPs of clinical significance and adverse drug events (ADE), that the acceptance rate among general practitioners (GPs) and patients is high, and that pharmaceutical care promotes more rational drug use among patients with elevated cholesterol levels and asthma patients.

A critical review, published by Blenkinsopp et al. in 2005 [29], about enhanced community pharmacy-based diabetes care included 17 studies between 1990 and 2003. They found only a few trials of community pharmacy-based interventions to improve diabetes care. However, the authors concluded that there is limited evidence of effectiveness of community pharmacy-based interventions in diabetes care.

A systematic review by Roughead et al. [30] of 2005 looking at the effectiveness of pharmaceutical care services in the community or outpatient setting on patient outcomes included 22 randomised, controlled trials from 1990 to 2003 [30] and provided an evidence base for the improvement of medication use. Within this review, studies showed improved surrogate endpoints such as changes in blood pressure, glycosylated haemoglobin (HbA_{1C}), lipids, and peak expiratory flow rates [23, 31-38]. However, improvement in other outcomes (e.g. morbidity and mortality [34, 36-44], knowledge or adherence [23, 33, 34, 39]) was less conclusive. The authors concluded that in future studies the outcome measure should be the resolution of medication-related problems as this is the focus of pharmaceutical care.

To cover the subsequent period after these reviews, we conducted a literature search on the effectiveness of pharmaceutical care over the last 6 years conducted at the end of March 2010 using the National Library of Medicine MEDLINE database. With the Medical Subject Heading (MeSH) ‘pharmaceutical services’ (‘pharmaceutical care’ is comprised within ‘pharmaceutical services’) we located 380 articles with the

following limits: review, meta-analysis, or randomized controlled trial (RCT); English or German language; all adult (>18 years) and humans. Sixteen studies (Table 1) and 7 reviews (Table 2) considering the effectiveness of pharmaceutical care were identified.

Out of 16 studies, 10 found positive effects with pharmaceutical care programmes [45-55]. However, the authors of 6 studies concluded that such programmes did not lead to reductions in hospital admissions [56], had no positive impact on clinical outcomes or quality of life [57], and were even associated with a significantly higher rate of hospital admissions [58]. Furthermore, Salter et al. [59] claimed that pharmacist interventions have the potential to undermine and threaten the patients' assumed competence, integrity, and self-governance. Zermansky et al. [60] concluded that pharmacists' recommendations by clinical pharmacists were usually accepted and that there was a reduction in the number of falls but no changes or improvements of costs, hospitalisations, and mortality. Bond et al. [11] reported that pharmacist-led services were more expensive than standard care and that no change in the proportion of patients receiving appropriate medication was observed.

The reviews identified in the literature search that met the criteria found that there are significant positive effects on HbA_{1c} levels [61, 62], systolic BP [63], and total cholesterol [64] as well as on low-density lipoprotein (LDL-) cholesterol and triglyceride levels. In addition, there is evidence that clinical pharmacy interventions can reduce the occurrence of DRPs [65]. However, no improvements on high-density lipoprotein (HDL-) cholesterol levels [64], diastolic BP, and adherence [63, 64, 66] were found. Moreover, no effects were found on mortality and all-case hospital admission [66], and there was unclear evidence about effects on quality of life [63, 64, 66].

Overall, there the effectiveness of pharmaceutical care remains unclear. However, several studies and reviews could show benefit and evidence for different activities considering economic, clinical, and humanistic outcomes (ECHO). Furthermore, patients and pharmacists as well as physicians in many cases were satisfied with pharmaceutical care services. Further research with larger intervention studies with improved quality of design is needed.

Table 1: Studies investigating the effectiveness of pharmaceutical care

Study	Design	Participants	Interventions	Outcomes	Conclusions
Sorensen et al. 2004 [55]	RCT	- 400 patients at risk of medication misadventure in the community	- home visits (HVs) - pharmacist-led medication review - implementation of action plans in consultation with patients	- quality of life (Short Form 36; SF-36) and satisfaction - adverse drug events - no. of GP visits - hospital services - severity of illness - costs	- positive trends in adverse drug events, severity of illness, and costs - no improvement of quality of life
Holland et al. 2005 [67]	RCT (HOMER)	- 872 patients - age ≥80 - ≥2 drugs	- 2 pharmacist-led HVs	- hospital readmissions - death and quality of life (EuroQol 5D; EQ-5D)	- significantly higher rate of hospital admissions - no significant improvement of quality of life or reduction of no. of deaths
Sadik et al. 2005 [47]	RCT	- 104 patients - heart failure (HF)	- pharmacist-led patient education and counselling - instruction for self-monitoring - provision of booklet - daily exercise	- exercise tolerance, pulse - BP - body weight - forced vital capacity (FVC) - quality of life (Minnesota living with heart failure questionnaire (MLHF); SF-36) - self-reported adherence - knowledge	- improvements in exercise tolerance, FVC, quality of life (MLHF), and adherence - tendency to higher incidence of casualty department visits but a lower rate of hospitalization
Zermansky et al. 2006 [60]	RCT	- 661 residents - age ≥65 - ≥1 drugs	- pharmacist-led clinical medication review with patient and clinical records	- no. of changes in medication - no. and cost of repeat medicines - mortality, falls, hospital admissions, GP consultations, Barthel index, Standardised Mini-Mental State Examination (SMMSE)	- significant change in patients' medication regimens without change in drug costs - significant reduction in the no. of falls - no significant change in GP consultations, hospitalisation, mortality, SMMSE or Barthel score - clinical pharmacists' recommendations usually accepted
Lee et al. 2006 [48]	RCT	- 200 community-based patients - age ≥65 - ≥ 4 chronic drugs	- standardized pharmacist-led medication education - regular follow-up - blister packs	- proportion of pills taken (vs. baseline) - BP - LDL-C	- improvement of medication adherence and persistence, systolic BP and LDL-C - discontinuation of the programme was associated with decreased medication adherence and persistence

continued next page

Study	Design	Participants	Interventions	Outcomes	Conclusions
Cabezas et al. 2006 [45]	Randomized clinical trial	- 134 patients - HF	- pharmacist-led patient education - telephone follow-up	- hospital readmissions - days of hospital stay - treatment compliance - satisfaction and quality of life (EQ-5D) - financial savings	- improvement of treatment compliance and satisfaction - reduction of hospital readmissions and days of hospital stay - evidence for savings in hospital costs - no improvement of quality of life
Wu et al. 2006 [46]	RCT	- 442 patients - non-adherent - ≥5 drugs for chronic diseases	- pharmacist-led phone counselling	- all cause mortality - association between adherence and mortality	- reduced mortality and improved compliance - poor compliance was associated with increased mortality
Holland et al. 2007 [56]	RCT (HeartMed)	- 293 patients - HF	- 2 pharmacist-led HVs	- hospital readmissions - mortality and quality of life (MLHF and EQ- 5D)	- no reductions in hospital readmissions - improved quality of life with EQ-5D but not with MLHF
Lenaghan et al. 2007 [57]	RCT (POLYMED)	- 136 patients living at home - age >80 - ≥4 drugs - ≥1 medicines-related risk factor	- 2 pharmacist-led HVs and patient education - assessment of the need for adherence-aid	- non-elective hospital admissions - no. of deaths - care home admissions - quality of life (EQ-5D) - impact of prescribed drugs	- no reduction of hospital and care home admissions as well as no. of deaths - small decrease of quality of life - significant reduction of prescribed drugs
Salter et al. 2007 [59]	Qualitative discourse analysis	- 29 (out of 758) patients out of HOMER trial (2005) - age ≥80 - patients admitted to hospital	- pharmacist-led medication review - in-depth interviews before and after the review	- extent to which advice given by pharmacists was accepted and acknowledged by patients	- advice giving role of pharmacists during consultations has the potential to undermine and threaten the patients' assumed competence, integrity, and self governance - caution is needed in assuming that commonsense interventions necessarily lead to health gain
Bond et al. 2007 [68]	RCT (MEDMAN)	- 1493 patients - coronary heart disease (CHD)	- pharmacist-led medication management	- appropriate treatment - quality of life (SF-36, EQ-5D) - economic evaluation - patient risk of cardiovascular (CV) death and satisfaction	- no significant improvement of appropriate treatment and quality of life - no reduction of healthcare costs - improvement in satisfaction - no improved self-reported adherence
Green et al. 2008 [50]	RCT	- 778 patients - hypertension - age 25-75	- home BP monitoring - online training - pharmacist care management	- percentage of patients with controlled hypertension (<140/90) - changes in systolic and diastolic BP	- increased percentage of patients with controlled BP - improved BP control

continued next page

Study	Design	Participants	Interventions	Outcomes	Conclusions
Mehuys et al. 2008 [51]	RCT	- 201 patients - asthma	- pharmacist-led patient education	- level of asthma control (Asthma Control Test®; ACT)	- significantly improvement of ACT score - reduction of reliever medication use and night-time awakenings due to asthma - significant improvement of inhalation technique and adherence to controller medication
Mc Lean et al. 2008 [52]	RCT	- 227 patients - diabetes type 1 or 2 - BP >130/80	- pharmacist-nurse-led patient education and counselling - BP measurement - referral to the GP - follow-up visits	- systolic BP	- clinically important improvement of BP even in relatively well controlled hypertensive diabetes patients
Al Mazroui et al. 2009 [53]	RCT	- 240 patients - diabetes type 2	- pharmacist-led patient education and counselling - self-monitoring of glycaemic control - physical exercise	- HbA_{1C} - 10-year CHD risk score (British National Formulary and Framingham scoring)	- significant reduction of HbA_{1C}, systolic and diastolic BP as well as the 10-year CHD risk
Hugtenburg et al. 2009 [54]	Controlled intervention study	- 715 patients - discharged from a hospital - ≥5 drugs	- extensive pharmacist-led medication review and drug counselling at patients' home	- changes in medication - discontinuation of drugs prescribed at discharge - mortality - medication cost savings - patient satisfaction	- HVs resulted in the clearing of redundant home drug supplies - medication costs were slightly decreased - no reduction of mortality - patients were highly satisfied with the counselling at discharge from hospital by their community pharmacist

Table 2: Reviews investigating the effectiveness of pharmaceutical care

Study	Design	Studies	Outcomes	Results
Hanlon et al. 2004 [65]	Literature review	- 3 databases - 14 studies	- hospital admissions - resolution of DRPs - quality of life - knowledge - adherence	- considerable evidence for a reduction of DRPs - limited evidence that interventions reduced morbidity, mortality or healthcare costs
Royal et al. 2006 [69]	Systematic review and meta-analysis	- 14 databases - 38 studies	- hospital admissions - preventable drug-related morbidity - reduction of falls	- some evidence for reduction of hospital admissions through pharmacist-led medication review - no evidence for other interventions with the aim to reduce admissions or preventable drug-related morbidity
Machado et al. 2007 [61] Part I	Systematic review and meta-analysis	- 5 databases - 108 studies	- levels of HbA_{1c}	- HbA_{1C} is sensitive to pharmacists' interventions - several potentially sensitive outcomes were identified, but too few studies were available for quantitative summaries
Machado et al. 2007 [63] Part II	Systematic review and meta-analysis	- 4 databases - 98 studies	- systolic and diastolic BP - quality of life - adherence	- systolic BP is sensitive to pharmacist-led interventions - nonsensitive results in diastolic BP, quality of life, and adherence
Machado et al. 2008 [64] Part III	Systematic review and meta-analysis	- 6 databases - 23 studies	- LDL-cholesterol (LDL-C) - HDL-cholesterol (HDL-C) - triglycerides - total cholesterol - adherence - quality of life	- total cholesterol is sensitive to pharmacist-led interventions - LDL-C and triglyceride levels are possibly sensitive to pharmacist-led interventions - no impact on HDL-C levels was found - unclear evidence for improvements in adherence and quality of life - clinically relevant but not statistically significant reduction in triglycerides
Holland et al. 2008 [66]	Systematic review and meta-analysis	- 11 databases - 32 studies	- hospital admission (all cause) - mortality - no. of prescribed drugs	- no significant effect on all-cause hospital admissions - no significant improvement of mortality - slightly decrease of no. of prescribed drugs possible - interventions could improve knowledge and adherence - insufficient data to know whether or not quality of life is improved
Wubben et al. 2008 [62]	Systematic review	- 5 databases - 21 studies	- haemoglobin HbA_{1c} - BP - lipids	- clinical significance of reported improvements in HbA_{1c} - greater effect when pharmacists were afforded prescriptive authority - reduction of long-term costs by improving glycaemic control

1.2 Drug-related problems

1.2.1 Definition and terminology

There are several definitions of a DRP in the literature but all of them are very similar. One of the first definition by Hepler and Strand was “an event or circumstance involving drug treatment that actually or potentially interferes with the patient’s experiencing an optimum outcome of medical care” [6]. In the same year, Strand redefined his own definition of a DRP into “an undesirable patient experience that involves drug therapy and that actually or potentially interferes with a desired patient outcome” [70]. Six years later, Segal defined a DRP as “a circumstance of drug therapy that may interfere with a desired therapeutic objective” [71]. Table 3 shows the definition and terms associated with problems of pharmacotherapy.

Table 3: Definition and terms associated with problems of pharmacotherapy (DRPs)

Adverse drug event	Any injury related to the use of a drug, even if the causality of this relationship is not proven [72].
Adverse drug reaction	Any response to a drug which is noxious and unintended and which occurs at doses normally used in humans for prophylaxis, diagnosis or therapy of diseases, or for the modification of physiological functions [73].
Medication error	Any error in the medication process (prescribing, dispensing, administering of drugs), whether there are adverse consequences or not [72].

In 1999, the Pharmaceutical Care Network Europe (PCNE) defined a DRP as “an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes” [74]. Only one year later, van den Bemt et al. [75] defined DRPs as “all problems, which can potentially affect the success of pharmacotherapy in a given patient, in particular medication errors, adverse drug events and adverse drug reactions (ADRs)”. In a review of DRPs in hospitals, published by Krähenbühl-Melcher et al. [76] in 2007, a DRP was defined as “all circumstances that involve a patient’s drug treatment that actually, or potentially, interfere with the achievement of an optimal outcome” (Fig. 1). The term medication-related problem is often used in the definition of a DRP.

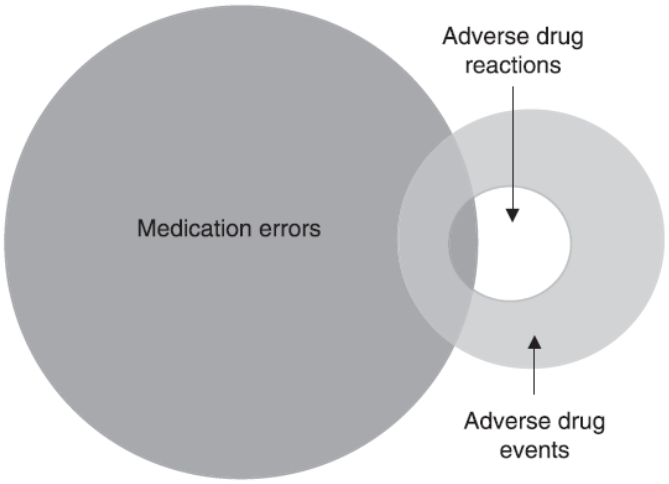

Fig. 1: Drug-related problems can be illustrated by the intersections of three circles representing medication errors, adverse drug events, and adverse drug reactions (Krähenbühl-Melcher et al. [76]).

1.2.2 Prevalence of drug-related problems

Many studies have shown DRPs to be very common in primary care and in hospital settings [6, 76-91]. In both settings, there is evidence that pharmacists' interventions can reduce the occurrence of DRPs [65, 76, 84, 89, 90]. A study in community pharmacies [92] showed that the detection rate of DRPs in community pharmacies was eightfold higher than in pharmacies that did not provide any pharmaceutical care. Studies in the hospital setting aimed at reducing the frequency of DRPs [93, 94].

Tarn et al. [95] found that physicians stated the specific medication name for 74% of new prescriptions and explained the purpose of the medication in 87% of cases. Adverse effects were addressed for 35% and duration of intake for 34% of medications. Physicians explicitly instructed 55% of patients about the number of tablets to take and explained the frequency or timing of dosing in 58% of cases. Thus, patients receiving their prescribed drug at a pharmacy are likely to have substantial deficits in knowledge about their drugs. Therefore, counselling patients, in particular on a newly prescribed drug, seems to be very important. As shown in previous studies, patients who were more fully informed about their medication are more adherent [96]. Before patients start with their new drug therapy, pharmacies are the last 'check point' to ensure that the patient understands the prescribed drug

therapy. Pharmacists are in an optimal position to prevent, identify, and solve DRPs because of their education and regular contacts with patients because they are obliged by law to validate prescriptions before dispensing a drug. In addition to DRPs with prescription-only medicines (POM), risks by self-medication pose a further important problem as we could show in an earlier study [97].

A review issued in 2009 [98] included 40 research articles between 1993 and 2007 and found counselling rates of community pharmacists between 8% and 100%: there were higher rates with new than with regular prescriptions and information about use, dose, medicine name, and indications were more frequently given than information on side effects, precautions, potential interactions, contraindications, and storage. Although such quoted rates may not be entirely reliable, pharmacists appear to have fulfilled the minimum legislative requirements or practice standards.

The possible causes of DRPs may be identified by the prescriber, pharmacist, or patient. Thus, interventions to prevent adverse outcomes due to DRPs must take place at these levels [99]. Any deviation from the intended beneficial effect of a drug therapy results in a DRP [99, 100]. An optimal therapeutic outcome is only achieved with the absence of DRPs [6, 99]. Examples of DRPs are adverse drug events or reactions, inappropriate drug choice, dosage or drug therapy, or inappropriate use of a drug, such as handling problems, for example.

1.2.3 Consequences of drug-related problems

Problems with pharmacotherapy have consequences for the patient [75, 76, 101, 102] resulting in costs for the hospitals [76, 103-105] and healthcare systems. Therefore, drug-related mortality and morbidity pose a major problem to healthcare systems. The costs of preventable drug-induced illnesses in the elderly population are substantial, with estimates of €7.5 billion annually in Canada and €131 billion in the United States [78, 106-108]. Costs associated with DRPs probably even exceed the expenditures for the cost of the medications themselves [109, 110]. In the elderly, 10% to 31% of hospital admissions are associated with DRPs, such as inappropriate prescribing, ADRs, and non-adherence [108, 111-113]. The rates of drug-related hospital admissions found in two meta-analyses [109, 114] amounted to 5.3%, and

Winterstein et al. [115] found a median preventability rate of drug-related hospital admissions of 59%. A review published in 2008 [116] included 25 studies and involved 106,586 hospitalized patients. On average, 5.3% of hospital admissions were associated with ADRs. The results suggest higher prevalence rates than those shown in an earlier systematic review. Lazarou et al. [117] reviewed 21 prospective studies published between 1966 and 1996 and estimated that 4.7% of hospital admissions were associated with ADRs. This difference is possibly due to the fact that Kongkaew et al. [116] focused the review on prospective observational studies that have used a well-established and consistent ADR definition.

In patients with ADRs, duration of hospital stays was increased by 2.2 to 3.2 days, and hospital costs were increased by €2400 to €3450, compared with patients who did not have any ADRs [118]. Antibiotics, anticoagulants, digoxin, diuretics, hypoglycaemic drugs, antineoplastic drugs, and nonsteroidal anti-inflammatory drugs (NSAIDs) are responsible for 60% of ADRs leading to hospital admission and 70% of ADRs occurring during hospitalization [119]. Pharmacists could play a crucial role in educating patients about potential ADRs so that they are not misinterpreted as another medical problem [120].

There is a need to reduce economic and medical burdens caused by DRPs by their identification, prevention, and solution in the process of pharmaceutical care [121]. The identification of patients at risk and an accurate management of their drug therapy are important challenges for healthcare professionals to avoid serious clinical consequences caused by ADRs [99]. This process of maximizing the benefits and minimizing the risks of a drug therapy for individual patients is complex and there are many steps where errors can occur [99]. The mission of healthcare providers is to provide systematic pharmaceutical care to reduce preventable drug-related morbidity and mortality [6].

1.2.4 Classification systems of drug-related problems

One rationale for classification systems is that researchers and practitioners need better information about the nature, prevalence, and causes of drug-related morbidity [74], defined as the manifestation of a DRP, preventable or not, with clear adverse

consequences for a patient's health [74]. This information will assist in creating awareness and identifying interventions to improve drug therapy outcomes [74]. Furthermore, to evaluate the benefit of pharmaceutical care, we need tools to describe DRPs and measure their impact on patient outcomes [74]. Pharmaceutical care practitioners need to be aware of common patterns of inappropriate care and the associated risk for adverse outcomes when they want to manage drug therapy successfully. [74]. In turn, our knowledge about the nature, prevalence, and causes of drug-related morbidity has to derive from practice. [74]. The classification of identified DRPs is useful to simplify the analysis, documentation, and prevention of further problems.

Thus, (1) screening and documenting of DRPs, (2) structured assessment of the findings and the development of guidelines and indicators for quality improvement initiatives, and (3) their application in practice represent a self-learning system: the pharmaceutical care system [74]. Furthermore, together with the anatomical therapeutic chemical classification (ATC) code, a classification system can be used to develop national databases [122]. These databases could serve as the basis for epidemiological studies (e.g. to elucidate which drug classes or patient groups cause which problems) or to document the causes and solutions of certain problems [70, 122]. In conclusion, a common, universally accepted, and practical reporting system for DRPs and drug-related morbidity is needed [74] for the development of pharmaceutical care practice [70, 123].

A number of classification systems are being used globally [121]. Fifteen different systems have been found in literature [121]:

- ABC of DRPs (The Netherlands)
- ASHP Classification (American Society of Hospital Pharmacists; USA)
- Cipolle et al. (Drug-therapy problems; USA)
- Granada Consensus (Spain)
- Hanlon Approach (USA)
- Hepler / Strand (USA)
- Krska et al. System (UK)
- Mackie Classification (UK)

- NCC-MERP Taxonomy of Medication Errors (National coordinating council for medication error reporting and prevention; USA)
- PAS Coding System (Problems, assessment, and solutions; The Netherlands)
- PCNE System (Europe)
- PI-Doc (Problem-Intervention-Documentation; Germany)
- PIE System (Problem, Intervention, Ergebnis; Germany)
- SHB-SEP Classification (Health Base Foundation, subjective/objective, evaluation, plan; NL)
- Westerlund System (Sweden)

An overview with detailed information about the classification systems has been published by van Mil et al. in 2004 [121]. One of the first classification system was published In 1990 by Strand et al. [70] who defined eight categories of DRPs, all of them actually or potentially interfering with the patient's drug therapy:

1. The patient has a medical condition that requires drug therapy (a drug indication) but the patient is not receiving a drug for that indication.
2. The patient has a medical condition for which the wrong drug is being taken.
3. The patient has a medical condition for which too little of the correct drug is being taken.
4. The patient has a medical condition for which too much of the correct drug is being taken.
5. The patient has a medical condition resulting from an ADR.
6. The patient has a medical condition resulting from a drug-drug, drug-food, or drug-laboratory interaction.
7. The patient has a medical condition that is the result of not receiving the prescribed drug.
8. The patient has a medical condition that is the result of taking a drug for which there is no valid medical indication.

This classification system has no hierarchical structure and does not allow modifying any items. In 2002, eight criteria that define a suitable classification system have been described by Schaefer [124]. Out of them, van Mil et al. [121] elaborated five major requirements for DRP classifications:

1. The classification should have a clear definition, both for the DRP in general and for each DRP category.
2. The classification should have a published validation.
3. The classification should be usable in practice (has been used in a published study).
4. The classification should have an open, hierarchical structure (with main groups, subgroups, and an open structure to include new problems, preferably on subgroup levels).
5. The classification should have a focus on the drug use process and outcome and separate the problem itself from the cause.

Most modern classifications have an open hierarchical structure, where higher levels are broadly defined and lower levels become more specific; new subcategories can be added in these systems as well [121]. The PCNE classification system comes closest to the above-mentioned criteria [121], and it is used on a European level in contrast to country-based systems, such as the PI-Doc or Westerlund systems although these are very elaborated, easy to use, and have proved useful in pharmacy practice [77, 81, 124-127]. However, in a study in 2007 [81] that employed the PI-Doc classification system, Hämmerlein et al. showed that 362 cases could not be classified with an extended version containing 27 new categories (in total 72). Krähenbühl et al. [83] developed a new classification system for DRPs, and in order to be comprehensive, technical problems related to prescriptions and clinical DRPs were analysed separately [83]. This allowed a complete classification of all DRPs found in the study.

The PCNE system has a clear definition of a DRP, is hierarchical, and comprises separate codes for problems, causes, and interventions with the corresponding outcome. However, to our knowledge no validation has been published. The PCNE system was presented during a conference in 1999 [122] and since then, several updates have been developed by van Mil et al. It was designed to be used in research, as a process indicator in experimental pharmaceutical care studies, and as an instrument to help healthcare professionals to document information about DRPs in the pharmaceutical care process [99, 121, 128]. The current version 5.01, which

was used for the study within this thesis, is available online [128] and comprises four dimensions (problems, causes, interventions, and outcome) with several main categories.

Validation is necessary to ensure that a code indeed reflects a unique DRP that is understood by practitioners and researchers alike [121]. Face validity of the PCNE classification scheme was tested in two ways: during a workshop conference, an expert group discussed items and domains with regard to conformity with the DRP definition, accuracy, redundancy, significance for its relationship to patient outcomes, comprehension, probability for report bias, homogeneity of domains, and comprehensiveness [74]. Secondly, every workshop participant independently coded a predefined set of 20 DRP patient cases [74]. If consensus on the selected codes was good, the codes were accepted but if not, the DRP items were refined accordingly [74]. Then, as part of the operational procedure, a report form that is based on the classification scheme was composed [74]. A set of guidelines for proper use of the report forms accompanies it [74]. Lastly, the sources for discovering DRPs were discussed [74]. The first source is the professional (the pharmacist), who either by talking to the patient or performing a drug use review would discover problems; the second source is the patients themselves [74]. Face validity is important for this kind of system because every problem can be understood in a different way by different persons who are working with the system.

1.3 Medication review

Several services with different characteristics are described as ‘medication review’ and different models of medication reviews, medication therapy management, and structured home visits with patients have been evaluated in several studies which differed in the design, setting, and type of intervention [129]. Table 4 shows a synopsis of different medication reviews developed in different countries.

To perform medication reviews, several recommendations are available, such as to include patients with the largest chance for DRPs first [130], to conduct an MR preferably face-to-face, to use the same standardized systematic method for all patients in the practice, and to ensure appropriate training and continuing education of pharmacists.

Medication reviews can be provided by hospital or community pharmacists, GPs, nurses, and collaborative or multidisciplinary teams; possible settings for medication reviews are GP practices, hospital outpatient clinics, residential aged-care facilities, pharmacies, and patient homes, with limited or no access to clinical data.

Experiences with medication reviews in the UK, USA, and Australia (AUS) showed how to apply CPS, which can be considered as a strategy to improve public health and the quality of drug therapy [131] in a meaningful way. The aims of an medication review are to prevent, reduce, or solve DRPs and thus, to improve a) healthcare outcomes (clinical outcomes), b) quality of life of patients (humanistic outcome), and c) utilization of resources (economic outcomes). The overall aim of a medication review is to optimize outcomes of a drug therapy.

1.3.1 Models of medication review in the United Kingdom

In the UK, medication reviews have been developed in the last decades from a four-level concept [132] with an *ad hoc*, unstructured, and opportunistic review (level 0), a prescription or technical review of a list of the patient's medicines (level 1), a treatment review, i.e. a review of medicines with the patient's full notes (level 2), and a clinical medication review, i.e. a face-to-face review of medicines and conditions (level 3) to a standardized three-step concept in 2008 [133]:

1. Prescription or technical review
2. Compliance and concordance review (medicines use review, MUR)
3. Clinical medication review

The first step (prescription or technical review) is considered as the essential basic pharmaceutical service which should be done by every pharmacist during each dispensing process. A technical review is focused primarily on administrative aspects and the provision of the drug including information about dosage and basic knowledge. It is not mandatory for the patient to be present (e.g. if someone obtains drugs for a bed-ridden partner).

Table 4: Definitions of different medication review services in different countries

Medication review (MR)		A structured, critical examination of a patient's medicines with the objective of reaching an agreement with the patient about treatment, optimising the impact of medicines, minimising the number of medication-related problems and reducing waste [133].
UK	Prescription review *Level 1*	To address practical medicines management issues that can improve the clinical and cost-effectiveness of medicines and patient safety. This type of review is usually conducted with one specific purpose in mind in the absence of the patient (only resulting changes to prescribed medicines must involve the patient) [133].
	Concordance or compliance review (Medicines use review; MUR) *Level 2*	A structured, concordance centred review with patients receiving medicines for long-term conditions, to establish a picture of their use of the medicines – both prescribed and non-prescribed. The review should help patients understand their therapy and it will identify any problems they are experiencing along with possible solutions [133].
	Clinical medication review (CMR) *Level 3*	A process where a health professional reviews the patient, the illness, and the drug treatment during a consultation. It involves evaluating the therapeutic efficacy of each drug and the process of the condition being treated. Other issues, such as compliance, actual and potential adverse effects, interactions, and the patients understanding of the condition and its treatment are considered when appropriate [134].
AUS	Home medicines review (HMR) or Domiciliary medication management review (DMMR)	A structured and collaborative healthcare service provided to consumers in the community setting to ensure their medicine use is optimal and fully understood and that continuity of care is enhanced [135].
	Residential medication management review (RMMR)	A comprehensive medication review that is resident-focused involving the systematic evaluation of the resident's complete medication regimen and management of that medication in the context of other clinical information and the resident's health status [136].

continued next page

US	Drug utilization review (DUR) or Drug use evaluation (DUE)	A process to assess the appropriateness of drug therapy by engaging in the evaluation of data on drug use in a given healthcare environment against predetermined criteria and standards [137].
	Drug regimen review (DRR) or Medication regimen review (MRR)	A synonym for DUR in nursing home settings [138].
	Medication therapy management (MTM)	Is designed to optimise therapeutic outcomes for targeted beneficiaries by improving medication use and reducing adverse drug events, including adverse drug interactions that may be furnished by a pharmacist [139].
CH	Prescription validation	A process to assess the appropriateness of drug therapy by engaging in the evaluation of data on drug use in a given healthcare environment against predetermined criteria and standards [137]. Composed of a) the delivery check which oblige the pharmacist to enter all relevant data into the computer system to be able to screen for interactions and accumulation and b) the drug check which aims at verify the dosage, interactions within the prescription, risk factors, contraindications, misuse, and others.
	Polymedication check (PMC) *	A pharmacist-led review which is performed in the pharmacy together with the patient and which is remunerated by the Swiss healthcare system with the aim to instruct the patient on the use of all drugs taken (prescription and non-prescription) leading to a written data sheet which documents for each drug the dosing regimen, check for motivation, experiences and difficulties, counselling on potential side effects and interactions, discussion of adherence goals, and documentation of agreed objectives. After the discussion the pharmacist has the possibility to dispense a pill organizer managed by the pharmacy and paid by the healthcare system. No physician referral is necessary for this service.

* At the time of printing this thesis, this cognitive pharmaceutical care service had only been elaborated but was not yet introduced in Swiss community pharmacy practice.

Medicines use reviews (MUR; compliance or concordance review) as the second step are carried out in pharmacies in the UK to assess and minimize non-adherence. The MUR was introduced in 2005 as the first 'advanced service' in the new NHS community pharmacy contractual framework for England and Wales [140]. The MUR was intended as a review focussing on patients' use and understanding of their medicines, usually to be conducted in the pharmacy (definition in Table 4) [141]. The provision of MURs substantially increased during 2006 and 2007, in terms of both the proportion of provider pharmacies (two-thirds now providing) and the number of reviews conducted (a four-fold increase) [141]. The MUR is remunerated by the NHS (currently €33.5).

A clinical medication review as described in the NHS guideline (definition in Table 4), represents the highest level of medication review [133] and requires a close coordination and cooperation with the responsible physician. This method is regarded as the most comprehensive method to analyse a patient's drug regimen including clinically oriented aspects of a patient's pharmacotherapy as, for example, the necessity of drug intake, dosage adjustments because of laboratory data, missing drugs but clear indications, or the appropriateness of the drugs. Such a review requires access to the patient's medical records of the GP.

1.3.2 Models of medication review in Australia

In Australia, accredited pharmacists perform medication reviews for patients to identify and resolve DRPs [142]. The Australian government remunerates accredited pharmacists to formally review non-hospitalised patients in either Home Medicines Reviews (HMRs), also known as Domiciliary Medication Management Review (DMMR), or Residential Medication Management Reviews (RMMRs) [142]. Both the HMR and RMMR are remunerated by the Australian healthcare system with €108 and €76 for pharmacists (€80 and €55 for physicians). HMRs are provided to patients living in their own home, whilst residential-care facility patients receive RMMRs.

First, a GP who provides the majority of medical services to the patient assesses the need for a review [143]. Subsequently, a pharmacist performs the HMR or RMMR, conducts the clinical assessment of the information gathered during the patient

interview, and prepares the report for the GP [143]. The accredited pharmacist is responsible for the review overall [143]. The community pharmacist coordinating the service will either be an accredited pharmacist him- or herself, or will employ or contract an accredited pharmacist [143]. An accredited pharmacist is an experienced pharmacist who has undertaken specified education programmes and examinations, and undertakes continuing professional education and re-accreditation as approved by the Australian Association of Consultant Pharmacy, or an examination as approved by the Society of Hospital Pharmacists of Australia [143]. A patient can have a DMMR once every 12 months or sooner if there has been a significant change in the patient's condition or medication requirements [143].

1.3.3 Models of medication review in the United States

The following models of medication review were identified in the United States (US) (definitions in Table 4: drug utilization review (DUR), drug regimen review (DRR), and medication therapy management (MTM).

With a DUR, the appropriateness of drug therapy is evaluated through the assessment of all drugs and the medication history. A DUR can be prospective (pDUR), concurrent (cDUR), or retrospective (rDUR). If a DUR is performed in hospitals, it is called ‘drug use evaluation’ (DUE) [138], while the term used in nursing home settings is ‘drug regimen review’ (DRR) or ‘medication regimen review’ (MRR) [138]. The pDUR is comparable to the ‘prescription or technical review’ in the UK.

American pharmacists are obliged to perform a pDUR, i.e. medication counselling, before a prescription is processed. There is no focus on a certain patient population, and the pDUR is intended to be used by every pharmacist, accredited or not [139]. No discussion or reporting with the responsible physician is required prior or after a pDUR. The pharmacist is not allowed to modify the prescription without permission of the physician [139]. To perform a drug-drug interaction (DDI) screening, over-the-counter (OTC) drugs have to be included and the screening must include a check about potential DRPs (i.e. therapeutic duplication, contra-indications, DDI, wrong or inappropriate dosage, wrong or inappropriate duration of therapy, drug allergy, and

clinical abuse or misuse) [139]. There is no special remuneration for pharmacists providing pDURs [139].

‘Drug regimen review’ (DRR) or ‘medication regimen review’ (MRR) is intended for use in a long-term facility, and the pharmacist has the possibility to incorporate the staff of the facility or the resident [139]. The DRR has to be provided regularly for all residents at least once a month, and no referral from a GP is required. The review can be performed even more regularly, and no accreditation or level of education for pharmacists is specified [139]. An interview with the patient is recommended but not required [139]. The multidisciplinary approach is emphasised for this kind of review, considering the reviewing pharmacist, staff, and GP [139]. If a review has been performed, it is mandatory for the pharmacist to provide a report to the physician as well as the director of nursing of the care facility [139]. Decisions about recommended interventions with respect to the drug therapy are up to the physician who is responsible for the patient. However, interventions not relating to the drug regimen can be carried out by the staff or the pharmacist [139]. Medical records from the care facility are the main source of information to screen for DRPs. In addition, consultations with the physician or staff as well as patient interviews are possible [139]. DRP screening should include OTC drugs, POM, and herbal, plant, or complementary products [139].

‘Medication therapy management’ is targeted to certain beneficiaries and is performed by pharmacy benefit managers (PBMs) or other qualified providers (there are no national requirements for the level of education of providers) [139] who are obliged to provide such reviews. At national level, most process characteristics of the MTM are not regulated, and no guidelines exist. However, PBMs have to develop and to perform MTM services to certain primary-care as well as institutional beneficiaries of Medicare and to inform the Center for Medicare & Medicaid Services [139] about the procedure and performance [139]. MTMs should be developed in collaboration with pharmacists and physicians, and PBMs are responsible for the proper documenting of these services [139]. Possible beneficiaries for such a service are patients with multiple chronic diseases taking multiple drugs who are likely to incur annual costs of as much as €2500 (for 2009) [139]. The participation in a MTM programme is voluntary [139]. PBMs have the possibility to include further patients

for MTM programmes as well as to define the frequency of the service. Aspects discussed are the patient's understanding and the importance of adherence, detection of ADEs, as well as patterns of over-use and under-use of medications [139]. Remuneration schemes for MTM services should be developed by PBMs. The costs are covered by Medicare, while the service is free for the beneficiary [139].

1.3.4 Medication review in Switzerland

In Switzerland, the 'prescription validation process' [144] is comparable to the 'technical review' (level 1) [132, 133] or the pDUR as defined by the US health system department [139] (Table 4). This service is remunerated at two different taxes by the Swiss healthcare system. Until now, no kind of advanced medication review which is remunerated by the Swiss healthcare system has been implemented in community pharmacy practice.

To implement such a new service, we need to prove the effectiveness. Hence, a prerequisite is the selection of patients likely to benefit from medication reviews, both clinically and economically [145]. A study performed in Switzerland in 2008 [76] showed that the cost of a drug therapy is a simple criterion to identify patients eligible for a medication review. However, the authors also concluded that their selection method (cost of drug therapy exceeding €1400 over a 6-month period) could be improved by combining drug cost with the use of specific high-risk drugs or the occurrence of severe diseases [145].

It is anticipated that a pilot medication review will shortly be implemented in Swiss community pharmacies. The so called polymedication check (PMC) aims to identify any problems the patient may have with his/her pharmacotherapy, and to avoid or to minimize non-adherence [144]. This PMC will be remunerated by the healthcare system without a physician's referral but after a pharmacist's suggestion and with the patient's agreement. The PMC is similar to the second level of the NHS guideline ('compliance and concordance review', MUR), but it is certainly not a clinical medication review.

Pharmaceutical care can be delivered on different levels which are mainly characterised through differences in the setting and the intensity of care:

1. *Ad hoc*: unstructured, opportunistic, point of sale (POS) intervention
2. Phone interview: structured counselling with respect to prior POS intervention; few days later
3. Monitoring: structured medication review and screening for pharmaceutical care issues; periodic 1-4 times per year (scheduled)
4. Home visits: comprehensive assessment of the patient's self-management

The PMC is a level 3 activity. The PMC was elaborated on behalf of the Swiss association of pharmacists (pharmaSuisse) by a working group consisting of research and community pharmacists. Taking into consideration the existing models of MR all over the world, in particular in the UK, US, and Australia, this service intended to be simple and easy to perform. Therefore, a single-page data sheet was developed to structure the procedure and to enable documentation. After a pilot phase, this service will be ready to be implemented in the Swiss healthcare system. The PMC is an opportunity for pharmacists to offer a simple MR to patients taking at least four drugs for a duration of at least 3 months.

Further cognitive services (e.g. check of correct handling or self-injection) are not included in the PMC. Such services can be offered by the pharmacists [144], but the cost are not covered by the healthcare system, and up to now, no standard procedure has been defined. This first implementation of a remunerated CPS will represent a paradigm shift for Swiss community pharmacies and enables pharmacists assuming an integral role and an important step forward to take responsibility of a patient's drug therapy with the purpose of achieving definite outcomes that improve a patient's quality of life.

1.3.5 Effectiveness of medication review

Chronically ill and older people are often affected by multiple diseases, and it is no surprise that such patients may have to take numerous medications [66]. The complexity and toxicity of such drug regimens requires that care must be taken to

promote adherence, minimize harm, and overcome problems with storage and stock-piling [66]. One method to solve problems or to identify risk factors are pharmacist-led medication reviews which may have important benefits for older people [66]. However, there is conflicting evidence concerning these benefits [146]. A Cochrane review including studies conducted between 1966 and 1999 looked at the role of the pharmacist with outpatients but did not successfully draw any conclusions due to the limited quality of the research available at that time [147]. More recently, a systematic review of clinical pharmacists and inpatient medical care concluded that there was generally improved care and no evidence of harm, but the authors did not attempt to pool the results statistically [10]. Another meta-analysis looked at medication review in the primary care setting and identified only weak evidence for an effect on admissions [69]. An Australian study of home-based medication reviews has demonstrated a reduction in hospital admissions of 25%, and also a reduction in out-of-hospital deaths [148].

When debating the usefulness and effectiveness of enhanced clinical pharmacy services, the question arises whether a specialised pharmacy service adds sufficient value to justify its costs. These considerations are critical to discuss such services with physicians or health insurances. Moreover, compelling arguments are needed to encourage colleagues to promote extended pharmacy practice services [149]. In the year 2005, Holland et al. (The HOMER RCT) [67] investigated the number of hospital (re)admissions and found significantly more readmissions in the intervention (n=415) than in the control (n=414) group (234 vs. 178) but fewer deaths in the intervention than in control group (49 vs. 63). Three years later, Holland et al. [66] concluded in a systematic review and meta-analysis that pharmacist-led medication review interventions do not have any effect on reducing mortality or hospital admission in older people, and can not be assumed to provide substantial clinical benefit. Such interventions may improve drug knowledge and adherence, but there are insufficient data to know whether or not quality of life is improved [66]. However, Krska [150] concluded in an RCT in 2007 that ‘hospital admission’ may not be a sufficiently sensitive outcome measure to evaluate the impact of pharmacist interventions.
A review by Hanlon et al. [65] about the evidence of clinical pharmacy services and whether or not DRPs and the related health outcomes can be modified by providing clinical pharmacy services for the elderly in community-based settings included 28

studies from 1966-2003. The authors concluded that these studies provided considerable evidence that clinical pharmacy interventions reduced the occurrence of DRPs in the elderly but showed limited evidence that such interventions reduced morbidity, mortality, or healthcare costs.

However, certain studies showed clinical pharmacy interventions to be associated with cost savings [12, 151, 152]. In 2008, Krähenbühl et al. [145] tried to estimate potential savings if all recommendations by pharmacists to solve DRPs and expense problems (defined as when a drug is not the least expensive alternative compared to others of equal effectiveness; [153]) were accepted. They reported a saving of 11% per day. To optimise patient benefits from such services, appropriate inclusion criteria, such as a high age (>70 years) in combination with at least 4 drugs, should be chosen. A randomised trial found that medication review by a pharmacist in general practice resulted in significant changes in prescribed medicines and saved more than the cost of the intervention without adversely affecting the workload of general practitioners [154, 155].

1.4 Rationale and approach

1.4.1 Pharmaceutical care in the community pharmacy

Much of the impetus for pharmaceutical care provision has been driven by academics [156], and only limited published data on the extent to which pharmaceutical care has been adopted and implemented are available. This is particularly true for community pharmacy practices, at a national as well as international level. In 1996, Odedina et al. [157] developed the Behavioural Pharmaceutical Care Scale (BPCS) in the United States. This scale measures the extent to which pharmaceutical care is provided to patients through assessing a community pharmacist's recent behavioural activities. Later on, the BPCS scale was modified and used in 1998 by Bell et al. [158] to evaluate the provision of pharmaceutical care in community pharmacies of Northern Ireland. Both studies revealed low scores of pharmaceutical care activities at that time. In many European countries, there are no published data available about the provision of pharmaceutical care in community pharmacies. Rossing et al. [159] found in 2003 that pharmaceutical care, as defined in policy documents in Denmark (DK), was not

evident in practice in Danish community pharmacies. While some aspects of pharmaceutical care were being performed, almost no documentation of efforts was taking place in community pharmacy. Major barriers to the general provision of cognitive services by pharmacists are their incomplete training in this regard, as well as the issue of reimbursement or compensation [160]. While some progress in addressing this problem has and is being made in a number of countries [20, 161, 162], the willingness of patients to pay and third-party payment for cognitive services remains a challenge for the profession [19, 163-167].

To our knowledge, no study has investigated the extent to which pharmaceutical care has been implemented in Swiss and German community pharmacies. In 2006, Eickhoff et al. [161] reported that in Germany, CPS had been developed over the previous 10 years [161]. In 1993, the ABDA (Confederation of German pharmacists' associations) issued a concept paper [161, 168]. This was the official starting point of the change that led to the community pharmacist moving from the image of a person primarily dispensing medicines toward a highly qualified advisor accepting responsibility for patients' drug-related needs [161]. In Switzerland, pharmaceutical care has been integrated into the Swiss 5-year university pharmacy curriculum since 2003 [4].

With this background, the PCNE initiated a research study across 13 European countries. As a partner of this network, we were in charge of conducting the survey in Switzerland and Germany, and contributed to the transnational analysis.
(→ Project A: Provision of pharmaceutical care by community pharmacists: a comparison across Europe)

Within this European project, we could use the opportunity to amend the BPCS questionnaire with specific questions with the intention to perform an additional analysis among German-speaking European community pharmacies.

Germany has a single healthcare system: physicians are not allowed to dispense any drugs to their patients, in contrast to Switzerland where there are many regions with dispensing doctors. Using the BPCS scale, we tried to explore differences between these two countries and healthcare systems. In addition, we hypothesized that quality

circle (QC) pharmacists of the German state Bavaria would score higher than the ordinary Swiss and German pharmacists because the QC pharmacists meet each other 10 times a year with the aim to improve their pharmacy practice and to implement pharmaceutical care in a way that makes patients realize the desire of pharmacists to optimise the care of chronically ill patients. We therefore performed an additional survey with our German version of the BPCS questionnaire in a selected sample of these QC pharmacists.
(→ Project B: Provision of pharmaceutical care by Swiss and German community pharmacists: in-depth analysis of data from the European BPCS project and comparison with a sample of quality circle pharmacists)

1.4.2 Classification of drug-related problems

In projects A and B, we analysed the extent to which pharmaceutical care is provided in community pharmacies in 13 European countries including Switzerland and Germany, and in a group of QC pharmacists who were specialised in providing pharmaceutical care [169]. Considering the previous 10 prescriptions (5 new and 5 repeat prescriptions)**,** pharmacists were asked a) if they checked for DRPs at all, and b) if they detected any DRPs for any of these prescriptions. Among all Swiss pharmacists, 334 (85.2%) reported to check regularly for DRPs, and in 135 (34.4%) prescriptions they had detected at least one. Among all German pharmacists, 652 (89.9%) indicated to check regularly for DRPs as well as 85 (90.4%) QC and 80 (58.4%) Danish pharmacists. They identified any DRP in 220 (30.3%; GER), 40 (42.6%; QC), and 31 (22.6%; DK) prescriptions. This wide range of detected DRPs by community pharmacists was surprising. The lowest score was reached by Danish pharmacists who have already implemented several cognitive services in community pharmacies, while the highest score was obtained by QC pharmacists who are active in providing pharmaceutical care. Among all Swiss community pharmacists, more than one-third detected a DRP, but probably only few community pharmacists know the concept of pharmaceutical care, and even fewer are applying it in daily pharmacy practice. Therefore, we wondered if this result was true, or if social desirability led many pharmacists to report that they had detected a DRP, but in fact, they did not. The only way to challenge this assumption was to conduct our own study on

prescriptions and problems which are identified by community pharmacists in daily practice.

Taking into consideration earlier studies [81, 83, 84] and the relevance of DRPs for healthcare systems, we aimed to explore the occurrence, nature, and pharmacist's management of clinical and technical DRPs detected in Swiss community pharmacies using a modified PCNE classification system in new prescriptions. Further, we aimed to analyse possible differences between new primary-care and hospital-discharge prescriptions as well as differences between electronically printed and handwritten prescriptions, and to evaluate the usefulness of the modified classification system.
(→ Project C: Classification of drug-related problems with new prescriptions using a modified PCNE classification system)

1.4.3 Medication review

In project C, we examined the frequency, nature, and pharmacist's management of DRPs with primary-care and hospital-discharge prescriptions which contained at least one new drug. We found a high occurrence of clinical (19.6%) and technical (36.0%) DRPs. More than half of all prescriptions showed a clinical or technical DRP, or both. Compared to other studies, our numbers were quite high but in this study, we set out to use prescriptions which we considered likely to have a high prevalence, i.e. newly started drugs and prescriptions with at least two drugs. Our results were retrieved in daily practice while serving clients as usual.

In order to achieve an optimal drug therapy, the absence of DRPs is essential. However, not all DRPs can be detected by a review in the pharmacy [170]. To get more information about the patient's medication management, it may be useful to visit them at home. Home visits allow conducting a prescription review and observing the patient's medicine-taking behaviour. In this way, insight into all aspects of self-management of a drug regimen and the patient's use of medicines in the context of their clinical condition may be possible [170].

Systematic medication review carried out by pharmacists has been shown to be an effective cognitive service to identify medication-related risk factors (MRRFs) [170], to clear redundant home drug supplies, and to improve patient's satisfaction with the counselling by their community pharmacist [54]. Sorensen et al. [170] monitored patients at their own home; most frequently, confusion of generic names and trade names was reported while poor adherence was reported with the second highest frequency. For the purpose of research, such medication reviews can be used to address the increasing number of DRPs experienced by chronically ill patients [65, 145].

Considering the high detection rate of clinical and technical DRPs with new prescriptions in project C, we set the goal to explore patients' knowledge a few days after receiving newly prescribed drugs using phone interviews. These interviews allowed assessing the knowledge and to recruit patients to be visited at home to gain first experiences in performing home visits. For the purpose of the main study, we had the aim to develop an interview guide specifically for home visits.
(→ Project D: Patient knowledge and management of newly prescribed medication: a pilot study)

Patients' knowledge a few days after receiving newly prescribed drugs was rather good, except for drug names and potential adverse effects. Only 35% of drug names could be given by patients. However, 92% of all stated purposes of drugs were correct. Patients knew the duration of intake in 96% of cases, frequency or timing in 96% of cases, and the number of tablets of all drugs in 84% of cases. Home visits showed to be a feasible service, presumably also for community pharmacists, and the structured interview guide developed in project D proved to be a useful tool. The pilot study gave important information on potential improvements of the interview guide which were incorporated in the subsequent main study.

Because we observed a rather good knowledge in the pilot study, we presumed a less extensive knowledge and more frequent DRPs in patients on long-term treatments. Furthermore, we hypothesized that the severity of disease would influence the quality of self-management. We chose diabetes and transplant patients as 'showcase' patient groups and expected to observe more DRPs in diabetes

patients. We planned to perform pharmacist-led comprehensive home visits with the aim to analyse the number and pattern of DRPs, as well as the patients' knowledge about the drugs and their management. We also aimed to explore opportunities for pharmaceutical care at the patients' home.

(→ Project E: Home visits of diabetes type 2 and solid organ transplant patients reveal opportunities for pharmaceutical care)

Synopsis of rationale and aims of the thesis

Project A: Provision of pharmaceutical care by community pharmacists: a comparison across Europe (European BPCS project)

Much of the impetus for pharmaceutical care provision has been driven by academics, and only limited published data on the extent to which pharmaceutical care has been adopted and implemented are available. This is particularly true for community pharmacy practices, at a national as well as international level.

It was the aim of this study to investigate the current extent to which pharmaceutical care is being implemented into routine practice within community pharmacies of 13 European countries, *and to examine the impact of a range of factors that could affect its implementation.*

Project B: Provision of pharmaceutical care by Swiss and German community pharmacists: in-depth analysis of data from the European BPCS project and comparison with a sample of quality-circle pharmacists

The objective of this project was to perform an in-depth analysis of data from Switzerland and Germany which had been collected for the European study for an additional comparison with specialised QC pharmacists and Danish BPCS data.

The aims were to analyse in detail the extent to which pharmaceutical care is provided in these two countries, to compare the results with QC pharmacists of Bavaria (Germany) and data from Danish community pharmacies from the European sample because they scored lowest in the transnational survey, and to evaluate the behavioural pharmaceutical care scale (BPCS) as well as to discuss its usefulness as a research tool for pharmacy practice.

Project C: Classification of drug-related problems with new prescriptions using a modified PCNE classification system

Receiving a newly prescribed drug may be an extraordinary situation for a patient who was recently informed about a diagnosis or at least was confronted with a new drug in his/her regimen. The risk of DRPs may be increased when introducing new

drug treatments or changes within an established drug-treatment plan. There is no accepted standard tool for classification and documentation of DRPs, both in the primary care or hospital (discharge) setting. The usefulness of different systems is not yet clear, and many investigations conclude that further studies are needed, with the aim to provide a tool that allows a complete classification of all DRPs that arise during prescription processing in community pharmacies.

The objectives of this study were to explore the occurrence, nature, *and pharmacist's management of DRPs detected in community pharmacies using a modified PCNE classification system in new prescriptions, to analyse differences between new primary-care and hospital-discharge prescriptions*, *as well as differences between electronically printed and handwritten prescriptions, and to evaluate the usefulness of a modified classification system.*

Project D: Patient knowledge and management of a newly prescribed medication: a pilot study

For patients collecting their prescribed drug at a pharmacy, it is possible to have substantial deficits in knowledge about a new drug. Before patients start with their new drug therapy, pharmacies are the last 'check point' to ensure patients' understanding and knowledge on prescribed drug therapy.

The aims of this pilot study were to determine patients' knowledge about newly prescribed medication shortly after the pharmacy visit, to explore the prevalence of drug use problems identified at patients' homes, *and to develop an interview guide for home visits which should be used in the subsequent main study.*

Project E: Home visits of diabetes type 2 and solid organ transplant patients reveal opportunities for pharmaceutical care

Recent studies on pharmacist-led medication reviews and home visits indicated that such services have the potential to yield benefits, but some randomised controlled trials failed to prove effectiveness. It is still an open question if tailored medication reviews by specifically trained pharmacists are needed. Home visits allow observing the patient's medication management and could therefore offer a possibility to gain a

more comprehensive insight into all aspects of self-management of a patient's drug regimen and use of medicines.

The aims of this study were to get insight into the self-management of medications of transplant and diabetes patients in the primary-care setting, to analyse drug-related problems as well as patients' knowledge about the drugs and their management, and to explore opportunities for pharmaceutical care and the suitability of the interview guide developed specifically for home visits.

2 Provision of pharmaceutical care by community pharmacists

2.1 Project A:

Provision of pharmaceutical care by community pharmacists: a comparison across Europe (European BPCS project)

Carmel M. Hughes[1], Ahmed F. Hawwa[1], Claire Scullin[1], Birthe Søndergaard[2], Cecilia B. Bernsten[3], Claire Anderson[4], Filipa Alves da Costa[5], Ingunn Björnsdóttir[2], Isabelle De Wulf[6], Kurt E. Hersberger[7], Maria A. Cordina[8], Marion A. Schaefer[9], Martin C. Henman[10], Mary P. Tully[11], Patrick M. Eichenberger[7], Tommy Westerlund[12], Veerle Foulon[13], James C. McElnay[1]

[1] School of Pharmacy, Queen's University Belfast, Belfast, UK
[2] Department of Pharmacology and Pharmacotherapy, University of Copenhagen, Denmark
[3] Department of Public Health & Caring Sciences, Uppsala University, Sweden
[4] Division of Social Research, School of Pharmacy, University of Nottingham, UK
[5] ISCSEM, Campus Universitário, Caparica, Portugal
[6] Association of Belgian Phamacists, Archimedesstraat, Brussels, Belgium
[7] Pharmaceutical Care Research Group, University of Basel, Switzerland
[8] Department of Pharmacy, Faculty of Medicine and Surgery, University of Malta, Malta
[9] Institute of Clinical Pharmacology, Charité University Medicine Berlin, Germany
[10] The School of Pharmacy and Pharmaceutical Sciences, Trinity College, Dublin, Ireland
[11] School of Pharmacy and Pharmaceutical Sciences, University of Manchester, UK
[12] Department of Public Health and Community Medicine, University of Gothenburg, Sweden
[13] Research Centre for Pharmaceutical Care and Pharmacoeconomics, Leuven, Belgium

Pharm World Sci 2010; published online 11 May 2010:
DOI 10.1007/s11096-010-9393-x

Abstract

Objective

To investigate the provision of pharmaceutical care by community pharmacists across Europe and to examine the various factors that could affect its implementation.

Methods

A questionnaire-based survey of community pharmacies was conducted within 13 European countries. The questionnaire consisted of two sections. The first section focussed on demographic data and services provided in the pharmacy. The second section was a slightly adapted version of the Behavioral Pharmaceutical Care Scale (BPCS) which consists of three main dimensions (direct patient care activities, referral and consultation activities and instrumental activities).

Results

Response rates ranged from 10–71% between countries. The mean total score achieved by community pharmacists, expressed as a percentage of the total score achievable, ranged from 31.6 (Denmark) to 52.2% (Ireland). Even though different aspects of pharmaceutical care were implemented to different extents across Europe, it was noted that the lowest scores were consistently achieved in the direct patient care dimension (particularly those related to documentation, patient assessment and implementation of therapeutic objectives and monitoring plans) followed by performance evaluation and evaluation of patient satisfaction. Pharmacists who dispensed higher daily numbers of prescriptions in Ireland, Germany and Switzerland had significantly higher total BPCS scores. In addition, pharmacists in England and Ireland who were supported in their place of work by other pharmacists scored significantly higher on referral and consultation and had a higher overall provision of pharmaceutical care.

Conclusion

The present findings suggest that the provision of pharmaceutical care in community pharmacy is still limited within Europe. Pharmacists were routinely engaged in

general activities such as patient record screening but were infrequently involved in patient centred professional activities such as the implementation of therapeutic objectives and monitoring plans, or in self-evaluation of performance.

Keywords

Pharmaceutical Care · Europe · Community Pharmacy · Pharmacists

Impact on findings on practice

- The overall level of pharmaceutical care provision as measured by this survey suggested that pharmacists across Europe still have much to achieve in order for the provision of pharmaceutical care to be considered as routine practice.

- Community pharmacists were routinely engaged in general activities such as patient record screening but were infrequently involved in patient centred professional activities such as the implementation of therapeutic objectives and monitoring plans.

- Community pharmacists who dispensed higher daily numbers of prescriptions, who were supported in their place of work by other pharmacists or who were participating in additional health services had higher overall provision of pharmaceutical care in several European countries

Introduction

The concept of pharmaceutical care, defined by Hepler and Strand as "the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life" [6], has been adopted by professional pharmacy associations and academic training programmes throughout the world and has redirected the focus of the pharmacist's role within community practice from a traditional dispensing role to a more outcome-oriented, patient-centred practice [70, 171]. In addition to pharmacists' commitment and effort, several changes in the organization of pharmacists' work and payment systems are, however, required for implementation of pharmaceutical care to be realised [6, 157, 172, 173]. These include dealing with workplace issues such as heavy workload [174] and reimbursement systems, which are traditionally based on the number of products dispensed rather than on providing a holistic service [175]. There is also a need for pharmacists to collaborate with other health care professionals and patients in designing a therapeutic plan and to contribute to patient education on their medications and disease state [176].

A review of 22 randomised controlled trials of pharmaceutical care services from 1990 to 2003 [30], provided an evidence base for the effectiveness of pharmaceutical care services provided by pharmacists in improving patient outcomes and medication use. Much of the impetus for pharmaceutical care provision has been driven by academicians [156], and to date, there have been limited published data, on the extent to which pharmaceutical care has been adopted and implemented, particularly within community pharmacy, at either national or international level.

Rossing et al. [159] developed an instrument to measure the general provision of pharmaceutical care in all Danish community pharmacies (n=288) in 1999. Their results led the authors to conclude that pharmaceutical care, in its fullest sense, as defined in policy documents in Denmark, was not evident in practice. An earlier measure, known as the Behavioural Pharmaceutical Care Scale (BPCS), was developed by Odedina and Segal [157] in the United States (US) to measure the perceived provision of pharmaceutical care through assessing a pharmacist's recent

behavioural activities. This scale (slightly modified) was used to investigate the extent of implementation of various aspects of pharmaceutical care in community pharmacy in Northern Ireland in 1996 [158]. The results of both the US and Northern Ireland studies indicated a low levels of provision of a comprehensive pharmaceutical care service at that time.

The aim of the present study was to evaluate, using the BPCS scale, the current provision of pharmaceutical care by community pharmacists, across 13 European countries (including Northern Ireland), and the impact of a range of factors that could affect its implementation.

Methods

This study was initiated by researchers in Northern Ireland via their links with Pharmaceutical Care Network Europe (PCNE; www.pcne.org). Following expressions of interest from various PCNE members, data were collected in: Belgium, Denmark, England, Germany, Iceland, Malta, Northern Ireland, Portugal, Republic of Ireland, Scotland, Sweden, the German-speaking part of Switzerland and Wales. Ethical approval was not required for the project, following consultation with the relevant research governance bodies in the participating countries.

Questionnaire / Instrument

The questionnaire consisted of two sections; Section A contained 15 questions largely related to demographic information and services provided in the pharmacy; Section B had 34 questions and was a slightly adapted version of the BPCS [157, 158] to account for differences in practice across countries. The latter scale contains three dimensions: direct care activities, referral and consultation activities and instrumental activities. Fourteen subscales or domains contribute to these three dimensions and provide a score which equates to the overall level of pharmaceutical care provided. The maximum score possible is 160 and the minimum is 15.

The questionnaire was checked for face and content validity by representatives from the different participating countries, in particular its applicability and relevance to the practice of community pharmacy in each respective country. Furthermore, the questionnaire was translated into the native language(s) in the different countries as required, according to Guillemin's guidelines (http://ist.inserm.fr/basisateliers/atel127/guillemin.pdf). The questionnaire was piloted as a further check on validity with five community pharmacists in each country prior to general distribution. These pilot data were not included in the final analysis.

Questionnaire distribution and data collection

Addresses of community pharmacies in each of the participating European countries were obtained from their respective professional bodies/pharmaceutical associations. The sampling strategy was based on the number of community pharmacies in each participating country and was largely a pragmatic decision (Table 1). The research question was the degree of implementation of pharmaceutical care in each country. Using the findings of a previous study [158], pharmaceutical care implementation was assumed to be 21%. Assuming a 3% error estimate for a CI of 95% and using the total number of pharmacies in each of the participating countries as the population (e.g. Ireland = 1,339), the sample size was estimated accordingly (e.g. Ireland = 464). For each participant country, the response rate was assumed based on previous studies with a similar design, and accordingly, the number of questionnaires to be sent was calculated. In some cases, the questionnaire was sent to all community pharmacies, while in others, it was sent to a representative sample, based on the sample size calculation above. When less than 100% of pharmacies were surveyed, those surveyed were selected randomly (e.g. utilising a random number generator). Apart from Germany and Sweden, the questionnaire, along with a prepaid return envelope and covering letter, were sent to the selected pharmacies via regular mail with a second mailing to increase the response rate. In Germany, questionnaires were sent out only once, whereas in Sweden, the questionnaire was transformed into a web-based version and members were invited to participate online. The pharmacist who was most involved in patient care activities within the pharmacy was requested to respond and no identifiers were included to preserve anonymity. All mailings took place between November 2005 and December 2006.

Instrument validity and reliability

The internal consistency of the instrument dimensions and domains was calculated for each country to obtain reliability estimates using Cronbach's alpha test. Reliability estimates for single-item scales, however, could not be calculated using Cronbach's alpha and were not reported in the present study. All reliability estimates >0.6 were considered acceptable as proposed by Robinson et al. [177]. To establish trait validity for the BPCS instrument, exploratory factor analysis (with Varimax rotation) was conducted for all dimensions and domains containing more than two items (since factors with fewer than three items are generally weak and unstable [178]). Five or more strongly loading items are desirable and indicate a solid factor. In the BPCS scale, dimensions and domains containing more than two items had at least 6 items. The number of factors to be retained was decided upon using the Scree test as suggested by Costello and Osborne [178]; the test involved examining the plot of eigenvalues and counting the data-points above the natural 'bend' or 'break' in the data where the curve flattens out. If the number of factors was different from that projected by a priori factor structure, item loadings tables were compared and the one with the cleanest factor structure (item loadings >0.3, no or few item cross-loadings, no factor with >3 items) was chosen as the best fit to the data. The adequacy of sample size was tested using the Kaiser–Meyer–Olkin (KMO) measure of sample adequacy and Bartlett's test of sphericity. The value of KMO >0.5 indicates adequate sample. In addition, item-to-remainder correlations were calculated for each scale item belonging to a domain of activities with more than one item and were screened for extreme multicollinearity (i.e. highly correlated variables, r>0.8) and singularity (perfectly correlated variables, r>0.9). The determinant of the R-matrix was also calculated as a further check on multicolleniarity. If the determinant of the matrix is exactly zero, then the matrix is singular.

Data analysis

Data analysis was performed using SPSS v15 (SPSS Inc., Chicago, IL, US). Scores for the BPCS three dimensions and 14 domains were calculated, by adding up individual item scores. Country specific total scores were calculated by adding the scores of the three dimensions. In addition, as in previous research involving this instrument [158], respondents were categorised into providers (top 20%) and non-providers (bottom 20%) of pharmaceutical care at both country level and the overall sample level. Top/bottom 20% cut-off values were compared against another value (top/bottom 25%, i.e. upper/lower quartiles of BPCS scores) as a different form of categorisation. The data were analysed for significant relationships between the dimension or domain totals and the demographic data collected at country level. The Pearson's correlation coefficient was used to test for correlation between continuous variables while the Student's t test (independent samples) was used to assess differences in means between categorical variables. P-values for multiple pair-wise comparisons of BPCS dimensions and total scores between different countries were corrected as per the Bonferroni justification for multiple testing. P-values <0.05 were considered statistically significant.

Results

The response rates for participating countries ranged from 10.1 (Germany) to 70.9% (Sweden) (Table 1). There were generally more female than male respondents in all participating countries, apart from England and Iceland. In addition, there was a marked variation in the types and locations of pharmacy which predominated in each country. In Portugal, Denmark, Belgium, Germany, Switzerland, Malta and Ireland most respondents worked in an independent pharmacy, while in the United Kingdom (UK; England, Wales, Scotland and Northern Ireland), Sweden and Iceland many pharmacists worked in large multiples (chains), Table 2. For most pharmacies in the UK, Iceland, Ireland and Malta there was usually only one full-time equivalent pharmacist per pharmacy. This was in contrast to Denmark, Germany, Switzerland and Portugal where at least half of the pharmacies had two or more full-time equivalent pharmacists per pharmacy. Dispensing staff also varied across countries

with Denmark reporting a mean of 9.2 dispensing staff per pharmacy followed by Switzerland (mean of 4.4). In addition, a pre-registration student (a pharmacy graduate undergoing a training internship prior to professional registration) was employed to a greater extent in Denmark, Belgium and Iceland than in other countries. There was a variation across countries in terms of the number of items dispensed per day (the mean ranged from 62.2–884.5 prescriptions per day). The majority (at least 75%) of pharmacies in Sweden and Denmark did not participate in the health services surveyed (question A15; health screening, patient monitoring and domiciliary visiting). Furthermore, the majority of pharmacies in Sweden and Denmark did not have a private consultation area. Even thought the majority (≥53%) of responding pharmacists in all participating countries (apart from Switzerland) did not have a post-graduate qualification, most respondents (with the exception of those in Iceland) participated regularly in continuing professional development to maintain and improve their competency. The majority of respondents, however, did not participate in regular local multi-disciplinary team meetings in any of the countries surveyed. The BPCS showed acceptable Cronbach's alpha values for BPCS dimensions and domains in all countries surveyed (Table 3) apart from 'documentation' domain in Northern Ireland and Sweden and 'instrumental activities' dimension in Sweden. KMO values for each country and for the pooled data from all countries were greater than 0.5 (range, 0.715–0.874) indicating relatively compact pattern of correlations between scale items and, hence, higher probability of getting distinct and reliable factors from the analysis [179] The Bartlett's test was significant ($p<0.05$) for all countries indicating that the r-matrix is not an identity matrix and, hence, adequate for performing factor analysis. The determinant of the r-matrix in all countries was non-zero and, hence, there was no problem of multicollinearity or singularity in the data. In addition, an examination of the correlation matrices did not yield any unreasonable values (i.e. all values were <0.8). Orthogonal rotation was chosen since BPCS domains were hypothesized to be uncorrelated when the scale was first developed [157] In addition, Scree test suggested the retention of 4 factors (Fig. 1) which was in accordance with the BPCS a priori factor structure (four domains contain [2 scale-items; 'documentation', 'patient assessment', 'patient referral and consultation' and 'instrumental activities'). After rotation, item loadings on the extracted factors (with a specified minimum value of 0.3) resulted in a clean

structure that conformed with the distribution of BPCS items in the four domains mentioned above with very minimal cross-loadings. Average absolute itemloading on extracted factors for all countries ranged from 0.504–0.616. For a pooled data from all countries, item loading ranged from 0.306–0.829. Table 4 shows rotation sums of the squared factor loadings of the 4 extracted domains on the construct of pharmaceutical care behaviour as well as the proportion of variability explained by each domain. Convergent validity of the BPCS scale was demonstrated by adequate loadings of scale-items on the predicted factors and divergent validity was confirmed by the fact that correlations between factors were not so high (values were <0.85 for all countries). This indicated that predicted factors did not overlap significantly. Finally, an inspection of item communalities did not yield any spurious solutions (i.e. did not exceed 1.0) for any county. Average item communalities ranged from 0.421–0.483 for the countries surveyed and from 0.26–0.70 for the pooled data. The mean total BPCS scores ranged from 50.6 (Denmark) to 83.5 (Ireland), Table 5. Total scores for Iceland could not be calculated due to missing data for most subscales of the 'direct patient care activities' dimension. Moreover, due to the small number of overall responses for Iceland (n=20), its scores could not be included in the subsequent analyses. Table 6 illustrates the categorisation of pharmacies within each country into two groups, 'providers' and 'non-providers' of pharmaceutical care according to the upper/lower quartiles of BPCS scores (as cut-off values of providers/non-providers, respectively) compared with the earlier categorisation of Odedina and Segal [157] i.e. top/lower 20% of BPCS scores). Ireland had significantly higher total scores than other countries ($p<0.001$). Denmark had the lowest mean total score ($p<0.001$) followed by Sweden ($p<0.001$; Fig. 2). In general, pharmacists scored less well on 'direct patient care activities' (means ranged from 17.9 to 43.8% of the maximum achievable score) than on the 'referral and consultation' (means ranged from 39.4 to 70.1%) or the 'instrumental activities' dimension (means ranged from 50.6 to 70.3%). Ireland had the highest scores for 'direct patient care activities' ($p<0.001$ when compared with the other countries apart from Switzerland). Pharmacists from Ireland scored well on documentation activities related to patient care, patient record screening, verification of patient understanding, patient consultation and implementation of therapeutic objectives and monitoring plans. In comparison with the rest of the group, the UK scored well on documentation and patient record screening but poorly on activities conducted to evaluate patients'

perceived status (patient assessment subscale). Conversely, pharmacists in Malta and Portugal scored poorly on documentation and patient record screening but very well on patient assessment and verification of patient understanding. Wales, Malta and Portugal had the highest scores for 'referral and consultation activities' ($p<0.001$). Denmark had the lowest scores for that dimension ($p<0.05$) followed by Switzerland ($p<0.005$). The responding pharmacists in Ireland and the UK (apart from Wales) had the highest scores for the 'instrumental activities' dimension ($p<0.001$) despite the fact that they generally failed to evaluate patient satisfaction or their own performance in providing pharmaceutical care. In contrast, Wales, Malta and Portugal scored poorly for 'instrumental activities' but very well on evaluation of patient satisfaction and performance evaluation subscales.

There were several significant relationships between the respondents' demographic characteristics and their BPCS scores (Table 7). In England and Ireland, the provision of pharmaceutical care was more extensive when there was a higher number of pharmacists employed ($p=0.001$ and $p=0.024$, respectively). Furthermore, 'referral and consultation activities' in both countries increased as the number of employed pharmacists increased ($r=0.251$, $p<0.001$ and $r=0.155$, $p=0.002$, respectively). The latter situation was also true for Switzerland ($r=0.212$, $p<0.001$) and Belgium ($r=0.175$, $p<0.001$). In Sweden and Portugal, the total number of full-time pharmacists had a positive impact on the score obtained for 'direct patient care activities' which specifically seeks to capture pharmacists' efforts to provide pharmaceutical care ($r=0.123$, $p=0.008$ and $r=0.127$, $p=0.007$, respectively).

Pharmacists in England, Scotland, Northern Ireland and Ireland who employed a higher number of dispensing staff achieved higher scores on the validation of filled prescriptions compared to those who had fewer numbers of assistants ($r=0.170$, $p=0.002$; $r=0.142$, $p=0.026$; $r=0.160$, $p=0.021$ and $r=0.131$, $p=0.005$, respectively). In addition, there was a significant positive relationship between the total number of dispensing staff in Portugal and the verification of patient understanding ($r=0.114$, $p=0.008$). In Ireland, Germany and Switzerland, there was a further significant relationship between pharmacists' BPCS total scores and the total number of dispensed items per day ($p=0.008$, $p=0.002$ and $p=0.044$, respectively; Table 7). The

pharmacists' perception of the pharmaceutical care provided, as measured by the BPCS, was higher among those who worked in pharmacies with a higher prescription turnover. The number of dispensed items per day, however, had a negative impact on performance evaluation and the evaluation of patient satisfaction in Sweden (r=-0.187, p<0.001 and r=-0.094, p=0.022, respectively). In all of the participating countries (except Malta and Wales), there was a statistically significant relationship between the provision of at least one of the health services (health screening; patient monitoring; domiciliary visiting; health promotion/education) and having higher BPCS total scores. The service that was related to the greatest increase in BPCS total scores was patient monitoring (mean difference ranged from 3.8 to 27.4 units) followed by the provision of health screening (mean difference was 6.1– 19.6 units).

Discussion

This is considered the first attempt to carry out a formal quantitative assessment of pharmacists' efforts to provide pharmaceutical care across Europe. Even though there is an international consensus about the components and processes of pharmaceutical care, which have not changed since the BPCS was used in NI [158], the validity and reliability of this scale have been rechecked and examined in the present study. This enabled the use of BPCS scale as a valid tool for the purposes of comparison across a wide range of countries in the European context. In common with other research involving the instrument, pharmacists scoring in the top 20% on the BPCS were considered providers of pharmaceutical care while those scoring in the bottom 20% were considered non-providers. To be classified as providers of pharmaceutical care at the country level, pharmacists had to achieve different total BPCS scores across the different participating countries. For example, they had to have a total BPCS score of at least 66 (in Denmark) to be considered providers while at least 99 (in Ireland), representing only 41.3–61.9% of the maximum achievable BPCS score. To be classified as non-providers of pharmaceutical care, pharmacists had to score less than 21.9% (in Denmark) while less than 42.5% (in Ireland) of the maximum achievable score. Comparable results were found when upper/lower quartiles were applied as a method of classifying pharmacists into providers and non-

providers, particularly in terms of the countries that have the highest and lowest percentages of providers/non-providers of pharmaceutical care.

The mean total BPCS score achieved by pharmacists, expressed as a percentage of the total score achievable, ranged from 31.6% (Denmark) to 52.2% (Ireland). The overall level of pharmaceutical care provision as measured by this survey suggested that pharmacists across Europe still have much to achieve in order for the provision of pharmaceutical care to be considered as routine practice. It is apparent that the different aspects of pharmaceutical care were implemented to differing degrees across Europe. However, if the overall mean scores for BPCS domains and dimensions for all participating countries were considered, some general conclusions can be drawn. The lowest mean scores were achieved in the direct patient care dimension, particularly in those related to documentation, patient assessment and implementation of therapeutic objectives and monitoring plan domains; mean scores were under a third of the maximum possible score in the respective domains (23.0, 31.5 and 26.2%, respectively). This could be explained by the fact that these activities tend to be more demanding and time-consuming. In addition, they would only be expected to be carried out if pharmacists were providing the full patient care aspects of pharmaceutical care [7]. Conversely, pharmacists scored higher on domains that related to more traditional areas of practice, such as verification of patient understanding (mean score, 73.8%) or patient record screening (mean score, 61.1%). Similar trends were observed within the instrumental dimension where responding pharmacists had their lowest mean scores in evaluation of patient satisfaction and performance evaluation subscales (49.6 and 47.1%, respectively). Pharmacists with higher average daily prescription numbers in Ireland, Germany and Switzerland scored significantly higher in terms of their overall provision of pharmaceutical care. It is possible that more patient contact led to more consultation activities, documentation and patient record screening as suggested by the significant relationship between higher prescription turnover and increased direct patient care activities in these countries. One possible criticism of the BPCS could be that too high a weight is given to documentation (30 out of 85 points for the direct patient care dimension) and that such documentation may be more prevalent in larger pharmacies with more sophisticated computer systems. Even though some

authors have suggested that a pharmacist's activity as a health care provider could be enhanced when prescription volume is low or when greater numbers of dispensing/support staff are employed, due to more time available for consultation activities [180], others have considered the ability to delegate and shift workload to other ancillary staff, as an overriding factor in determining the extent of pharmaceutical care provision [181]. The latter was supported, in part, by the fact that additional dispensing staff had a positive impact on pharmacists' scores for filled prescription validation in England, Scotland, Northern Ireland and Ireland compared to those who undertook the dispensing role themselves, but did not have a significant impact on patient consultation or pharmaceutical care provision as a whole.

In England and Ireland, pharmacists who were supported in their place of work by other pharmacists scored significantly higher on referral and consultation, which is a measure of collegial interaction, and had higher overall provision of pharmaceutical care. Lack of time, an important impediment to the provision of pharmaceutical care, could be overcome through employing additional pharmacists. However, employing and training extra staff requires an investment of both time and money. One solution is through reimbursement for services from third party payers. In Portugal, community pharmacists have recently obtained reimbursement for diabetes disease management [121]. In most of Europe, however, there is no consistent source of reimbursement for pharmacists' pharmaceutical care services [20]. An alternative option would be to implement and maintain health services within a financially viable business model. In the present study, participating in extra health services (such as patient monitoring, health screening, domiciliary visiting and health promotion/education) was significantly associated with improved provision of pharmaceutical care in several European countries. In addition, another factor which may have an impact on the provision of pharmaceutical care in community pharmacy is the different pharmacy cultures and health service systems across different countries. Similar patterns of pharmaceutical care provision, as measured by the BPCS, are identifiable in areas with similar health care culture and systems; for example, Denmark and Sweden (Scandinavian countries in Northern Europe); Scotland, England and Northern Ireland (Western Europe); Malta and Portugal (Southern Europe); Germany and Switzerland (Central Europe).

One of the study limitations was the relatively low response rate in some countries (mainly Germany). However, the mean response rate across the different countries surveyed was around 40% which, in comparison with other published surveys of community pharmacy, can be considered a good response. In addition, a limited comparison of the demographics of respondents versus available published information on the demographics of the wider profession showed only minimal differences between respondents and overall profession demographics (data not shown). One reason for the different response rates achieved in the present study may have been the use of different types of administration methods. In Germany for example, the questionnaire was sent only once in a regular mailing package of the association which could explain, in part, the lowest response rate achieved in that country. On the other hand, the highest response rate in the current study (71%) was achieved in Sweden where the questionnaire was transformed into a web-based version and members were invited to participate online. Even though a lower response rate does not mean lower survey accuracy, it could introduce the possibility of bias in the data since those with a particular interest in the subject matter or the research itself are often more likely to return mailed questionnaires than those who are less interested [182]. For example, Portuguese respondents were quite young, therefore may have been more motivated to provide an enhanced pharmaceutical service. Only tentative conclusions were, therefore, derived from countries where the proportion of responding pharmacies was less than 10% (e.g. Germany). Due to the nature of the study, which was completely anonymous, it was not possible to contact non-respondents to carry out a non-respondent analysis. Anonymity was necessary to counteract the potentially strong social desirability bias which could otherwise have been introduced. A previous survey of pharmaceutical care provision in Danish pharmacies [159] has shown that 78% of non-respondents reported lack of time, lack of personnel or not participating in pharmaceutical care as reasons for not returning the questionnaire. Some of these reasons may also explain nonresponse to the present survey.

Conclusion

The present study attempted to measure the general provision of pharmaceutical care in community pharmacies across 13 European countries using a slightly modified version of the BPCS. The findings suggest that the provision of this type of service in a comprehensive fashion is still limited within Europe. Pharmacists routinely screened patient records, verified patient understanding and validated filled prescriptions but infrequently documented activities related to patient care, evaluated patients' perceived status, engaged in implementing therapeutic objectives and monitoring plans, evaluated patient satisfaction or self-evaluated their performance in providing pharmaceutical care on regular basis.

Conflicts of interest statement

None declared.

Funding

All national studies were funded locally by the researchers. Coordination of the studies was not funded separately.

Tables and figures

Table 1: Sampling strategy for each participating country and their response rates

Countries	No. of pharmacies to which questionnaire was distributed	Sample as a % of total number of pharmacies in country	Response rates n (%)
Belgium	2,500	50%	623 (24.9)
Denmark	321	100%	137 (42.7)
England	1,096	10%	327 (29.8)
Germany	7,151	33%	725 (10.1)
Iceland	56	100%	20 (35.7)
Ireland	897	67%	464 (51.7)
Malta	202	100%	112 (55.4)
N. Ireland	514	100%	213 (41.4)
Portugal	2,698	100%	564 (20.9)
Scotland	600	51%	250 (41.7)
Sweden	1,010	100%	717 (70.9)
Switzerland	814	100%	392 (48.2)
Wales	718	100%	152 (21.2)
Overall	18,577	40%	4,696 (25.3)

Table 2: Demographic characteristics of participating pharmacists

	Country Name												
	Belgium	Denmark	England	Germany	Ireland	Malta	N. Ireland	Portugal	Scotland	Sweden	Switzerland	Wales	Iceland
Gender													
Male (%)	42.7	16.8	57	38.8	48.7	36.6	45.1	21.8	37.6	6.7	38.3	49.3	50.0
Female (%)	57.3	82.5	43	59.7	51.3	63.4	54.9	78.2	62.4	92.9	61.0	50.7	45.0
Missing (%)	0.0	0.7	0	1.5	0.0	0.0	0.0	0.0	0.0	0.4	0.8	0.0	5.0
Year of registration													
1950–1969 (%)	2.2	4.4	8	7.7	2.4	8.9	0.0	1.6	1.6	10.9	4.1	2.0	0.0
1970–1989 (%)	51.4	51.1	49	48.8	20.9	33.0	26.3	22.0	46.4	43.8	55.1	46.7	25.0
1990–2008 (%)	45.6	40.9	43	39.4	74.4	57.1	70.0	73.0	49.6	45.0	38.3	50.7	50.0
Missing (%)	0.8	3.6	1	4.0	2.4	0.9	3.8	3.4	2.4	0.3	2.6	0.7	25.0
Type of pharmacy[a]													
Independent (%)	82.7	100.0	36	96.6	64.4	87.5	40.8	100.0	30.4	0.0	87.2	29.6	20.0
Small multiple (>4 pharmacies) (%)	3.2	0.0	13	0.0	15.3	12.5	13.1	0.0	16.4	0.0	0.0	11.2	10.0
Large multiple (10+ pharmacies) (%)	13.8	0.0	51	2.5	20.0	0.0	45.5	0.0	53.2	100.0	12.0	59.2	70.0
Missing (%)	0.3	0.0	0	1.0	0.2	0.0	0.5	0.0	0.0	0.0	0.8	0.0	0.0
Location													
Rural (%)	32.6	17.5	14	31.0	27.2	13.4	23.0	27.8	21.6	17.2	36.0	25.0	10.0
Suburban (%)	29.4	51.1	36	14.8	30.0	30.4	27.7	17.0	30.4	11.6	17.3	31.6	20.0
City or town centre (%)	23.6	27.0	35	18.1	40.5	51.8	38.5	36.3	38.4	18.4	25.0	30.3	70.0
Out of town (%)	13.8	2.9	7	14.3	1.5	3.6	4.2	17.4	6.0	15.5	12.8	6.6	0.0
Health centre (%)	0.0	0.0	6	21.7	0.4	0.0	2.8	0.0	2.8	36.7	8.4	4.6	0.0
Missing (%)	0.6	1.5	2	0.1	0.4	0.9	3.8	1.4	0.8	0.7	0.5	2.0	0.0
Pre-registration student employed?													
Yes (%)	39.8	27.0	13	10.1	10.8	31.3	33.3	14.4	13.2	15.1	15.1	7.2	45.0
Missing (%)	0.3	0.7	1	0.3	0.6	0.0	0.5	0.5	0.8	3.2	0.5	0.0	0.0
CPD participation?													
Yes (%)	81.2	89.8	94	95.4	78.9	62.5	94.4	97.9	93.2	61.5	96.2	97.4	25.0
Missing (%)	1.8	0.0	1	0.3	0.9	0.0	0.0	0.2	1.2	3.8	1.0	0.7	0.0
Postgrad qualification?													
Yes (%)	3.9	43.8	19	46.9	14.0	2.7	8.5	11.2	18.4	3.2	71.9	11.8	5.0
Missing (%)	0.3	0.7	1	0.1	1.1	0.0	0.5	0.9	0.4	1.3	0.0	2.0	0.0
Participation in multi-disciplinary meetings?													
Yes (%)	34.7	29.9	28	23.2	9.1	11.6	14.1	12.8	22.4	10.5	20.4	19.1	15.0
Missing (%)	0.5	0.7	1	0.3	1.7	0.0	0.9	1.2	0.4	3.3	0.3	0.7	0.0

continued next page

	Country Name												
	Belgium	Denmark	England	Germany	Ireland	Malta	N. Ireland	Portugal	Scotland	Sweden	Switzerland	Wales	Iceland
Consultation area?													
Yes (%)	18.8	46.0	66	81.0	55.8	75.9	49.8	85.8	69.2	31.7	77.0	59.9	70.0
Missing (%)	1.0	0.7	1	0.0	1.3	0.0	0.0	0.2	0.8	3.2	0.0	0.7	0.0
Information available from GP?													
Yes (%)	41.7	43.1	64	56.6	77.8	59.8	81.2	30.5	80.4	31.7	63.8	76.3	60.0
Missing (%)	14.3	24.8	3	1.9	3.4	0.9	3.8	68.6	3.2	3.2	5.1	4.6	25.0
Participate in health screening?													
Yes (%)	89.1	20.4	34	96.0	27.6	34.8	38.0	76.1	37.6	7.9	84.9	32.2	5.0
Missing (%)	1.1	4.4	3	0.0	3.4	0.0	6.1	4.1	5.6	4.5	0.0	2.0	95.0
Participate in patient monitoring?													
Yes (%)	55.9	5.1	34	65.1	52.6	43.8	45.1	45.0	46.0	10.6	75.8	33.6	0.0
Missing (%)	1.9	6.6	4	0.7	3.0	0.0	5.6	6.4	5.2	4.9	0.8	3.9	100.0
Participate in domiciliary visiting?													
Yes (%)	50.1	0.0	21	53.0	22.8	3.6	42.3	12.4	45.2	0.0	29.3	24.3	5.0
Missing (%)	0.8	5.1	3	0.4	3.7	0.0	4.7	10.6	4.4	5.6	1.3	4.6	95.0
Participate in health promotion/education?													
Yes (%)	95.5	48.9	91	81.2	77.2	58.0	95.8	81.0	90.0	21.1	89.3	88.2	10.0
Missing (%)	1.4	1.5	1	0.3	1.7	0.0	0.0	2.7	0.4	4.0	0.3	0.7	90.0
No. of full time equivalent pharmacists													
Mean (SD)	n/a	2.18 (1.20)	1.29 (0.68)	2.08 (3.90)	1.46 (0.66)	1.23 (0.46)	1.25 (0.48)	2.26 (1.22)	1.24 (0.50)	0.58[b] (1.02)	1.83 (1.12)	1.17 (0.49)	1.53 (1.02)
No. of dispensing staff													
Mean (SD)	1.12 (1.48)	9.21 (5.20)	2.52 (1.74)	3.20 (4.73)	1.69 (1.51)	1.17 (1.06)	2.10 (1.52)	2.39 (1.44)	2.63 (1.94)	1.89 (2.23)	4.36 (3.98)	2.41 (1.48)	3.36 (2.50)
No. of items dispensed per day													
Mean (SD)	78.0 (55.84)	884.5 (515.3)	393.5 (915.4)	107.3 (71.0)	158.3 (92.2)	27.2 (17.2)	219.1 (136.8)	217.3 (205.9)	237.9 (129.3)	294.6 (177.7)	62.2 (47.0)	262.7 (147.7)	88.8 (17.3)

CPD continuing professional development, *GP* general practitioner

[a] At the time of the study, national legislation did not permit the existence of chain pharmacies in Portugal or Denmark, therefore all pharmacies were classified as independent. In Sweden all pharmacies were State owned, and hence were categorized as large multiples. It is also important to note that the different distribution method of the questionnaire in Sweden may have influenced the response rate

[b] In Sweden, a majority of the respondents were prescriptionists with a 3-year pharmaceutical university education

Table 3: Reliability estimates of BPCS dimensions and domains by country

	Reliability estimate (Cronbach's alpha)											
	Belgium (n=623)	Denmark (n=137)	England (n=327)	Germany (n=725)	Ireland (n=464)	Malta (n=112)	N.Ireland (n=213)	Portugal (n=564)	Scotland (n=250)	Sweden (n=717)	Switzerland (n=392)	Wales (n=152)
Direct patient care activities (N of items = 17)	0.85	0.84	0.86	0.87	0.83	0.88	0.81	0.88	0.82	0.81	0.83	0.84
Documentation (N of items = 6)	0.67	0.71	0.61	0.74	0.63	0.66	0.52	0.85	0.65	0.49	0.68	0.60
Patient assessment (N of items = 6)	0.85	0.78	0.87	0.84	0.81	0.84	0.87	0.85	0.85	0.83	0.81	0.87
Referral and consultation (N of items = 8)	0.70	0.79	0.79	0.76	0.79	0.80	0.79	0.73	0.78	0.67	0.74	0.77
Instrumental activities (N of items = 7)	n/a*	0.63	0.68	0.69	0.62	0.67	0.67	0.68	0.69	0.57	0.67	0.67

* Reliability estimate for instrumental activities could not be calculated for Belgium since item B34 was missing for all respondents

Table 4: Exploratory factor analysis of BPCS domains

Domain	Rotation sums of squared loadings	% of variance explained by domain
Documentation	2.502	9.266
Patient assessment	3.727	13.805
Referral and consultation	4.228	15.658
Instrumental activities	3.023	11.197

Table 5: Respondents' scores on modified behavioural pharmaceutical care scale

	Country name												
	Belgium	Denmark	England	Germany	Ireland	Malta	N. Ireland	Portugal	Scotland	Sweden	Switzerland	Wales	Iceland
Direct patient care activities total													
Mean	32.79	15.19	29.00	31.95	37.25	28.22	30.49	29.01	28.20	22.61	35.59	25.81	n/a
Valid *N* (%)	483 (78)	104 (76)	277 (85)	671 (93)	382 (82)	112 (100)	184 (86)	460 (82)	204 (82)	460 (64)	354 (90)	152 (100)	0 (0)
Minimum	0	0	0	0	2	0	0	0	3	0	0	0	n/a
Maximum	85	62	79	85	71	71	74	81	85	80	84	69	n/a
Documentation total													
Mean	7.11	2.02	9.39	7.71	10.32	2.12	9.28	3.33	9.37	3.42	10.50	8.19	n/a
Valid *N* (%)	516 (83)	112 (82)	279 (85)	713 (98)	394 (85)	112 (100)	187 (88)	472 (84)	206 (82)	477 (67)	373 (95)	152 (100)	0 (0)
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	n/a
Maximum	30	28	28	30	25	18	26	30	30	25	30	25	n/a
Patient assessment total													
Mean	12.29	7.17	5.98	12.56	9.73	14.20	6.63	15.08	5.16	9.54	10.36	4.76	n/a
Valid *N* (%)	587 (94)	126 (92)	305 (93)	718 (99)	434 (94)	112 (100)	203 (95)	529 (94)	230 (92)	523 (73)	380 (97)	152 (100)	0 (0)
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	n/a
Maximum	30	20	28	30	30	30	29	30	30	30	30	24	n/a
Implementation of therapeutic objectives and monitoring plans total													
Mean	3.11	1.11	2.59	3.03	3.76	2.79	3.26	1.67	2.76	2.31	3.02	2.04	0.31
Valid *N* (%)	534 (86)	114 (83)	299 (91)	688 (95)	404 (87)	112 (100)	192 (90)	491 (87)	222 (89)	501 (70)	370 (94)	152 (100)	16 (80)
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	10	10	10	10	10	10	10	10	10	10	10	10	4
Patient record screening total													
Mean	3.25	0.63	4.43	3.04	4.57	1.52	4.47	0.92	4.62	0.47	4.32	4.45	1.00
Valid *N* (%)	606 (97)	128 (93)	312 (95)	724 (100)	462 (100)	112 (100)	206 (97)	529 (94)	235 (94)	543 (76)	389 (99)	152 (100)	5 (25)
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	1
Maximum	5	5	5	5	5	5	5	5	5	5	5	5	1
Patient consultation total													
Mean	3.61	1.98	3.09	2.52	4.35	3.46	3.53	4.10	3.17	2.64	3.66	3.08	1.00
Valid *N* (%)	612 (98)	127 (93)	312 (95)	723 (100)	461 (99)	112 (100)	207 (97)	555 (98)	235 (94)	578 (81)	388 (99)	152 (100)	9 (45)
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	1
Maximum	5	5	5	5	5	5	5	5	5	5	5	5	1

continued next page

	Country name												
	Belgium	Denmark	England	Germany	Ireland	Malta	N. Ireland	Portugal	Scotland	Sweden	Switzerland	Wales	Iceland
Verification of patient understanding total													
Mean	3.77	2.20	3.37	3.31	4.33	4.14	3.71	4.46	3.43	4.10	4.15	3.28	1.00
Valid *N* (%)	611 (98)	127 (93)	311 (95)	721 (99)	462 (100)	112 (100)	207 (97)	555 (98)	235 (94)	593 (83)	387 (99)	152 (100)	3 (15)
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	1
Maximum	5	5	5	5	5	5	5	5	5	5	5	5	1
Referral and consultation total													
Mean	20.74	15.76	20.71	20.36	22.74	27.04	19.79	27.96	20.85	19.81	17.81	28.02	15.00
Valid *N* (%)	562 (90)	118 (86)	312 (95)	701 (97)	417 (90)	112 (100)	199 (93)	496 (88)	222 (89)	538 (75)	380 (97)	152 (100)	13 (65)
Minimum	9	8	6	9	10	10	8	10	9	9	8	13	9
Maximum	40	33	38	36	40	40	37	40	39	37	40	40	30
Instrumental activities total													
Mean	20.95	19.63	24.59	18.93	24.02	18.85	23.75	18.81	24.31	20.93	20.23	17.71	19.27
Valid *N* (%)	569 (91)	113 (82)	317 (97)	688 (95)	436 (94)	112 (100)	209 (98)	525 (93)	235 (94)	576 (80)	380 (97)	152 (100)	15 (75)
Minimum	9	7	9	9	9	7	13	7	12	9	8	9	12
Maximum	35	29	35	33	35	35	32	33	35	32	35	35	28
Counsellling location total													
Mean	2.78	2.65	3.79	3.10	3.98	2.54	3.75	2.53	3.82	2.40	2.98	2.24	2.78
Valid *N* (%)	614 (99)	133 (97)	322 (98)	725 (100)	460 (99)	112 (100)	209 (98)	552 (98)	247 (99)	602 (84)	392 (100)	152 (100)	18 (90)
Minimum	1	1	1	1	1	1	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	5	5	5	5	5	5	5	5
Filled script validation total													
Mean	3.32	3.78	4.61	1.66	4.58	1.96	4.87	2.01	4.62	3.62	2.58	1.43	4.83
Valid *N* (%)	596 (96)	134 (98)	322 (98)	700 (97)	460 (99)	112 (100)	210 (99)	537 (95)	244 (98)	607 (85)	389 (99)	152 (100)	18 (90)
Minimum	1	1	1	1	1	0	3	1	1	1	1	1	3
Maximum	5	5	5	5	5	5	5	5	5	5	5	5	5
Infomational support total													
Mean	4.04	3.95	3.62	3.16	3.95	2.76	3.58	2.67	3.54	4.30	3.69	2.47	3.39
Valid *N* (%)	617 (99)	135 (99)	323 (99)	720 (99)	462 (100)	112 (100)	210 (99)	551 (98)	246 (98)	610 (85)	392 (100)	152 (100)	18 (90)
Minimum	1	1	1	1	1	1	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	5	5	5	5	5	5	5	5
Evaluation of patient satisfaction total													
Mean	1.85	1.50	2.16	2.31	1.93	3.53	1.85	3.67	2.05	2.69	2.32	3.88	1.82
Valid *N* (%)	615 (99)	131 (96)	322 (98)	721 (99)	455 (98)	112 (100)	210 (99)	548 (97)	244 (98)	606 (85)	392 (100)	152 (100)	17 (85)

continued next page

	Country name												
	Belgium	Denmark	England	Germany	Ireland	Malta	N. Ireland	Portugal	Scotland	Sweden	Switzerland	Wales	Iceland
Minimum	1	1	0	1	1	1	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	5	5	5	5	5	5	5	4
Competency improvement total													
Mean	3.38	2.47	3.95	3.69	3.25	2.83	3.63	2.61	3.94	2.97	3.72	1.99	1.71
Valid *N* (%)	615 (99)	116 (85)	323 (99)	720 (99)	456 (98)	112 (100)	210 (99)	550 (98)	247 (99)	605 (84)	388 (99)	152 (100)	17 (85)
Minimum	1	1	1	1	1	0	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	5	5	5	5	5	5	5	4
Performance evaluation total													
Mean	1.95	1.68	2.59	1.70	2.18	2.98	2.18	3.58	2.49	1.50	1.87	3.59	1.47
Valid *N* (%)	615 (99)	128 (93)	319 (98)	720 (99)	443 (95)	112 (100)	210 (99)	545 (97)	243 (97)	602 (84)	386 (98)	152 (100)	15 (75)
Minimum	1	1	0	1	1	0	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	5	5	5	5	5	5	5	3
Provision of medical information total													
Mean	3.60	3.73	3.90	3.39	4.03	2.25	3.90	1.77	3.94	3.47	3.13	2.13	3.47
Valid *N* (%)	615 (99)	131 (96)	323 (99)	725 (100)	459 (99)	112 (100)	210 (99)	550 (98)	248 (99)	605 (84)	391 (100)	152 (100)	17 (85)
Minimum	1	1	1	1	1	1	1	1	1	1	1	1	2
Maximum	5	5	5	5	5	5	5	5	5	5	5	5	5
Total BPCS score													
Mean	74.10	50.61	73.94	70.77	83.48	74.12	73.97	76.48	73.06	62.88	73.22	71.54	n/a
Valid *N* (%)	425 (68)	83 (61)	266 (81)	624 (86)	337 (73)	112 (100)	172 (81)	409 (73)	179 (72)	404 (56)	339 (86)	152 (100)	0 (0)
Minimum	29	23	18	19	32	43	29	27	32	23	28	39	n/a
Maximum	131	113	140	145	132	113	129	130	152	124	140	105	n/a

Table 6: Summary of providers and non-providers of pharmaceutical care by country based on BPCS scores

Countries	BPCS score range	Score range of non-providers[a] (cut-off as % of maximum score)		Score range of providers[a] (cut-off as % of maximum score)		% of non-providers overall[b]		% of providers overall[b]	
		Bottom 20%	Bottom 25%	Top 20%	Top 25%	Bottom 20%	Bottom 25%	Top 20%	Top 25%
Belgium	29–131	29–56 (35%)	29–60 (38%)	91–131 (57%)	88–131 (55%)	12.1%	11.7%	25.2%	28.9%
Denmark	23–113	23–35 (22%)	23–37 (23%)	66–113 (41%)	63–113 (39%)	8.4%	6.4%	4.8%	6.0%
England	18–140	18–55 (34%)	18–59 (37%)	93–140 (58%)	90–140 (56%)	8.2%	8.2%	26.7%	29.7%
Germany	19–145	19–52 (33%)	19–55 (34%)	90–145 (56%)	86–145 (54%)	23.7%	22.4%	21.5%	26.0%
Ireland	32–132	32–68 (43%)	32–73 (46%)	99–132 (62%)	97–132 (61%)	4.1%	4.5%	43.0%	49.0%
Malta	43–113	43–64 (40%)	43–66 (41%)	85–113 (53%)	83–113 (52%)	1.0%	1.6%	11.6%	20.5%
N. Ireland	29–129	29–58 (36%)	29–61 (38%)	91–129 (57%)	88–129 (55%)	4.7%	4.3%	25.0%	26.7%
Portugal	27–130	27–66 (41%)	27–68 (43%)	86–130 (54%)	84–130 (53%)	2.9%	2.9%	17.4%	23.5%
Scotland	32–152	32–58 (36%)	32–60 (38%)	87–152 (54%)	84–152 (53%)	4.0%	5.6%	19.6%	24.6%
Sweden	23–124	23–50 (31%)	23–51 (32%)	77–124 (48%)	73–124 (46%)	21.7%	20.2%	6.2%	9.9%
Switzerland	28–140	28–58 (36%)	28–60 (38%)	89–140 (56%)	86–140 (54%)	8.2%	9.7%	22.4%	27.1%
Wales	39–105	39–62 (39%)	39–64 (40%)	81–105 (51%)	79–105 (49%)	1.8%	2.6%	9.9%	15.8%

a Within top/bottom 20% at country level

b Within top/bottom 20% when all data from 13 countries are combined

Table 7: Summary of relationships between demographic and practice characteristics and mean total BPCS score by country

Country	Gender	Pre-Registration Student employed?		CPD participation?		Post-grad qualification?		Participation in multi-disciplinary meetings?		Consultation area?		Participate in Health screening?		Participate in patient monitoring?		Participate in domiciliary visiting?		Participate in health promotion/ education?		Year of Registration	No. of full time equivalent pharmacists	No. of dispensing staff	No. of items dispensed per day
		Mean		Mean		Mean		Mean		Mean		Mean		Mean		Mean		Mean		Pearson (r)	Pearson (r)	Pearson (r)	Pearson (r)
Belgium	Male	73.5	Yes	75.1	Yes	75.6**	Yes	74.2	Yes	78.2**	Yes	78.2*	Yes	75.7**	Yes	79.8**	Yes	76.3*	Yes	74.8**	0.147**	n/a	0.022	0.019
	Female	74.7	No	73.4	No	68.6**	No	74.1	No	71.8**	No	73.3*	No	60.8**	No	67.2**	No	72.0*	No	56.5**				
Denmark	Male	50.9	Yes	47.3	Yes	50.3	Yes	52.0	Yes	63.7**	Yes	53.4	Yes	53.5	Yes	75.0**	Yes	n/a	Yes	55.5*	0.123	−0.022	0.055	−0.022
	Female	50.8	No	51.7	No	52.3	No	49.8	No	45.7**	No	48.1	No	49.4	No	47.6**	No	49.8	No	46.5*				
England	Male	73.7	Yes	79.1	Yes	74.9**	Yes	76.1	Yes	85.4**	Yes	77.1**	Yes	82.6**	Yes	84.4**	Yes	86.4**	Yes	74.7	0.192**	0.200**	0.102	0.047
	Female	74.3	No	73.1	No	56.0**	No	73.7	No	69.6**	No	68.1**	No	69.5**	No	68.5**	No	71.1**	No	67.6				
Germany	Male	68.5*	Yes	77.7**	Yes	71.7**	Yes	71.9	Yes	80.1**	Yes	72.6**	Yes	71.6**	Yes	75.0**	Yes	75.3**	Yes	73.3**	−0.020	0.035	0.035	0.131**
	Female	72.3*	No	70.0**	No	53.2**	No	69.8	No	68.0**	No	63.3**	No	52.0**	No	62.3**	No	65.7**	No	60.3**				
Ireland	Male	81.1*	Yes	88.4	Yes	85.3**	Yes	91.5**	Yes	94.5**	Yes	84.9	Yes	89.9**	Yes	88.7**	Yes	95.0**	Yes	85.0**	0.111*	0.124*	0.087	0.145**
	Female	85.7*	No	82.9	No	76.2**	No	82.3**	No	82.4**	No	81.7	No	80.6**	No	77.4**	No	79.8**	No	78.1**				
Malta	Male	74.6	Yes	73.2	Yes	72.5	Yes	83.0	Yes	76.2	Yes	74.5	Yes	75.7	Yes	75.4	Yes	77.8	Yes	75.5	−0.126	0.125	0.051	−0.016
	Female	73.8	No	74.5	No	76.9	No	73.9	No	73.8	No	73.0	No	73.3	No	73.1	No	74.0	No	72.3				
N. Ireland	Male	71.1	Yes	76.7	Yes	74.4	Yes	71.5	Yes	83.6*	Yes	77.4*	Yes	78.6*	Yes	81.5**	Yes	78.9*	Yes	74.3	0.084	0.103	0.010	0.032
	Female	76.3	No	72.8	No	65.8	No	74.0	No	72.5*	No	71.2*	No	71.4*	No	68.7**	No	71.0*	No	63.6				
Portugal	Male	77.1	Yes	77.0	Yes	76.5	Yes	77.6	Yes	78.3	Yes	76.2	Yes	76.8	Yes	78.4**	Yes	78.4	Yes	76.6	0.092	0.048	0.001	−0.017
	Female	76.3	No	76.4	No	73.1	No	76.3	No	76.2	No	78.3	No	74.8	No	74.6**	No	76.2	No	75.7				
Scotland	Male	73.4	Yes	72.9	Yes	73.4	Yes	77.0	Yes	78.5	Yes	74.1	Yes	76.4*	Yes	79.0**	Yes	78.7**	Yes	73.9	−0.027	0.064	0.134	0.020
	Female	72.9	No	73.2	No	68.9	No	72.2	No	71.8	No	69.5	No	70.3*	No	67.4**	No	68.4**	No	67.0				
Sweden	Male	63.1	Yes	67.5**	Yes	65.4**	Yes	69.2	Yes	67.6	Yes	65.9*	Yes	65.4	Yes	72.8**	Yes	n/a	Yes	67.0**	0.205**	0.068	0.031	0.022
	Female	62.9	No	61.9**	No	57.6**	No	62.6	No	62.4	No	61.6*	No	62.6	No	61.4**	No	62.7	No	61.6**				
Switzerland	Male	70.4*	Yes	74.5	Yes	73.5	Yes	73.2	Yes	82.1**	Yes	74.5*	Yes	74.1*	Yes	75.4**	Yes	77.8**	Yes	74.4**	0.071	0.085	0.050	0.113*
	Female	75.2*	No	73.0	No	61.2	No	73.3	No	70.9**	No	69.3*	No	67.8*	No	66.9**	No	71.3**	No	63.3**				
Wales	Male	72.3	Yes	72.3	Yes	71.5	Yes	68.9	Yes	69.3	Yes	72.8	Yes	72.4	Yes	71.6	Yes	70.1	Yes	71.6	−0.016	−0.127	−0.057	−0.0.20
	Female	70.8	No	71.5	No	69.7	No	71.6	No	72.0	No	69.6	No	71.1	No	71.2	No	71.9	No	70.5				

* Significant at 0.05 level

** Significant at 0.01 level

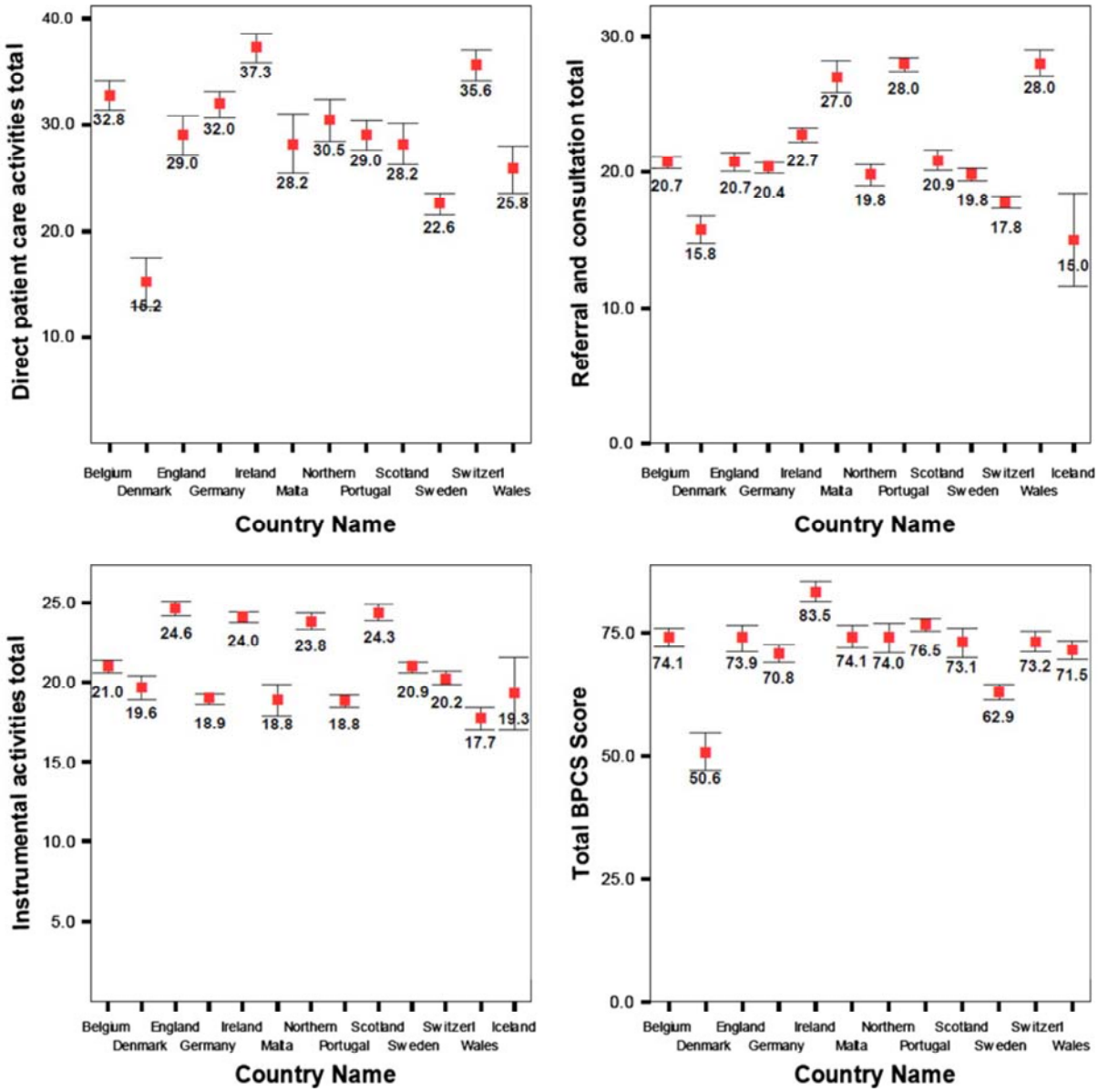

Figure 1: Modified BPCS dimensions and total scores by country. Error bars represent means ± 95% CI

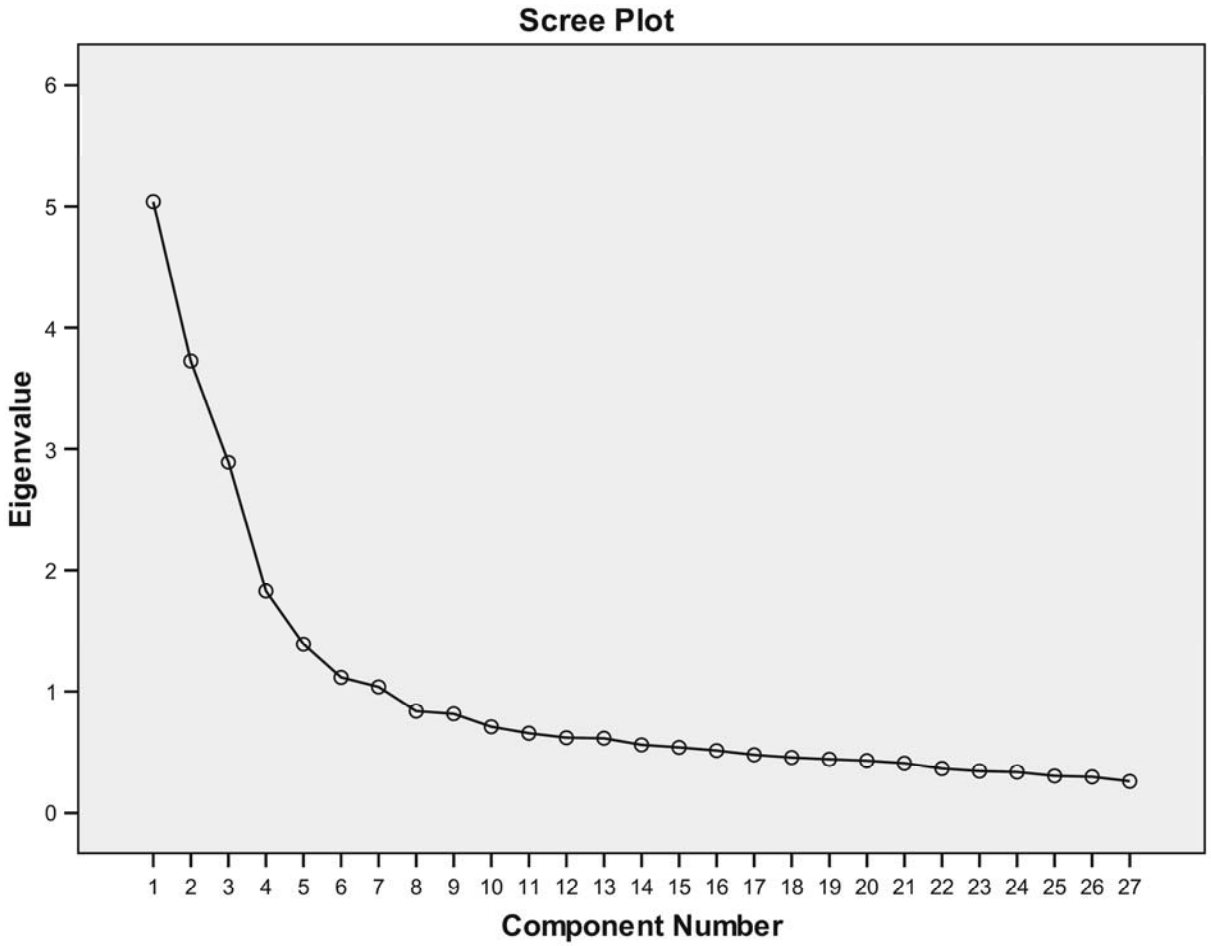

Figure 2: Scree plot of the extracted components versus their eigenvalues for a pooled data from all European countries surveyed

2.2 Project B:

Provision of pharmaceutical care by Swiss and German community pharmacists: in-depth analysis of data from the European BPCS project and comparison with a sample of quality circle pharmacists

Patrick Eichenberger[1], Kurt E. Hersberger[1]

[1] Pharmaceutical Care Research Group, University of Basel, Switzerland

Work report on behalf of the
Förderinitiative Pharmazeutische Betreuung e.V.
c/o ABDA (Germany)

Abstract

Background and aims

The purpose of the present study was an in-depth analysis of data regarding Switzerland and Germany from a previous study which investigated the provision of pharmaceutical care by community pharmacists across Europe using the behavioural pharmaceutical care scale (BPCS). The first aim was to analyse in detail the extent to which pharmaceutical care is provided in these two countries. We also compared data from quality circle pharmacists and data from Danish community pharmacies in the European sample, because they scored lowest in the transnational survey. The second aim was to evaluate the BPCS and to discuss its applicability as a research tool for pharmacy practice.

Methods

A questionnaire-based survey among community pharmacists was conducted in the German speaking part of Switzerland (CH) and in Germany (GER). The first section of the questionnaire focussed on demographic data and services provided in the pharmacy. The second section was an adapted version of the validated BPCS and consisted of three main dimensions (direct patient care activities, referral and consultation activities and instrumental activities). In a prospective way we used the same questionnaire for a survey among quality circle (QC) pharmacists of Bavaria (Germany), a specialised subgroup of community pharmacists who educate themselves regularly in pharmaceutical care. After the publication of the European results we amended our analysis with a comparison of our sample with the BPCS data from pharmacists of Denmark (DK).

Results

Response rates ranged from 10.1% (GER) to 59.9% (QC). The mean total score achieved by community pharmacists, expressed as a percentage of the total score achievable, ranged from 31.6% (DK) to 45.8% (CH). Even though different aspects of pharmaceutical care were implemented to different extent, it was noted that the lowest scores were achieved in the direct patient care dimension (particularly those related to documentation if not automatically done by the computer system, patient

assessment and implementation of therapeutic objectives and monitoring plans), followed by performance evaluation and evaluation of patient satisfaction. In addition, pharmacists who offer domiciliary visiting or health promotion and education scored significantly higher on total score. The specialised quality circle and Danish pharmacists reached significantly lower scores in some dimensions and domains than Swiss and German pharmacists (e.g. dimension: direct patient care activities; domains: documentation, patient record screening, discussion of drug therapy or verification of patient understanding).

Conclusion

The results show that pharmacies in all regions are adequately equipped to provide pharmaceutical care, however, the provision of pharmaceutical care mainly occurs when pharmacists were supported by their computer system, while individual patient approaches seem to be less frequent. Overall, there is much room for improvement. These results should stimulate further research and efforts at a local level to achieve a higher extent of provision of pharmaceutical care. Surprisingly, specialised pharmacists with regular meetings to improve pharmaceutical care in pharmacy practice have lower scores than standard community pharmacies. This result casts doubt on the results of the whole BPCS study, and the question arises if the BPCS tool is sensitive enough to enable a conclusion about the extent to which pharmaceutical care is provided to patients. Thus, further efforts are needed to develop valid assessment tools including indicators for pharmaceutical care activities.

Keywords

Pharmaceutical Care · Switzerland · Germany · Denmark · Quality circles · Community Pharmacy · Pharmacists

Introduction

Pharmaceutical care was first defined in 1975 by Mikael et al. [2]. In 1990, Hepler and Strand defined it as 'the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life.' These outcomes are (i) cure of a disease; (ii) elimination or reduction of a patient's symptomatology; (iii) arresting or slowing of a disease process; or (iv) preventing a disease or symptomatology [6]. Different services provided by community pharmacists have been developed or analysed in different countries (e.g. medication review [40, 183], pharmaceutical care programmes for diabetes [184-186], asthma [23, 31, 32, 38, 187, 188], hypertension [189-192] or heart failure [47]; special services to terminally-ill patients, compliance support [48, 193, 194], methadone services to drug misusers, detecting and preventing drug-related problems [77, 195-202], anti-smoking campaigns [203], and support of nicotine replacement (within a public health strategy) [54, 69, 142, 170, 194, 204-211]. However, pharmaceutical care models and practices differ in various countries [20]. Systematic reviews revealed in 2006 [10, 194], 2007 [61, 63] and 2008 [64] that pharmaceutical care services can be effective in improving medication use and surrogate endpoints, but improvement in other outcomes is less conclusive [30, 66, 212, 213].

To measure pharmacists' pharmaceutical care activities, Odedina et al. [157] developed and validated in 1996 a behavioural pharmaceutical care scale (BPCS) which was adapted two years later and used for a study in Northern Ireland [158] for a survey among community pharmacists. The scale measures three dimensions of pharmaceutical care: Direct patient care activities, referral and consultation activities and instrumental activities. Fourteen domains contribute to these dimensions and to the overall level of pharmaceutical care provided [158].

With this background the Pharmaceutical Care Network Europe (PCNE) initiated a research study across 13 European countries. Within this European project we were in charge of conducting the survey in Switzerland and in Germany and we could use the opportunity to amend the BPCS questionnaire with specific questions with the

intention to perform an analysis among German speaking European community pharmacies.

Switzerland features three main systems to dispense drugs: either the pharmacy is the unique channel to dispense drugs or both physicians and pharmacists have the permission to dispense drugs or the dispensing doctor (DD) is the main channel where patients have the possibility to receive their prescribed drugs. Therefore, Swiss community pharmacies dispense only 55.8% of all drug packages and they share this market with DDs (18.0%), hospitals (19.7%), and drug stores (6.5%) [214]. In Germany, physicians are not allowed to dispense any drugs.

We imagined that different healthcare systems could influence the provision of pharmaceutical care; in particular, DDs could be a barrier for a broad implementation of pharmaceutical care. Therefore, we planned to use our Swiss and German data which we had collected for the survey across 13 countries for an in-depth analysis. In addition, we hypothesized that quality circle pharmacists (QC) of the German state Bavaria – who meet each other 10 times a year with the aim to improve their daily practice and implement pharmaceutical care in a way that patients realize the desire of pharmacists to optimise care of chronically ill patients – would score higher than the ordinary Swiss and German pharmacists. We therefore performed an additional survey with our German version of the BPCS questionnaire with a selected sample of these QC pharmacists.

After completion of our surveys among these three samples, we saw in the survey across the 13 European countries that – surprisingly – Denmark scored lowest [169].

In Denmark several pharmaceutical care services have already been implemented such as medication review and home visits with clinical interventions related to assessment of individuals' drug therapy at the pharmacy or in their homes [28]. These services currently are not provided by community pharmacists in Switzerland and Germany. Thus, we were very surprised to see the significantly lower scores of Danish pharmacists and we used the opportunity to compare our results of standard Swiss and German community pharmacists and the specialised quality circle pharmacists with BPCS data from Danish pharmacists (Fig. 1).

The first aim of this study was to analyse in-depth the extent to which pharmaceutical care is being implemented into routine practice within community pharmacies in the German speaking part of Switzerland and Germany. The second aim was to explore differences between standard pharmacists, pharmacists participating in quality circles, Danish pharmacists and between Swiss pharmacists in regions with or without DDs. The third aim was to evaluate the BPCS scale and to discuss its reliability and applicability as a research tool for pharmacy practice.

Methods

This prospective cross-sectional survey was part of a study across thirteen European countries [169]: Belgium, Denmark, England, Germany, Iceland, Ireland, Malta, Northern Ireland, Portugal, Scotland, Sweden, Switzerland and Wales.

For all thirteen countries the same BPCS was used, although section A was adapted to specific interests with respect to demographic information and services provided in the pharmacy. Therefore, we could introduce some specific questions on the different healthcare systems in Germany and Switzerland.

Data collection

For the survey we used a German version of the questionnaire which was checked for applicability and relevance to the community pharmacy practice in Switzerland and Germany. Section B of the questionnaire was translated into German by two independent translators whose native language was German. The translated version was then back-translated into English. This process included the development of consensus versions resulting from the use of independent back and forward translators, according to Guillemin's guidelines (http://ist.inserm.fr/basisateliers/atel127/guillemin.pdf). The questionnaire was piloted with five community pharmacists as a further check of validity and comprehensibility prior to general distribution. These pilot data were not included in the final analysis.

The four-page questionnaire was sent by regular mail to all community pharmacies (n=814) in the German-speaking part of Switzerland. The mailer included a prepaid return envelope and a covering letter. In Germany, all 16 states were invited to send the questionnaire to their pharmacists (n=21,551) by regular mail. In Bavaria and North Rhine-Westphalia only a randomly selected sample of 29.2% and 13.4% was approached. All specialised quality circle pharmacists who participated in one of the 20 quality circles in the German state Bavaria (Allgäu/Kempten, Ansbach, Aschaffenburg, Augsburg, Bad Tölz, Bamberg, Bayreuth, Cham, Dillingen, Ingolstadt, Landshut, München, Nürnberg, Nürnberger Land, Passau, Regensburg, Rosenheim, Schweinfurt, Traunstein, Würzburg) were invited to fill in the BPCS questionnaire. They received the BPCS questionnaire in their monthly meeting distributed by their circle facilitator.

The covering letter explained the nature of the study. In establishments where several pharmacists were employed, we requested that the questionnaire was completed by the pharmacist with most patient contacts. In the hope of attaining a high response rate through preservation of anonymity, no identifiers were included on the questionnaire. In Switzerland, respondents could choose to give their name to enter an optional prize draw. As a further measure to increase the response rate, a second mailing of questionnaires, along with a new covering letter and prepaid return envelope, was undertaken in Switzerland one month after the first mailing. For logistical reasons it was not possible to send a reminder to German and quality circle pharmacists.

To characterise non-responders in Switzerland (n=422), gender, year of registration, drug dispensing system and type of pharmacy of 100 (23.7%) randomly selected Swiss community pharmacists were assessed by telephone to establish their reasons for not participating. If a pharmacist had already filled in the questionnaire but not indicated his name for the raffle he was not interviewed and the next pharmacist in alphabetical order was contacted. German non-responders were not analysed.

In Denmark the procedure of data collection was carried out as described in the European study [169].

BPCS questionnaire

The questionnaire consisted of two sections. Section A contained 15 questions largely related to demographic information and the characteristics of the pharmacies and different healthcare systems in Germany and Switzerland.

Section B is validated in its original version [157]. Therefore, the adaptation process was restricted to linguistic adaptation and any change in structure was considered inappropriate. Section B included 34 questions and described the frequency of providing pharmaceutical care activities and was a slightly adapted version of the BPCS [157, 158]. The latter scale measures the provision of pharmaceutical care classified under three dimensions (direct patient care activities, referral and consultation) as well as instrumental activities. Fourteen subscales or domains contribute to these three dimensions and provide a score which equates to the overall level of pharmaceutical care provided. Prior the start of section B, a definition of pharmaceutical care was provided to avoid misunderstandings in the interpretation of these words.

The first 17 questions of section B, which constituted the first dimension (direct patient care activities), required the pharmacist to indicate how many of their last five patients who presented a prescription for a chronic condition, were provided certain activities. For example, in one question, the pharmacist was asked to record the number of patients from the last five, with whom they had ‘discussed the patient’s drug therapy with him or her’. To calculate a total score on this dimension, all scores were summed.

The last 15 questions of section B constituted the instrumental activities dimension and the referral and consultation dimension, and asked the pharmacist to indicate how often they carried out various activities over the last two weeks for all their patients, e.g. whether the pharmacist ‘Used a quiet location for patient counselling’.

Two questions within the questionnaire asked how often pharmacists tried to provide pharmaceutical care and how often they consciously decided and made the effort to

provide pharmaceutical care, but responses did not contribute to any scores in any of the dimensions. Therefore, the maximum score possible is 160, the minimum is 15.

Total scores for the three dimensions and the 14 domains were calculated, by adding up individual item scores, for each of the dimensions and domains. A total score was also calculated for the whole scale by adding together the scores of the three dimensions. Some demographic items were grouped for analysis purposes, e.g. year of registration and type of pharmacy. Respondents were further categorised into providers and non-providers of pharmaceutical care. In each case, pharmacies whose total scores fell in the top 20% were considered providers, while those in the bottom 20% were considered non-providers. Results are expressed as proportions and as means ± standard deviation (SD) or medians with the corresponding interquartile range (IQR). Main descriptive results are expressed as absolute numbers and percentages.

Data analysis

Data from all returned questionnaires was processed with the automated forms processing software Teleform® version 7.0 (Cardiff Software Inc., Vista, USA) at the study centre in Basel, Switzerland. Automated forms processing software was validated by Jorgensen et al. [215] who showed an improved quality of the data while reducing the processing time. To avoid potential errors, all numeric and letter recognitions were verified visually on data sheets and on screen. The data was directly transferred to a Microsoft Access® database. Distinct plausibility ranges were defined for each numeric variable and data were deleted when out of this range. Data entry was performed between September 2006 and October 2006 in Basel. Data were analysed with the SPSS® for Windows statistical package version 15.0 (SPSS, Inc, Chicago, IL, USA).

The data were analysed for statistically significant relationships between any of the dimension or domain totals and the demographic data collected by country. In both cases (domains and dimensions), Pearson's correlation coefficient and chi-square were used to test for correlation between continuous variables, and Student's t test (independent samples) was used to assess differences in means between two

categorical variables. One-way analysis of variance (ANOVA) for multiple comparisons was run when appropriate. Non-parametric Mann-Whitney-U and Kruskal-Wallis-H-test were used for unpaired two-sample and multiple comparisons which were not normal distributed; normal distribution was tested with Kolmogorov-Smirnov-test. p values less than 0.05 were considered statistically significant. Every dimension and domain was checked for reliability (Cronbach's alpha).

Results

Response rate

Out of the 814 pharmacies in the German-speaking part of Switzerland, 394 (48.4%) returned the BPCS questionnaire to the study centre. Out of them, 2 questionnaires had to be excluded from analysis due to missing data. Out of all 16 German states we received questionnaires from 8 states, resulting in a sample of 725 (10.1%) completed questionnaires; this largely pragmatic sample was used for the German analysis. Out of 157 quality circle community pharmacists in Bavaria, 94 (59.9%) sent back the BPCS questionnaire. In Denmark 137 (42.7%) out of the 321 community pharmacies sent back questionnaires. Consequently, the eligible study population included 392 CH, 725 GER, 94 QC and 137 DK questionnaires.

Demographics

Demographic characteristics of the respondents and of their pharmacies corresponding to each country are shown in Table 1. The fraction of female pharmacists differed significantly between Danish (82.5%) and other pharmacists: 58.7% (QC) – 61.4% (CH).

Only 37.8% of Swiss pharmacists worked in an independent pharmacy in contrast to 77.4% QC, 77.7% GER and 100.0% of Danish pharmacists. In Denmark only 22.6% of pharmacies employed less than two pharmacists but 42.3% employed 2.0 – 2.9 and 30.7% more than 3 pharmacists. Most other pharmacies in our sample only had

1.0 – 1.9 pharmacists employed (63.6% QC – 70.7% CH) and only 6.7% (CH) – 9.1% (QC) pharmacies more than 3 pharmacists.

The relation between the number of pharmacists and the number of dispensing assistants is 0.21 in Danish but 0.46 in Swiss and 0.67 in quality circle pharmacies. Sixty-seven percent (QC) – 81.0% (GER) of pharmacists indicated to have a private consultation area in their pharmacy, whereas only 46.0% of Danish pharmacists affirmed this question.

Quality circle pharmacists participate significant more frequently in regular local multi-disciplinary team meetings than Swiss (20.5%) or Danish pharmacists (29.9%). Danish pharmacists offer significantly fewer health services, such as health screening (20.4%) or patient monitoring (5.1%) than Swiss (84.9%; 76.3%), German (96.0%; 65.6%) or quality circle (95.7%; 51.1%) pharmacists. None of the Danish pharmacists reported to offer domiciliary visiting; 29.7% (CH) – 53.2% (GER) pharmacists provided this service.

Assuming an average number of five items per prescription, Danish pharmacies process an average of 177 prescriptions per day in contrast to 62.2 (CH) and 107.3 (GER). More detailed demographic characteristics of the respondents and of their pharmacies corresponding to each country are shown in Table 1.

Respondents' scores on the BPCS

The respondents' scores of the modified BPCS questionnaire of Swiss, German, quality circle and Danish pharmacists are shown in Table 2. Every dimension and domain was checked for reliability (Cronbach's alpha). The values are shown in Table 9.

Swiss pharmacists reached a mean of 45.8% (73.2 ± 18.7) of the maximum achievable total score, German pharmacists 44.3% (70.8 ± 22.0), quality circle pharmacists 38.2% (61.1 ± 20.1) and Danish pharmacists 31.6% (50.6 ± 17.8). The mean total score of Danish and quality circle pharmacists differed significantly from those of Swiss and German pharmacists ($p<0.001$; t test); mean total scores of

Danish and quality circles differed significantly ($p<0.001$; t test); there was no significant difference between the mean total scores of Swiss and German community pharmacists ($p=0.057$; Mann-Whitney-U-test) (Fig. 2).

Drug-related problems

Pharmacists had to indicate whether or not they had detected a drug-related problem (DRP) within the last 10 prescriptions (five new and five repeat prescriptions) they processed (Table 6 and Table 7). Two questions were not part of the validated BPCS total score *(Section B: 18. How often did you try to provide pharmaceutical care to these patients? Section B: 19. How often did you consciously decide and make the effort to provide pharmaceutical care to these patients?);* they referred to the self-estimated extent of provision of pharmaceutical care by pharmacists (Table 8) in general, considering all the patients with chronic conditions that the pharmacist had seen in the previous six weeks.

Providers and non-providers of pharmaceutical care

Pharmacists scoring in the top 20% on the BPCS were categorized as providers of pharmaceutical care (score range 89 – 140 (CH), 90 – 145 (GER), 78 – 105 (QC), 66 – 113 (DK)), those scoring in the bottom 20% as non-providers (score range 28 – 58 (CH), 19 – 52 (GER), 24 – 41 (QC), 23 – 34 (DK)). According to this definition, we found in our study 17.9% (CH), 17.4% (GER), 18.1% (QC) and 13.1% (DK) pharmacists classified as providers and 18.9% (CH), 18.1% (GER), 17.0% (QC) and 11.7% (DK) as non-providers, respectively.

Overall (CH, GER, QC, DK; n=1348), the percentages of providers within top 20% (range 89 – 145) was 17.3% and the percentage of non-providers within bottom 20% (range 19 – 53) was 17.7%.

Non-respondent analysis

We could only perform a non-respondent analysis in Switzerland. A sample of non-respondents among Swiss community pharmacists (n=100) was contacted by

telephone for a short interview to elicit reasons for not answering the questionnaire. The main reason for not participating was lack of time, indicated by 64%. Other reasons were a general policy not to answer to questionnaires (16%), absence of the responsible pharmacist (7%) and that the pharmacy did not practice pharmaceutical care (5%). In all characteristics (gender, year of graduation, type and geographic location of pharmacy and practicing in a region with dispensing doctors) non-respondents did not differ from the study sample.

Discussion

This in-depth analysis of the Swiss, German and Danish BPCS study sample and the comparison with a sample of quality circle pharmacies tried to measure the general provision of pharmaceutical care in community pharmacies from the pharmacists' perspective. This analysis resulted in valuable findings which enrich the published analysis across the 13 European countries [169] which showed that community pharmacies seem to be adequately equipped to provide pharmaceutical care but there is much room for improvement to intensify the provision of pharmaceutical care in the daily routine of community pharmacy practice. Results show that pharmacists are documenting patients' data if they are supported by their computer system while information on patients' health condition is not documented. Considering that pharmaceutical care is the 'promise to do whatever possible to make sure the patient achieves positive outcomes from drug therapy' [171] pharmacists should not only document details of prescription processing but also document follow-up activities for chronic patients.

The low scores found in this study can be explained by known barriers to the provision of pharmaceutical care from the literature: excessive workload, lack of privacy, patient attitudes, store layout [174], lack of financially viable business models to implement care services, access to patients' clinical and laboratory data, and motivation to implement care services [20]. Possible barriers to intensify collaboration with physicians are difficulties contacting them because of physicians' workloads or negative physician attitudes toward pharmacists' recommendations [174].

Through the in-depth analysis of our own results we found that the BPCS score has weaknesses, mainly in section A. In contrast to section B, this section is not validated and each country was free to add specific questions or to adapt to characteristics of the healthcare system (e.g. in Switzerland regions with or without dispensing doctors). We hypothesize that a considerable number of participants probably did not understand several questions or topics of the BPCS and therefore, results should be interpreted carefully. There is no opportunity for complex statistical analysis; the simple univariate analysis enables us to discuss potential influences coming from the healthcare system and is only a first attempt to elaborate hypothesis for a possible follow-up study.

Demographics

The structure of pharmacies differed a lot between our samples; these differences are important to consider if comparisons are made (Table 1). Pharmacies of different regions differed in the affiliation to chains, the service of domiciliary visiting as well as health screening, which is more frequently done by German standard and quality circle pharmacists than by Swiss or Danish pharmacists. Local multidisciplinary team meetings are arranged significantly more frequent by quality circle than by Swiss, German or Danish pharmacies. Swiss pharmacists indicated they more often verified patient understanding in contrast to German and Danish pharmacists. Danish pharmacists have fewest private consultation areas and they indicated they documented very rarely or never all patients' medications; quality circle pharmacists also have significant fewer consultation areas than Swiss and German pharmacists. The lower scores of specialized than standard pharmacists in different variables (e.g. direct patient care activities, documentation, check for possible DRPs) are surprising and difficult to interpret. One possible explanation is that most quality circle pharmacists responded to the questionnaire but only a selected sample did so in Switzerland and Germany.

There were twice as many prescriptions carried out per day in German than in Swiss community pharmacies. We checked the number of prescriptions in Swiss pharmacies with national data (RoKA – 'Rollende Kostenanalyse Schweizer Apotheken') of the Swiss pharmacists' association and could verify our findings.

However, the number of prescriptions in German quality circle pharmacists is similar (p=0.682; Mann-Whitney-U-test) to the number in standard German pharmacies.

In German pharmacies there are more pharmacists but fewer dispensing assistants employed than in Swiss pharmacies, and in quality circle pharmacies there are fewer pharmacists and dispensing assistants than in the other two countries. Danish pharmacies have a similar mean number of employed pharmacists than other countries but they have twice and four times as many employed dispensing assistants as other countries.

In German and quality circle pharmacies the number of prescriptions per pharmacist and dispensing assistant was significantly higher than in Switzerland. Danish pharmacists seem to process many more prescriptions. Assuming to have an approximate number of five items per prescription there are about 177 prescriptions per day per pharmacy in contrast to 62.2 (CH) and 107.3 (GER). Considering the number of inhabitants in relation to the number of pharmacies in each country we find a ratio of more than 17,000 for Denmark, 4,500 for Switzerland and only 3,800 for Germany. Danish pharmacies seem to be very big with a high workload.

For the survey it was not important if the pharmacy of the participating pharmacist was large or not; this did not influence the respondents' score because we asked about pharmaceutical care activities of the last two or six weeks of one single pharmacist and not of the whole pharmacy. However, depending on the workload of each pharmacist, the willingness to provide pharmaceutical care could be influenced by the time available for each patient.

Pharmacists of all countries indicated they participate very often in continuing professional development, with the lowest score for Danish pharmacists. In Switzerland the number of pharmacists who passed a postgraduate qualification (PQ) is significantly higher than in all other groups (Table 1). However, this postgraduate qualification was mostly achieved without attending a specific curriculum but through a temporary arrangement for pharmacists with at least 5 years of professional experience before the implementation of PQs for community pharmacists in 2004 by the Swiss association of pharmacists.

Participants had to indicate whether or not they check for possible DRPs during the prescription processing. About one third of all pharmacists of all countries reported they detect one or more DRP (Table 6). With 90.4%, quality circles pharmacists were most active and again, the Danish pharmacists had the lowest scores. But it is in question if all pharmacists – in particular Swiss and German pharmacists – are aware of a proper DRP definition and if they know how to recognize DRPs. We hypothesize that quality circle pharmacies are much more sensitised to screen for DRPs and the high frequency reflects their adoption of the philosophy of pharmaceutical care. A recently published study about self reported DRPs in Switzerland revealed that there are only 0.8 – 1.9% of clinical and technical DRPs in all prescriptions carried out in Swiss community pharmacies [83]. A survey of DRPs focussing only on new prescriptions in Switzerland showed that in 53.4% of all prescriptions at least one DRP could be detected [169]. Thus, it is very important to assess in section A of the questionnaire if repeat prescriptions are allowed; in Switzerland this is possible whereas in Germany not. To implement routinely the documentation of DRPs it would be important to have the possibility to document them electronically as in Sweden where all pharmacies have an information technology-based DRP documentation system [121].

Swiss pharmacists scored highest in the total score (Table 2) and the results differed significantly from those of Danish and quality circle pharmacists (Table 5); all total scores between all countries differed significantly from each other. Total scores were significantly higher if medical or clinical information was provided by the GP (apart from Denmark) and if domiciliary visits (apart from Denmark) or health promotion and education are offered by the pharmacy (Table 4).

Comparison with quality circle and Danish pharmacists

We expected quality circle pharmacists to reach higher scores in all items and dimensions than other pharmacists but the reverse was observed (Table 2). Quality circle pharmacies had the lowest scores for the instrumental activities and achieved in almost all items lower values for pharmaceutical care activities than standard German and Swiss community pharmacies. Danish pharmacists reached the lowest

scores for direct patient care and referral and consultation activities even if in Denmark different cognitive pharmaceutical care services are implemented as, for example, a medication review service, which the patients have to pay for themselves and a governmental paid technical service 'check the inhalation'. In Switzerland a new cognitive service paid by the health insurance providers is expected to start soon; no similar service is officially provided by German pharmacies. In Denmark, elaborated cognitive services (e.g. medication review) probably are provided to some few patients but basic PC elements which are asked for in the BPCS questionnaire (e.g. ‘documentation of therapeutic goals’, ‘carrying out a follow-up plan’) are not done.

One explanation could be that quality circle and Danish pharmacists know better the philosophy and practice of pharmaceutical care. And, with additional services provided to patients they had experienced all the barriers and difficulties to implement pharmaceutical care into daily practice; therefore, they might have rated themselves very critically because of their individual knowledge. They are probably much more sensitised to screen their patients for pharmaceutical care issues and hereby experience all the difficulties of its provision in a comprehensive way.

On the other hand, Swiss and German standard pharmacists with probably limited knowledge of and experience with the provision of pharmaceutical care rated themselves more positively because they think they are performing already pharmaceutical care very well. Such different appraisal of pharmaceutical care could be influenced by the extent of continuing education and specific training on pharmaceutical care. Pharmacists of both subgroups, Switzerland and Germany, participate very regularly in CPD; no significant differences could be found between Swiss, German and the quality circle pharmacists, but they existed between Denmark and all other samples. Only German community pharmacists reached significantly increased total scores if they participated regularly in CPD.

Probably, this result among others is not well coded because there was too little explanation of the questioned services (e.g. check for DRPs: what is a DRP? carry out a follow-up plan: what is a follow-up plan? assessment of actual patterns of use of the medication: what is a pattern of use of the medication?).

Understanding of the BPCS questionnaire's wording was tested through a pilot. The pilot concerned testing of the phrasing and understanding of questions. If necessary we changed the wording of questions in a way to make it more comprehensible for participants taking into account not to change the content of the questions because of its validation. Maybe we assumed by mistake that the meaning of questions was understandable for all pharmacists and in the BPCS survey we probably had not sufficiently explored, how providers and non-providers of pharmaceutical care would respond to our questions. Such a validation is lacking and the provision of the Hepler definition of pharmaceutical care in our questionnaire was supposably not enough. For a further use in research of the BPCS comprehensive definitions of discussed services and actions should be given to the responder.

A further explanation could be that pharmacists who voluntarily participate in quality circles show a higher awareness of the benefits of pharmaceutical care activities and have higher expectations on themselves. It becomes obvious that both the comparison of pharmacists who work in different types of pharmacies in different countries and different regions and the interpretation of the results are very difficult. The social desirability of participants should not be underestimated even if we guaranteed anonymity of questionnaires. This is a potential source of bias which is well known [216-218].

Discussion in focus groups of the results of this questionnaire survey with community pharmacists might be a rational procedure to deepen these explanations as carried out by Odedina et al. [180]. In addition, such a survey needs very profound knowledge about respondents' characteristics. Thus, section A of the questionnaire becomes very important. In the PCNE-BPCS project only questions in the section B were standardised and validated across all countries and section A could be freely modified. For future research much more emphasis should be placed on the development of adequate questions in section A. In addition, the nature and severity of the detected problems should be assessed to have the possibility to compare pharmaceutical care activities.

Different healthcare systems in Switzerland

The comparison between the different healthcare systems in Switzerland revealed a trend towards higher (direct patient care and referral activities) or similar (instrumental activities) scores when prescribed drugs were exclusively dispensed through pharmacies. In half of all cantons of Switzerland this channel of drug dispensing is allowed, all over Germany regular drug dispensing through physicians is prohibited by law. There were no further differences.

Reliability estimate

Because the results in single items of all countries differed significantly from the composed result on domain or dimension level – in particular for the domain 'documentation' (B2, B3, B5, B13, B14, B17) – we checked dimensions and domains for reliability using cronbach's alpha resulting in values which indicate that some dimensions and domains may need a revision. Typically, [219] cronbach's alpha values of at least 0.7 are considered to reflect sufficient reliability. Even if some domains or dimensions showed alpha values >0.7 (e.g. direct patient care activities, patient assessment), the remaining domains or dimensions should be re-evaluated in the case of a further use of this tool.

Therefore, results should be analysed rather in detail than in dimensions or domains to be able to provide community pharmacists with helpful information about their current performance of pharmaceutical care and to show where possible gaps could be. The consideration only of dimensions and domains results in a possible undifferentiated view and this could lead to misinterpretations of pharmacists' pharmaceutical care activities. Looking at single questions provides much more insight into differences of the practice of pharmaceutical care in different regions. At the same time they give important information about how to improve particular activities. Therefore we amended the way to present the results and listed every single item in contrast to the original BPCS study.

Limitations

One major limitation of the study is the sample selection ('response rate selection'). The response rate in Switzerland (48.2%) and Denmark (42.7%) are satisfactory but too low to represent pharmacists' activities in general.

In Germany most likely only pharmacists responded to the questionnaire with a positive attitude to pharmaceutical care or to scientific studies in general because of the low response rate (10.1%). Thus, it is not possible to make a valid statement about the extent of pharmaceutical care provision. However, 59.9% of the quality circles of Bavaria, within Germany, sent back their questionnaires, which allows a conclusion about the degree of the implementation of pharmaceutical care in these pharmacies. They meet each other ten times a year and elaborate pharmaceutical care tools for the community pharmacy practice.

Because we did not reach a response rate of 60%, there is the limitation that only people participated in the survey who are interested in the field of pharmaceutical care [220]. Response rates in postal questionnaire surveys among healthcare professionals have been falling lasting recent years because of an increasing number of commercial requests and other reasons, such as increasing paperwork and time constraints [221]. In addition, the length of our questionnaire, 64 items on 4 pages, may not have motivated recipients to complete it.

One of the most significant factors enhancing response rates is a monetary incentive [222]. However, such incentives are often not affordable for adequately powered analysis. Another effective method to increase response rates is sending several reminders [222]. In our study this was only possible in Switzerland.

Outlook

A possibility for a further use of the BPCS could be a tool to compare a sample of randomly selected pharmacists or regions over a certain time. If monitoring pharmacists' efforts to provide pharmaceutical care, we suggest that the same pharmacists should answer in the same way and with the same extent of social

desirability if they complete the same questionnaire twice. However, a limitation could be that the BPCS tool is not sensitive enough and is not tested and validated for such a survey.

A further possibility would be to conduct a survey with the BPCS questionnaire but instead of evaluating themselves they are evaluated by an other pharmacist. This allows one to reach a probably more realistic estimation of the provision of pharmaceutical care without any social desirability. In doing so the problem would be a low number of investigated pharmacists because of the huge effort.

Some of the BPCS items assessing pharmaceutical care activities could be integrated in the pharmacy software. Each time the pharmacist is checking or entering certain data into the software, an electronic reminder could prompt them to provide more frequently pharmaceutical care services. An Australian study recently showed that computerized prompts are effective in changing the behaviour of health professionals in a variety of settings [223].

The advantage of electronic prompts is that activities carried out would be stored automatically in a database which could be used for an evaluation regarding pharmaceutical care as, for example, the BPCS. Social desirability would no longer be a potential bias because of the availability of objective data. Such databases already exist in Sweden for the documentation of DRPs [125].

Conclusion

The results show that pharmacies of all regions are adequately equipped to provide pharmaceutical care. However, activities mainly occur when pharmacists were supported by their computer system while individual patient approaches like documentation of patients' medical condition or desired therapeutic objectives for patients seem to be less frequent. Overall, much room for improvement in different activities is evident. Professional continuing education and advanced training in the topic of pharmaceutical care, as well as more explanations and definitions within the questionnaire, could be a possibility to avoid misunderstandings in the

comprehension of what is meant with ‘pharmaceutical care services’ by the responding pharmacists. Results should stimulate further research and efforts at local level to achieve a higher extent of provision of pharmaceutical care. Therefore, results presented in detail are much more meaningful than when aggregated in domains and dimensions.

However, if the results are analysed in detail, the question arises if the BPCS tool is sensitive enough to enable a conclusion about the extent to which pharmaceutical care is provided to patients. Surprisingly, specialised pharmacists with regular meetings to improve pharmaceutical care in pharmacy practice have lower scores in several dimensions and domains than standard community pharmacies. This result questions on principle the results of the whole BPCS study. Thus, further efforts are needed to develop valid assessment tools including indicators for pharmaceutical care activities. The goals are to monitor regularly the extent to which pharmaceutical care is implemented in practice, to evaluate outcomes of this practice and to deduce the competences and skills required.

Acknowledgements

We would like to thank all the pharmacists who completed the BPCS questionnaire and enabled this study. Furthermore, we would like to thank Prof. Dr. Marion Schaefer, Berlin, for the support of the data collection in Germany, Dr. Helmut Schlager, Munich, for the data collection in quality circle pharmacists and Prof. Dr. Birthe Søndergaard, Copenhagen for the provision of the Danish database.

Funding

The Senglet Foundation (Basel, Switzerland) and the Förderinitiative Pharmazeutische Betreuung e.V. (c/o ABDA, Berlin, Germany) funded this research project.

Conflicts of interests

None

Tables and figures

Table 1: Characteristics of study sample (n=1348) of Swiss (n=392), German (n=725), Danish (n=137) and quality circle pharmacists (n=94) as well as statistical comparisons between each group

		CH (n=392)	GER (n=725)	QC (n=94)	DK (n=137)	CH vs. GER	CH vs. QC	CH vs. DK	GER vs. QC	GER vs. DK	QC vs. DK
		No. (%)				p values (95%; 2-sided)					
Gender	female	239 (61.4)	433 (60.6)	54 (58.7)	113 (82.5)	p=0.796[a]	p=0.628[a]	p<0.001[a]	p=0.719[a]	p<0.001[a]	p<0.001[a]
	missing	*3*	*11*	*2*	*1*						
Years since registration	mean ± SD	20.3 ± 9.8	21.0 ± 11.1	18.5 ± 9.5	19.5 ± 12.0	p=0.498[b]	p=0.157[b]	p=0.881[b]	p=0.071[b]	p=0.663[b]	p=0.249[a]
	missing	*10*	*29*	*5*	*5*						
Type of pharmacy	independant	147 (37.8)	558 (77.7)	72 (77.4)	137 (100.0)	p<0.001[a]	p<0.001[a]	p<0.001[a]	p=0.948[a]	p<0.001[a]	p<0.001[a]
(group: ≥2	member of a chain	47 (12.1)	18 (2.5)	1 (1.1)	0 (0.0)	p<0.001[a,b]	p<0.001[a,b]	p<0.001[a]	p=0.390[a]	p=0.061[a]	p=0.224[a]
<u>independent</u>	arranged in a group	195 (50.1)	142 (19.8)	20 (21.5)	0 (0.0)	p<0.001[a]	p<0.001[a]	p<0.001[a]	p=0.695[a]	p<0.001[a]	p<0.001[a]
pharmacies)	*missing*	*3*	*7*	*1*	*0*	-	-	-	-	-	-
Dispensing doctors	allowed	143 (36.5)	†	†	†	†	†	†	†	†	†
	not allowed	110 (28.1)	†	†	†	†	†	†	†	†	†
	mixed form	125 (31.9)	†	†	†	†	†	†	†	†	†
	missing	*14 (3.6)*	†	†	†	†	†	†	†	†	†

continued next page

		CH (n=392)	GER (n=725)	QC (n=94)	DK (n=137)	CH vs. GER	CH vs. QC	CH vs. DK	GER vs. QC	GER vs. DK	QC vs. DK
		No. (%)				p values (95%; 2-sided)					
Location	city or town centre	91 (23.2)	160 (22.1)	29 (30.9)	37 (27.0)	p=0.754[a]	p=0.102[a]	p=0.342[a]	p=0.055[a]	p=0.217[a]	p=.503[a]
	suburban	110 (28.1)	269 (37.1)	26 (27.7)	74 (54.0))	p=0.001[a]	p=0.991[a]	p<0.001[a]	p=0.073[a]	p<0.001[a]	p<0.001[a]
	rural	150 (38.3)	248 (34.2)	35 (37.2)	24 (17.5)	p=0.237[a]	p=0.941[a]	p<0.001[a]	p=0.550[a]	p<0.001[a]	p=0.001[a]
	in a shopping centre	39 (9.9)	34 (4.7)	2 (2.1)	-	p=0.001[a]	p=0.016[a]	p<0.001[a]	p=0.255[a]	p=0.009[a]	p=0.083[a]
	missing	*2*	*14*	*2*	*2*	-	-	-	-	-	-
Pharmacy integrated in a health centre or centre with several physicians	yes	33 (8.4)	157 (21.7)	12 (12.8)	-	p<0.001[a]	p=0.152[a]	p<0.001[a]	p=0.180[a]	p<0.001[a]	p<0.001[a]
	missing	*45*	*9*	*16*	*-*						
No. of full-time equivalent pharmacists	1.0-1.9	275 (70.7)	491 (69.2)	56 (63.6)	31 (22.6)	p=0.013[b]	p=0.616[b]	p=0.001[b]	p=0.104[b]	p<0.001[b]	p=0.041[b]
	2.0-2.9	88 (22.6)	160 (22.1)	24 (27.3)	58 (42.3)						
	≥3	26 (6.7)	59 (8.3)	8 (9.1)	42 (30.7)						
	missing	*3*	*15*	*6*	*6*						
No. of full-time equivalent dispensing assistants	0.0-0.9	5 (1.3)	52 (7.3)	7 (7.9)	5 (3.6)	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.120[b]	p<0.001[b]	p<0.001[b]
	1.0-1.9	43 (11.1)	190 (26.5)	31 (34.8)	2 (1.5)						
	2.0-2.9	80 (20.7)	191 (26.7)	25 (28.1)	4 (2.9)						
	≥3	258 (66.8)	283 (39.5)	26 (29.2)	124 (90.5)						
	missing	*6*	*9*	*5*	*2*						

continued next page

		CH (n=392)	GER (n=725)	QC (n=94)	DK (n=137)	CH vs. GER	CH vs. QC	CH vs. DK	GER vs. QC	GER vs. DK	QC vs. DK
		No. (%)				p values (95%; 2-sided)					
Number of pharmacists per number of dispensing assistants	median (IQR)	0.46 (0.30)	0.61 (0.57)	0.67 (0.68)	0.21 (0.11)	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.043[b]	p<0.001[b]	p<0.001[b]
	missing	*12*	*35*	*9*	*7*						
No. of prescriptions per pharmacist	mean (SD)	36.7 ± 25.8	70.0 ± 53.4	63.5 ± 25.4	84.3 ± 28.3	p<0.001[b]	p<0.001b	¦	p=0.970[b]	¦	¦
	median (IQR)	30.9 (30.0)	60.0 (42.0)	61.1 (30.3)	176.9 ‡ (-)						
	missing	*30*	*69*	*21*	*30*						
No. of prescriptions per dispensing assistant	median (IQR)	13.8 (13.6)	37.5 (27.7)	45.2 (33.5)	102.5 ‡ (73.0)	p<0.001[b]	p<0.001[b]	¦	p=0.109[b]	¦	¦
	missing	*35*	*75*	*20*	*35*						
Pre-registration student employed	yes	59 (15.1)	73 (10.1)	13 (13.8)	37 (27.0)	p=0.013[a]	p=0.751[a]	p=0.002[a]	p=0.267[a]	p<0.001[a]	p=0.016[a]
	missing	*2 (0.5)*	*2 (0.3)*	*0*	*1*						
Participating in continuing professional development (CPD)	yes	377 (97.2)	692 (95.7)	93 (98.9)	123 (89.8)	p=0.226[a]	p=0.323[a]	p<0.001[a]	p=0.130[a]	p=0.004[a]	p=0.006[a]
	missing	*4*	*2*	*0*	*0*						
Private consultation area existing	yes	302 (77.0)	587 (81.0)	63 (67.0)	63 (46.0)	p=0.120[a]	p=0.044[a]	p<0.001[a]	p=0.002[a]	p<0.001[a]	p=0.002[a]
	missing	*0*	*0*	*0*	*1*						

continued next page

		CH (n=392)	GER (n=725)	QC (n=94)	DK (n=137)	CH vs. GER	CH vs. QC	CH vs. DK	GER vs. QC	GER vs. DK	QC vs. DK
		No. (%)				p values (95%; 2-sided)					
Postgraduate qualification in community, hospital or clinical pharmacy or pharmacy practice	yes	282 (71.9)	340 (46.9)	46 (48.9)	60 (43.8)	p<0.001[a]	p<0.001[a]	p<0.001[a]	p=0.717[a]	p=0.542[a]	p=0.471[a]
	missing	*0*	*1*	*0*	*1*						
Participation of regular local multi-disciplinary team meetings	yes	80 (20.5)	168 (23.2)	59 (62.8)	41 (29.9)	p=0.288[a]	p<0.001[a]	p<0.021[a]	p<0.001[a]	p=0.085[a]	p<0.001[a]
	missing	*1*	*2*	*0*	*1*						
Provision of medical/clinical information from GP	yes	250 (67.2)	410 (57.7)	38 (42.2)	59 (43.1)	p=0.002[a]	p<0.001[a]	p<0.062[a]	p=0.005[a]	p=0.941[a]	p=0.037[a]
	missing	*20*	*14*	*4*	*34*						
Offering of health screening	yes	333 (84.9)	696 (96.0)	90 (95.7)	28 (20.4)	p<0.001[a]	p=0.005[a]	p<0.001[a]	p=0.906[a]	p<0.001[a]	p<0.001[a]
	missing	*0*	*0*	*0*	*6*						
Offering of patient monitoring	yes	297 (76.3)	472 (65.6)	48 (51.1)	7 (5.1)	p<0.001[a]	p<0.001[a]	p<0.001[a]	p=0.006[a]	p<0.001[a]	p<0.001[a]
	missing	*3*	*5*	*0*	*9*						
Offering of domiciliary visiting	yes	115 (29.7)	384 (53.2)	38 (40.4)	0 (0.0)	p<0.001[a]	p=0.046[a]	p<0.001[a]	p=0.020[a]	p<0.001[a]	p<0.001[a]
	missing	*5*	*3*	*0*	*7*						
Offering of health promotion / education	yes	350 (89.5)	589 (81.5)	59 (62.8)	67 (48.9)	p<0.001[a]	p<0.001[a]	p<0.001[a]	p<0.001[a]	p<0.001[a]	p=0.049[a]
	missing	*5*	*2*	*0*	*2*						

continued next page

a) Pearson’s chi-square

b) Mann-Whitney-U-test (for variables not corresponding to the theoretical distribution)

c) Student-t-test (for variables corresponding to the theoretical distribution)

d) ANOVA

† No data because drug dispensing through physicians is only allowed in some regions of Switzerland

‡ The ‘number of prescriptions’ in Denmark corresponds to the number of prescription items dispensed in an average day (originally we received the number of prescription

Items dispensed per month)

¦ No comparisons possible because of different data in different countries (CH/GER/QC: no. of prescriptions; DK: no. of prescription items)

Table 2: Respondents' scores (section B) of Swiss (n=392), German (n=725), Danish (n=137) and quality circle (n=94) pharmacists

		Switzerland (n=392)		Germany (n=725)		Quality circles (n=94)		Denmark (n=137)	
Dimension and Domain	possible range	Median (IQR)	MD †	Median (IQR)	MD †	Median (IQR)	MD †	Median (IQR)	MD †
Direct patient care activities (1-17)	0-85	*35.6 ± 13.9* ‡	38	*31.9 ± 16.0* ‡	54	*24.7 ± 14.5* ‡	6	*15.2 ± 11.8* ‡	33
Documentation (2,3,5,13,14,17)	0-30	10 (10)	19	6 (9)	12	5 (7)	2	0 (2)	25
Patient assessment (1, 4, 9-12)	0-30	9 (8)	12	12 (11)	7	9 (9)	1	6.5 (8)	11
Implementation of therapeutic objectives and monitoring plans (15,16)	0-10	2 (5)	22	2 (5)	37	2 (4)	4	0 (1)	23
1: Assessment of medical condition	0-5	1 (2)	4	2 (3)	2	1 (2)	0	0 (1)	8
2: Documentation of medical condition	0-5	0 (2)	4	0 (1)	1	0 (1)	0	0 (0)	8
3: Documentation of all medications	0-5	5 (1)	3	3 (3)	1	2 (4.3)	0	0 (0)	8
4: Assessment of patient's expectations of drug therapy	0-5	0 (1)	6	0 (2)	2	0 (1)	0	0 (1)	9
5: Documentation of desired therapeutic objectives for the patient	0-5	0 (0)	6	0 (0)	3	0 (0)	0	0 (0)	9
6: Patient record screening	0-5	5 (1)	3	3 (3)	1	3 (4)	0	0 (0.8)	9
7: Discussion of drug therapy	0-5	4 (2)	4	2 (3)	2	2 (3.3)	0	2 (3)	10
8: Verification of patient understanding	0-5	5 (2)	5	4 (3)	4	2 (4)	0	2 (3)	10
9: Assessment of actual patterns of use of the medication	0-5	2 (3)	5	3 (3)	1	3 (3)	0	2 (2)	6
10: Check for possible DRPs	0-5	2 (2)	5	2 (3)	0	2 (2)	0	1 (1.8)	5
11: Assessment of perceived effectiveness of drugs already used	0-5	2 (2)	4	2 (2)	1	1 (3)	0	1 (2)	5
12: Assessment of achievement of therapeutic goals	0-5	1 (2)	7	2 (3)	3	1 (3)	1	1 (2)	6
13: Documentation of DRPs	0-5	1 (5)	8	0(2)	2	0 (2)	0	0 (0)	21
14: Documentation of therapeutic goals for each DRP identified	0-5	0 (1)	13	0 (0)	5	0 (0)	2	0 (0)	22
15: Implementation of a strategy to resolve DRPs	0-5	1 (3)	8	2 (3)	2	1 (3)	1	0 (1)	21
16: Carrying out follow-up plan	0-5	0 (2)	22	0 (2)	37	0 (1)	4	0 (0)	23
17: Documentation of interventions	0-5	2 (4)	9	1 (3)	2	0 (2)	0	0 (0)	22

continued next page

		Switzerland (n=392)		Germany (n=725)		Quality circles (n=94)		Denmark (n=137)	
Dimension and Domain	possible range	Median (IQR)	MD †	Median (IQR)	MD †	Median (IQR)	MD †	Median (IQR)	MD †
Referral and consultation activities (20-26,33)	8-40	17 (7)	12	20 (8)	24	19 (7)	1	15 (6.3)	19
20: Consultation with other pharmacists	1-5	3 (1)	1	3 (2)	11	3 (2)	0	2 (1)	10
21: Made referrals to other pharmacists	1-5	2 (2)	3	3 (2)	14	3 (2)	1	2 (2)	14
22: Made referrals to a GP	1-5	4 (2)	1	4 (1)	1	4 (2)	0	3 (0)	8
23: Communication with GP	1-5	2 (2)	1	2 (1)	2	2 (2)	0	1 (1)	9
24: Initiation of discussion with GP	1-5	2 (1)	1	2 (1)	1	2 (2)	0	2 (2)	8
25: Provided the GP with a written summary	1-5	1 (1)	1	1 (1)	1	1 (1)	0	1 (0)	9
26: Made referrals to help groups	1-5	2 (1)	1	2 (2)	1	2 (2)	0	1 (1)	9
33: Provision of written copies to professional colleagues	1-5	1 (1)	4	1 (1)	2	1 (1)	0	1 (1)	7
Instrumental activities (27-32, 34)	7-35	20 (6)	12	19 (6)	37	17 (6)	5	20 (5)	24
27: Counseling location	1-5	3 (1)	0	3 (2)	0	2 (1)	1	3 (1)	4
28: Filled-prescription validation	1-5	2 (3)	3	1 (1)	25	1 (1)	4	4 (2)	3
29: Informational support	1-5	4 (1.8)	0	3 (2)	5	3 (1)	0	4 (2)	2
30: Evaluation of patient satisfaction	1-5	2 (2)	0	2 (2)	4	2 (2)	0	1 (1)	6
31: Competency improvement	1-5	4 (1)	4	4 (1)	5	4 (1)	1	3 (3)	21
32: Performance evaluation	1-5	2 (2)	6	1 (1)	5	1 (1)	0	1 (1)	9
34: Provision of medical information	1-5	3 (1)	1	3 (1)	0	3 (1)	0	4 (1)	6
Provision of pharmaceutical care (18, 19)	*2-10*	*6 (3)*	*6*	*6 (3)*	*3*	*5.5 (2)*	*0*	*6 (3)*	*9*
18: Tried to provide pharmaceutical care	*1-5*	*3 (1)*	*5*	*3 (2)*	*0*	*3 (1)*	*0*	*3 (1)*	*9*
19: Made the psychological commitment and effort to provide pharmaceutical care	*1-5*	*3 (2)*	*6*	*3 (2)*	*3*	*2.5 (1)*	*0*	*3 (2)*	*8*
Total score (1-17, 20-34)	*15-160*	*73.2 ± 18.7* ‡	*53*	*70.8 ± 22.0* ‡	*101*	*61.1 ± 20.1* ‡	*12*	*50.6 ± 17.8* ‡	*54*
Achieved range by country	*-*	*28-140*		*19-145*		*24-105*		*23-113*	

† MD: missing data

‡ Mean ± SD (standard deviation) for variables corresponding to the theoretical distribution

Table 3: Respondents' scores (section B) of two sub-groups of Swiss pharmacists (regions with dispensing doctors vs. without dispensing doctors)

		Switzerland (dispensing doctors; n=143)		Switzerland (no dispensing doctors; n=110)	
Dimension and Domain	Possible Range	Median (IQR)	MD †	Median (IQR)	MD †
Direct patient care activities (1-17)	0-85	*32.7 ± 14.9* ‡	14	*37.2 ± 13.0* ‡	11
Documentation (2,3,5,13,14,17)	0-30	*8.7 ± 6.3* ‡	8	*11.6 ± 5.8* ‡	4
Patient assessment (1, 4, 9-12)	0-30	*9.8 ± 7.0* ‡	7	*10.4 ± 6.5* ‡	2
Implementation of therapeutic objectives and monitoring plans (15,16)	0-10	2 (5)	7	2 (5.5)	5
1: Assessment of medical condition	0-5	1 (2)	4	1 (2)	0
2: Documentation of medical condition	0-5	0 (1.75)	3	0 (1)	1
3: Documentation of all medications	0-5	5 (4)	3	5 (0)	0
4: Assessment of patient's expectations of drug therapy	0-5	0 (1.25)	5	0 (1)	0
5: Documentation of desired therapeutic objectives for the patient	0-5	0 (0)	3	0 (0)	2
6: Patient record screening	0-5	5 (2)	2	5 (0)	1
7: Discussion of drug therapy	0-5	4 (2)	2	4 (2)	2
8: Verification of patient understanding	0-5	5 (1)	3	5 (1)	2
9: Assessment of actual patterns of use of the medication	0-5	2 (2)	4	3 (3)	1
10: Check for possible DRPs	0-5	2 (2)	4	2 (3)	1
11: Assessment of perceived effectiveness of drugs already used	0-5	2 (2)	3	2 (2)	1
12: Assessment of achievement of therapeutic goals	0-5	2 (3)	3	1 (2)	2
13: Documentation of DRPs	0-5	1 (3)	3	2 (5)	1
14: Documentation of therapeutic goals for each DRP identified	0-5	0 (0)	7	0 (1)	1
15: Implementation of a strategy to resolve DRPs	0-5	1 (3)	2	1 (3)	1
16: Carrying out follow-up plan	0-5	0 (2)	7	0 (2.5)	5
17: Documentation of interventions	0-5	1 (5)	3	3 (4)	1

continued next page

		Switzerland (dispensing doctors; n=143)		Switzerland (no dispensing doctors; n=110)	
Dimension and Domain	Possible Range	Median (IQR)	MD †	Median (IQR)	MD †
Referral and consultation activities (20-26,33)	8-40	*17.3 ± 4.4* ‡	4	*18.1 ± 4.6* ‡	5
20: Consultation with other pharmacists	1-5	2 (2)	0	3 (2)	0
21: Made referrals to other pharmacists	1-5	2 (2)	0	2 (2)	2
22: Made referrals to a GP	1-5	4 (2)	0	4 (2)	1
23: Communication with GP	1-5	2 (2)	0	2 (2)	1
24: Initiation of discussion with GP	1-5	2 (1)	0	2 (1)	1
25: Provided the GP with a written summary	1-5	1 (0)	1	1 (1)	0
26: Made referrals to help groups	1-5	2 (1)	1	2 (1)	0
33: Provision of written copies to professional colleagues	1-5	1 (1)	2	1 (1)	0
Instrumental activities (27-32, 34)	7-35	*20.3 ± 4.5* ‡	5	*19.8 ± 4.0* ‡	5
27: Counseling location	1-5	3 (2)	0	3 (1)	1
28: Filled-prescription validation	1-5	2 (3)	1	2 (2)	0
29: Informational support	1-5	4 (2)	0	4 (1)	0
30: Evaluation of patient satisfaction	1-5	2 (2)	0	2 (2)	3
31: Competency improvement	1-5	4 (1)	0	4 (1)	2
32: Performance evaluation	1-5	2 (2)	3	2 (1)	1
34: Provision of medical information	1-5	3 (1)	1	3 (1)	0
Provision of pharmaceutical care (18, 19)	2-10	6 (3)	4	6 (2)	1
18: Tried to provide pharmaceutical care	1-5	3 (1.75)	3	3 (1)	1
19: Made the psychological commitment and effort to provide pharmaceutical care	1-5	3 (2)	4	3 (1)	1
Total score (1-17, 20-34)	15-160	*69.6 ± 19.8* ‡	17	*74.5 ± 16.7* ‡	19
Achieved range by country	-	*28-135*		*37-120*	

† MD: missing data

‡ Mean ± SD (standard deviation) for variables corresponding to the theoretical distribution

Table 4: Relationship between BPCS total score and items of section A (Student t test) among Swiss (n=392), German (n=725), Danish (n=137) and quality circle (n=94) pharmacists and 2 sub-groups of Swiss community pharmacists: regions with dispensing doctors (DD; n=143) and regions without dispensing doctors (no DD; n=110)

	Switzerland (n=392)	Germany (n=725)	Quality circles (n=94)	Denmark (n=137)	Switzerland (DD) (n=143)	Switzerland (no DD) (n=110)
Gender male vs. female	p=0.021 70.4 vs. 75.2	p=0.034 68.5 vs. 72.3	p=0.333 58.4 vs. 62.9	p=0.986 50.9 vs. 50.8	p=0.165 66.4 vs. 71.6	p=0.361 72.5 vs. 75.8
Independence of pharmacy yes vs. no	p=0.107 74.5 vs. 73.0	p=0.760 70.8 vs. 70.2	p=0.080 59.2 vs. 68.6	‡	p=0.825 70.0 vs. 69.2	p=0.960 74.9 vs. 74.7
Affiliation to a chain yes vs. no	p=0.118 77.7 vs. 72.7	p=0.752 69.0 vs. 70.7	p=0.562 73.0 vs. 61.1	‡	p=0.496 73.3 vs. 69.2	p=0.891 74.0 vs. 74.9
Affiliation to a group yes vs. no	p=0.709 72.9 vs. 73.7	p=0.853 70.4 vs. 70.7	p=0.104 68.4 vs. 59.4	‡	p=0.504 68.3 vs. 70.6	p=0.975 74.8 vs. 74.7
Dispensing doctors yes vs. no	p=0.059 69.6 vs. 74.5	†	†	†	†	†
location: city or town centre yes vs. no	p=0.140 75.9 vs. 72.4	p=0.798 70.2 vs. 70.7	p=0.501 58.9 vs. 62.2	p=0.184 53.6 vs. 48.1	p=0.920 69.3 vs. 69.7	p=0.696 75.8 vs. 74.0
location: suburban yes vs. no	p=0.545 72.3 vs. 73.6	p=0.767 70.3 vs. 70.8	p=0.984 61.3 vs. 61.2	p=0.278 47.8 vs. 51.9	p=0.346 75.0 vs. 69.1	p=0.792 73.9 vs. 74.8
location: rural yes vs. no	p=0.821 72.9 vs. 73.4	p=0.500 71.4 vs. 70.2	p=0.467 63.3 vs. 59.9	p=0.866 49.0 vs. 49.9	p=0.160 67.3 vs. 72.2	p=0.440 76.4 vs. 73.5
location: integrated in a shopping centre yes vs. no	p=0.429 70.9 vs. 73.5	p=0.732 69.2 vs. 70.7	p=0.742 56.5 vs. 61.3	‡	p=0.182 75.2 vs. 68.6	p=0.096 62.2 vs. 75.1
location: integrated in a health centre yes vs. no	p=0.121 77.5 vs. 72.0	p=0.984 70.8 vs. 70.7	p=0.205 68.0 vs. 59.2	‡	p=0.136 78.7 vs. 68.4	p=0.288 82.2 vs. 73.5

continued next page

	Switzerland (n=392)	Germany (n=725)	Quality circles (n=94)	Denmark (n=137)	Switzerland (DD) (n=143)	Switzerland (no DD) (n=110)
No. of prescriptions°	p=0.346	p=0.009	p=0.446	p=0.890	p=0.694	p=0.697
Pre-registration student employed	p=0.599	p=0.009	p=0.009	p=0.324	p=0.953	p=0.712
yes vs. no	74.5 vs. 73.0	77.7 vs. 70.0	71.7 vs. 59.6	47.3 vs. 51.7	70.0 vs. 69.7	75.8 vs. 74.1
Continuing professional development	p=0.053	p<0.001	p=0.250	p=0.732	p=0.261	p=0.192
yes vs. no	73.5 vs. 61.2	71.7 vs. 53.2	61.4 vs. 38.0	50.3 vs. 52.3	69.9 vs. 54.0	75.0 vs. 63.8
Postgraduate qualification in community / hospital / clinical pharmacy or pharmacy practice	p=0.734	p=0.966	p=0.322	p=0.595	p=0.215	p=0.652
yes vs. no	87.6 vs. 88.1	82.5 vs. 82.5	81.3 vs. 78.4	52.0 vs. 49.8	84.6 vs. 87.7	89.2 vs. 90.5
Participation in multi-disciplinary team meetings	p<0.001	p<0.001	p=0.105	p<0.001	p=0.033	p=0.004
yes vs. no	82.1 vs. 70.9	80.1 vs. 68.0	63.9 vs. 56.5	63.7 vs. 45.7	77.7 vs. 67.9	84.8 vs. 71.9
Private consultation area available	p=0.030	p<0.001	p=0.459	p=0.177	p=0.285	p=0.075
yes vs. no	74.5 vs. 69.3	72.6 vs. 63.3	62.3 vs. 58.7	53.4 vs. 48.1	70.6 vs. 66.0	76.3 vs. 70.3
Provision of medical and clinical information from GP	p=0.001	p<0.001	p=0.006	p=0.255	p=0.134	p=0.673
yes vs. no	75.6 vs. 68.3	73.8 vs. 67.0	68.7 vs. 56.2	53.3 vs. 48.2	72.0 vs. 66.5	75.2 vs. 73.4
Health screening	p=0.028	p<0.001	p=0.159	p=0.451	p=0.050	p=0.085
yes vs. no	74.1 vs. 67.8	71.6 vs. 52.0	61.7 vs. 45.0	53.5 vs. 49.4	70.6 vs. 57.9	75.5 vs. 69.7
Patient monitoring	p<0.001	p<0.001	p=0.195	p<0.001	p=0.005	p=0.079
yes vs. no	75.4 vs. 66.9	75.0 vs. 62.3	63.9 vs. 58.1	75.0 vs. 47.6	73.2 vs. 62.8	76.3 vs. 69.1

continued next page

	Switzerland (n=392)	Germany (n=725)	Quality circles (n=94)	Denmark (n=137)	Switzerland (DD) (n=143)	Switzerland (no DD) (n=110)
Domiciliary visiting yes vs. no	p=0.004 77.8 vs. 71.3	p<0.001 75.3 vs. 65.7	p=0.001 69.5 vs. 54.6	‡	p=0.132 74.7 vs. 68.3	p=0.174 77.5 vs. 72.4
Health promotion / education yes vs. no	p=0.001 74.4 vs. 63.3	p<0.001 73.3 vs. 60.3	p=0.010 65.4 vs. 53.7	p=0.027 55.5 vs. 46.5	p=0.006 71.3 vs. 55.4	p=0.078 75.4 vs. 64.5

† no data because drug dispensing through physicians is only allowed in some regions of Switzerland

‡ no data because there is no data for at least one group

° ANOVA instead of Student t test

Table 5: Comparison of section B items between countries and within subgroups

	CH vs. GER	CH vs. QC	CH vs. DK	GER vs. QC	GER vs. DK	QC vs. DK	CH DD vs. CH nonDD
Direct patient care activities (1-17)	p<0.001[c]	p<0.001[c]	p<0.001[c]	p<0.001[c]	p<0.001[b]	p<0.001[c]	p=0.017[c]
Documentation (2,3,5,13,14,17)	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.003[b]	p<0.001[b]	p<0.001[b]	p<0.001[b]
Patient assessment (1, 4, 9-12)	p<0.001[b]	p=0.777[b]	p<0.001[b]	p=0.003[b]	p<0.001[b]	p=0.001[b]	p=0.249[b]
Implementation of therapeutic objectives and monitoring plans (15,16)	p=0.802[b]	p=0.185[b]	p<0.001[b]	p=0.118[b]	p<0.001[b]	p<0.001[b]	p=0.203[b]
1: Assessment of medical condition	p<0.001[b]	p=0.583[b]	p<0.001[b]	p=0.001[b]	p<0.001[b]	p<0.001[b]	p=0.974[b]
2: Documentation of medical condition	p<0.011[b]	p=0.002[b]	p<0.001[b]	p=0.057[b]	p<0.001[b]	p<0.001[b]	p=0.671[b]
3: Documentation of all medications	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.002[b]	p<0.001[b]	p<0.001[b]	p<0.001[b]
4: Assessment of patient's expectations of drug therapy	p<0.001[b]	p=0.285[b]	p=0.039[b]	p=0.002[b]	p<0.001[b]	p=0.561[b]	p=0.491[b]
5: Documentation of therapeutic objectives	p=0.046[b]	p=0.081[b]	p=0.104[b]	p=0.007[b]	p=0.005[b]	p=0.722[b]	p=0.167[b]
6: Patient record screening	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.006[b]	p<0.001[b]	p<0.001[b]	p=0.002[b]
7: Discussion of drug therapy	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.008[b]	p=0.001[b]	p=0.957[b]	p=0.969[b]
8: Verification of patient understanding	p<0.001[b]	p<0.001[b]	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.160[b]	p=0.978[b]
9: Assessment of actual patterns of medication's use	p<0.001[b]	p=0.083[b]	p=0.011[b]	p=0.120[b]	p<0.001[b]	p=0.001[b]	p=0.029[b]
10: Check for possible DRPs	p=0.006[b]	p=0.479[b]	p<0.001[b]	p=0.020[b]	p<0.001[b]	p=0.033[b]	p=0.201[b]
11: Assessement of perceived effectiveness of drugs already used	p=0.225[b]	p=0.090[b]	p=0.002[b]	p=0.020[b]	p<0.001[b]	p=0.398[b]	p=0.427[b]
12: Assessment of achievement of therapeutic goals	p=0.065[b]	p=0.639[b]	p<0.001[b]	p=0.129[b]	p<0.001[b]	p=0.019[b]	p=0.313[b]
13: Documentation of DRPs	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.257[b]	p<0.001[b]	p<0.001[b]	p<0.001[b]
14: Documentation of therapeutic goals	p=0.459[b]	p=0.057[b]	p<0.001[b]	p=0.108[b]	p<0.001[b]	p=0.058[b]	p=0.334[b]
15: Implementation of a strategy to resolve DRPs	p=0.437[b]	p=0.477[b]	p<0.001[b]	p=0.226[b]	p<0.001[b]	p<0.001[b]	p=0.402[b]
16: Carrying out follow-up plan	p=0.664[b]	p=0.093[b]	p<0.001[b]	p=0.125[b]	p<0.001[b]	p<0.001[b]	p=0.103[b]
17: Documentation of interventions	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.195[b]	p<0.001[b]	p<0.001[b]	p=0.002

	CH vs. GER	CH vs. QC	CH vs. DK	GER vs. QC	GER vs. DK	QC vs. DK	CH DD vs. CH nonDD
Referral and consultation activities (20-26,33)	p<0.001[b]	p=0.166[b]	p<0.001[b]	p=0.003[b]	p<0.001[b]	p<0.001[b]	p=0.223[b]
20: Consultation with other pharmacists	p<0.001[b]	p=0.057[b]	p=0.562[b]	p=0.656[b]	p=0.002[b]	p=0.055[b]	p=0.001[b]
21: Made referrals to other pharmacists	p<0.001[b]	p=0.003[b]	p=0.067[b]	p=0.422[b]	p<0.001[b]	p<0.001[b]	p=0.048[b]
22: Made referrals to a GP	p<0.001[b]	p=0.054[b]	p<0.001[b]	p=0.106[b]	p<0.001[b]	p<0.001[b]	p=0.267[b]
23: Communication with GP	p<0.001[b]	p=0.710[b]	p=0.001[b]	p<0.001[b]	p<0.001[b]	p=0.043[b]	p=0.979[b]
24: Initiation of discussion with GP	p=0.072[b]	p=0.009[b]	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.344[b]	p=0.983[b]
25: Provided the GP with a written summary	p=0.394[b]	p=0.115[b]	p<0.001[b]	p=0.040[b]	p<0.001[b]	p=0.005[b]	p=0.003[b]
26: Made referrals to help groups	p<0.001[b]	p=0.032[b]	p=0.388[b]	p=0.027[b]	p<0.001[b]	p=0.048[b]	p=0.106[b]
33: Provision of written copies to professional colleagues	p=0.453[b]	p=0.542[b]	p=0.789[b]	p=0.856[b]	p=0.871[b]	p=0.794[b]	p=0.816[b]
Instrumental activities (27-32, 34)	p<0.001[b]	p<0.001[b]	p=0.258[b]	p<0.001[b]	p=0.089[b]	p<0.001[c]	p=0.491[b]
27: Counselling location	p=0.058[b]	p<0.001[b]	p=0.001[b]	p<0.001[b]	p<0.001[b]	p=0.300[b]	p=0.038[b]
28: Filled-prescription validation	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.217[b]	p<0.001[b]	p<0.001[b]	p=0.856[b]
29: Informational support	p<0.001[b]	p<0.001[b]	p=0.006[b]	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.598[b]
30: Evaluation of patient satisfaction	p=0.856[b]	p=0.037[b]	p<0.001[b]	p=0.044[b]	p<0.001[b]	p<0.001[b]	p=0.719[b]
31: Competency improvement	p=0.719[b]	p=0.052[b]	p<0.001[b]	p=0.059[b]	p<0.001[b]	p<0.001[b]	p=0.799[b]
32: Performance evaluation	p=0.002[b]	p=0.002[b]	p=0.030[b]	p=0.129[b]	p<0.725[b]	p=0.322[b]	p=0.661[b]
34: Provision of medical information	p<0.001[b]	p=0.533[b]	p<0.001[b]	p<0.001[b]	p<0.001[b]	p<0.001[b]	p=0.064[b]
1-17; 20-34: BPCS total score	p=0.057[b]	p<0.001[c]	p<0.001[c]	p<0.001[c]	p<0.001[c]	p<0.001[c]	p=0.059[c]

a) Pearson's chi-square

b) Mann-Whitney-U-test (for variables not corresponding to the theoretical distribution)

c) Student-t-test (for variables corresponding to the theoretical distribution)

d) ANOVA

Table 6: Check for possible DRPs (Switzerland, Germany, Denmark, Quality circles) as well as comparisons between different samples (chi-square)

	CH (n=392)	GER (n=725)	QC (n=94)	DK (n=137)	CH vs. GER	CH vs. QC	CH vs. DK	GER vs. QC	GER vs. DK	QC vs. DK
Check for DRPs	85.2% (n=334)	89.9% (n=652)	90.4% (n=85)	58.4% (n=80)	p=0.300	p=0.465	p<0.001	p=0.853	p<0.001	p<0.001
DRP detected	34.4% (n=135)	30.3% (n=220)	42.6% (n=40)	22.6% (n=31)	p=0.091	p=0.233	p=0.013	p=0.019	p=0.120	p=0.003
missing	*11+2*	*1+2*	*0+1*	*6+0*	-	-	-	-	-	-

Table 7: Check for possible DRPs (Switzerland; regions with and without dispensing doctors) as well as comparisons between samples (chi-square)

Switzerland (n=392)*	DD (n=143; 36.5%) prescriptions: 37.7±31.8	p-value (95%; 2-sided)	no DD (n=110; 28.1%) prescriptions: 83.2±48.7
Check for DRPs	114 (79.7%)	0.121	95 (86.4%)
DRP detected	37 (25.9%)	0.016	44 (40.0%)

* regions in Switzerland with a mixed system (regions with DD and without DD): n=125 (31.9%) not analysed; missing=14

Table 8: Extent of provision of pharmaceutical care considering all the patients with chronic conditions seen in the previous 6 weeks

	CH (n=392)	GER (n=725)	QC (n=94)	DK (n=137)	CH (DD) (n=143)	CH (no DD) (n=110)
frequently or always tried to provide pharmaceutical care	166 (42.3%)	310 (42.7%)	17 (18.1%)	31 (22.7%)	59 (41.3%)	49 (44.6%)
frequently or always consciously decided and made the effort to provide extensive services	121 (30.9%)	237 (32.7%)	15 (15.9%)	38 (27.7%)	48 (33.6%)	32 (29.1%)

Table 9: Reliability estimates of dimensions and domains of all groups

Dimension and domain	CH (n=392)	GER (n=725)	QC (n=94)	DK (n=137)	CH (DD) (n=143)	CH (no DD) (n=110)
Dimension: Direct patient care activities	0.830	0.874	0.863	0.840	0.861	0.812
Domain: Documentation	0.683	0.742	0.574	0.705	0.690	0.650
Domain: Patient assessment	0.807	0.837	0.823	0.775	0.865	0.819
Domain: Implementation of therapeutic objectives and monitoring plans	0.677	0.674	0.634	0.798	0.771	0.757
Dimension: Referral and consultation activities	0.740	0.755	0.791	0.791	0.682	0.745
Dimension: Instrumental activities	0.673	0.691	0.701	0.626	0.701	0.658

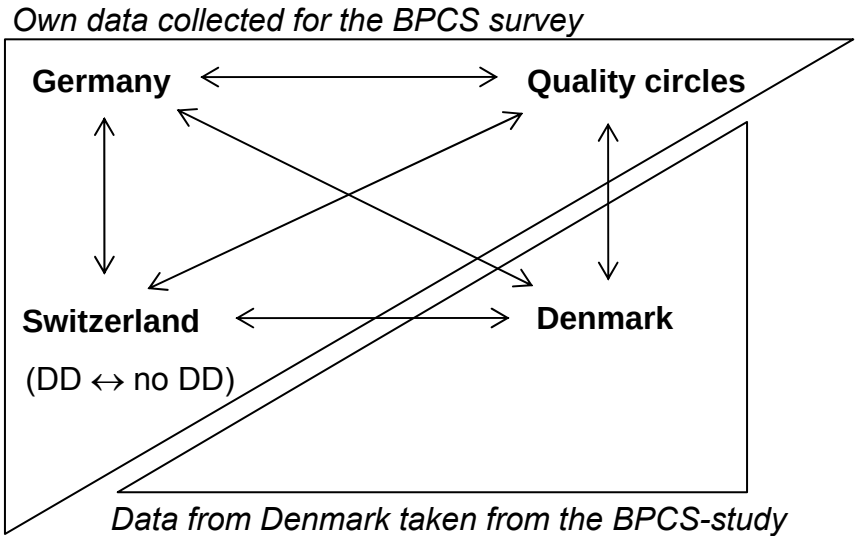

Fig. 1: In-depth analysis using own data from Switzerland, Germany and quality circles and comparison with data from the Danish BPCS study cohort

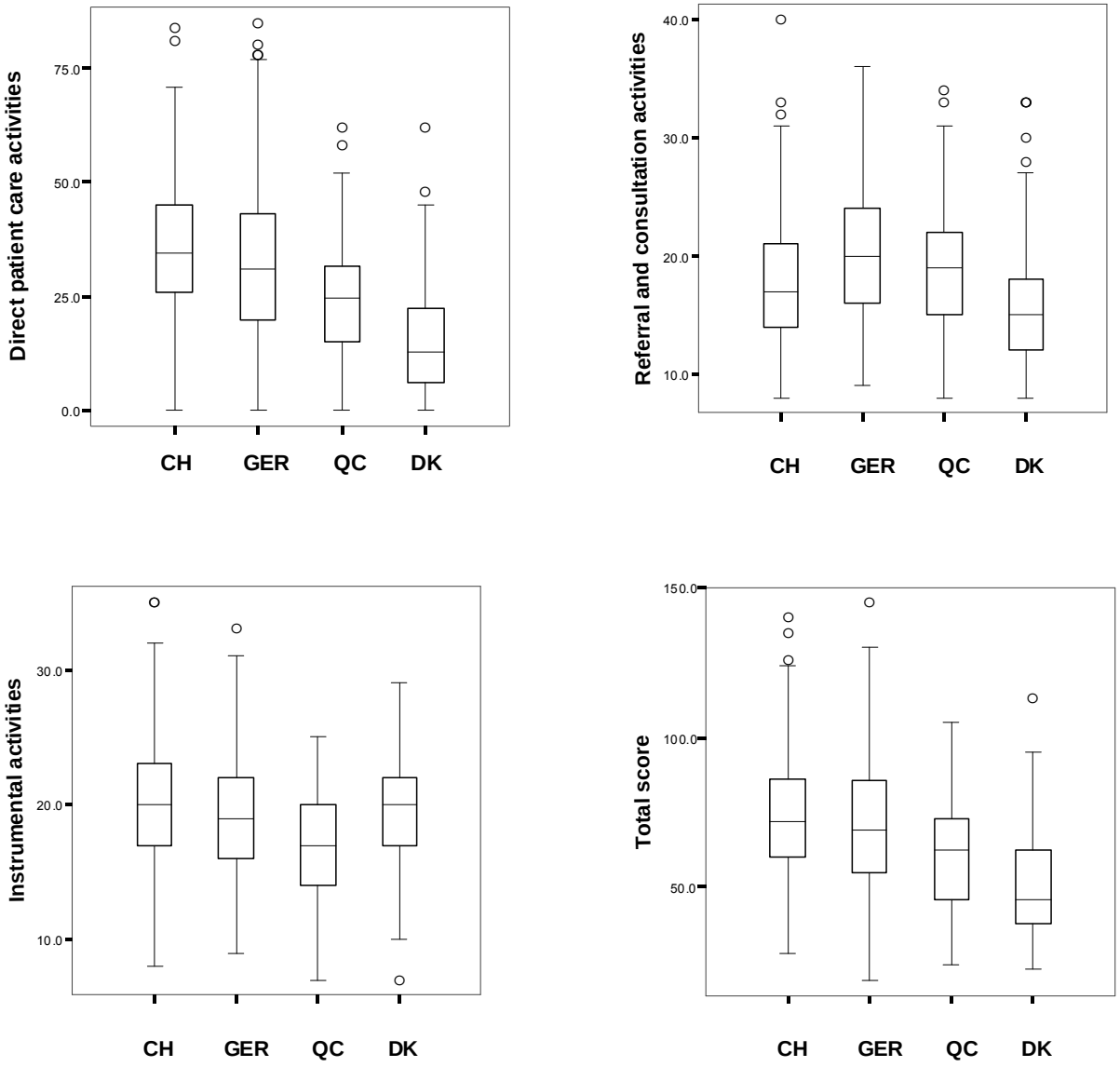

Fig. 2: Boxplots of BPCS dimensions and total scores by subgroup: Switzerland (CH; n=392), Germany (GER; n=725), quality circles (QC; n=94), Denmark (DK; n=137). Dimensions: direct patient care activities (0-85), referral and consultation activities (0-40), instrumental activities (0-35) and total score (15-160).

3 Classification of drug-related problems

Project C:

Classification of drug-related problems with new prescriptions using a modified PCNE classification system

Patrick Eichenberger[1], Markus L. Lampert[1,2], Irene Vogel Kahmann[3], JWF van Mil[4] and Kurt E. Hersberger[1]

[1] Pharmaceutical Care Research Group, University of Basel, Switzerland
[2] Clinical and hospital pharmacy, Cantonal hospital Bruderholz, Switzerland
[3] Clinical and hospital pharmacy, Cantonal hospital Schaffhausen, Switzerland
[4] van Mil Consultancy, Margrietlaan 1, 9471 CT Zuidlaren, The Netherlands

Pharm World Sci 2010;32:362-72

Abstract

Objectives

To explore and classify drug-related problems (DRPs) with new prescriptions detected in community pharmacies using a modified PCNE (Pharmaceutical Care Network Europe) classification system.

Setting

Sixty-four Swiss community pharmacies offering internships for pharmacy students.

Main outcome measures

Occurrence, nature and pharmacist's management of DRPs.

Methods

Fifth year pharmacy students collected consecutively hospital discharge and primary care prescriptions. After training, they documented clinical and technical DRPs, causes and interventions.

Results

Prescriptions of 616 patients (43.0% discharged from hospital) were analysed. The patients' median age was 56 years and they received a median of 3 (range 2−19) different drugs. In 121 (19.6%) prescriptions 141 clinical DRPs were detected. The most frequent clinical DRPs were potential drug-drug interactions (DDIs) (37.6%), drug choice (24.8%) and drug use problems (15.6%). These clinical DRPs led to a total of 299 interventions. There were 222 prescriptions (36.0%) that showed 278 technical DRPs, resulting in a total of 417 interventions. Most frequent technical DRPs were missing or unclear package size or therapy duration (32.7%) and missing or unclear dosing/application instructions (30.9%). Most DRPs (75.4%) could be managed by the pharmacist alone. The number of prescribed drugs was the main factor with an influence on the frequency of clinical and technical DRPs.

Conclusion

Clinical and technical DRPs are frequently observed in primary care as well as in hospital discharge prescriptions. The modified PCNE classification system, especially the amendment with a technical DRP category, proved to be useful and allowed the classification of all DRPs. Neither the setting (hospital discharge vs. primary care) nor the quality of electronically printed prescriptions, but only the number of prescribed drugs influenced the occurrence of clinical or technical DRPs.

Keywords

Drug-related problems · Pharmaceutical care · PCNE · Classification system · Community pharmacy · Hospital discharge · Primary care · Switzerland

Impact of findings on practice

- In Switzerland, half of all new prescriptions show a DRP; two-thirds are technical DRPs.

- The PCNE classification V5.1 needs to be amended, to include technical DRPs.

- The occurrence of clinical or technical DRPs is only influenced by the number of prescribed drugs. It is not relevant if the prescriptions were electronically printed.

Introduction

Many studies have shown drug-related problems (DRPs) to be very common in primary care and in hospital settings [76-91]. In both settings there is evidence that pharmacists' interventions can reduce the occurrence of DRPs [65, 76, 84, 89, 90].

Receiving a newly prescribed drug is most likely an extraordinary situation for a patient who was recently informed about a diagnosis or at least was confronted with a new drug in his regimen. Because the risk of DRPs may be increased on the initiation of new drug treatments or changes within an established drug-treatment plan, a thorough consultation with a pharmacist is required to consider the new medication and, in particular, to make an accurate check for DRPs to achieve desired health outcomes [80, 224]. Thus, patients with at least one newly prescribed drug represent a relevant population to study DRPs and especially for studying the applicability of a comprehensive classification system which includes technical DRPs.

Usually, patients discharged from hospital also have new drugs prescribed and are at increased risk of experiencing DRPs [80]. Therefore, we decided to focus on both prescriptions from hospital discharge and new primary care prescriptions, expecting that there are differences between these two settings (e.g. pattern and number of DRPs) as well as differences between electronically printed and handwritten prescriptions. To our knowledge, no previous study focused on new primary care and hospital discharge prescriptions processed in Swiss community pharmacies in everyday life.

In different studies, different detection rates of DRPs were found because of variations in the methods used to identify DRPs, the classification systems and the inclusion criteria. There is no accepted standard tool for classification and documentation of DRPs, for the primary care or hospital (discharge) settings. The applicability of different systems is not yet clear, and many studies conclude that further studies are needed, with the aim to provide a tool that allows a complete classification of all DRPs that arise during prescription processing in community pharmacies.

From different pilot studies we had experience in the use of the PCNE classification (PCNE Classification V 5.01) [128]. This system attributes at least four items to each observation: (a) coding for the problem itself, (b) the actual or suspected cause(s) of the problem, (c) the intervention(s) required to resolve the DRP and (d) its outcome. We recognised as a probably important deficiency the lack of possibilities to classify technical DRPs, which arise frequently from prescription processing in community pharmacies (e.g. missing or unclear specification of drug dosage form, drug dosage and dosage regimen). In a very recent study on pharmacists' interventions during the prescription dispensing process of new prescriptions for acute respiratory tract infections, we observed a need for addition of specifications in 11.6% of all prescription items [225]. Therefore, we planned to amend the existing PCNE classification accordingly.

The first objective of this study was to explore the occurrence, nature and pharmacist's management of drug-related problems (DRPs) detected in community pharmacies using the modified PCNE classification system in new prescriptions. The second aim was to analyse possible differences between new primary care and hospital discharge prescriptions as well as differences between electronically printed and handwritten prescriptions. The third aim was to evaluate the applicability of the modified classification system.

Methods

Setting and participants

This prospective observational study was conducted from January to April 2007 in 64 Swiss community pharmacies offering internships for fifth-year pharmacy students. Prescriptions of patients aged 18 years or older were eligible for the study if they comprised at least two prescribed drugs and if at least one drug was new (a new drug was defined as a new drug, drug form or dosage or a generic drug but not a new package size). In Switzerland not every prescription contains a new drug because the healthcare system allows physicians to issue repeat prescriptions and

thus enable patients to get their medications up to 12 months without further visit of the physician. Prescriptions issued by primary care physicians, physicians from ambulatory care centres or outpatient clinics of hospitals were classified as ‘primary care prescriptions’; ‘hospital discharge prescription’ was defined as a prescription issued by a hospital after the patient had been admitted for least one night.

Data collection

Sixty-four fifth-year pharmacy students had the mandatory mission from the university to collect five hospital discharge and five primary care prescriptions in a consecutive way during their pharmacy internships, leading to a convenient sample of prescriptions with at least one new medication. They were free to select one day to do so within the designated study period. While serving clients as usual they only had to identify if they were in possession of a prescription with a new drug and to check for inclusion criteria regardless whether they identified any problem or not. Then they were to check for DRPs with all the information available in a standard pharmacy, including the patient’s medication history. The software used in all Swiss community pharmacies performs computerized screening and alerts the attending employee of potential drug-drug interactions (DDIs). Whether a potential DDI was documented as a DRP or not depended on the student and the pharmacist: if the DDI was seen as a problem for the patient they had to complete a classification form.

Thereafter, prescription validation was performed as usual by a pharmacist. Accordingly, the pharmacist or the student could detect a DRP or a problem that arose during patient counselling or processing the prescription. After they had included the first prescription they were obliged to collect the subsequent nine prescriptions fulfilling the inclusion criteria leading to five hospital and five primary care prescriptions. This consecutive collecting enabled the estimation of the incidence of DRPs with new prescriptions and the compilation of a randomized, convenient sample to reflect the daily life setting in Swiss community pharmacies. For each prescription at least one data sheet had to be filled out and if multiple problems were detected in the same prescription for each problem a new data sheet was used. To each problem multiple causes and interventions could be attributed. Students were instructed to document each case shortly after dispensing the

prescribed drugs. We retrieved the number of prescribed drugs per prescription from copies of prescriptions and verified plausibility of students' documentation. Students anonymised all documents before delivery to the study centre.

Students were trained during a lecture at the university. Three case studies were used to test their performance in documenting problems, causes and interventions resulting in a proportion of 91.9% of correct coding. In addition, ongoing support was assured by the study team being in contact by e-mail or phone.

Classification of DRPs

We used the PCNE classification system for DRPs (version 5.01) [128]. This system distinguishes four dimensions: problems, causes, interventions and the corresponding outcome.

The six main categories of clinical DRPs are: (P1) adverse reaction(s), (P2) drug choice problem, (P3) dosing problem, (P4) drug use problem, (P5) interactions and (P6) other. We added a seventh category (P7) 'technical DRP' with the aim to be able to classify and to distinguish between "clinical DRPs" (P1−P6) and 'technical DRPs'. A technical DRP is related to prescription quality and impedes to unambiguously dispense a drug in the correct dose, dosage form and package size (e.g. unreadable prescription, missing specifications). Accordingly, we created a seventh category of causes: C7 prescription quality (e.g. unreadable prescription, missing or unclear drug form, dosage, package size or therapy length). The pre-existing categories of causes were: (C1) drug/dose selection, (C2) drug use process, (C3) information, (C4) patient/psychological, (C5) (pharmacy) logistics and (C6) other. Categories in the intervention domain remained unchanged: (I0) 'no intervention', (I1) at prescriber level, (I2) at patient level, (I3) at drug level, (I4) other. Unchanged outcome categories were: (O0) outcome unknown, (O1) problem solved, (O2) problem partially solved, (O3) problem not solved.

We created a one-side data sheet with four dimensions, 20 categories and a total of 95 items (24 problem codes, 41 causes, 23 interventions and 7 outcome codes) to

enable easy data collection, including patients' age and sex, number of medications on the prescription and whether it was a primary care or a hospital discharge prescription. In total, 14 items and one main category (technical DRP) were added to the existing classification system (Table 1).

Users' opinion on the usability of the tool

To evaluate usability of and satisfaction with the modified classification system, an 8-item questionnaire used in a prior published study [123] was administered to the students who used this tool. They were asked about the extent to which they agree or disagree (five-point scale) with statements regarding the usability and usefulness, satisfaction and their willingness to use the tool in their practice in the future.

Statistical analysis

All returned data sheets were processed with the automated forms processing software TeleForm® version 7.0 from Cardiff Software Inc., Vista, USA. To avoid potential errors, all numeric and letter recognitions were verified visually on data sheets and on screen.

Results are expressed as proportions and as medians with the corresponding interquartile range (IQR). The non-parametric Mann-Whitney test was used for unpaired two-sample comparisons, if data was normal distributed with Student's t test. Statistical significance was defined as a p value <0.05. To check for possible risk factors, McNemar's chi-square test was used. To investigate factors with influence on problems, different methods were tried, such as univariate analysis of variance, analysis of discriminance, logistic regression and correlation (bivariate, Spearman). We cite only results that proved robust in different methods of analysis. To consider the difference of prescribed number of drugs in primary care and hospital prescriptions, we analyzed influences of the setting only for a subgroup of prescriptions with ≤5 prescribed drugs. This subgroup was chosen because our sample contained few primary care prescriptions with >5 drugs and because the relationship between the number of prescribed drugs and the error rate changes significantly for >5 drugs (Fig. 1). Statistical analyses were performed using SPSS for Windows version 15.0 (SPSS Inc., Chicago, USA).

Results

During the study period (January to April 2007) 625 prescriptions were collected. Nine cases did not fulfil the inclusion criteria (in one case only one drug was prescribed, eight cases had an age below 18), resulting in a sample of 616 prescriptions (57.0% primary care) equal to 616 patients receiving a total of 2,309 prescribed drugs. Table 2 shows basic study characteristics.

Drug-related problems

During prescription processing in the community pharmacies, 419 clinical and technical DRPs (or both) were detected in 329 prescriptions. In relation to the total number of prescribed drugs (*n* = 2309) we found 6.1% (*n* = 141) clinical and 12.0% (*n* = 278) technical DRPs. All problems could be classified with the modified PCNE classification system.

Multiple clinical problems were present in 12 prescriptions, multiple technical DRPs in 49 prescriptions and 14 prescriptions showed both clinical and technical DRPs.

The analysis of the clinical problems revealed that 52 (36.9% of all clinical DRPs) were potential interactions (PCNE code P5), 35 (24.8%) drug choice problems (P2) and 22 (15.6%) drug use problems (P4). The most frequent technical DRPs were missing or unclear package size or therapy length (32.7%) and missing or unclear dosing/application instruction (30.9%). The details of clinical and technical DRPs, are shown in Table 3 and Table 4, respectively.

The main contributing factor for presentation of clinical and technical DRPs was the number of drugs per prescription. Other variables had no significant influence in our dataset (univariate analysis of variance, analysis of discriminance, logistic regression and correlation).

The probability for a clinical DRP was similar in prescriptions between two and five drugs; if >5 drugs were prescribed then the probability increased (see Fig). The

number of drugs is correlated with the chance of a clinical DRP (r=0.220; p<0.001; bivariate correlation, Spearman) and with 'any problems' (r=0.132; p=0.001; bivariate correlation, Spearman) but not with technical DRPs (r=0.012; p=0.775; bivariate correlation, Spearman).

The mean number of prescribed drugs was significantly higher for prescriptions from hospital discharge than from primary care (5.1 vs. 2.7; p<0.001; t test). This higher number of prescribed drugs in hospital discharge prescriptions caused more clinical but not more technical DRPs. To analyse the influence of the setting (primary care and hospital discharge), we only considered prescriptions with ≤5 prescribed drugs because primary care prescriptions rarely included >5 prescribed drugs. We observed significantly more technical DRPs among prescriptions from primary care (p=0.043; chi-square; 95%; 2-tailed) but no influence of the setting for any problem (p=0.080; chi-square; 95%; 2-tailed) or clinical DRPs (p=0.924; chi-square; 95%; 2-tailed). There was no association between gender and problems. Because the relationship between the number of prescribed drugs and technical DRPs is not linear and we do not have sufficient data we could not statistically correct for this effect.

Causes

To each problem a maximum of three causes could be attributed. Overall, 166 causes for clinical DRPs were reported, with a majority (50.0%, *n* = 83) that was related to the selection of the drug and/or dosage schedule (C1). The second and third most common causes with 15.7% (*n* = 26) involved the information process (C3) and the drug use process with 14.5% (*n* = 24) (C2) (see Table 5).

Interventions

A total of 716 interventions (see Table 6) were reported for all prescriptions (1.2 per 616 prescriptions / 2.2 per 329 prescriptions with problems). All 141 clinical DRPs induced 299 (41.8% out of 716) interventions (2.1 per clinical DRP / 2.5 per prescription with clinical DRPs / 0.5 per 616 prescriptions; range 1−7) and 278 technical DRPs induced 417 (58.2% out of 716) interventions (1.5 per technical DRP / 1.9 per prescription with a technical DRP / 0.7 per 616 prescriptions; range of 0−6).

To manage all problems a total of 81 (13.1% out of 616 prescriptions) direct contacts to the prescriber (call / conversation) were necessary: 42 (6.8% out of 616) prescriptions with one or more clinical DRPs and 46 (7.5% out of 616) prescriptions with one or more technical DRPs led to a direct contact with the prescriber (7 prescriptions with both a clinical DRP and a technical DRP). One hundred and seventy-five (63.0% of 278) of technical DRPs could be solved by the pharmacy together with the patient, but only 56 (39.7% out of 141) of clinical DRPs were solved in cooperation with the patient.

The 299 interventions induced by clinical DRPs involved 178 drugs (in 48 cases 2 drugs were related to one problem, e.g. interaction). Cardiovascular drugs (C; 21.9%, *n* = 39) were most often involved, followed by nervous system (N; 21.3%, *n* = 38) and musculo-skeletal system drugs (M; 10.1%, *n* = 18).

Users' opinion

After training and data collection, observers were asked 8 questions about the acceptability and usability of the classification system they had used in this study (see Table 7). Most of the users think that it is important to have an opportunity to document the efforts of the pharmacies but only one third agreed that the tool is easy to use and practical.

Discussion

This study examined the frequency, nature and pharmacist's management of DRPs with primary care and hospital discharge prescriptions which comprised at least one new drug. We found a high occurrence of clinical (19.6%) and, in particular, of technical DRPs (36.0%). More than 50% of all prescriptions showed a clinical or a technical DRP or both. Compared to other studies our numbers are quite high but in this study we set out to use prescriptions which we considered likely to have a high prevalence i.e. newly started drugs and prescriptions with at least two drugs. In 2007 Hammerlein found only 0.93 DRPs per 100 patients and 1.16 DRPs per 100 prescriptions [81]. Westerlund conducted a survey on DRPs in prescription-only medicines in 1999 and found 2.8 DRPs per 100 patient contacts [77]. A recent Swiss study detected 0.74 clinical DRPs per 100 prescriptions with the need of an intervention and 1.9 technical DRPs per 100 prescriptions [83]. These figures illustrate the problem that such comparisons are hampered by different settings, measurements methods and classification systems. Paulino [80] found in a study in six European countries even more DRPs than we did (103.7 DRPs per 100 patients discharged from hospital; 63.7% out of all patients had at least one DRP). Uncertainty or lack of knowledge about the aim of the drug (29.5%), side effects (23.3%) and practical problems (7.6%) were the most common DRPs. However, only few DDIs (4.0%) were detected, probably because most of them did not have access to patient medication histories. In Switzerland every pharmacy is equipped with software that includes an automatic DDI screening system and participants in our study probably indicated every possible potential interaction, even if not clinical relevant. Therefore, the most frequently reported clinical DRPs in our study were DDIs (37.6% of all clinical DRPs; 7.0% of all patients). In the German study [81] DDIs were also most frequent but the fraction was only 8.5% of all DRPs. In another primary care study DDIs were the third most common problem with 3.2%, and in a study performed in hospital setting they observed 17.0% DDIs [83, 84]. Paulino et al. found 60.0% of patients after hospital discharge with a potential interaction [80].

However, the comparison of the study's findings with those of other studies is difficult due to differences in setting and aim [77, 80, 81, 83, 84, 226]. Furthermore, the

frequency of detected problems can be influenced by the systematic screening under study conditions, which differs significantly from daily practice (Hawthorne effect [227]). In our study, students and pharmacists probably had a more positive attitude towards the provision of pharmaceutical care (e.g. check for DRPs) and they probably detected most possible problems. This may explain our high detection rate of 22.9. If DDIs are as frequent as found in this or other studies more emphasis should be placed on best management of potential DDIs in community pharmacies. However, if we omit all interactions we still found a detection rate of 14.3.

Using fifth year pharmacy students for data collection during their internship and collecting primary care as well as hospital discharge prescriptions in a continuous way, enabled us to compile a randomized, convenient sample and to estimate the prevalence of DRPs with new prescriptions. We had instructed the students to perform prescription processing as usual. Thus, every prescription was checked by a pharmacist before dispensing and we were not depending on inferior competencies of students. Factors associated with clinical and technical DRPs were tested with several statistical methods and the main factor influencing the presence of any clinical problems was the number of drugs. Older people showed both more clinical and technical DRPs, but this was to be expected because the number of drugs increased with age. In addition, we expected the setting to have an influence on the occurrence of DRPs but different statistical tests did not show any relationship. More clinical DRPs were found in hospital discharge than in primary care prescriptions but the mean number of prescribed drugs was higher on these prescriptions, which explains the higher frequency of problems. Surprisingly, more technical DRPs were found in primary care prescriptions with fewer prescribed drugs than in hospital discharge prescriptions.

Most problems were caused by drug selection and/or drug dose selection and many problems were solved after discussion with patients or family members. More than two-thirds of technical but less than half the clinical DRPs could be solved by the pharmacy together with the patient. Pharmacists should therefore actively involve patients and relatives in the screening and solving process for DRPs. Almost two thirds of all interventions and 50% of all contacts with the prescriber were related to

technical DRPs which shows their importance and frequency in daily life practice in community pharmacies. Therefore, inclusion of technical DRPs into the classification is strongly recommended. Looking at the intervention part, pharmacists indicate the importance of the detected clinical DRPs, in particular activities at prescriber and drug level. The high frequency of interventions is related to the high detection rates of DRPs.

We amended in this study the original PCNE system with 80 items by addition of 15 items (incl. technical DRPs as one new main category) resulting in a total of 95 items. This new problem category was specified with seven items to receive enough information. As suggested by Lampert [84] and Allenet [228], we further added two items in the category ‘drug use problem’ to categorise wrong or improper use of a drug and wrong or improper time of applying a drug. A previous study showed a documentation rate of 97.8% in a hospital setting without any modification of the classification system but they reported a lack of certain items for in-patients [84]. Therefore, an important result of this study is the fact that our modified system allowed a complete classification of all problems. In contrast, a study [81] with the PI-Doc system with 72 items was amended with 27 items but 362 out of 10,427 (3.5%) cases still could not be classified. Our study found twice as many technical DRPs as clinical ones. Most of the documentation systems do not separate technical from clinical DRPs and give them the same level of importance, or they have integrated technical DRPs in ‘prescribing errors’ or ‘other’ [77, 124, 128, 195, 229]. Often there is only a definition for clinical but not for technical DRPs. The German study of 2007 reported 8.3% (out of 10,427) of technical DRPs and difficulties to classify technical DRPs in over 50% of the cases [81]. Our results strongly support the inclusion of a new problem category ‘technical DRPs’ with enough further possibilities to specify them. Furthermore, different classification systems should feature at least the same main categories with the possibility to change single items to be able to compare results from different studies.

Our study has strengths and limitations. We selected prescriptions from primary care during prescription processing in a daily-life setting. We could ascertain the reported problems with the copies of the prescriptions and we could retrospectively differentiate between handwritten and electronically written prescriptions. All

problems could be coded with our modified PCNE classification system. However, we did not assess the level of severity and the clinical or economic impact of clinical and technical DRPs. Furthermore, we cannot assure that the prescriptions selected were consecutive ones and the diversity of persons who documented clinical and technical DRPs could lead to variability in coding for the same problem, even though the participant observers were trained with specific and detailed instructions. In our study the PCNE system showed to be easy to use for a majority of the users and took little time, as it has been created for the documentation of DRPs in the community pharmacy setting. However, one quarter of students evaluated the PCNE tool as not comprehensive although they had classified all problems. Our students rated very critically all questions if comparing with the study from which the questions were retrieved [123].

Our study reflects only the situation in Switzerland. A recent multinational study by Mc Elnay et al. investigated the extent to which pharmaceutical care has already been implemented into daily community pharmacy practice across Europe (Mc Elnay J, Hughes C. Provision of pharmaceutical care by community pharmacists: a comparison across Europe). The behavioural pharmaceutical care scale was used and the mean of all 13 countries was 72.1 ± 8.5 (mean ± SD) with a range of mean scores from 50.6 to 83.5 (possible score: 15−160) reflecting a considerable variation between countries. Switzerland had a score of 73.2 ± 18.7 (mean ± SD) indicating that Swiss pharmacists behave most probably not very differently from their counterparts in other European countries. Furthermore, this study revealed an important lack of documentation activities throughout Europe: only 25.2% of all possible documentation possibilities were used. Thus, a documentation and classification system is urgently needed. Intensive training can increase the number of interventions without increasing the time spent on documentation. [92, 230]. As Lampert [84] reported, the PCNE system with its classification of each DRP on four different levels gives enough detail to allow qualitative and even economic analyses.

Conclusion

In the delivery process of new prescribed medications, clinical and technical DRPs are frequently observed in new primary care and in hospital discharge prescriptions. Neither the setting (hospital discharge vs. primary care) nor the quality of electronically printed prescriptions, but only the number of prescribed drugs influenced the occurrence of clinical or technical DRPs in this study. Most DRPs could be managed by the pharmacist alone or after discussion with the patient but without any contact to the prescriber. Therefore, the management of DRPs in community pharmacies is a very important activity which should be explored more intensively in further studies. The modified PCNE classification system, especially the amendment with a technical DRP category, proved to be useful and allowed the classification of all DRPs, but still rather complicated to apply in pharmacy practice.

Acknowledgements

We would like to thank the owners of the 64 participating pharmacies and Michael Mittag for the support in statistical analysis.

Funding

No funding was provided for this Ph.D. student research.

Conflicts of Interest

None

Tables and figures

Table 1: Added items to the original PCNE classification system V5.01

Problems (P)	Causes (C)	Interventions (I)
	C7 prescription quality	
P4.3 wrong or improper application method of drug (e.g. tablets without break score cut into halves)	C7.1 unreadable prescription	I2.5 patient asked for further information
P4.4 wrong or improper time of application or intake	C7.2 missing or unclear drug name, though readable	I2.6 more information retrieved from patient‘s history
P7.1 technical DRP	C7.3 missing or unclear drug form if multiple forms are available	I3.7 adaptation of amount of drug dispensed
	C7.4 missing or unclear drug potency if multiple forms are available	I4.3 information retrieved from literature
	C7.5 missing or unclear package size or therapy length	I4.4 information retrieved from toxicology or drug information centre
	C7.6 missing or unclear dosage or application instruction	
	C7.7 missing prescription of necessary applications aids	

Table 2: Basic study characteristics

	Primary care	Hospital discharge	Total	*p-values*
Prescriptions (=patients) – n (%)	351 (57.0)	265 (43.0)	616 (100.0)	-
Age – mean years (SD, median)	53.3 (19.0;53)	59.3(18.6; 62)	55.9 (19.0;	*p<0.001* [a]
(IQR*, range)	(28.5; 18−98)	(27.3; 19−94)	56)	
			(32; 18-98)	
Female − n (%)	212 (60.4)	139 (52.5)	351 (57.0)	*p=0.069* [b]
Electronic prescriptions – n (% of prescriptions)	36 (10.3)	143 (54.0)	179 (29.1)	*p<0.001* [b]
Total number of prescribed drugs – n (%)	962 (41.7)	1347 (58.3)	2309	*p<0.001* [b]
Number of drugs per prescription − median (IQR, range)	2 (1; 2−10)	4 (5; 2−19)	3 (2; 2−-19)	*p<0.001* [a]
Clinical DRPs – n (% of prescriptions)	55 (15.7)	86 (32.5)	141 (22.9)	*p<0.001* [b]
Technical DRPs – n (% of prescriptions)	175 (49.9)	103 (38.9)	278 (45.1)	*p=0.007* [b]
Prescriptions with clinical DRPs –n (% of prescriptions)	52 (14.8)	69 (26.0)	121 (19.6)	*p=0.001* [b]
Prescriptions with technical DRPs – n (% of prescriptions)	135 (38.5)	87 (32.8)	222 (36.0)	*p=0.149* [b]
Prescriptions without any problem – n (% of prescriptions)	167 (47.6)	120 (45.3)	287 (46.6)	*p=0.572* [b]

a) p-values for comparisons with t test (2-tailed, 95%)

b) p-values for comparisons with chi-square (2-tailed, 95%)

Table 3: Clinical DRPs (n=141) in 121 prescriptions, classified according to PCNE classification V5.1

Primary domain	Code	Detailed classification	Primary care	Hospital discharge	Total
			n (% of 141)	n (% of 141)	n (% of 141)
Adverse reactions	P1	Total			3 (2.1)
	P1.1	Side effect suffered (non-allergic)	1 (0.7)	1 (0.7)	2 (1.4)
	P1.2	Side effect suffered (allergic)	1 (0.7)	-	1 (0.7)
	P1.3	Toxic effects suffered	-	-	-
Drug choice problem	P2	Total			35 (24.8)
	P2.1	Inappropriate drug (not most appropriate for indication)	6 (4.3)	5 (3.5)	11 (7.8)
	P2.2	Inappropriate drug form (not most appropriate for indication)	4 (2.8)	3 (2.1)	7 (5.0)
	P2.3	Inappropriate duplication of therapeutic group or active ingredient	1 (0.7)	3 (2.1)	4 (2.8)
	P2.4	Contra-indication for drug (incl. pregnancy/breast feeding)	2 (1.4)	-	2 (1.4)
	P2.5	No clear indication for drug use	6 (4.3)	4 (2.8)	10 (7.1)
	P2.6	No drug prescribed but clear indication	-	1 (0.7)	1 (0.7)
Dosing problem	P3	Total			18 (12.8)
	P3.1	Drug dose too low or dosage regimen too long	2 (1.4)	2 (1.4)	4 (2.8)
	P3.2	Drug dose too high or dosage regimen too frequent	1 (0.7)	7 (5.0)	8 (5.7)

continued next page

Primary domain	Code	Detailed classification	Primary care	Hospital discharge	Total
	P3.3	Duration of treatment too short	2 (1.4)	2 (1.4)	4 (2.8)
	P3.4	Duration of treatment too long	1 (0.7)	1 (0.7)	2 (1.4)
Drug use problem	P4	Total			22 (15.6)
	P4.1	Drug not taken/administered at all	-	-	-
	P4.2	Wrong drug taken/administered	-	1 (0.7)	1 (0.7)
	P4.3	Wrong/not appropriate drug use/application	5 (3.5)	4 (2.8)	9 (6.4)
	P4.4	Wrong/not appropriate time of use/application	8 (5.7)	4 (2.8)	12 (8.5)
Interactions	P5	Total			53 (37.6)
	P5.1	Potential interaction	10 (7.1)	42 (29.8)	52 (36.9)
	P5.2	Manifest interaction	1 (0.7)	-	1 (0.7)
Others	P6	Total			10 (7.1)
	P6.1	Patient dissatisfied with therapy despite taking drug(s)	-	-	-
	P6.2	Insufficient awareness of health and diseases	4 (2.8)	6 (4.3)	10 (7.1)
	P6.3	Unclear complaints, further clarification necessary	-	-	-
	P6.4	Therapy failure (reason unknown)	-	-	-
Total			55 (39.0)	86 (61.0)	141 (100.0)

Table 4: Technical DRPs (n=278) in 222 prescriptions

Technical DRPs [a]	Primary care	Hospital discharge	Total
	n (% of 278)	n (% of 278)	n (% of 278)
Missing prescription of necessary application aids	1 (0.4)	2 (0.7)	3 (1.1)
Missing/unclear drug name though legible	6 (2.2)	8 (2.9)	14 (5.0)
Missing/unclear drug form, if several available	17 (6.1)	6 (2.2)	23 (8.3)
Missing/unclear drug potency, if several available	15 (5.4)	13 (4.7)	28 (10.1)
Unreadable prescription	26 (9.4)	7 (2.5)	33 (11.9)
Missing/unclear dosing/application instruction	64 (23.0)	22 (7.9)	86 (30.9)
Missing/unclear package size and/or therapy length	46 (16.5)	45 (16.2)	91 (32.7)
Total	175 (62.9)	103 (37.1)	278 (100.0)

a) ≥1 technical DRP per prescription possible

Table 5: Top ten of the most frequently reported causes (n=166) induced by clinical DRPs (n=141), classified according to PCNE classification V5.1

Primary domain	Code	Detailed classification	Primary care	Hospital discharge	Total
			n (% of 166)	n (% of 166)	n (% of 166)
Drug/dose selection	C1	Total			83 (50.0)
	C1.1	Inappropriate drug selection	17 (10.2)	38 (22.9)	55 (33.1)
	C1.2	Inappropriate dosage selection	5 (3.0)	9 (5.4)	14 (8.4)
	C1.4	Pharmakokinetic problems, incl. ageing/deterioration in organ function and interaction	3 (1.8)	7 (4.2)	10 (6.0)
Drug use process	C2	Total			24 (14.5)
	C2.1	Inappropriate timing of administration and/or dosing intervals	5 (3.0)	8 (4.8)	13 (7.8)
	C2.3	Drug overused/over-administered	2 (1.2)	3 (1.8)	5 (3.0)
	C2.6	Patient unable to use drug (form) as directed	3 (1.8)	1 (0.6)	4 (2.4)
Information	C3	Total			26 (15.7)
	C3.1	Instructions for use/taking not known	9 (5.4)	6 (3.6)	15 (9.0)
	C3.2	Patient unaware of reason for drug treatment	-	4 (2.4)	4 (2.4)

continued next page

Primary domain	Code	Detailed classification	Primary care	Hospital discharge	Total
			n (% of 166)	n (% of 166)	n (% of 166)
Patient / Psychological	C4	Total			14 (8.4)
	C4.8	Burden of therapy	2 (1.2)	3 (1.8)	5 (3.0)
(Pharmacy) Logistics	C5	Total			5 (3.0)
	C5.1	Prescribed drug not available	1 (0.6)	3 (1.8)	4 (2.4)

Table 6: Top ten of the most frequently reported interventions (n=716) induced by clinical or technical DRPs, classified according to PCNE classification V5.1

Primary domain	Code	Detailed classification	Primary care		Hospital discharge		Total
			clinical DRPs	technical DRPs	clinical DRPs	technical DRPs	all DRPs
			n (% of 716)	n (% of 716)	n (% of 716)	n (% of 716)	n (% of 716)
At prescriber level	I1	Total					102 (14.2)
	I1.1	Prescriber informed only	2 (0.3)	3 (0.4)	7 (1.0)	2 (0.3)	14 (2.0)
	I1.2	Asked prescriber for further information	7 (1.0)	26 (3.6)	14 (2.0)	6 (0.8)	53 (7.4)
	I1.3	Intervention proposed, approved by prescriber	6 (0.8)	11 (1.5)	8 (1.1)	3 (0.5)	28 (3.9)
At patient/ carer level	I2	Total					171 (23.9)
	I2.1	Patient (medication) counselling	25 (3.5)	66 (9.2)	63 (8.8)	42 (5.9)	196 (27.4)
	I2.5	Patient asked for further information	21 (2.9)	83 (11.6)	25 (3.5)	28 (3.9)	157 (21.9)
	I2.6	Further information retrieved from patient history	4 (0.6)	20 (2.8)	21 (2.9)	9 (1.3)	54 (7.5)

continued next page

Primary domain	Code	Detailed classification	Primary care		Hospital discharge		Total
			clinical DRPs	technical DRPs	clinical DRPs	technical DRPs	all DRPs
			n (% of 716)	n (% of 716)	n (% of 716)	n (% of 716)	n (% of 716)
At drug level	I3	Total					94 (13.1)
	I3.1	Drug changed	4 (0.6)	9 (1.3)	5 (0.7)	3 (0.4)	21 (2.9)
	I3.2	Dosage changed	4 (0.6)	4 (0.6)	4 (0.6)	1 (0.1)	13 (1.8)
	I3.4	Instructions for use changed	9 (1.3)	9 (1.3)	3 (0.4)	3 (0.4)	24 (3.4)
	I3.7	Amount of drug to dispense changed	5 (0.7)	5 (0.7)	4 (0.6)	4 (0.6)	18 (2.5)

Table 7: Users' opinion (n=64) of the tool. 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree

	Mean score ± SD	Agree or strongly agree	Neutral	Disagree or strongly disagree
		n (%)	n (%)	n (%)
1. The classification system was comprehensive and included all drug-related problems I identified.	3.4 ± 1.1	29 (45.3)	18 (28.1)	17 (26.6) [a]
2. I did not have problems finding out the proper classification of drug-related problems I identified.	2.9 ± 1.0	18 (28.1)	23 (35.9)	23 (35.9) [a]
3. The classification system was easy to use and practical.	3.1 ± 0.9	22 (34.4)	28 (43.8)	14 (21.9) [a]
4. I will use the classification system in my practice in the future.	2.3 ± 1.3	5 (7.8)	14 (21.9)	41 (64.1) [b]
5. In general I am satisfied with the classification system.	3.3 ± 1.0	30 (46.9)	19 (29.7)	15 (23.4) [a]
6. The expenditure of time to classify the problems was adequate.	3.7 ± 1.0	42 (65.6)	12 (18.8)	10 (15.6) [a]
7. I think it is important to have an opportunity to classify the effort of pharmacies.	4.4 ± 0.7	56 (87.5)	7 (10.9)	-
8. The PCNE classification would be a good tool to document the activities of pharmacies.	3.1 ± 1.1	21 (32.8)	22 (34.4)	19 (29.7) [a]

a) No user answered this question with 'strongly disagree'

b) Twenty users answered this question with 'strongly disagree'

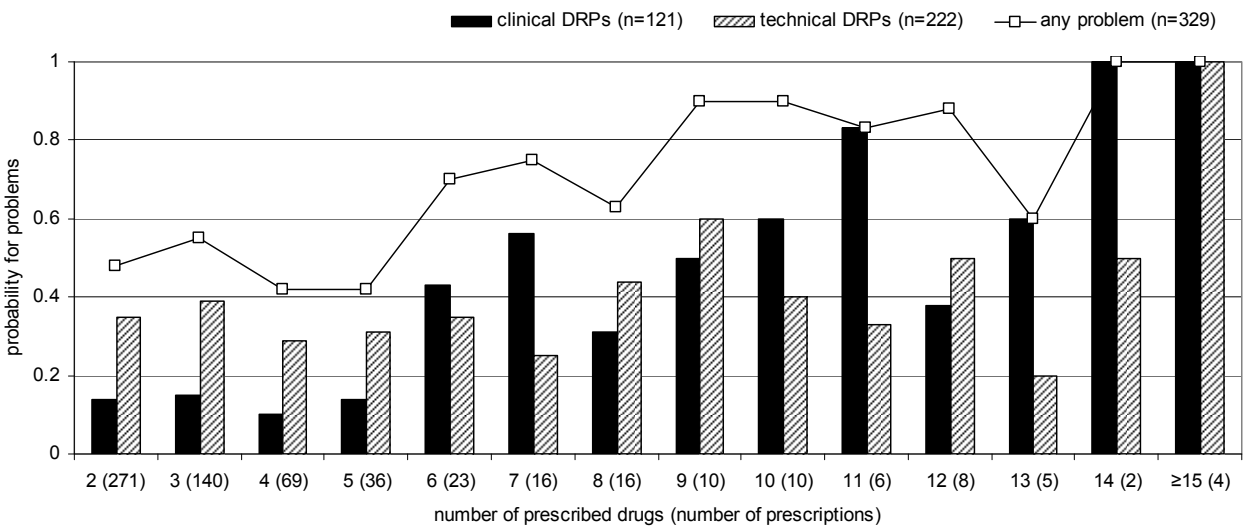

Fig. 1: Probability for prescriptions to present 'any' problems (n=329), clinical (n=121) or technical DRPs (n=222) according to the number of prescribed drugs

4 Opportunities for pharmaceutical care

4.1 Project D:

Patient knowledge and management of newly prescribed medication: a pilot study

Patrick Eichenberger[1]

[1] Pharmaceutical Care Research Group, University of Basel, Switzerland

Short report on a pilot study

Background and aims

Medications have to be applied correctly to act effectively [95]. Misuse of medication can lead to progression of disease or treatment failure; non-adherence (NAH) can cause adverse drug events, drug over- or underdose, unnecessary hospitalizations, additional newly prescribed drugs, and higher costs [95]. Therefore, counselling patients on a newly prescribed drug is important [95]. In an earlier study we found that in Switzerland, half of all new prescriptions show a drug-related problem (DRP). Potential drug-drug interactions (DDIs; 37.6%), drug choice (24.8%), and drug use problems (15.6%) were the most frequent DRPs.

Using the medication communication index (MCI), Tarn et al. [95] showed that during consultation, physicians mentioned the name of the medication in 74% of the prescribed drugs, stated the purpose or justification for taking a medication in 87%, the duration of intake in 34%, the number of tablets or sprays in 55%, the frequency or timing of intake in 58%, and adverse effects in 35%. The study did not assess the patient's knowledge but only the physician's information given to the patient (Fig. 1). Thus, patients collecting their prescribed drug from a pharmacy are likely to have substantial deficits in knowledge about a new drug. Before patients start with their new drug therapy, pharmacies are the last 'check point' to ensure patients' understanding and knowledge on prescribed drug therapy.

Medication review by community pharmacists has been shown to be an effective service to identify medication-related risk factors (MRRFs) [170]. However, not all DRPs can be detected by a review in the pharmacy [170]. To get more information about the patient's medication management, it is useful to visit them at home [170]. Sorensen et al. [170] visited 204 patients in their own homes in Australia. Confusion of generic and trade names was reported most frequently (56%), followed by risk for non-adherence (53%). Such risk factors may be associated with adverse drug events or hospital (re)admission [170].

Using this information, we set the goal to address patients with newly prescribed medication and to gain first experience in performing home visits.

The aims of this pilot study were to assess the patients' knowledge about newly prescribed medication shortly after their pharmacy visit and to identify the prevalence of MRRFs and problems associated with the use of the drugs at patients' homes.

Methods

Twenty community pharmacies in the region of Basel, Switzerland, participated in this pilot study. After counselling patients with a newly issued prescription, all staff members were instructed to refer these patients to the investigator who was present in the pharmacy during one working day. The investigator explained the nature and aim of the study to each patient, and he arranged a telephone interview within the coming two days.

Newly prescribed medications were defined as those that had not been used in the previous 12 months or those prescribed at a different dosage or for a different route of administration. Drugs that were replaced by generics at the same dosage and for the same route of administration were not included. To qualify for the phone interviews**,** patients had to be at least 18 years old. Moreover, they had to fluent in German, and the medication had to be intended for the person who had come to the pharmacy. Parents getting a new drug for a child (≤12 years old) were also included. For patients who did not agree to take part, the reason was recorded. Questionnaires for the interview as well as the prescriptions were made anonymous.

At the end of each completed phone interview, all patients were asked to be visited at their home by an investigator. For this home visit, we developed a 36-item interview guide. We assessed patients' characteristics; patients' knowledge about drugs based on the MCI by Tarn et al. [95]; the prevalence of MRRFs by Sorensen et al. [170], i.e. risk for non-adherence using the self-reported medication-taking scale of Morisky [231], expired medications present, hoarding of over-the-counter (OTC) drugs and prescription-only medicines (POMs) (one or more drugs no longer required but retained at home), therapeutic duplications (two or more drugs containing the same active ingredient that were taken concomitantly), multiple locations of medication

storage, no medication administration routine (e.g. no pill organizers used), discontinued medication repeats retained, ~~and~~ the patient's confusion of generic and trade names), and additional risk factors (e.g. drugs belonging to other individuals living in the same household, any problems with using or handling the drugs, or any suspected ADR since starting to take the drug).

After the visit, the patients' drugs were screened for potential drug interactions using Pharmavista® [232]. They were noted as 'interactions present' if at least one interaction was documented as 'moderate' (frequent therapeutic problems; combination can be administered but close monitoring required) or 'severe' (life-threat / intoxication / permanent harm).

Results are expressed as proportions. Statistical significance was defined as a p value <0.05. Statistical analyses were performed using SPSS for Windows version 15.0 (SPSS Inc., Chicago, USA).

Results

Phone interview

Out of 252 patients with a newly prescribed drug, 80 (31.7%) agreed to participate in the phone interview. Seventy interviews could be completed (four patients were not reachable, two felt too ill, two did not want to participate anymore, and two had given the wrong phone number). The mean (SD; range) number of newly prescribed drugs was 1.3 (0.6; 1-3). Forty (70%) patients received more than one drug. The mean (SD; range) age was 51.5 years (19.2; 19-89). Six interviews were performed with the parents of a child. The mean (SD) MCI score was 3.4 (0.8) on a 5-point scale (68%). The MCI ranged from 2.8 (cardiovascular drugs) to 4.3 (psychiatric drugs) (Table 1).

We asked patients what they would do in the case of adverse effects. Patients gave the following answers (multiple answers were possible; missing=3):

- ask the physician (n=55, 57.3%)
- discontinuing the medicines (n=20; 20.8%)

- ask the pharmacist (n=7; 7.3%)
- lowering the dosage (n=1; 1.1%)
- other (n=13; 13.5%)

Further, we wanted to know what patients would do in the case of a missed dose (no multiple answers were possible; missing=1).

- missed dose just ignore (n=42; 60.0%)
- missed dose taken later (n=8; 11.4%)
- will never occur (n=7; 10.0%)
- inconsistent action (n=5; 7.1%)
- read the package insert (n=2; 2.9%)
- ask the physician or pharmacist (n=2; 2.9%)
- next dose doubled (n=1; 1.4%)
- other (n=2; 2.9%)

Home visits

Out of 70 interviewed patients, 20 (65.0% female, 55.0% retired) agreed to be visited at their home. The mean (SD) age of patients was 59.2 (16.2) years, and the mean (SD) duration of a visit was 42.9 min (24.3) with a range of 15 to 125 min. We observed a mean (SD) number of 4.6 (2.5) drugs per patient. Seventeen (85.0%) patients got their drugs mostly (90-100%) from only one pharmacy. Two (10.0%) patients had any drug use problems (e.g. big tablets), seven (35.0%) suffered from any adverse drug events (e.g. gastrointestinal problems, headache). Most patients kept their drugs in the kitchen (75%), followed by the bathroom (50%) and the bedroom (35%). Multiple answers were possible. No patient used a medicine cupboard. Seven (35%) patients showed moderate or severe interactions. Fig. 2 shows the medication-related risk factors.

Discussion

Phone interviews

Few people could remember the drug's name (35%), especially patients receiving gastrointestinal (10%) or cardiovascular (20%) drugs. Patients with psychiatric drugs could recall the name of the newly prescribed drug best (63%). Tarn et al. [95] showed that 74% of the physicians mentioned the name. Maybe patients cannot remember the names of the drugs because these are often hard to memorise. Akici et al. [233] showed that only 3% (out of 385) of patients with a newly prescribed drug could remember the drug's name when leaving the physician's office. Perhaps the patients in our study could better remember the names because they had already used the drug for 2-3 days. How important is it to know the name? If a pharmacist or a physician asks for other medications during counselling, it is very important for a patient to know the name because of safety reasons, but, for the everyday life it seems to be not very important.

More important than knowing the name is to know the purpose of intake. Overall, 92% could name the reason why to take the drugs. Amazingly, 40% of purposes of cardiovascular drugs were not known by patients. In particular for patients suffering from cardiovascular diseases it would be important to know the reason of intake because often no direct effect can be noticed by the patient himself whether or not he/her takes the drugs. Overall, 92% of all stated purposes of drugs were correct. Compared with the results of Tarn et al., patients in our study were well informed. Tarn reported that 87% of physicians talked anything about the purpose of drugs. However, we do not know about the patient knowledge after the physician consultation. Maybe pharmacies' counselling had contributed to this level of information.

Patients knew the duration of intake in 89% of all cases. Worst results could be found for ear, nose, and throat drugs. In this group only 67% answered correctly. Surprisingly, for antibiotics all of the patients knew how long to take them. Because of resistances it is pleasant to see that patients were good informed about this duration.

Tarn et al. found that physicians mentioned the duration of intake only in 34% of all cases. Overall, the frequency or timing (e.g. dermatologic medication) was known in 96% of cases, and the number of tablets of all drugs in 84% of cases.

Patients with urogenital drugs knew the correct number of tablets in 84%. Tarn et al. found that the physician mentioned the frequency or timing in 58% and the number of tablets in only in 55% of patients. The percentage in our study is high. One reason is certainly that patients were allowed to look at the package when answering and they probably could depict some information from the individualised etiquette, which in Switzerland always should be added to each newly dispensed package.

From all of the five MCI-components the patients had least information about potential adverse effects. For antibiotics, cardiovascular, ear, nose and throat as well as for gastrointestinal drugs, nobody reported to be informed about adverse effects. Especially for antibiotics as well as for cardiovascular drugs it would be very important to be informed about possible adverse effects. Patients receiving psychiatric drugs were good informed about adverse effects (75%). Overall, 24% of the patients knew potential adverse effects of their drugs. Tarn et al. found that physicians informed about adverse effects in 25%. Perhaps, physicians and/or pharmacists mentioned the topic of adverse effects but the patients could not remember, or patients were actually not informed at all in order not to frighten the patient. It is not easy to talk and inform about adverse effects. Some patients could become scared and will not take the drugs at all or they think they will experience all of the adverse effects.

Toren et al. [234] found 77% (out of 130) of patients who knew the purpose and 11% could remember adverse effects one week after discharge of the hospital. In our study more patients stated the correct purpose and they also had more information about adverse effects.

This pilot had several limitations. When the patients were talking, it was difficult to document the answers and to listen at the same time. Perhaps, it would be better to audiotape the interviews in a further study. When the patients did not know the drug's name, it was difficult to be able to relate which information of the patient refers to

which drug. Of course, with this study sample only tendencies can be shown. Because all patients live in the region of Basel the statements do not count throughout Switzerland.

Home visits

The most often detected risk factor was the risk for non-adherence (n=15; 75%). Sorensen et al. [170] found 53% of the patients with a risk for non-adherence. Many research groups try to find solutions to enable good adherence as for example with phone counselling [46]. Such phone counselling by a pharmacist improved adherence, reduced mortality, and reduced the use of healthcare resources in patients receiving polypharmacy. Our phone interviews aimed solely at investigation of patient knowledge. However, they could be used for a further counselling through pharmacists or for enabling patients to ask questions about their new drugs. Sorensen et al. named this risk factor ‘poor adherence’, however, we changed the wording into ‘risk for non-adherence’ because only due to some positive answers it seems to be daring to already talk about ‘poor adherence’. In our opinion, the Morisky questions are a tool to identify patients at risk for non-adherence enabling pharmacists to discuss this problem with a patient.

The risk factors ‘no administration routine’ and ‘multiple medication storage locations used’ were each found in 55% (n=11). The pharmacist could ask such patients with several drugs if they would like to use a Dosette® or similar memory assistance to gain better adherence. Probably soon, the first kind of medication review, which will be paid by the healthcare system, will be implemented in Switzerland enabling pharmacists to perform a kind of concordance review (as described in the UK; [133]) in the pharmacy and to provide a pill box for 3 months after the review. This review would be performed without a referral of a physician.

Most patients kept their drugs in the kitchen or the bathroom where it is often moist and warm. These are not the best places for medication storage. An alternative could be medicine cupboards which moreover allow a better overview. Furthermore, the presence of a medicine cupboard could help to detect quickly expired and hoarding of medications. However, none of the patients in this pilot used a medicine cupboard.

To decrease the amount of hoarding, pharmacists could give advice to the patients to pay attention to the presence of unused drugs. Expired medications can be brought to every pharmacy. All drugs at home should be periodically checked, either by the patient or by a pharmacist.

In 25% of the home visits, patients reported to be confused of generic and trade names. Patients often do not know whether they take an original or a generic drug. This fact does not have to be a problem, but, if patients are not informed, the confusion could lead to therapeutic duplications (present in 15% of patients in this pilot). Thus, it seems to be important to better inform patients about original and generic drugs.

Fourteen (70%) patients do not live alone. In these households the drugs were identified with different storage locations in 14%; and 43% reported that all people living in the household know the drugs. The remaining 6 (43%) patients do not have any system or have never thought about this risk factor.

Two patients (10%) reported about any problems with application (e.g. big tablets), seven (35%) about supposed adverse drug effects. Considering that most of the patients are not informed about adverse effects and how to act in the case of adverse effects, this is a domain with a large room for improvement. Pharmacists, and physicians, should inform patients how to use the drugs correctly and also what to do in the case of an omitted drug intake or if experiencing supposed adverse drug effects.

Sorensen et al. found that most frequently ‘confusion of generic and trade names’ was reported (56% vs. 25% in our study) while ‘risk for non-adherence’ was noted with the second highest frequency (53% vs. 75%). ‘Therapeutic duplications’ were identified in 25% (vs. 15% in our study), ‘expired medications’ were present in 20% as in our study, and ‘multiple medication storage locations’ were only used in 8% (vs. 55% in our study). However, the patients included by Sorensen were chronically ill, i.e. more than four regular medications, suffering on more than two medical conditions or more than 11 doses of medication per day. This means that they already have taken their drugs for a longer time in contrast to our study with patients

taking a drug the first time and probably only for a limited time. Further, the home visits were performed by community pharmacists and general practitioners with more experience than the investigator of this pilot.

The patients were good informed 2-3 days after getting their new prescribed medication about purpose of intake (92%) and dosage (number of tablets known in 84% and frequency or timing of ingestion known in 96%). During the home visits, about 30 days after taking up the new prescribed drug in the pharmacy, 85% still knew the purpose and in 90% the dosage of all their drugs. However, for the phone interviews every drug was evaluated separately in contrast to the home visits where all drugs together were rated. This means that if the purpose of one drug was unknown in the home visit, the domain ‘purpose of drug’ was assessed as unknown. Because of rather good knowledge of patients with new prescribed drugs we decided to focus on chronically ill patients for the main study.

The newly developed interview guide for home visits proved to be a useful tool. The pilot gave important information on improvements, which were incorporated in the following main study. These were amendments to the interview guide, such as questions about the intake of self-purchased over-the-counter (OTC) drugs (including herbal and traditional Chinese medicine (TCM) products), more detailed questions about the handling of drugs (e.g. use of pill organizers), actions in the case of a missed dose or a suspected adverse drug reaction (ADR), efforts to inform other healthcare professionals (HCP) about all drugs taken, knowledge about potential ADRs and interactions (drug-drug and drug-food), assessment of any concerns about the drugs, information on whether package inserts were read, the year of diagnosis of the diabetes or of the transplantation, and the number of pharmacies from which drugs are obtained.

Most importantly, we recognised that such medication reviews pursues two different goals: Research and individualised patient service. To fulfil both, we will in future consider performing home visits by two persons of which one has the mandate to assess the data.

Conclusion

Patients obviously had limited knowledge about adverse effects. The knowledge about dosage and frequency was satisfactory. Deficits could be avoided by concise and more subject-oriented written information. Confusion of generic and trade names could be avoided by informing patients about this subject. With this information, therapeutic duplications could probably be limited as well. The risk for non-adherence is difficult to be lowered. Home visits showed to be a feasible service, presumably also for community pharmacies. There is a potential to reduce MRRFs in patients' homes and to improve patient knowledge.

Tables and figures

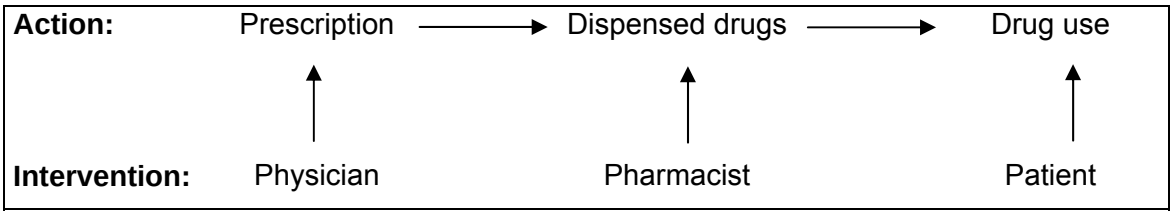

Fig. 1: Prescribing, dispensing, and use of drugs

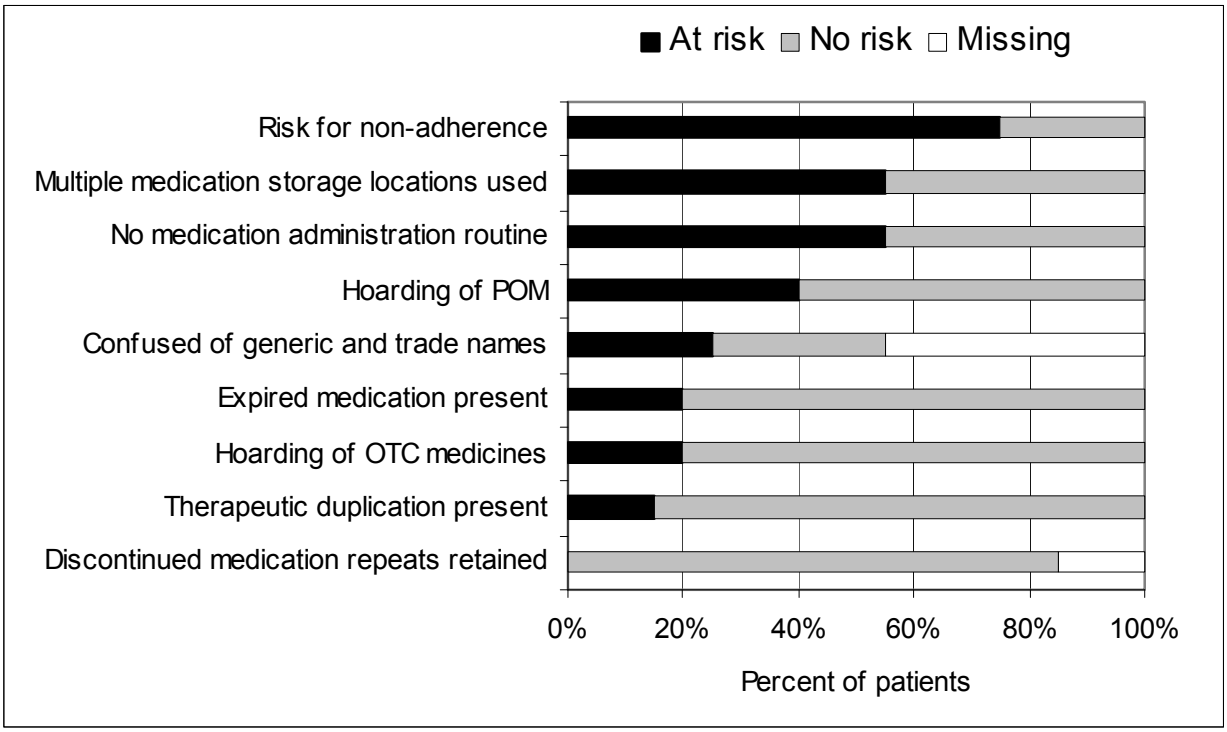

Fig. 2: Prevalence of medication-related risk factors detected in home visits (n=20)

Table 1: Results from phone interviews (n=70) stratified into medication class and medication type: over-the-counter (OTC) and prescription-only medicines (POM). Abbreviations: medication communication index (MCI); not applicable (NA).

		MCI Score, %		MCI Score Components, %					
	No. of drugs	Mean (SD)	Range	Name	Purpose or Justification	Duration of Intake	Tablets or Sprays	Frequency or Timing of Intake	Adverse Effects
Medication class									
Analgesic	15	3.7 (0.7)	3-5	60	100	87	100	47	33
Antibiotic	5	3.2 (0.4)	3-4	20	100	100	100	50	0
Blood and haematopoietic systems	5	3.6 (0.6)	3-4	60	100	80	100	50	20
Cardiovascular	5	2.8 (0.8)	2-4	20	60	100	100	50	0
Dermatologic	13	2.9 (0.9)	1-4	23	85	85	NA	92	8
Ear, nose and throat	3	3.0 (1.0)	2-4	33	100	67	100	50	0
Gastrointestinal	10	3.1 (0.3)	3-4	10	100	100	100	45	0
Ophthalmic	9	3.4 (0.5)	3-4	22	89	89	88	50	33
Psychiatric	8	4.3 (0.7)	3-5	63	100	100	100	50	75
Pulmonary	4	3.0 (0.8)	2-4	25	75	75	100	50	25
Urogenital system	6	3.3 (0.8)	3-4	17	83	100	84	50	33
Other	6	3.3 (0.8)	3-5	50	100	67	84	42	33
Mean	89	3.4 (0.8)	1-5	35	92	89	84	96	24
Medication type									
OTC medicines	24	3.3 (0.7)	1-4	50	96	75	71	92	13
POM	65	3.4 (0.8)	2-5	29	91	94	89	97	28

For dermatologic medication, the MCI is calculated by assigning 1 point to each of the topics: name, purpose or justification, duration, frequency or timing of use, and adverse effects

4.2 Project E:

Home visits of diabetes type 2 and solid organ transplant patients reveal opportunities for pharmaceutical care

Patrick Eichenberger[1], Manuel Haschke[2], Markus Lampert[1,3], Kurt E. Hersberger[1]

[1] Pharmaceutical Care Research Group, University of Basel, Switzerland
[2] Clinical Pharmacology & Toxicology, University Hospital Basel, Switzerland
[3] Clinical and hospital pharmacy, Cantonal hospital Bruderholz, Switzerland

Pharm World Sci; submitted

Abstract

Objectives

To get insight into the self-management of medications by diabetes type 2 (DM) and solid organ transplant (Tx) patients, to analyse drug-related problems (DRPs) and patients' knowledge about the drugs, and to explore opportunities for pharmaceutical care.

Setting

Seventy-one Swiss community pharmacies offering internships for pharmacy students.

Methods

Diabetes and transplant patients were recruited in community pharmacies and were visited at home by the study investigator together with a fifth-year pharmacy student, using a specific interview guide developed for this study.

Results

In total, 24 (Tx patients) and 54 home visits (DM patients) were carried out. Mean age of visited patients was 71.4 ± 8.1 years (DM) and 52.6 ± 13.8 years (Tx). Overall, 37.0% (DM) and 50.0% (Tx) of the participants were female. We identified 7.4 ± 2.4 (mean ± SD) DRPs per visited patient, with significant differences between Tx and DM patients (6.3 ± 1.7 vs. 7.8 ± 2.5; p=0.010; Student t test). The most frequent DRPs were confusion of generic and trade names (DM: 74.1%; Tx: 27.3%), hoarding of over-the-counter (DM: 48.1%; Tx: 4.5%) and prescription-only medicines (DM: 37.0%; Tx: 36.4%), and gaps in knowledge about potential interactions (DM: 61.1%; Tx: 18.2%) and purpose of drugs (DM: 48.1%; Tx: 36.4%). Mean (SD) duration of the visits was 51.7 ± 21.4 min.

Conclusion

Visiting Tx and DM patients in their homes allowed the identification of specific DRPs which most probably would have escaped a medication review in the pharmacy. As

expected, Tx patients had fewer DRPs than DM patients because of their continuous care.

Keywords Pharmaceutical care · Home visits · Medication review · Community pharmacy · Diabetes type 2 · Solid organ transplantation · Medication management

Impact of findings on practice

- Home visits seem to be a useful service and allow assessing a wide range of drug-related problems which most probably would not have been detected in an interview in the pharmacy.

- The interview guide developed specifically for the purpose of this study proved useful in the selected patient population. However, more tailored interview guides for different diseases would enable more efficient home visits.

- The most frequently observed DRPs (e.g. confusion of generic and trade names, hoarding of medications, gaps in knowledge) are important shortcomings which easily can be solved by pharmacists.

Introduction

Medication review by pharmacists is increasingly being implemented in the primary care setting and has been incorporated into the new pharmacy contract in the UK [235]. A medication review is defined as “a structured, critical examination of a patient’s medicines with the objective of reaching an agreement with the patient about treatment, optimising the impact of medicines, minimising the number of medication-related problems, and reducing waste” [235]. Regular performance of such reviews is prominent among methods that have been advocated to reduce the extent and seriousness of drug-related problems (DRPs) [55]. Recent studies indicated that pharmacist-led medication review and home visits are potentially beneficial [54, 142, 145, 206-208], but some randomised controlled trials failed to prove effectiveness [67, 146, 236, 237]. It is still an open question if tailored medication reviews by specifically trained pharmacists are needed.

There are different levels of medication reviews described, such as in the UK by the National Health System (NHS): type 1 (prescription review), type 2 (concordance and compliance review), and type 3 (clinical medication review) [133]. The different review types are not hierarchical but each has a distinct purpose: prescription reviews address technical issues relating to the prescription (e.g. anomalies, changed items, cost effectiveness); concordance reviews address issues relating to the patient’s medicine-taking behaviour, and the clinical medication reviews address issues relating to the patient’s use of medicines in the context of their clinical condition.

Systematic medication review carried out by pharmacists has been shown to be an effective cognitive service to identify DRPs [40, 54, 142, 170, 208, 238, 239]. However, not all DRPs can be detected by a review in the pharmacy [170]. To get more information about the patient’s medication management, it may be useful to visit them at home. Sorensen et al. [170] observed patients in their own home and screened for so-called medication-related risk factors (MRRFs). Most frequently, confusion by generic and trade names was observed while poor adherence was reported with the second highest frequency. Further common risk factors or DRPs

were therapeutic duplications, expired medications, multiple medication storage locations, and medication hoarding. These risk factors may be related to adverse drug events, hospitalisation due to adverse drug events, and hospital readmission [170].

Home visits allow conducting a prescription review and observing the patient's medicine-taking behaviour. In this way, insight into all aspects of self-management of a drug regimen and the patients' use of medicines in the context of their clinical condition may be possible [170].

Chronically ill patients, e.g. those suffering from diabetes type 2 (DM) or patients after solid organ transplantation (Tx) are often faced with complex pharmacotherapeutic regimens requiring intake of multiple drugs several times daily. Diabetic patients often suffer from hypertension, coronary heart disease, and/or hypercholesterolaemia. Transplant patients have a high risk of developing gout, hypertension, or hypercholesterolaemia [240-247] if not already present before transplantation. For these patients living in their own homes, self-management poses an important challenge and continuity of pharmaceutical care is a key issue to promote persistence with drug therapy and to avoid DRPs [235].

In Switzerland, the healthcare system allows physicians to issue repeat prescriptions, theoretically enabling patients to get their medications up to 12 months without further physician appointment. Within this period, the pharmacist is the only healthcare professional with whom patients have contact. If not well informed by the general practitioner (GP) and the pharmacy, patients may have a lack of knowledge leading to problems with their drug regimen. On the other hand, transplant patients are coached extensively before, during, and after transplantation for a long period of time. After this intensive care programme, most nephrological patients, for example, do not have a GP but continue to consult their nephrologist for any complaint, even if minor. Both, DM and Tx patients are reliable pharmacy visitors with regular attendance at the community pharmacy to get their drugs.

Long-term treatment of diabetes and transplant patients varies substantially. Therefore, we selected these two patient populations for a comparison in order to

reveal opportunities for pharmaceutical care. We hypothesized that Tx patients are highly adherent and have a considerable knowledge about their drugs and disease because of their extensive instruction and counselling in the hospital, whereas DM patients may become less reliable over time leading to a risk for non-adherence and a decreased knowledge about their pharmacotherapy or the reason why they have to take their drugs. Taking into consideration the continuous care provided to transplant patients, we expected to observe important differences between DM and Tx patients in pattern and frequency of DRPs.

The first objective of this study was to get insight into the self-management of medications by DM and Tx patients in the primary care setting. The second objective was to analyse DRPs and patients' knowledge about the drugs and their management. The third objective was to explore opportunities for pharmaceutical care and the suitability of the interview guide developed specifically for home visits.

Methods

This prospective, cross-sectional, observational study was conducted in Switzerland from April 2007 to April 2009. We started with a pilot of 4 months and the development of an interview guide before conducting the main study.

Development of the interview guide

In the pilot study, we assessed patients' knowledge about prescribed medications in a phone interview two days after visits in the pharmacy. These findings as well as results of a previous study of DRPs [248] and a literature review allowed developing a first draft of a structured interview guide whose usefulness was tested with patients who were recruited by the phone interviews. We carried out 70 phone interviews with patients who were recruited through a direct contact by fifth-year pharmacy students in community pharmacies in the region of Basel, Switzerland. Of the 70 contacted patients, 20 individuals agreed to be visited at home by the researcher. This pilot study resulted in important amendments to the interview guide, such as the intake of self-purchased over-the-counter (OTC) drugs (including herbal and traditional

Chinese medicine [TCM] products), more detailed questions about the handling of drugs (e.g. use of pill organizers), actions in the case of missed dose or a suspected adverse drug reaction (ADR), efforts to inform other healthcare professionals (HCP) about all drugs taken, knowledge about potential ADRs and interactions (drug-drug and drug-food), assessment of any concerns about the drugs, information on whether package inserts were read, the year of diagnosis of the diabetes or of the transplantation, and the number of pharmacies from which drugs are obtained. In addition, we recognised that home visits performed by one person alone results in poor quality of data. To ensure optimum reliability of information acquisition, we decided to conduct all home visits in the main study with two persons, i.e. the fifth-year pharmacy student who had recruited the patient together with one of three specifically trained investigators. The final version of the interview guide comprised 57 items.

Outcome measures

We assessed the patients' knowledge about drug therapy (purpose and dosage of each drug) and the prevalence of MRRFs as defined by Sorensen et al. [170], i.e. risk for non-adherence using the self-reported medication-taking scale by Morisky [231], expired medications present, hoarding (one or more drugs no longer required but retained at home) of OTC drugs and prescription-only medicines (POMs), therapeutic duplications (two or more concomitant medications containing the same active ingredient), multiple locations of medication storage, no medication administration routine (e.g. no pill organizers used), discontinued medication repeats retained, and the patient's confusion of generic and trade names. To avoid confusion with the generally used term DRP, we decided to rename MRRFs as DRPs according to the definition given by the Pharmaceutical Care Network Europe (PCNE), i.e. as events or circumstances involving drug therapy that actually or potentially interfere with desired health outcomes [128]. We assessed the self-management of prescribed pharmacotherapy and additional problems (e.g. drugs belonging to other individuals living in the same household, any problems with using or handling the drugs, or any suspected ADR since taking the drug). Furthermore, we considered hazardous actions in the case of a suspected ADR (e.g. discontinuing the medicines; accepting minor ADR, e.g. skin modification; lowering the dosage).

Similarly, we addressed the patients' actions in case of missed doses (e.g. missed dose taken later, missed dose just ignore, inconsistent action, next dose doubled). Overall, we evaluated the pattern and frequency of 25 different DRPs. Out of them we selected 11 DRPs that could probably not be assessed by a medication review performed in the pharmacy but would only be detected through home visits. These included multiple locations of medication storage, hoarding of OTC drugs, hoarding of POM, confusion of generic and trade names, absent administration routine, discontinued medication repeats retained, therapeutic duplication, expired medications present, intake of OTC drugs, intake of herbal products, and use of the same medication storage location by different people living in the same household. We always included self-medication and therapies outside the main treatment. In addition, we used pharmacy records and copies of prescriptions of the previous 12 months to compare the currently taken medications with the prescribed drug therapy.

Setting and participants

A total of 79 Swiss community pharmacies offering internships for fifth-year pharmacy master students took part in the study. Inclusion criteria for the main study were: diabetes type 2 patients aged 60 years or older and solid organ transplant patients 18 years or older who took at least 4 prescribed drugs, were literate in the German language, lived in their own home without external support, and whose medication history for the previous 12 months was available at the internship pharmacy.

Data collection

Fifth-year pharmacy master students of the University of Basel had to recruit either a Tx or DM patient from the regular customers of their internship pharmacy. To prepare the home visit, the pharmacy record was used to establish a drug-use and drug-interaction profile for each patient, thus gaining insight into the medication regimen, potential non-adherence gaps, as well as potential drug interactions. Any problems seen were later integrated in the discussion with the patient.

Potential drug-drug interactions were classified using Pharmavista® [232] which distinguishes five categories of severity. However, only those classified as 'severe' (life-threatening, intoxication, permanent harm) or 'moderate' (frequent therapeutic problems/combination can be administered but close monitoring required) were considered.

Because this was not an intervention study, no recommendations were made directly to the patients, except in a few situations (e.g. the removal of expired drugs, explanations about possible purposes of drugs). For each patient, recommendations made because of relevant observations were summarised in a short note that was given to the responsible pharmacists who had to decide whether intervention was needed or not. The interviews were tape-recorded to ensure that patients' statements were assessed correctly. All documents were made anonymous.

The study was approved by the Ethics Committee of Basel, Switzerland. Patients gave their written informed consent to participate in the study. If necessary, we informed the patient's responsible pharmacies of any relevant findings or patient's statements in the interest of the patient's safety.

Statistical analysis

Results are expressed in frequencies and means ± standard deviations (SD) for normally distributed and interval-scaled variables, and as medians with the corresponding interquartile range (IQR) for non-normally distributed and ordinally scaled variables. The non-parametric Mann-Whitney test was used for unpaired two-sample comparisons, and if data were normally distributed with Student's t test and analysis of variance (ANOVA). To check for possible correlations, McNemar's chi-square test and bivariate correlation (Pearson) were used. Statistical significance was defined as a p value <0.05. Statistical analyses were performed using SPSS for Windows version 15.0 (SPSS Inc., Chicago, IL, USA).

Results

During the study period (April 2007 to April 2009), 23 home visits (Tx patients) and 56 home visits (DM patients) were carried out. Three cases did not fulfil the inclusion criteria (one patient had only 3 prescribed drugs, two DM patients were younger than 60 years), resulting in a sample of 76 home visits. Table 1 shows the basic study characteristics.

From the drug list of the DM patients, we deduced the most frequent diseases in addition to diabetes. These were hypertension in 45 (83.3%) patients, dyslipidaemia (n=28; 51.9%), coronary heart disease (n=14; 25.9%), pain (n=10; 18.5%), and arthrosis (n=5; 9.3%). For Tx patients, the most frequent concomitant diseases were hypertension (n=10; 45.5%), gastro-intestinal diseases (n=3; 13.6%), and cystic fibrosis, dyslipidaemia, gout, osteoporosis, and risk for thrombosis (n=2 each; 9.1%).

Drug-related problems

We identified a mean of 7.4 ± 2.4 DRPs per visited patient, with significant differences between Tx and DM patients (6.3 ± 1.7 vs. 7.8 ± 2.5; p=0.010; Student t test). All patients had at least one DRP. Table 2 summarises the results for all items of the interview guide.

Transplant patients stored drugs either in the kitchen (n=9; 40.9%), the living room (n=8; 36.4%), or the bathroom (n=5; 22.7%). All Tx patients kept their drugs in a medicine cupboard. Most DM patients stored their drugs in the kitchen (n=22; 40.7%) or the bathroom (n=13; 24.1%). Forty-four (81.5%) DM patients used a specific cupboard. Four (18.2%) Tx patients reported to have forgotten at least once to prepare enough drugs for the holidays whereas 14 (25.9%) DM patients reported such a mistake. With respect to self-reported non-adherence, 17 (77.3%) Tx patients and 33 (61.1%) DM patients gave at least one positive answer to the Morisky questions indicating a risk for non-adherence. Among these, there were 2 (9.1%) Tx patients and 17 (31.5%) DM patients who gave two or more positive answers.

Among all patients, 11 (14.5%) reported to have problems with their drugs (e.g. swallowing, opening of a bottle, use of a pipette). A total of 19 (86.4%) Tx patients and 26 (48.1%) DM patients stated that they had experienced one or more adverse drug events since the start of the drug therapy (p=0.002). History of allergies (active ingredients or excipients) was reported by 9 (40.9%) Tx and 12 (22.2%) DM patients.

If interviews had been conducted at the pharmacies rather than the patients' homes, we most probably would have detected only 3.6 ± 1.5 (48.6%) DRPs. Thus, we reason that 51.4% of all DRPs were only identified because we performed visits at the patient's home.

Discussion

This study provides insight into the self-management of drug therapies by transplant and diabetes patients. We observed a total of 7.4 ± 2.4 DRPs per visited patient, with significant differences between transplant and diabetes patients.

For this study, we developed a specific interview guide for home visits which was tested within a large pilot study. We used the MRRFs described by Sorensen et al. [170] and carefully assessed further DRPs. In addition, we used integrated questions with respect to knowledge resulting in a comprehensive 57-item interview guide. A total of 17 items were specifically included for the purpose of home visits.

Other studies of home visits used the term 'pharmaceutical care issues' (PCIs) without differentiation between MRRFs and DRPs. In our study, we used the term DRP for both the MRRFs defined by Sorensen [170] and the other DRPs. We feel that risk factors can easily be attributed to circumstances that actually or potentially interfere with desired health outcomes, as stipulated by the definition of a DRP [128].

The interview guide was designed to provide the basis for pharmacist-led home visits of patients and to screen for opportunities for pharmaceutical care. The median (IQR) duration of visits was 60 (30) min and 45 (25) min for Tx and DM patients, respectively. Other studies reported similar durations of medication reviews at

patients' homes, ranging from 15 to 120 min [54, 58, 206, 208, 237, 238, 249], illustrating that home visits represent a time-consuming process for both the health professional and the patient. In our study, pharmacy master students visited the patients and therefore, no on-site interventions were performed. The interviewers had to document opportunities for intervention for discussion with the responsible pharmacist who then decided upon the need for action. The concept of conducting the home visits with two investigators resulted in very complete data sheets with no missing data.

Our study revealed a higher number of DRPs compared to earlier studies [80, 208, 238, 250]. Other studies involving home-dwelling residents reported DRPs ranging from 2.2 [251] to 4.1 [238] per person, with 81% of DM patients having at least one DRP. Similarly, studies in residents of care facilities reported between 2.4 [239] and 3.5 [208] DRPs per patient. A European study conducted in 2004 documented 5.9 potential DRPs per patient [80]. However, Krska et al. [40] conducted home visits and found 8.4 and 7.2 PCIs per patient. If we compare our results with the study by Sorensen [170], the prevalence of DRPs is similar, and both studies revealed the risk for non-adherence (52.5% vs. 65.8%) and the confusion of generic and trade names (55.9% vs. 60.5%) as the most frequent DRPs.

To identify patients at risk for non-adherence, we used the self-reported 4-item medication-taking behaviour scale by Morisky [231]. According to the definition of Soerensen [170], only one criterion had to be met for a patient to be considered at risk for non-adherence. While our study was in process, Morisky published a revised tool to determine medication adherence containing 8 questions [252]. This 8-item instrument had a higher sensitivity (93%) and specificity (53%) than the original 4-item scale (81% and 44%) and was designed to function as a screening tool to identify patients who are at risk for non-adherence [252]. However, because the original instrument is short and has proven useful in practice [249, 253], we feel that the 4-item Morisky score is a suitable and simple tool for home visits to identify patients at risk for non-adherence and to address any problems and other factors jeopardising the adherence to therapeutic regimens.

Nevertheless, if the patient reports very good adherence to his or her therapeutic regimen, this may not be true objectively. Even if patients are told that it is 'human' to forget a dose or to be careless with drug intake, it is reasonable to assume that patients may not be entirely honest. Thus, non-adherence levels would be expected to be higher than reported. This is a potential source of bias which is well known [216-218]. However, if patients confess that they occasionally forget to take a dose, this scale would provide a basis for discussion with the patient about non-adherence in general.

In 2008, Vuong et al. [249] reported a risk for non-adherence of 59% which the authors had determined on the basis of slightly modified Morisky questions. We found more patients hoarding drugs (50.0% vs. 21.5%), not apply any medication administration routine (36.8% vs. 27.8%), and using multiple medication storage locations (34.2% vs. 8.3%). However, in our study fewer patients kept expired medications (9.2% vs. 19.3%) or retained discontinued medication repeats (10.5% vs. 21.4%) than in the study by Vuong et al. [249].

Thus, the results of this study show that a) the prevalence of DRPs in both patient groups was similar or even higher than those previously described in the literature, and b) the extension of our interview guide for home visits resulted in detection of a higher number of DRPs. Several reasons may explain this higher number in our study. First, students may be more eager to find as many DRPs as possible. In addition, students tend to have much more time than employed pharmacists for conducting home visits. Furthermore, it is reasonable to assume that patients are more willing to talk to students than to pharmacists or physicians about their disease, drugs, and concerns. Furthermore, our interview guide with 57 items was very comprehensive. The more items there are, the higher the probability to detect any DRPs. Another reason for the discrepant prevalence of DRPs in the various studies may be the use of different coding systems, different data collection methods, and different education levels of the persons collecting the data [127].

Comparison of the pattern and prevalence of DRPs between Tx and DM patients revealed similarities but also interesting differences. Diabetes patients were at a significantly higher risk of hoarding any OTC drugs ($p=0.001$) and were significantly

more often confused by generic and trade names ($p<0.001$) than transplant patients. However, these two findings can be partially explained because of the higher mean age of diabetes patients (Table 1Table).

Most Tx patients did not live alone (86.4%) and had support by a family member. Overall, 63.6% of them were still employed with daily routine and were younger than many DM patients (mean age 52.6 years vs. 71.4 years) because the need for transplantation does not have to be associated with greater age. Many diabetes patients had no basic knowledge about potential interactions (61.1%), but only 18.2% of Tx patients knew little about interactions. If a dose was missed, Tx patients reported that they would ask their physician in 40.9%, while only 5.6% of DM patients would contact their GP; 61.1% of DM patients would just ignore it (vs. 27.3% of Tx patients). During home visits, many Tx patients reported that they tolerated certain ADRs and were highly appreciative of their ‘second life’ after transplantation, in particular if they received an organ from a living donor. In contrast, DM patients often regarded their disease as a burden and found their drug regimen cumbersome because of the increasing complexity over the years and their dependence on medication for the rest of their lives.

The differing perception of the medical condition in the two patient groups could have important consequences for several DRPs (e.g. non-adherence, concerns, and little knowledge) which could be a topic for further research. The different numbers and patterns of DRPs in Tx and DM patients can be explained by variable pre-conditions, monitoring, and medical support. Hence, these differences raise the question if, for implementation in routine pharmacy practice, more tailored interview guides are needed to perform home visits efficiently in other medical conditions.

The potential risk for non-adherence was the most frequent risk factor with 65.8% and even more frequently expressed in Tx patients (77.3% vs. 61.1%). Jansà et al. [36] used the same Morisky questions with the same cut-off (≥1 question positively answered) for patients with multiple chronic conditions and revealed 82% of patients at risk for non-adherence. Looking at the first two Morisky questions reveals that Tx patients reported to forget to take a drug significantly less frequently than DM patients (13.6 vs. 44.4%) but they seemed to be much more cautious with respect to

adherence to timing (‘careless at times about taking your medicine’; 72.7% vs. 35.2%). Thus, we have some doubts about the appropriateness of the assessment of the ‘risk for non-adherence’ as defined by Sorensen [14] and we presented detailed data for all Morisky questions as Jansà et al. [36] did. Such analysis of the pattern of answers to the Morisky questions results in very important information for tailored counselling.

Overall, the home visits revealed a large number of opportunities for pharmaceutical care. Important issues which a pharmacist could solve on-site and which he or she should review regularly were confusion about generic and trade names, hoarding of OTC and prescription-only medicines, gaps in knowledge about interactions and purpose of drugs, problems with the use of medicines, and the taking of OTC medicines or herbal products. To our knowledge, this is the first pharmaceutical care study observing patients at their homes in Switzerland. Therefore, this work could be seen as a starting point for further research in Switzerland.

The advantage of home visits is the possibility to get insight into the patient’s management of his/her drug therapy at the place where it happens, and to detect DRPs which most probably would not be picked up by interviews in the pharmacy, even if the so called ‘brown bag’ method is used [183, 254-256]. Therefore, we tried to tag items of our interview guide which could only be assessed by home visits. Our evaluation resulted in an important fraction of DRPs (51.4%) that were identified only because we performed visits at the patient’s home. Thus, our results clearly underline the value of home visits in chronically ill patients.

There are several limitations to our study. First, we were only able to recruit willing patients who were motivated to be visited at home by a researcher leading to a potential selection bias. Probably, pharmacotherapy management by such patients is better than by randomly selected patients. Second, the data analysed in this study were collected with the aid of a standardised interview guide, but we conducted the home visit for research purposes. If a DRP was not part of the interview guide, the problem was probably not picked up by the less experienced students because of their faith in the present interview guide. The task was not to find as many DRPs as possible but to deliver a complete data sheet. These visits may therefore not

accurately represent what they could if performed in practice by a trained pharmacist. Third, DRPs were reported only by the patient and were based on the information available from the pharmacy. Medical records (laboratory data, medical reports, therapy plans, etc.) were not consulted and the prescriber was not involved. Clearly, such a multidisciplinary approach would allow a more complete assessment and would minimise the risk of researchers to identify any DRPs that had already been addressed by the GP.

We could not definitively identify any erroneous dosages of patients but could only check if a dosage was plausible and if the timing of taking the medication was appropriate. Therefore, we only checked the appropriateness of dosages (e.g. timing, frequency). Therapy failure was not part of the interview guide and was therefore not detected. In addition, the large number of different persons collecting the data may question the reliability of data collection. However, all participating fifth-year pharmacy students had been trained to collect data and each student was accompanied by a master student.

Conclusion

Home visits of transplant and diabetes patients allowed us to assess more drug-related problems than would have been detected with a medication review in the pharmacy. As expected, transplant patients had fewer drug-related problems than diabetes patients. In diabetes patients, confusion about generic and trade names, hoarding of drugs, and gaps in knowledge about interactions and purpose of drugs were most frequently observed. These aspects represent important opportunities for pharmaceutical care.

The interview guide developed specifically for the purpose of this study proved useful in the selected patient populations. More tailored interview guides for different diseases would enable more efficient home visits.

Acknowledgements

We thank Flavia Gregorini, Barbara Slejska, and Romina Caluori for collecting the data as well as the owners of the 79 participating pharmacies who made this study possible.

Funding

The Pharmaceutical Care Research Group of the University of Basel (Switzerland) funded this study.

Conflicts of interest

None

Tables and figures

Table 1: Basic study characteristics of transplant (Tx; n=22) and diabetes (DM; n=54) patients

	Transplant patients	Diabetes patients	Total	*p-values (Tx vs. DM)*
	n (%)	n (%)	n (%)	*95%; 2-tailed*
Home visits	22 (28.9)	54 (71.1)	76	-
Age − mean ± SD years	52.6 ± 13.8	71.4 ± 8.1	66.0 ± 13.2	*p<0.001*[a]
(range, years)	(23−75)	(58−91)	(23−91)	
Female − n (%)	11 (50.0)	20 (37.0)	31 (40.8)	*p=0.297*[b]
No. of patients living alone − n (%)	3 (13.6)	25 (46.3)	28 (36.8)	*p=0.007*[b]
No. of patients still employed − n (%)	14 (63.6)	10 (18.5)	24 (31.6)	*p<0.001*[b]
No. of chronic medical conditions[†] – mean ± SD				
- self report of patient (during the visit)	*2.3 ± 1.6*	*3.5 ± 1.3*	*3.2 ± 1.5*	*p<0.001*[b]
- deduction from drug list (after the visit)	*4.3 ± 1.6*	*4.5 ± 1.3*	*4.5 ± 1.4*	*p=0.362*[b]
comparison within each patient group (self report vs. deduction)	*p=0.018*[d]	*p<0.001*[d]	*p<0.000*[d]	-
No. of medications – mean ± SD				
- self report of patient (during the visit)	*10.2 ± 4.9*	*9.8 ± 3.5*	*10.0 ± 4.0*	*p=0.331*[c]
- deduction from drug list (after the visit)	*12.5 ± 4.4*	*13.9 ± 5.4*	*13.5 ± 5.1*	*p=0.708*[a]
comparison within each patient group (self report vs. deduction)	*p=0.834*[d]	*p<0.001*[d]	*p=0.011*[d]	-

continued next page

	Transplant patients	Diabetes patients	Total	*p-values (Tx vs. DM)*
Years since diagnosis of type 2 diabetes or since transplantation –				
mean ± SD	7.5 ± 5.5	14.2 ± 10.6	12.0 ± 9.7	*p=0.009*[c]
median (IQR)	6.5 (7.25)	10 (13.25)	10.0 (11)	
Duration of visits (minutes) − mean ± SD	60.0 ± 26.0	48.3 ± 18.4	51.7 ± 21.4	*p=0.039*[c]
median (IQR)	60.0 (30)	45.0 (25)	50.0 (25)	

a) Student t test

b) Chi-square

c) Mann-Whitney u test

d) analysis of variance (ANOVA)

‡ insufficient data to calculate statistical comparisons

† number of chronic medical conditions including transplantation or diabetes (with treatments >3 months)

Table 2: Drug-related problems identified in transplant (Tx; n=22) and diabetes type 2 (DM; n=54) patients

	Transplant patients (n=22)	Diabetes type 2 patients (n=54)	Total (n=76)	*p-values (Tx vs. DM)*
	n (%)	n (%)	n (%)	*95%; 2-tailed*
Uncertainty about one or multiple purposes or justification of all drugs	8 (36.4)	26 (48.1)	32 (42.1)	*p=0.101*[a]
Uncertainty about one or multiple dosages (drug amount and timing)	1 (4.5)	2 (3.7)	3 (3.9)	*p=0.367*[a]
Uncertainty about potential adverse effects	7 (31.8)	27 (50.0)	12 (44.7)	*p=0.063*[a]
No. of severe potential interactions	1 (4.5)	3 (5.6)	4 (5.3)	*p=0.859*[c]
No. of moderate potential interactions	15 (68.2)	41 (75.9)	56 (73.7)	*p=0.013*[c]
No basic knowledge about potential interactions (e.g. grapefruit, St. John's wort; beta-blockers)	4 (18.2)	33 (61.1)	37 (48.7)	*p=0.027*[a]
Multiple pharmacies visited to receive drugs	0 (0.0)	1 (1.9)	1 (1.3)	*p=0.527*[d]
Drugs belonging to other people living in the same household [†]	17 (77.3)	28 (51.9)	45 (59.2)	*p=0.031*[a]
Concerns about medicines	7 (31.8)	9 (16.7)	16 (21.1)	*p=0.118*[a]
Any problems with the use of drugs	3 (13.6)	8 (14.8)	11 (14.5)	*p=0.896*[a]
No efforts to inform other HCP about all drugs taken if receiving an OTC drug or a prescription for a POM	9 (40.9)	9 (16.7)	18 (23.7)	*p=0.277*[a]
Hazardous actions in the case of suspected ADR				
discontinuing the medicines	*0 (0.0)*	*3 (5.6)*	*3 (3.9)*	*p=0.083*[a]
accepting minor ADR (e.g. skin modifications)	*1 (4.5)*	*0 (0.0)*	*1 (1.3)*	*p=0.329*[a]
lowering the dosage	*0 (0.0)*	*1 (1.9)*	*1 (1.3)*	*p=0.527*[a]

continued next page

	Transplant patients (n=22)	Diabetes type 2 patients (n=54)	Total (n=76)	*p-values (Tx vs. DM)*
Hazardous actions in the case of missed doses				
missed dose taken later	*12 (54.5)*	*29 (53.7)*	*41 (53.9)*	*p=0.948*[a]
missed dose just ignore	*6 (27.3)*	*33 (61.1)*	*39 (51.3)*	*p=0.006*[a]
inconsistent action	*5 (22.7)*	*14 (25.9)*	*19 (25.0)*	*p=0.774*[a]
next dose doubled	*1 (4.5)*	*0 (0.0)*	*1 (1.3)*	*p=0.329*[a]
Package insert not read	6 (27.3)	7 (13.0)	13 (17.1)	*p=0.613*[b]
Any suspected ADR since start of drug intake	19 (86.4)	26 (48.1)	45 (59.2)	*p=0.002*[b]
No. of patients taking OTC drugs* † (purchased by themselves)	10 (45.5)	31 (57.4)	41 (53.9)	*p=0.716*[b]
No. of patients taking herbal, homeopathic or TCM products †	6 (27.3)	20 (37.0)	26 (34.2)	*p=0.896*[b]
Therapeutic duplication present° †	2 (9.1)	4 (7.4)	6 (7.9)	*p=0.805*[b]
Expired medications present° †	2 (9.1)	5 (9.3)	7 (9.2)	*p=0.656*[b]
Discontinued medication repeats retained° †	4 (18.2)	4 (7.4)	8 (10.5)	*p=0.302*[b]
Multiple medication storage locations used° †	9 (40.9)	17 (31.5)	26 (34.2)	*p=0.432*[b]
Hoarding of OTC medicines° †	1 (4.5)	26 (48.1)	27 (35.5)	*p=0.001*[b]
No medication administration routine° †	8 (36.4)	20 (37.0)	28 (36.8)	*p=0.956*[b]

continued next page

	Transplant patients (n=22)	Diabetes type 2 patients (n=54)	Total (n=76)	*p-values (Tx vs. DM)*
Hoarding of prescription only medicines° †	8 (36.4)	20 (37.0)	28 (36.8)	*p=0.956*[b]
Confusion of generic and trade names° †	6 (27.3)	40 (74.1)	46 (60.5)	*p<0.001*[b]
Risk for non-adherence°	17 (77.3)	33 (61.1)	50 (65.8)	*p=0.178*[b]
Do you ever forget to take your medicine?	*3 (13.6)*	*24 (44.4)*	*27 (35.5)*	*p=0.011*[b]
Are you careless at times about taking your medicine?	*16 (72.7)*	*19 (35.2)*	*35 (46.1)*	*p=0.003*[b]
When you feel better do you sometimes stop taking your medicine?	*0 (0.0)*	*5 (9.3)*	*5 (6.6)*	*p=0.140*[b]
Sometimes if you feel worse when you take the medicine, do you stop taking it?	*0 (0.0)*	*5 (9.3)*	*5 (6.6)*	*p=0.140*[b]

a) Student t test

b) Chi-square

c) Mann-Whitney u test

d) analysis of variance (ANOVA)

‡ insufficient data to calculate statistical comparisons

* Tx patients: paracetamol (40.9%), 'drops for cough' (9.0%)

DM patients: vitamins (13.0%), paracetamol (11.1%), ibuprofen, diclofenac and loperamide (each 7.5%), aspirin (3.7%), codeine/guaifenesin (1.9%)

○ These drug-related problems have been retrieved from the study of Sorensen et al. [170] who named them medication-related risk factors

† These drug-related problems could probably not be assessed by a medication review performed in the pharmacy but only through home visits

5 General discussion and conclusions

In this thesis we evaluated different aspects of pharmaceutical care including self-assessment of its provision, documenting community pharmacists' activities, and opportunities for new community pharmacy services.

In **project A** the provision of pharmaceutical care by community pharmacists across Europe was investigated and factors that could affect its implementation were examined. Pharmacies in all regions are adequately equipped to provide pharmaceutical care. However, its provision in a comprehensive fashion seems to be still limited within Europe. Pharmacists rarely documented activities related to patient care, evaluated patients' perceived status or engaged in implementing therapeutic objectives, and monitoring plans. In Denmark, similar results have been revealed by Rossing et al. [159] in 2003. One important barrier of the implementation and provision of pharmaceutical is most probably reimbursement [20]. In Australia, for example, pharmacists are reimbursed for several types of cognitive services [257] and in Portugal, community pharmacists obtain reimbursement for diabetes disease management [20]. The basic pharmaceutical activities (e.g. documentation of medical condition, establish a follow-up plan) which the BPCS study asked for, are generally not remunerated. Further, not all countries have specifically appointed professors to educate pharmacy students in this area of pharmacy practice [20]. Overall, much room for improvement in different activities is evident. Results should stimulate further research and efforts at local level to achieve a higher extent of provision of pharmaceutical care.

The objective of **project B** was an in-depth analysis of data from Switzerland and Germany which had been collected for the European BPCS study for an additional comparison with specialised quality circle pharmacists and Danish BPCS data. The specialised quality circle and Danish pharmacists reached significantly lower scores than Swiss and German pharmacists. This was surprising because quality circle pharmacists meet each other regularly with the aim to implement and improve pharmaceutical care activities in a way that patients realize the desire of pharmacists

to optimise care of chronically ill patients. In Denmark, several pharmaceutical care services have already been implemented such as medication review and home visits with clinical interventions related to assessment of individuals' drug therapy at the pharmacy or in their homes. Keeping in mind these facts, the results of this study casts doubt on the results of the whole BPCS study, and the question arises if the BPCS scale is sensitive enough to enable a conclusion about the extent to which pharmaceutical care is provided to patients. We suggest one explanation for the low scoring of pharmacists, who in our view were well placed to perform pharmaceutical care activities. Both, quality circle and the Danish pharmacists follow regularly professional continuing education and advanced training in the topic of pharmaceutical care. They know the concept of pharmaceutical care and the process of solving DRPs while other pharmacists probably think that their 'standard' care yet represents pharmaceutical care and thus reported much higher frequency of corresponding activities. A difference in quality consciousness might represent a major bias. Therefore, such a questionnaire based survey needs much more emphasis on good explanation and definition of what is meant with 'pharmaceutical care services' as well as key questions to assess responders' knowledge of the concept of pharmaceutical care. Thus, further efforts are needed to develop valid assessment tools including indicators for pharmaceutical care activities.

Project C aimed to explore the occurrence of clinical and technical DRPs with new primary care and hospital discharge prescriptions in community pharmacies, to analyse possible differences between new primary care and hospital discharge prescriptions as well as differences between electronically printed and handwritten prescriptions, and to evaluate the applicability of the modified classification system. We found a high occurrence of clinical and, in particular, of technical DRPs. The occurrence was only influenced by the number of prescribed drugs. More than the half of all prescriptions showed a clinical or a technical DRP or both. Compared to other studies our numbers are quite high, but in this study we set out to use prescriptions which we considered likely to have a high prevalence (i.e. newly started drugs and prescriptions with at least two drugs). Most of DRPs could be managed by the pharmacist alone or after discussion with the patient. These results show that the management of DRPs with new prescriptions is a very important activity in the community pharmacy which should be explored in further studies with respect to

indicators for good counselling and outcomes for the patient. The modified PCNE classification system, especially the amendment with a technical DRP category, proved to be useful and allowed the classification of all DRPs, but still rather complicated to apply in pharmacy practice. Although users agreed that it is important to have an opportunity to classify the effort of pharmacies and pharmacists, they most probably would not use this classification system in the future. Because of the complex nature of many DRPs and the use of classification systems in various settings, it seems to be very difficult to achieve a system which fulfils all requirements. For future research in development of a classification system for use in daily practice, our study clearly indicates that technical problems need to be incorporated.

With a pilot we set the goal in **project D** to explore the knowledge of patients shortly after reception of newly prescribed drugs by a community pharmacy and to gain first experiences in performing home visits. Patients had little knowledge about adverse effects and the name of the drugs. However, they were good informed about dosage, frequency, duration of intake, and purpose of drugs. Phone interviews could also be used to improve adherence or knowledge about drugs or diseases. Wu et al. [46] showed that periodic phone counselling by a pharmacist enables an improvement of adherence and a reduction of mortality. However, we used the interviews only for the assessment of knowledge and to recruit patients for following home visits which showed to be a feasible service. The results of this pilot study are based on a rather big number of individuals compared to the main study. This enabled important amendments of the structured interview guide, which proved to be very valuable in the subsequent main study.

In **project E** we performed home visits to get insight into the medication management of transplant and diabetes patients. We aimed to analyse DRPs and patients' knowledge, to explore opportunities for pharmaceutical care, and to evaluate the suitability of the interview guide developed specifically for home visits. Home visits allowed assessing most probably more DRPs than would have been detected with an interview in the pharmacy. The results show that the prevalence of DRPs in both patient groups was similar or even higher than previously described in the literature and that the extension of our interview guide for home visits resulted in

detection of a higher number of DRPs. Most frequently observed DRPs (e.g. confusion of generic and trade names, hoarding of medications, gaps in knowledge) represent important shortcomings which are easy to be solved by community pharmacists. Limitations of this study were that no medical records were available and the prescriber was not involved and we could only check if a dosage was plausible and if the timing of taking the medication was appropriate.
Presumably due to continuous care, transplant patients showed significantly less DRPs than diabetes patients. The interview guide developed specifically for the purpose of this study proved to be useful in the selected patient population. However, differences in the investigated samples raise the question if for implementation in routine pharmacy practice more tailored interview guides are needed to perform home visits efficiently in other medical conditions. This first study in Switzerland on home visits represents an important starting point for future research. First, the procedure needs to be optimised to be feasible in daily practice. For this purpose focus group discussions with practitioners are important. Second, this service must be further developed in cooperation with other healthcare providers to assure complementarity of services, Third, an improved procedure, considering these aspects, needs a proof of concept and studies looking at clinical, humanistic and economic outcomes.

In **conclusion** this thesis shows that:

- The provision of pharmaceutical care in a comprehensive fashion is still limited within Europe. Pharmacists routinely screened patient records and verified patient understanding but rarely documented activities related to patient care, evaluated patients' perceived status, engaged in implementing therapeutic objectives and monitoring plans or self-evaluated their performance in providing pharmaceutical care on regular basis. There is a large room for improvements.

- Pharmacies are adequately equipped to provide pharmaceutical care. However, the provision of pharmaceutical care mainly occurs when pharmacists were supported by their computer system. If the results of such a survey are presented in detail, they are much more meaningful than when

aggregated in domains and dimensions. However, the question arises if the BPCS tool is sensitive enough to enable a conclusion about the extent to which pharmaceutical care is provided to patients. Thus, further efforts are needed to develop valid assessment tools including indicators for pharmaceutical care activities.

- Clinical and technical DRPs are frequently observed in new primary care and in hospital discharge prescriptions and the occurrence was only influenced by the number of prescribed drugs. Therefore, the management of DRPs in community pharmacies is a very important activity. The modified PCNE classification system proved to be useful and allowed the classification of all DRPs, but still rather complicated to apply in pharmacy practice.

- The knowledge of patients few days after reception of newly prescribed drugs was rather good (except for drug names and knowledge about potential adverse effects), indicating that patients who get their drugs in a pharmacy were well informed. Home visits of such patients showed to be a feasible service, presumably also for community pharmacists.

- Home visits of chronically ill patients allowed assessing most probably more DRPs than would have been detected with an interview in the pharmacy. Transplant patients showed significantly less DRPs than diabetes patients who were often confused of generic and trade names, hoarded drugs, and had gaps in knowledge about interactions and purpose of drugs. These aspects represent important opportunities for pharmaceutical care. The interview guide developed specifically for the purpose of this study proved useful in the selected patient population. More tailored interview guides for different diseases would enable more efficient home visits.General introduction.

6 References

1. FIP, Standards for quality of pharmacy services - Good pharmacy practice. Int Pharm Fed, 1997: p. 1-7.

2. Mikael, R.L., et al., Quality of pharmaceutical care in hospitals. Am J Hosp Pharm, 1975. 32: p. 567-574.

3. Hepler, C.D. and T.J. Grainger-Rousseau, Pharmaceutical care versus traditional drug treatment. Is there a difference? Drugs, 1995. 49(1): p. 1-10.

4. Hersberger, K.E. and I. Arnet, Pharmaceutical care - a new discipline in the curriculum: introducing pharmacy students to medication non-compliance. Chimia, 2006. 60(1/2): p. 4.

5. Hepler, C.D., The future of pharmacy: pharmaceutical care. Am Pharm, 1990. NS30(10): p. 23-9.

6. Hepler, C.D. and L.M. Strand, Opportunities and responsibilities in pharmaceutical care. Am J Hosp Pharm, 1990. 47(3): p. 533-43.

7. Cipolle, R.J., L.M. Strand, and P.C. Morley, Pharmaceutical Care Practice. 1998, New York: McGraw Hill Higher Education.

8. Bond, C., An evidence base for professional competence. Int J Pharm Practice, 2009. 17: p. 77.

9. ESCP. (European Society of Clinical Pharmacy). What is clinical pharmacy? http://www.escpweb.org [cited 2010 February 26].

10. Kaboli, P.J., et al., Clinical pharmacists and inpatient medical care: a systematic review. Arch Intern Med, 2006. 166(9): p. 955-64.

11. Bond, C.A. and C.L. Raehl, Clinical and economic outcomes of pharmacist-managed antimicrobial prophylaxis in surgical patients. Am J Health Syst Pharm, 2007. 64(18): p. 1935-42.

12. De Rijdt, T., L. Willems, and S. Simoens, Economic effects of clinical pharmacy interventions: a literature review. Am J Health Syst Pharm, 2008. 65(12): p. 1161-72.

13. Finley, P.R., et al., Impact of a collaborative pharmacy practice model on the treatment of depression in primary care. Am J Health Syst Pharm, 2002. 59(16): p. 1518-26.

14. Haumschild, M.J., et al., Clinical and economic outcomes of a fall-focused pharmaceutical intervention program. Am J Health Syst Pharm, 2003. 60(10): p. 1029-32.

15. Kopp, B.J., et al., Cost implications of and potential adverse events prevented by interventions of a critical care pharmacist. Am J Health Syst Pharm, 2007. 64(23): p. 2483-7.

16. Blenkinsopp, A., et al., Extended adherence support by community pharmacists for patients with hypertension: a randomised controlled trial. Int J Pharm Practice, 2000. 8: p. 165-75.

17. Van Wijk, B.L., et al., Effectiveness of interventions by community pharmacists to improve patient adherence to chronic medication: a systematic review. Ann Pharmacother, 2005. 39(2): p. 319-28.

18. WHO, Adherence to long-term therapies - evidence for action. 2003.

19. Hill, P. and R. Dowse, Cognitive pharmaceutical services and the community pharmacist: are South African patients receiving them and are they willing to pay? Int J Pharm Practice, 2007. 15: p. 201-8.

20. Farris, K.B., F. Fernandez-Llimos, and S.I. Benrimoj, Pharmaceutical care in community pharmacies: practice and research from around the world. Ann Pharmacother, 2005. 39(9): p. 1539-41.

21. Chapman, N.R., et al., Pharmacist interventions to improve the management of coronary artery disease. Am J Health Syst Pharm, 2004. 61(24): p. 2672-8.

22. Lee, S.S., P.Y. Cheung, and M.S. Chow, Benefits of individualized counseling by the pharmacist on the treatment outcomes of hyperlipidemia in Hong Kong. J Clin Pharmacol, 2004. 44(6): p. 632-9.

23. Cordina, M., J.C. McElnay, and C.M. Hughes, Assessment of a community pharmacy-based program for patients with asthma. Pharmacotherapy, 2001. 21(10): p. 1196-203.

24. Holdford, D., Disease management and the role of pharmacists. Dis Manage Health Outcomes, 1998. 3: p. 257-70.

25. Rothman, R., et al., Pharmacist-led, primary care-based, disease management improves haemoglobin A1c in high-risk patients with diabetes. Am J Med Qual, 2003. 18: p. 51-9.

26. Beney, J., L.A. Bero, and C. Bond, Expanding the roles of outpatient pharmacists: effects on health services utilisation, costs, and patient outcomes. Cochrane Database Syst Rev, 2006. CD000336.

27. Frokjaer, B., B. Sondergaard, and H. Herborg, Evidence report 3 - Follow-up on outcomes of drug therapy (Pharmaceutical Care). Pharmakon, 2003: p. 1-16.

28. Damso, L.B., B. Frokjaer, and B. Sondergaard, Evidence report 3 - Follow-up on outcomes of drug therapy (Pharmaceutical Care). Pharmakon, 2003: p. 1-16.

29. Blenkinsopp, A. and A. Hassey, Effectiveness and acceptability of community pharmacy-based interventions in type 2 diabetes: a critical review of intervention design, pharmacist and patient perspectives. Int J Pharm Practice, 2005. 13: p. 231-40.

30. Roughead, E.E., S.J. Semple, and A.I. Vitry, Pharmaceutical care services: A systematic review of published studies, 1990 to 2003, examining effectiveness in improving patient outcomes. Int J Pharm Practice, 2005. 13: p. 53-70.

31. Herborg, H., et al., Improving drug therapy for patients with asthma--part 1: Patient outcomes. J Am Pharm Assoc (Wash), 2001. 41(4): p. 539-50.

32. Herborg, H., et al., Improving drug therapy for patients with asthma-part 2: Use of antiasthma medications. J Am Pharm Assoc (Wash), 2001. 41(4): p. 551-9.

33. Park, J.J., et al., Comprehensive pharmaceutical care in the chain setting. J Am Pharm Assoc (Wash), 1996. NS36(7): p. 443-51.

34. Taylor, C.T., D.C. Byrd, and K. Krueger, Improving primary care in rural Alabama with a pharmacy initiative. Am J Health Syst Pharm, 2003. 60(11): p. 1123-9.

35. Carter, B.L., et al., Interpreting the findings of the IMPROVE study. Am J Health Syst Pharm, 2001. 58(14): p. 1330-7.

36. Clifford, R.M., K.T. Batty, and T.M.E. Davis, A randomised controlled trial of a pharmaceutical care programme in high-risk diabetic patients in an outpatient clinic. Int J Pharm Practice, 2002. 10: p. 85-9.

37. Jaber, L.A., et al., Evaluation of a pharmaceutical care model on diabetes management. Ann Pharmacother, 1996. 30(3): p. 238-43.

38. Stergachis, A., et al., Improving pediatric asthma outcomes in the community setting: does pharmaceutical care make a difference? J Am Pharm Assoc (Wash), 2002. 42(5): p. 743-52.

39. Hanlon, J.T., et al., A randomized, controlled trial of a clinical pharmacist intervention to improve inappropriate prescribing in elderly outpatients with polypharmacy. Am J Med, 1996. 100(4): p. 428-37.

40. Krska, J., et al., Pharmacist-led medication review in patients over 65: a randomized, controlled trial in primary care. Age Ageing, 2001. 30(3): p. 205-11.

41. Sellors, J., et al., A randomized controlled trial of a pharmacist consultation program for family physicians and their elderly patients. Cmaj, 2003. 169(1): p. 17-22.

42. Solomon, D.K., et al., Clinical and economic outcomes in the hypertension and COPD arms of a multicenter outcomes study. J Am Pharm Assoc (Wash), 1998. 38(5): p. 574-85.

43. Gourley, G.A., et al., Humanistic outcomes in the hypertension and COPD arms of a multicenter outcomes study. J Am Pharm Assoc (Wash), 1998. 38(5): p. 586-97.

44. Bernsten, C., et al., Improving the well-being of elderly patients via community pharmacy-based provision of pharmaceutical care: a multicentre study in seven European countries. Drugs Aging, 2001. 18(1): p. 63-77.

45. Cabezas, C.L., et al., Randomized clinical trial of a postdischarge pharmaceutical care program vs. regular follow-up in patients with heart failure. Farm Hosp, 2006. 30: p. 328-342.

46. Wu, J.Y., et al., Effectiveness of telephone counselling by a pharmacist in reducing mortality in patients receiving polypharmacy: randomised controlled trial. Bmj, 2006. 333(7567): p. 522.

47. Sadik, A., M. Yousif, and J.C. McElnay, Pharmaceutical care of patients with heart failure. Br J Clin Pharmacol, 2005. 60(2): p. 183-93.

48. Lee, J.K., K.A. Grace, and A.J. Taylor, Effect of a pharmacy care program on medication adherence and persistence, blood pressure, and low-density lipoprotein cholesterol: a randomized controlled trial. Jama, 2006. 296(21): p. 2563-71.

49. Weinberger, M., et al., Effectiveness of pharmacist care for patients with reactive airways disease: a randomized controlled trial. Jama, 2002. 288(13): p. 1594-602.

50. Green, B.B., et al., Effectiveness of home blood pressure monitoring, Web communication, and pharmacist care on hypertension control: a randomized controlled trial. Jama, 2008. 299(24): p. 2857-67.

51. Mehuys, E., et al., Effectiveness of pharmacist intervention for asthma control improvement. Eur Respir J, 2008. 31(4): p. 790-9.

52. McLean, D.L., et al., A randomized trial of the effect of community pharmacist and nurse care on improving blood pressure management in patients with diabetes mellitus: study of cardiovascular risk intervention by pharmacists-hypertension (SCRIP-HTN). Arch Intern Med, 2008. 168(21): p. 2355-61.

53. Al Mazroui, N.R., et al., Influence of pharmaceutical care on health outcomes in patients with Type 2 diabetes mellitus. Br J Clin Pharmacol, 2009. 67(5): p. 547-57.

54. Hugtenburg, J.G., S.D. Borgsteede, and J.J. Beckeringh, Medication review and patient counselling at discharge from the hospital by community pharmacists. Pharm World Sci, 2009. 31(6): p. 630-7.

55. Sorensen, L., et al., Medication reviews in the community: results of a randomized, controlled effectiveness trial. Br J Clin Pharmacol, 2004. 58(6): p. 648-64.

56. Holland, R., et al., Effectiveness of visits from community pharmacists for patients with heart failure: HeartMed randomised controlled trial. BMJ, 2007. 334(7603): p. 1098.

57. Lenaghan, E., R. Holland, and A. Brooks, Home-based medication review in a high risk elderly population in primary care--the POLYMED randomised controlled trial. Age Ageing, 2007. 36(3): p. 292-7.

58. Holland, R., et al., Does home based medication review keep older people out of hospital? The HOMER randomised controlled trial. BMJ, 2005. 330(7486): p. 293.

59. Salter, C., et al., "I haven't even phoned my doctor yet." The advice giving role of the pharmacist during consultations for medication review with patients aged 80 or more: qualitative discourse analysis. BMJ, 2007. 334(7603): p. 1101.

60. Zermansky, A.G., et al., Clinical medication review by a pharmacist of elderly people living in care homes--randomised controlled trial. Age Ageing, 2006. 35(6): p. 586-91.

61. Machado, M., et al., Sensitivity of patient outcomes to pharmacist interventions. Part I: systematic review and meta-analysis in diabetes management. Ann Pharmacother, 2007. 41(10): p. 1569-82.

62. Wubben, D.P. and E.M. Vivian, Effects of pharmacist outpatient interventions on adults with diabetes mellitus: a systematic review. Pharmacotherapy, 2008. 28(4): p. 421-36.

63. Machado, M., et al., Sensitivity of patient outcomes to pharmacist interventions. Part II: Systematic review and meta-analysis in hypertension management. Ann Pharmacother, 2007. 41(11): p. 1770-81.

64. Machado, M., et al., Sensitivity of patient outcomes to pharmacist interventions. Part III: systematic review and meta-analysis in hyperlipidemia management. Ann Pharmacother, 2008. 42(9): p. 1195-207.

65. Hanlon, J.T., C.I. Lindblad, and S.L. Gray, Can clinical pharmacy services have a positive impact on drug-related problems and health outcomes in community-based older adults? Am J Geriatr Pharmacother, 2004. 2(1): p. 3-13.

66. Holland, R., et al., Does pharmacist-led medication review help to reduce hospital admissions and deaths in older people? A systematic review and meta-analysis. Br J Clin Pharmacol, 2008. 65(3): p. 303-16.

67. Holland, R., Does home based medication review keep older people out of hospital? The HOMER randomised controlled trial. BMJ, 2005. 330: p. 293-8.

68. Bond, C., The MEDMAN study: a randomized controlled trial of community pharmacy-led medicines management for patients with coronary heart disease. Fam Pract, 2007. 24(2): p. 189-200.

69. Royal, S., et al., Interventions in primary care to reduce medication related adverse events and hospital admissions: systematic review and meta-analysis. Qual Saf Health Care, 2006. 15(1): p. 23-31.

70. Strand, L.M., et al., Drug-related problems: their structure and function. DICP, 1990. 24(11): p. 1093-7.

71. Segal, R., Therapeutic outcomes monitoring: a method for implementing pharmaceutical care, in Health outcomes and pharmaceutical care:

measurement, applications and initiatives, A. Escovitz and D.S. Pathak, Editors. 1996, Pharmaceutical Products Press, an imprint of the Haworth Press, Inc. p. 193-8.

72. Leape, L.L., Preventing adverse drug events. Am J Health Syst Pharm, 1995. 52(4): p. 379-82.

73. ASHP guidelines on adverse drug reaction monitoring and reporting. American Society of Hospital Pharmacy. Am J Health Syst Pharm, 1995. 52: p. 417-419.

74. van Mil, F. International working conference on outcomes measurements in pharmaceutical care. in Pharmaceutical Care Network Europe (PCNE). 1999. Hilleroed, Denmark, 1999 January 26-29.

75. van den Bemt, P.M., et al., Drug-related problems in hospitalised patients. Drug Saf, 2000. 22: p. 321-33.

76. Krahenbuhl-Melcher, A., et al., Drug-related problems in hospitals: a review of the recent literature. Drug Saf, 2007. 30(5): p. 379-407.

77. Westerlund, L.T., A.B. Almarsdottir, and A. Melander, Drug-related problems and pharmacy interventions in community practice. IJPP, 1999. 7: p. 11.

78. Ernst, M.E., S.S. Iyer, and W.R. Doucette, Drug-related problems and quality of life in arthritis and low back pain sufferers. Value Health, 2003. 6(1): p. 51-8.

79. Triller, D.M., et al., Resolution of drug-related problems in home care patients through a pharmacy referral service. Am J Health Syst Pharm, 2003. 60(9): p. 905-10.

80. Paulino, E.I., et al., Drug related problems identified by European community pharmacists in patients discharged from hospital. Pharm World Sci, 2004. 26(6): p. 353-60.

81. Hammerlein, A., N. Griese, and M. Schulz, Survey of drug-related problems identified by community pharmacies. Ann Pharmacother, 2007. 41(11): p. 1825-32.

82. Howard, R., A. Avery, and P. Bissell, Causes of preventable drug-related hospital admissions: a qualitative study. Qual Saf Health Care, 2008. 17(2): p. 109-16.

83. Krahenbuhl, J.M., et al., Practical evaluation of the drug-related problem management process in Swiss community pharmacies. Pharm World Sci, 2008. 30(6): p. 777-86.

84. Lampert, M.L., S. Kraehenbuehl, and B.L. Hug, Drug-related problems: evaluation of a classification system in the daily practice of a Swiss University Hospital. Pharm World Sci, 2008. 30(6): p. 768-76.

85. Patel, P. and P.J. Zed, Drug-related visits to the emergency department: how big is the problem? Pharmacotherapy, 2002. 22(7): p. 915-23.

86. Becker, M.L., et al., Hospitalisations and emergency department visits due to drug-drug interactions: a literature review. Pharmacoepidemiol Drug Saf, 2007. 16(6): p. 641-51.

87. Rupp, M.T., M. DeYoung, and S.W. Schondelmeyer, Prescribing problems and pharmacist interventions in community practice. Med Care, 1992. 30(10): p. 926-40.

88. Smith, C.P. and D.B. Christensen, Identification and clarification of drug therapy problems by Indian health service pharmacists. Ann Pharmacother, 1996. 30(2): p. 119-24.

89. Blix, H.S., et al., The majority of hospitalised patients have drug-related problems: results from a prospective study in general hospitals. Eur J Clin Pharmacol, 2004. 60(9): p. 651-8.

90. Viktil, K.K., et al., Interview of patients by pharmacists contributes significantly to the identification of drug-related problems (DRPs). Pharmacoepidemiol Drug Saf, 2006. 15(9): p. 667-74.

91. Shalansky, S., R. Nakagawa, and A. Wee, Drug-related problems identified and resolved using pharmaceutical care versus traditional clinical monitoring. Can J Hosp Pharm, 1996. 49(6): p. 7.

92. Currie, J.D., et al., Effect of a training program on community pharmacists' detection of and intervention in drug-related problems. J Am Pharm Assoc (Wash), 1997. NS37(2): p. 182-91.

93. Bremberg, E.R., et al., An evaluation of pharmacist contribution to an oncology ward in a Swedish hospital. J Oncol Pharm Pract, 2006. 12(2): p. 75-81.

94. Gerdemann, A., N. Griese, and M. Schulz, Pharmacy interns on the ward--a pilot study. Pharm World Sci, 2007. 29(1): p. 34-8.

95. Tarn, D.M., et al., Physician communication when prescribing new medications. Arch Intern Med, 2006. 166(17): p. 1855-62.

96. Hulka, B.S., et al., Communication, compliance, and concordance between physicians and patients with prescribed medications. Am J Public Health, 1976. 66(9): p. 847-53.

97. Indermitte, J., et al., Prevalence and patient awareness of selected potential drug interactions with self-medication. J Clin Pharm Ther, 2007. 32(2): p. 149-59.

98. Puspitasari, H.P., P. Aslani, and I. Krass, A review of counseling practices on prescription medicines in community pharmacies. Res Social Adm Pharm, 2009. 5(3): p. 197-210.

99. Indermitte, J., Potential drug interactions - exposure and management in hospital and ambulatory settings, in Pharmaceutical Care Research Group. 2006, University of Basel: Basel. p. 1-166.

100. Johnson, J.A. and J.L. Bootman, Drug-related morbidity and mortality. A cost-of-illness model. Arch Intern Med, 1995. 155(18): p. 1949-56.

101. Bond, C.A., C.L. Raehl, and T. Franke, Medication errors in United States hospitals. Pharmacotherapy, 2001. 21(9): p. 1023-36.

102. Classen, D.C., et al., Adverse drug events in hospitalized patients. Excess length of stay, extra costs, and attributable mortality. Jama, 1997. 277(4): p. 301-6.

103. Bates, D.W., et al., The costs of adverse drug events in hospitalized patients. Adverse Drug Events Prevention Study Group. Jama, 1997. 277(4): p. 307-11.

104. Bordet, R., et al., Analysis of the direct cost of adverse drug reactions in hospitalised patients. Eur J Clin Pharmacol, 2001. 56(12): p. 935-41.

105. Gautier, S., et al., The cost of adverse drug reactions. Expert Opin Pharmacother, 2003. 4(3): p. 319-26.

106. Ernst, F.R. and A.J. Grizzle, Drug-related morbidity and mortality: updating the cost-of-illness model. J Am Pharm Assoc (Wash), 2001. 41(2): p. 192-9.

107. Kidney, T. and N.J. MacKinnon, Preventable drug-related morbidity and mortality: updating the cost-of-illness model. Geriatrics Today, 2001. 4: p. 120-7.

108. Lau, E. and L.R. Dolovich, Drug-related problems in elderly general practice patients receiving pharmaceutical care. Int J Pharm Practice, 2005. 13: p. 165-77.

109. Sullivan, S.D., D.H. Krelig, and T.K. Hazlet, Noncompliance with medical regimens and subsequent hospitalization: a literature analysis and cost of hospitalization estimate. J Res Pharm Econ, 1990. 2: p. 19-33.

110. Smith, D.L., The effect of patient non-compliance on health care costs. Med Interface, 1993. 6(4): p. 74-76, 78, 84.

111. Grymonpre, R.E., et al., Drug-associated hospital admissions in older medical patients. J Am Geriatr Soc, 1988. 36(12): p. 1092-8.

112. Lindley, C.M., et al., Inappropriate medication is a major cause of adverse drug reactions in elderly patients. Age Ageing, 1992. 21(4): p. 294-300.

113. Williamson, J. and J.M. Chopin, Adverse reactions to prescribed drugs in the elderly: a multicentre investigation. Age Ageing, 1980. 9(2): p. 73-80.

114. Einarson, T.R., Drug-related hospital admissions. Ann Pharmacother, 1993. 27(7-8): p. 832-40.

115. Winterstein, A.G., et al., Preventable drug-related hospital admissions. Ann Pharmacother, 2002. 36(7-8): p. 1238-48.

116. Kongkaew, C., P.R. Noyce, and D.M. Ashcroft, Hospital admissions associated with adverse drug reactions: a systematic review of prospective observational studies. Ann Pharmacother, 2008. 42(7): p. 1017-25.

117. Lazarou, J., B.H. Pomeranz, and P.N. Corey, Incidence of adverse drug reactions in hospitalized patients: a meta-analysis of prospective studies. Jama, 1998. 279(15): p. 1200-5.

118. Suh, D.C., et al., Clinical and economic impact of adverse drug reactions in hospitalized patients. Ann Pharmacother, 2000. 34(12): p. 1373-9.

119. Routledge, P.A., M.S. O'Mahony, and K.W. Woodhouse, Adverse drug reactions in elderly patients. Br J Clin Pharmacol, 2004. 57(2): p. 121-6.

120. Linnebur, S.A., et al., Pharmacy practice, research, education, and advocacy for older adults. Pharmacotherapy, 2005. 25(10): p. 1396-430.

121. van Mil, J.W., et al., Drug-related problem classification systems. Ann Pharmacother, 2004. 38(5): p. 859-67.

122. van Mil, J.W., Arzneimittelbezogene Probleme in der öffentlichen Apotheke. Pharm Ztg, 2001. 146: p. 1308-14.

123. AbuRuz, S.M., N.R. Bulatova, and A.M. Yousef, Validation of a comprehensive classification tool for treatment-related problems. Pharm World Sci, 2006. 28(4): p. 222-32.

124. Schaefer, M., Discussing basic principles for a coding system of drug-related problems: the case of PI-Doc. Pharm World Sci, 2002. 24(4): p. 120-7.

125. Westerlund, L.O., et al., Pharmacy practitioners' views on computerized documentation of drug-related problems. Ann Pharmacother, 2003. 37(3): p. 354-60.

126. Westerlund, L.T. and H.T. Bjork, Pharmaceutical care in community pharmacies: practice and research in Sweden. Ann Pharmacother, 2006. 40(6): p. 1162-9.

127. Westerlund, T., A.B. Almarsdottir, and A. Melander, Factors influencing the detection rate of drug-related problems in community pharmacy. Pharm World Sci, 1999. 21(6): p. 245-50.

128. PCNE. The PCNE Classification V 5.01 2006 29 May 2006 [cited 2007 15 Jan 2007]; 9]. Available from: http://www.pcne.org/dokumenter/DRP/PCNE%20classification%20V5.01.pdf.

129. De Smet, P.A. and M. Dautzenberg, Repeat prescribing: scale, problems and quality management in ambulatory care patients. Drugs, 2004. 64(16): p. 1779-800.

130. Koecheler, J.A., et al., Indicators for the selection of ambulatory patients who warrant pharmacist monitoring. Am J Hosp Pharm, 1989. 46(4): p. 729-32.

131. Hopp, T.R., et al., Implementation of cognitive pharmaceutical services (CPS) in professionally active pharmacies. Int J Pharm Practice, 2005. 13: p. 21-31.

132. Shaw, J., R. Seal, and M. Pilling, Room for review - A guide to medication review: the agenda for patients, practitioners and managers. 2002.

133. Clyne, W., A. Blenkinsopp, and R. Seal, A guide to medication review 2008. 2008.

134. Zermansky, A.G. and J. Silcock, Is medication review by primary-care pharmacists for older people cost effective?: a narrative review of the literature, focusing on costs and benefits. Pharmacoeconomics, 2009. 27(1): p. 11-24.

135. Framework document for domiciliary medication management reviews - Developed by the Medication Management Implementation Steering Group. 2001: p. 1-14.

136. Deans, K., et al., Guidelines and standards for the collaborative and pharmacist residential medication management review (RMMR) program and associated quality use of medicines (QUM) services. Guidelines and standards for pharmacists, 2006: p. 1-28.

137. Cahill, J.A., et al., Principles of a sound drug formulary system. 2000: p. 1-7.

138. Pharmacopeia, U.S. United States Pharmacopeia. [cited 2010 3 March]; Available from: http://www.usp.org/.

139. Centers for medicare & medicaid services. [cited 2010 19 March]; Available from: http://www.cms.hhs.gov.

140. Department of Health. Implementing the new community pharmacy contractual framework (draft). 2005 [cited 2008 May 12]; Available from: www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4109256.

141. Blenkinsopp, A., et al., Medicines use review: adoption and spread of a service innovation. Int J Pharm Practice, 2008. 16: p. 271-6.

142. Stafford, A.C., et al., Drug-related problems identified in medication reviews by Australian pharmacists. Pharm World Sci, 2009. 31(2): p. 216-23.

143. Australian Government. Department of Health and Ageing. 2008 [cited 2010 16 march]; Available from: http://www.healthyactive.gov.au/internet/main/publishing.nsf/Content/health-epc-dmmr-answers.htm.

144. Hersberger, K.E., P. Eichenberger, and I. Arnet, Polymedication-Check. pharmaJournal, 2010. 4: p. 20-22.

145. Krahenbuhl, J.M., A. Decollogny, and O. Bugnon, Using the costs of drug therapy to screen patients for a community pharmacy-based medication review program. Pharm World Sci, 2008. 30(6): p. 816-22.

146. Krska, J. and A.J. Avery, Evaluation of medication reviews conducted by community pharmacists: a quantitative analysis of documented issues and recommendations. Br J Clin Pharmacol, 2007.

147. Beney, J., L.A. Bero, and C. Bond, Expanding the roles of outpatient pharmacists: effects on health services utilisation, costs, and patient outcomes. Cochrane Database Syst Rev, 2000. CD000336.

148. Stewart, S., S. Pearson, and J.D. Horowitz, Effects of a home-based intervention among patients with congestive heart failure discharged from acute hospital care. Arch Intern Med, 1998. 158(10): p. 1067-72.

149. Simoens, S., Economic evaluation of pharmacy practice: research informing policy. Int J Pharm Practice, 2008. 16: p. 337-8.

150. Krska, J., et al., Is hospital admission a sufficiently sensitive outcome measure for evaluating medication review services? A descriptive analysis of admissions within a randomised control trial. Int J Pharm Practice, 2007. 15: p. 85-91.

151. Schumock, G.T., et al., Economic evaluations of clinical pharmacy services--1988-1995. The Publications Committee of the American College of Clinical Pharmacy. Pharmacotherapy, 1996. 16(6): p. 1188-208.

152. Willett, M.S., et al., Prospectus on the economic value of clinical pharmacy services. A position statement of the American College of Clinical Pharmacy. Pharmacotherapy, 1989. 9(1): p. 45-56.

153. Hanlon, J.T., et al., A method for assessing drug therapy appropriateness. J Clin Epidemiol, 1992. 45(10): p. 1045-51.

154. Phelan, M., et al., Pharmacist-led medication review for knee pain in oder adults: content, process and outcomes. Int J Pharm Practice, 2008. 16: p. 347-55.

155. Zermansky, A.G., et al., Randomised controlled trial of clinical medication review by a pharmacist of elderly patients receiving repeat prescriptions in general practice. BMJ, 2001. 323(7325): p. 1340-3.

156. Lambert, B.L., Face and politeness in pharmacist-physician interaction. Soc Sci Med, 1996. 43(8): p. 1189-98.

157. Odedina, F.T. and R. Segal, Behavioral pharmaceutical care scale for measuring pharmacists' activities. Am J Health Syst Pharm, 1996. 53(8): p. 855-65.

158. Bell, H.M., et al., Provision of pharmaceutical care by community pharmacists in Northern Ireland. Am J Health Syst Pharm, 1998. 55(19): p. 2009-13.

159. Rossing, C., E.H. Hansen, and I. Krass, The provision of pharmaceutical care in Denmark: a cross-sectional survey. J Clin Pharm Ther, 2003. 28(4): p. 311-8.

160. Li, S.C., An overview of community pharmacist interventions: assessing cost-effectiveness and patient's willingness to pay. Dis Manage Health Outcomes, 2003. 11: p. 95-110.

161. Eickhoff, C. and M. Schulz, Pharmaceutical care in community pharmacies: practice and research in Germany. Ann Pharmacother, 2006. 40(4): p. 729-35.

162. Farris, K.B., et al., Outcomes-based pharmacist reimbursement: reimbursing pharmacists for cognitive services part 1. J Manag Care Pharm, 2002. 8(5): p. 383-93.

163. Snella, K.A., et al., Pharmacist compensation for cognitive services: focus on the physician office and community pharmacy. Pharmacotherapy, 2004. 24(3): p. 372-88.

164. Murphy, A.L., et al., Pharmacists' participation in an inhaled respiratory medication program: reimbursement of professional fees. Ann Pharmacother, 2005. 39(4): p. 655-61.

165. Rupp, M.T., Performing and billing for cognitive services: implications for the US. Ann Pharmacother, 2000. 34(3): p. 401-2.

166. Scott, D.M. and L.G. Miller, Reimbursement for pharmacy cognitive services: Pharmacists' assessment. J Manag Care Pharm, 1999. 5: p. 420-4.

167. Blumenschein, K. and M. Johannesson, Use of contingent valuation to place a monetary value on pharmacy services: an overview and review of the literature. Clin Ther, 1999. 21(8): p. 1402-17; discussion 1401.

168. Schulz, M., H. Morck, and R. Braun, Neues Apothekenprofil: good pharmacy practice and pharmaceutical care. Pharm Ztg, 1993. 138: p. 191-7.

169. Hughes, C.M. and J.C. McElnay, Provision of pharmaceutical care by community pharmacists: a comparison across Europe. Pharm World Sci, 2010. submitted.

170. Sorensen, L., et al., Medication management at home: medication risk factor prevalence and inter-relationships. J Clin Pharm Ther, 2006. 31(5): p. 485-91.

171. Rovers, P.R., et al., A practical guide to pharmaceutical care. The American Pharmaceutical Association. 1998, WA, USA.

172. Bagozzi, R.P., The self-regulation of attitudes, intentions, and behavior. Soc Psychol Q, 1992. 55: p. 178-204.

173. Penna, R.P., Pharmaceutical care: pharmacy's mission for the 1990s. Am J Hosp Pharm, 1990. 47(3): p. 543-9.

174. Raisch, D.W., Barriers to providing cognitive services. Am Pharm, 1993. NS33(12): p. 54-8.

175. Reutzel, T.J., The compatibility of the retail setting with a patient-based practice model: reports from community pharmacists. J Clin Pharm Ther, 1994. 19(5): p. 301-12.

176. Elnour, A.A., et al., Pharmaceutical care of patients with gestational diabetes mellitus. J Eval Clin Pract, 2008. 14(1): p. 131-40.

177. Robinson, J.P., P.R. Shaver, and L.S. Wrightsman, Criteria for scale selection and evaluation, in Measures of personality and social psychological attitudes. 1991, Academic Press: San Diego. p. 1-15.

178. Costello, A.B. and W. Osborne, Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. Pract Assess Res Eval, 2005. 10: p. 1-9.

179. Kaiser, H.F., An index of factorial simplicity. Psychometrika, 1974. 39: p. 31-6.

180. Odedina, F.T., R. Segal, and C.D. Hepler, Providing pharmaceutical care in community practice: Differences between providers and non-providers of pharmaceutical care. J Soc Adm Pharm, 1995. 12: p. 170-80.

181. Harris, W.E., P.H. Rivers, and R. Goldstein, The potential role of community pharmacists in care management. Health Soc Care Community, 1998. 6(3): p. 196-203.

182. Fowler, F.J., Survey Research Methods. Third ed. 2002, London, Thousand Oaks, CA: Sage Publications.

183. Nathan, A., et al., 'Brown bag' medication reviews as a means of optimizing patients' use of medication and of identifying potential clinical problems. Fam Pract, 1999. 16(3): p. 278-82.

184. Baran, R.W., et al., Improving outcomes of community-dwelling older patients with diabetes through pharmacist counseling. Am J Health Syst Pharm, 1999. 56(15): p. 1535-9.

185. Cranor, C.W. and D.B. Christensen, The Asheville Project: short-term outcomes of a community pharmacy diabetes care program. J Am Pharm Assoc (Wash), 2003. 43(2): p. 149-59.

186. Cranor, C.W., B.A. Bunting, and D.B. Christensen, The Asheville Project: long-term clinical and economic outcomes of a community pharmacy diabetes care program. J Am Pharm Assoc (Wash), 2003. 43(2): p. 173-84.

187. Barbanel, D., S. Eldridge, and C. Griffiths, Can a self-management programme delivered by a community pharmacist improve asthma control? A randomised trial. Thorax, 2003. 58(10): p. 851-4.

188. Schulz, M., et al., Pharmaceutical care services for asthma patients: a controlled intervention study. J Clin Pharmacol, 2001. 41(6): p. 668-76.

189. Carter, B.L., et al., Evaluation of hypertensive patients after care provided by community pharmacists in a rural setting. Pharmacotherapy, 1997. 17(6): p. 1274-85.

190. Chabot, I., et al., Pharmacist intervention program for control of hypertension. Ann Pharmacother, 2003. 37(9): p. 1186-93.

191. Cote, I., et al., A pharmacy-based health promotion programme in hypertension: cost-benefit analysis. Pharmacoeconomics, 2003. 21(6): p. 415-28.

192. Garcao, J.A. and J. Cabrita, Evaluation of a pharmaceutical care program for hypertensive patients in rural Portugal. J Am Pharm Assoc (Wash), 2002. 42(6): p. 858-64.

193. Berringer, R., et al., Outcomes of a community pharmacy-based diabetes monitoring program. J Am Pharm Assoc (Wash), 1999. 39(6): p. 791-7.

194. Lindenmeyer, A., et al., Interventions to improve adherence to medication in people with type 2 diabetes mellitus: a review of the literature on the role of pharmacists. J Clin Pharm Ther, 2006. 31(5): p. 409-19.

195. Leemans, L., et al., Frequency and trends of interventions of prescriptions in Flemish community pharmacies. Pharm World Sci, 2003. 25(2): p. 65-9.

196. Chamba, G., G. Bauguil, and J. Galiezot, The role of the French community pharmacist in drug dispensing. Pharm World Sci, 1999. 21(3): p. 142-3.

197. Schaefer, M. and J. Kresser, Pharmazeutische Betreuung vermeidet Schäden. [Pharmaceutical care prevents damage.]. Pharm Ztg, 1998. 143: p. 4446-4454.

198. van Mil, J.W.F., et al., Interventions and documentation for drug-related problems in Dutch community pharmacies. Am J Health Syst Pharm, 2001. 58: p. 1428-1431.

199. Buurma, H., et al., Nature, frequency and determinants of prescription modifications in Dutch community pharmacies. Br J Clin Pharmacol, 2001. 52(1): p. 85-91.

200. Saanum, D.T. and K.S. Mellbye, [The prescription as an aid for communication between physicians and pharmacists. A study of errors and insufficient information on prescriptions]. Tidsskr Nor Laegeforen, 1996. 116(19): p. 2325-9.

201. Hawksworth, G.M., et al., Clinical pharmacy interventions by community pharmacists during the dispensing process. Br J Clin Pharmacol, 1999. 47: p. 695-700.

202. Tully, M.P. and E.M. Seston, The impact of pharmacists providing prescription review and monitoring service in ambulatory care or community practice. Ann Pharmacother, 2000. 34: p. 1320-1331.

203. Dent, L.A., K.J. Harris, and C.W. Noonan, Tobacco interventions delivered by pharmacists: a summary and systematic review. Pharmacotherapy, 2007. 27(7): p. 1040-51.

204. Hudson, S.A., J.J. Mc Anaw, and B.J. Johnson, The changing role of pharmacists in society. IeJSME, 2007. 1: p. 22-34.

205. Locca, J.F., et al., Development of pharmaceutical care services in nursing homes: practice and research in a Swiss canton. Pharm World Sci, 2009. 31(2): p. 165-73.

206. Delate, T., et al., Clinical outcomes of a home-based medication reconciliation program after discharge from a skilled nursing facility. Pharmacotherapy, 2008. 28(4): p. 444-52.

207. Vuong T, et al., Implementation of a community liaison pharmacy service: a randomised controlled trial. IJPP, 2008. 16: p. 127-135.

208. Finkers, F., et al., A study of medication reviews to identify drug-related problems of polypharmacy patients in the Dutch nursing home setting. J Clin Pharm Ther, 2007. 32(5): p. 469-76.

209. Schnipper, J.L., et al., Role of pharmacist counseling in preventing adverse drug events after hospitalization. Arch Intern Med, 2006. 166(5): p. 565-71.

210. Hopp TR, et al., Implementation of cognitive pharmaceutical services in Danish community pharmacies- perceptions of strategists and practitioners. Int J Pharm Practice, 2006. 14: p. 37-49.

211. Holland, R., et al., Delivering a home- based medication review, process measures from the HOMER randomised controlled trial. IJPP, 2006. 14: p. 71-79.

212. Kennie, N.R., B.G. Schuster, and T.R. Einarson, Critical analysis of the pharmaceutical care research literature. Ann Pharmacother, 1998. 32(1): p. 17-26.

213. Plumridge, R.J. and R.E. Wojnar-Horton, A review of the pharmacoeconomics of pharmaceutical care. Pharmacoeconomics, 1998. 14(2): p. 175-89.

214. Augsburger, S., et al., Pharma-Markt Schweiz - Ausgabe 2007. Vol. 14. Auflage. 2007, Basel: Interpharma. 104.

215. Jorgensen, C.K. and B. Karlsmose, Validation of automated forms processing. A comparison of Teleform with manual data entry. Comput Biol Med, 1998. 28(6): p. 659-67.

216. Furnham, A., Response bias, social desirability and dissimulation. Person Individ Diff, 1986. 7(3): p. 385-400.

217. Sjostrom, O. and D. Holst, Validity of a questionnaire survey: response patterns in different subgroups and the effect of social desirability. Acta Odontol Scand, 2002. 60(3): p. 136-40.

218. Tourangeau, R. and T. Yan, Sensitive questions in surveys. Psychol Bull, 2007. 133(5): p. 859-83.

219. Bühl, A. and P. Zöfel, SPSS - Einführung in die moderne Datenanalyse unter Windows. 2002: München.

220. Bergk, V., et al., Mail surveys: obsolescent model or valuable instrument in general practice research? Swiss Med Wkly, 2005. 135(13-14): p. 189-91.

221. Barclay, S., et al., Not another questionnaire! Maximizing the response rate, predicting non-response and assessing non-response bias in postal questionnaire studies of GPs. Fam Pract, 2002. 19(1): p. 105-11.

222. Edwards, P., et al., Increasing response rates to postal questionnaires: systematic review. Bmj, 2002. 324(7347): p. 1183.

223. Reeve, J.F., P.C. Tenni, and G.M. Peterson, An electronic prompt in dispensing software to promote clinical interventions by community pharmacists: a randomized controlled trial. Br J Clin Pharmacol, 2008. 65(3): p. 377-85.

224. Barber, N., et al., Patients' problems with new medication for chronic conditions. Qual Saf Health Care, 2004. 13(3): p. 172-5.

225. Hersberger, K., et al., Prescribed medications and pharmacy interventions for acute respiratory tract infections in Swiss primary care. J Clin Pharm Ther, 2009. 34(4): p. 9.

226. Westerlund, L.T., et al., Nonprescription drug-related problems and pharmacy interventions. Ann Pharmacother, 2001. 35(11): p. 1343-9.

227. Eccles, M., et al., Research designs for studies evaluating the effectiveness of change and improvement strategies. Qual Saf Health Care, 2003. 12(1): p. 47-52.

228. Allenet, B., et al., Validation of an instrument for the documentation of clinical pharmacists' interventions. Pharm World Sci, 2006. 28(4): p. 181-8.

229. Knapp, K.K., et al., Community pharmacist interventions in a capitated pharmacy benefit contract. Am J Health Syst Pharm, 1998. 55(11): p. 1141-5.

230. Benrimoj, S.I., et al., Economic impact of increased clinical intervention rates in community pharmacy. A randomised trial of the effect of education and a professional allowance. Pharmacoeconomics, 2000. 18(5): p. 459-68.

231. Morisky, D.E., L.W. Green, and D.M. Levine, Concurrent and predictive validity of a self-reported measure of medication adherence. Med Care, 1986. 24(1): p. 67-74.

232. Pharmavista, Information for Health Care Professionals. 2009, e-mediat AG Bern.

233. Akici, A., et al., Patient knowledge about drugs prescribed at primary healthcare facilities. Pharmacoepidemiol Drug Saf, 2004. 13(12): p. 871-6.

234. Toren, O., et al., Patients' knowledge regarding medication therapy and the association with health services utilization. Eur J Cardiovasc Nurs, 2006. 5(4): p. 311-6.

235. Shaw J, Seal R, and Pilling M, Room for review. 2002.

236. Holland, R., et al., Does pharmacist-led medication review help to reduce hospital admissions and deaths in older people? A systematic review and meta-analysis. Br J Clin Pharmacol, 2007.

237. Tinelli, M., et al., Patient evaluation of a community pharmacy medications management service. Ann Pharmacother, 2007. 41(12): p. 1962-70.

238. Haugbolle, L.S. and E.W. Sorensen, Drug-related problems in patients with angina pectoris, type 2 diabetes and asthma--interviewing patients at home. Pharm World Sci, 2006. 28(4): p. 239-47.

239. Ruths, S., J. Straand, and H.A. Nygaard, Multidisciplinary medication review in nursing home residents: what are the most significant drug-related problems? The Bergen District Nursing Home (BEDNURS) study. Qual Saf Health Care, 2003. 12(3): p. 176-80.

240. Saag, K.G. and H. Choi, Epidemiology, risk factors, and lifestyle modifications for gout. Arthritis Res Ther, 2006. 8(1): p. 1-7.

241. Abbott, K.C., et al., New-onset gout after kidney transplantation: incidence, risk factors and implications. Transplantation, 2005. 80(10): p. 1383-91.

242. Clive, D.M., Renal transplant-associated hyperuricemia and gout. J Am Soc Nephrol, 2000. 11(5): p. 974-9.

243. Haller, H., et al., Aktuelle Probleme der Nierentransplantation. Internist, 2009. 50: p. 523-35.

244. Seeman, T., Hypertension after renal transplantation. Pediatr Nephrol, 2009. 24(5): p. 959-72.

245. Ramezani, M., et al., Hyperlipidemia after renal transplantation and its relation to graft and patient survival. Transplant Proc, 2007. 39(4): p. 1044-7.

246. Glatz, N., et al., Hypertension in solid organ transplants. Rev Med Suisse, 2009. 5(216): p. 1771-4.

247. Gago Fraile, M., et al., Clinical and Epidemiological Characteristics of Refractory Hypertension in Renal Transplant Patients. Transplantation Proceedings, 2009. 41: p. 2132-3.

248. Eichenberger, P.M., et al., Classification of drug-related problems with new prescriptions using a modified PCNE classification system. Pharm World Sci, 2010. DOI 10.1007/s11096-010-9377-x.

249. Vuong, T., et al., Implementation of a community liaison pharmacy service: a randomised controlled trial. IJPP, 2008. 16: p. 127-135.

250. Sturgess, I.K., et al., Community pharmacy based provision of pharmaceutical care to older patients. Pharm World Sci, 2003. 25(5): p. 218-26.

251. Roughead, E.E., J.D. Barratt, and A.L. Gilbert, Medication-related problems commonly occurring in an Australian community setting. Pharmacoepidemiol Drug Saf, 2004. 13(2): p. 83-7.

252. Morisky, D.E., et al., Predictive validity of a medication adherence measure in an outpatient setting. J Clin Hypertens (Greenwich), 2008. 10(5): p. 348-54.

253. Jansà, M., et al., Multidimensional analysis of treatment adherence in patients with multiple chronic conditions. A cross-sectional study in a tertiary hospital. Patient Educ Couns, (2010). doi:10.1016/j.pec.2009.12.012.

254. Caskie, G., et al., Congruence of Medication Information from a Brown Bag Data Collection and Pharmacy Records: Findings from the Seattle Longitudinal Study. Int J Pharm Practice, 2005. 32(1): p. 79-103.

255. Larrat, E.P., A.H. Taubmann, and C. Willey, Compliance-related problems in the ambulatory population. Am Pharmacy, 1990. NS30: p. 18-23.

256. Edmondson, H.M., A case study of the introduction of a medicine review service in a Hull inner city area. Pharm J, 1995. 255((suppl)): p. R5.

257. Benrimoj, S.I. and M.S. Frommer, Community pharmacy in Australia. Aust Health Rev, 2004. 28(2): p. 238-46.

7 Appendix

Project A and B:

Project C:

Project D and E:

7.1 Data dictionary for the European BPCS study

Section A

A1i Gender
1 = Male
2 = Female

A1ii Year of Registration as Pharmacist

A2 Type of Pharmacy
1 = Independent
2 = Small Multiple (>4 pharmacies)
3 = Large Multiple (10+ pharmacies)

A3 Location of Pharmacy
1 = Rural
2 = Suburban
3 = City or Town Centre
4 = Out of Town
5 = Health Centre

A4 No. of full time equivalent pharmacists who work in the pharmacy

A5 No. of ancillary, skilled staff involved in the dispensing process (excluding pre-registration student)

A6 Pre-registration student employed?
1 = Yes
2 = No

A7 Approximate number of prescription items dispensed in the pharmacy in an average day

A8 Do you participate regularly in continuing education programmes/ continuing professional development to maintain and improve your competency?
1 = Yes
2 = No

A9 Do you have a postgraduate qualification in clinical pharmacy?
1 = Yes
2 = No

A10 Do you participate in regular local multi-disciplinary team meetings, e.g. GP, community nurse, social workers?
1 = Yes
2 = No

A11 Does your pharmacy have a private consultation area?
1 = Yes
2 = No

A12 What pharmacy practice-related software do you use in your practice?

A13 What do you use this software for?

A14 If you need medical/clinical information about patients to whom you provide care, do the GPs make this information available to you?
1 = Yes
2 = No

Do you participate in the following activities?

A15i Health screening
1 = Yes
2 = No

A15ii Patient monitoring
1 = Yes
2 = No

A15iii Domiciliary visiting
1 = Yes
2 = No

A15iv Health promotion/education
1 = Yes
2 = No

Section B

Indicate how many of the last five patients, who presented a NEW prescription used to treat a chronic condition, you provided the following activities to (0-5 patients).

B1 Asked the patient to describe his or her medical condition, including a description of medical problems and symptoms.

B2 Documented information about the patient's medical condition(s) on written records or computerised patient medication records or by other formal mechanisms in a form that could be read or interpreted by another healthcare professional in my absence.

B3 Documented all medications currently being taken by the patient on written records or computerised patient medication records or by other formal mechanisms in a form that could be read or interpreted by another healthcare professional in my absence.

B4 Asked the patient what he or she wanted to achieve from the drug therapy.

B5 Documented the desired therapeutic objectives for the patient.

B6 Checked the patient's records for potential drug-related problems (e.g. interactions, side-effects, poor compliance)

B7 Discussed the patient's drug therapy with him or her.

B8 Verified that the patient understood the information I presented to him or her.

Indicate how many of the last five patients, who presented a REPEAT prescription used to treat a chronic condition, you provided the following activities to (0-5 patients).

B9 Asked the patient questions to assess actual patterns of use of the medication.

B10 Asked the patient questions to find out if he or she might be experiencing drug-related problems (e.g. interactions, side-effects, poor compliance).

B11 Asked the patient questions to find out about the perceived effectiveness of drugs he or she was taking.

B12 Asked the patient questions to ascertain whether the therapeutic goals were being reached.

Question B12.5 does not form part of the questionnaire total score.

B12.5 Was a drug-related problem uncovered?
1 = A drug-related problem was detected in any of these ten patients (i.e. neither box is ticked).
2 = I do not check for drug-related problems in my patients (i.e. the top box is ticked).
3 = I routinely check for drug-related problems, but these 10 patients did not experience any (i.e. the bottom box is ticked).

Indicate how many of the last five patients who you discovered were experiencing drug-related problems you provided the following activities to (0-5 patients).

B13 Documented the drug-related problem(s), potential or actual on written notes on patient medication records.

B14 Documented the desired therapeutic goal(s) for each drug-related problem(s) identified.

B15 Implemented a strategy to resolve (or prevent) the drug-related problem(s).

B16 Carried out the follow-up plans established for the patient's progress towards his or her therapeutic objectives.

B17 Documented any intervention made on the patient's file or patient medication records in a form that could be read and interpreted by another healthcare professional.

In general, considering all the patients with chronic conditions that you have seen in the last six weeks, please indicate the extent to which you provided pharmaceutical care to these patients (1=never, 2=rarely, 3=sometimes, 4=often, 5=always).

Questions B18 and B19 do not form part of the questionnaire total score.

B18 How often did you try to provide pharmaceutical care to these patients?

B19 How often did you consciously decide and make the effort to provide pharmaceutical care to these patients?

In general, considering all the patients you saw in the last two weeks, please indicate how often you carried out the following activities (1=never, 2=rarely, 3=sometimes, 4=often, 5=always). For questions that deal with communication, we are referring to communication that the pharmacist initiates.

B20 Consulted with other pharmacists in my practice group about difficult or unusual patient problems.

B21 Made referrals to other pharmacists whenever it was in the best interest of the patient.

B22 Made referrals to a GP when necessary.

B23 Communicated patients' progress on their drug therapy, good or bad, to their GP.

B24 Initiated discussion with GPs whenever I believed one of their patients was experiencing a drug-related problem or might experience a drug-related problem.

B25 Provided the GP with a written summary of the patient's medication history and any related problems when referring a patient.

B26 Referred patients with social problems to appropriate help groups.

B27 Used a quiet location for patient counselling.

B28 Double checked each prescription prepared by another person before giving the medication to the patient.

B29 Used appropriate information services, e.g. personal reference library, Drug Information Unit at Royal Victoria Hospital, to assist me in my practice when necessary.

B30 Enquired of patients about their satisfaction with my services in order to evaluate my work.

B31 Participated regularly in continuing education programmes to maintain and improve my competency.

B32 Used the clinical outcomes of my patients to evaluate my work.

B33 Provided written copies of relevant patient information to professional colleagues authorised to have such information for the purpose of solving or preventing specific drug-related problems.

B34 Provided general medical information to patients.

7.2 BPCS questionnaire for Switzerland

Pharmazeutische Betreuung in Europa Version für die Schweiz

Europaweite Befragung zur Umsetzung der Pharmazeutischen Betreuung in öffentlichen Apotheken

Dieser Fragebogen sollte durch den/die Apotheker/in ausgefüllt werden, welche/r hauptsächlich für die Patientenbetreuung zuständig ist und nicht durch jemanden, der vor allem in der täglichen Betriebsführung tätig ist.

Bitte benutzen Sie einen **blauen** oder **schwarzen** Kugelschreiber.

Teil A - Allgemeine Informationen

Bitte geben Sie folgende Informationen zu Ihrer Person und der Apotheke, in der Sie arbeiten:

1. a) Geschlecht: ☐ männlich ☐ weiblich b) Abschlussjahr Pharmaziestudium: ☐☐☐☐

2. a) Typ der Apotheke
   - ☐ Unabhängig
   - ☐ Apotheke ist Teil einer Kette
   - ☐ Mitglied einer Gruppierung (unabhängige Apotheke)

   b) Welche Form der Arzneimittelabgabe überwiegt in Ihrem Einzugsgebiet?
   - ☐ Keine Selbstdispensation
   - ☐ Eingeschränkte Selbstdispensation
   - ☐ Mischform
   - ☐ Selbstdispensation

3. a) Lage der Apotheke (nur eine Antwort möglich)
   - ☐ Zentrumslage (City, Passantenlage, Bahnhof, Ladenpassage)
   - ☐ Periphere Lage (Quartier, Aussenquartier, Nebenstrasse)
   - ☐ Dorf- oder Landapotheke
   - ☐ Apotheke in Einkaufszentrum

   b) Apotheke in Ärztehaus bzw. in Gesundheitszentrum (oder direkt angrenzend)
   ☐ ja ☐ nein

4. Anzahl vollzeitbeschäftigter ApothekerInnen:
   (Bsp.:1 Apotheker 100% + 1 Apothekerin 80% = 180 Stellenprozente = 1.8 Vollzeitstellen)
   ☐☐.☐ Vollzeitstellen

5. Anzahl weiterer ausgebildeter MitarbeiterInnen, welche bei der Abgabe von Medikamenten mitwirken exkl. Studierende vor dem Staatsexamen?
   (Bsp.:1 Pharma-Assistentin(PA) 80% + 1 PA in Ausbildung 60% = 140 Stellenprozente = 1.4 Vollzeitstellen)
   ☐☐.☐ Vollzeitstellen

6. Sind Studierende vor dem Staatsexamen angestellt? ☐ ja ☐ nein

7. Anzahl Rezepte (inkl. Bezüge auf Wiederholungsrezept) an einem durchschnittlichen Tag? ☐☐☐

8. Nehmen Sie regelmässig an Fort- oder Weiterbildungsprogrammen teil, um Ihre fachliche Kompetenz zu erhalten oder zu verbessern? ☐ ja ☐ nein

9. Führen Sie einen Titel in Offizin- oder Spitalpharmazie (Fachapotheker/in FPH) oder haben Sie einen Lehrgang in Klinischer Pharmazie absolviert?
   - FachapothekerIn FPH für Offizinpharmazie ☐ ja ☐ nein
   - FachapothekerIn FPH für Spitalpharmazie ☐ ja ☐ nein
   - Lehrgang in Klinischer Pharmazie ☐ ja ☐ nein

10. Nehmen Sie an lokalen, regelmässig stattfindenden multidisziplinären Treffen z.B. mit Allgemeinärzten, Pflegefachpersonen, Sozialdiensten o.ä. teil? (z.B.Qualitätszirkel) ☐ ja ☐ nein

11. Hat Ihre Apotheke einen abgetrennten Beratungsraum? ☐ ja ☐ nein

12. Welche Apotheken-Software benutzen Sie?
    - ☐ Pro Pharma
    - ☐ Pharmacy (PMS)
    - ☐ Golden Gate (Pharmatic)
    - ☐ Inpha
    - ☐ CSE
    - ☐ Triamun
    - ☐ Andere, welche? .....

INSTITUT FÜR KLINISCHE PHARMAZIE
Departement Pharmazie der Universität Basel
Pharmaceutical Care Research Group
Klingelbergstrasse 50, 4056 Basel

M.Yagicibulut, P. Eichenberger, Dr. Kurt Hersberger
Bei Fragen: Tel. +41 (0) 61 267 14 27

40208

Pharmazeutische Betreuung in Europa Seite 2 von 4

13. Kann Ihre Software folgende Anwendungen ausführen?

Führung des Dossiers (Medikationshistorie)	☐ ja	☐ nein
Speicherung von Kunden-Gesundheitsdaten	☐ ja	☐ nein
Erstellen eines Medikationsprofils (Compliance-Kontrolle)	☐ ja	☐ nein
Automatische Kontrolle auf Interaktionen bei Arzneimittelabgabe	☐ ja	☐ nein
Automatische Kontrolle auf Kontraindikationen bei Arzneimittelabgabe	☐ ja	☐ nein

14. Wenn Sie medizinische/klinische Informationen über die von Ihnen betreuten Patienten benötigen, erhalten Sie diese vom behandelnden Arzt? ☐ ja ☐ nein

15. Bieten Sie folgende Leistungen an?

Gesundheits-Screening (z.B. Blutdruck, Blutzucker, Blutlipide)	☐ ja	☐ nein
Patientenüberwachung (z.B. Blutdruck, Peak-Flow)	☐ ja	☐ nein
Hausbesuche (Patientenberatung vor Ort)	☐ ja	☐ nein
Gesundheitsförderung /-erziehung (z.B. Raucherberatung,Gewichtsreduktion)	☐ ja	☐ nein

Definition Pharmazeutische Betreuung *(Hepler und Strand)*

"Pharmazeutische Betreuung ist die konsequente Wahrnehmung der Mitverantwortung der Apothekerin/des Apothekers bei der Arzneimitteltherapie mit dem Ziel, bestimmte therapeutische Ergebnisse zu erreichen, die die gesundheitsbezogene Lebensqualität des Patienten verbessern."

Pharmazeutische Betreuung beinhaltet nicht nur die Bereitstellung von Arzneimitteln, sondern auch die Beratung zum Gesundheitszustand von Patienten und zur Pharmakotherapie. Ein weiterer Aspekt ist die Erstellung eines Betreuungsplans um zu überprüfen (Monitoring), ob spezifische therapeutische Ziele erreicht werden (z.B. Reduktion oder Eliminierung von Symptomen eines Krankheitszustandes).

Eine pharmazeutische Betreuung sollte deshalb folgende Elemente beinhalten:

- *Rücksprache mit dem Patienten, um dessen Verständnis der Pharmakotherapie abzuschätzen und arzneimittelbezogene Bedürfnisse zu erkennen.*
- *Beurteilung der Pharmakotherapie des Patienten, um potenzielle arzneimittelbezogene Probleme zu erkennen (z.B. unerwünschte Arzneimittelwirkungen, Interaktionen, schlechte Compliance).*
- *Erstellen eines Betreuungsplanes zur Überwachung der therapeutischen Ziele und zur Vermeidung neuer arzneimittelbezogener Probleme.*
- *Den Patienten über seinen Krankheitszustand aufklären (inkl. Beratung zur Gesundheitsförderung).*
- *ApothekerInnen arbeiten mit den anderen Gesundheitsberufen zusammen, um gemeinsam arzneimittelbezogene Probleme zu verhindern, zu erkennen und zu lösen.*

Teil B - Fragen zur Pharmazeutischen Betreuung

Bitte denken Sie an Ihre letzten 5 Patienten oder Kunden, welche Ihnen ein NEUES Rezept für ein Arzneimittel zur Behandlung einer chronischen Erkrankung, wie z.B. Asthma oder Diabetes vorlegten.

Bei wie vielen dieser Patienten **haben Sie folgende Aktivitäten ausgeführt?**	Anzahl Patienten
1. Der Patient wurde gebeten, seine Krankheitssituation, einschliesslich der medizinischen Probleme und Symptome zu beschreiben.	0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
2. Informationen zur Krankheitssituation des Patienten wurden schriftlich oder computergestützt in einer geeigneten Form dokumentiert, so dass sie bei meiner Abwesenheit auch von anderen MitarbeiterInnen gelesen und interpretiert werden können.	0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
3. Alle Arzneimittel, die der Patient gegenwärtig anwendet, wurden in schriftlichen oder computer-gestützten Medikationshistorien in geeigneter Form dokumentiert, so dass sie in meiner Abwesenheit auch von anderen MitarbeiterInnen gelesen und interpretiert werden können.	0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
4. Der Patient wurde gefragt, welche Therapieziele er mit der Arzneimitteltherapie erreichen möchte.	0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

40208

M. Yagicibulut, P. Eichenberger, Dr. Kurt Hersberger - Institut für Klinische Pharmazie
Pharmazentrum 0059 - Klingelbergstrasse 50 - 4056 Basel - Tel. +41 (0) 61 267 14 27

Pharmazeutische Betreuung in Europa **Seite 3 von 4**

	Anzahl Patienten
5. Die gewünschten Therapieziele des Patienten wurden für den Patienten dokumentiert.	0 1 2 3 4 5
6. Das Patienten-Dossier (Medikationshistorie) wurde auf potenzielle arzneimittelbezogene Probleme überprüft (Interaktionen, schlechte Compliance).	0 1 2 3 4 5
7. Die Arzneimitteltherapie wurde mit dem Patienten diskutiert.	0 1 2 3 4 5
8. Sich vergewissert, dass der Patient die ihm vermittelten Informationen verstanden hat.	0 1 2 3 4 5

Als nächstes möchten wir Sie bitten, an Ihre letzten 5 Patienten oder Kunden zu denken, die von einem Wiederholungsrezept Arzneimittel zur Behandlung einer chronischen Krankheit, wie z.B. Asthma oder Diabetes bezogen haben.

Bei wie vielen dieser Patienten **haben Sie folgende Aktivitäten ausgeführt?**	Anzahl Patienten
9. Der Patient wurde zum Arzneimittelgebrauch befragt (z.B. Häufigkeit / Art der Einnahme).	0 1 2 3 4 5
10. Dem Patienten wurden Fragen gestellt, um herauszufinden, ob er arzneimittelbezogene Probleme hat (Interaktionen, unerwünschte Arzneimittelwirkungen, schlechte Compliance)	0 1 2 3 4 5
11. Dem Patienten wurden Fragen gestellt, um herauszufinden, wie er die Wirksamkeit der verwendeten Arzneimittel empfindet.	0 1 2 3 4 5
12. Dem Patienten wurden Fragen gestellt, um festzustellen ob die therapeutischen Ziele erreicht wurden.	0 1 2 3 4 5

Haben Sie bei irgendeinem dieser 10 Patienten (*5 Patienten mit neuem Rezept + 5 Patienten mit Wiederholungsrezept)* **ein arzneimittelbezogenes Problem entdeckt?**

☐ Ja Gehen Sie bitte direkt zur Frage 13.

☐ Nein, bei keinem dieser Patienten wurde ein arzneimittelbezogenes Problem erkannt, weil:

- ☐ Ich überprüfe meine Patienten nicht auf arzneimittelbezogene Probleme (weiter mit Frage 18)
- ☐ Ich überprüfe routinemässig auf arzneimittelbezogene Probleme, aber bei diesen 10 Patienten sind keine aufgetreten. (Weiter mit Frage 13 und beantworten Sie bitte die Frage auf der Basis Ihrer letzten 5 Patienten, die arzneimittelbezogene Probleme hatten).

Nun denken Sie bitte an Ihre letzten 5 Patienten oder Kunden, bei denen Sie arzneimittelbezogene Probleme entdeckt haben.

Bei wie vielen dieser Patienten **haben Sie die folgenden Aktivitäten umgesetzt?**	Anzahl Patienten
13. Arzneimittelbezogene Probleme, seien es potenzielle oder reale, wurden schriftlich oder im entsprechenden Formblatt des Computerprogramms dokumentiert.	0 1 2 3 4 5
14. Für jedes identifizierte arzneimittelbezogene Problem wurde ein therapeutisches Ziel dokumentiert.	0 1 2 3 4 5
15. Es wurde eine Strategie zur Lösung (oder Vermeidung) arzneimittelbezogener Probleme in die Tat umgesetzt.	0 1 2 3 4 5
16. Der für den Patienten vereinbarte Betreuungsplan wurde ausgeführt, damit er sein therapeutisches Ziel erreichen kann.	0 1 2 3 4 5
17. Jede Intervention in den Patientenunterlagen erfolgte in einer Form, dass sie von anderen MitarbeiterInnen gelesen und interpretiert werden kann.	0 1 2 3 4 5

40208

M. Yagicibulut, P. Eichenberger, Dr. Kurt Hersberger - Institut für Klinische Pharmazie
Pharmazentrum 0059 - Klingelbergstrasse 50 - 4056 Basel - Tel. +41 (0) 61 267 14 27

Pharmazeutische Betreuung in Europa

Ganz allgemein, wenn Sie alle Patienten oder Kunden mit chronischen Erkrankungen berücksichtigen, die Sie in den letzten 6 Wochen gesehen haben, geben Sie bitte das Ausmass an, in dem Sie Pharmazeutische Betreuung angeboten/praktiziert haben.

	nie	selten	manchmal	oft	immer
18. Wie oft haben Sie versucht, diesen Patienten Pharmazeutische Betreuung anzubieten?	☐	☐	☐	☐	☐
19. Wie oft haben Sie sich ganz bewusst entschieden und sich aktiv bemüht, diesen Patienten Pharmazeutische Betreuung anzubieten?	☐	☐	☐	☐	☐

Ganz allgemein, wenn Sie alle Patienten berücksichtigen, die Sie in den letzten 2 Wochen gesehen haben, geben Sie bitte an, welche der folgenden Aktivitäten Sie wie oft umgesetzt haben. Bei Fragen, die sich mit Kommunikation beschäftigen, meinen wir diejenige Kommunikation, die der/die Apotheker/in initiiert.

	nie	selten	manchmal	oft	immer
20. Konsultation mit anderen ApothekerInnen in meiner Apotheke bezüglich schwieriger oder ungewöhnlicher Patientenprobleme.	☐	☐	☐	☐	☐
21. Weiterleitung an andere ApothekerInnen, wann immer es im Interesse des Patienten am besten war.	☐	☐	☐	☐	☐
22. Empfehlung zum Arztbesuch, falls erforderlich.	☐	☐	☐	☐	☐
23. Information an den behandelnden Arzt bezüglich Fortschritt der Arzneimitteltherapie des Patienten (Verbesserungen und Verschlechterungen)	☐	☐	☐	☐	☐
24. Anregung einer Diskussion mit dem behandelnden Arzt, wann immer ich glaubte, einer seiner Patienten hätte ein arzneimittelbezogenes Problem oder könnte eines bekommen.	☐	☐	☐	☐	☐
25. Dem Arzt wurde eine schriftliche Zusammenfassung der Medikationshistorie des Patienten sowie Informationen über etwaige sich daraus ableitende Probleme zur Verfügung gestellt, wenn diesem Patienten ein Arztbesuch empfohlen wurde.	☐	☐	☐	☐	☐
26. Patienten wurden an geeignete Selbsthilfegruppen weiter verwiesen.	☐	☐	☐	☐	☐

Wenn Sie noch immer an alle Patienten denken, die Sie in den letzten 2 Wochen gesehen haben, geben Sie bitte an, wie oft Sie die folgenden Aktivitäten umgesetzt haben.

	nie	selten	manchmal	oft	immer
27. Die Patientenberatung erfolgte an einem ungestörten Ort (Beratungsraum/ -ecke)	☐	☐	☐	☐	☐
28. Jede Verschreibung, welche Sie selbst ausgeführt haben, wurde durch eine zweite Person überprüft, bevor das Arzneimittel an den Patienten abgegeben wurde.	☐	☐	☐	☐	☐
29. Es wurden geeignete Informationsdienste genutzt, z.B. persönliche Bibliotheken oder externe Arzneimittelinformationsdienste (Micromedex, toxikologischer Auskunftsdienst, Pharmavista o.a.), falls dies zur Unterstützung notwendig war.	☐	☐	☐	☐	☐
30. Die Patienten wurden nach Ihrer Zufriedenheit gefragt, um meine Dienstleistung beurteilen zu können.	☐	☐	☐	☐	☐
31. Ich habe daran gedacht, an Weiterbildungsprogrammen teilzunehmen, um meine fachliche Kompetenz zu erhalten und zu verbessern.	☐	☐	☐	☐	☐
32. Ich habe anhand der klinischen Ergebnisse der Patienten meine Arbeit bewertet.	☐	☐	☐	☐	☐
33. Wichtige Kopien von relevanten Patienteninformationen wurden an berechtigte BerufskollegInnen vermittelt, damit sie spezifische arzneimittelbezogene Probleme lösen können.	☐	☐	☐	☐	☐
34. Den Patienten wurde allgemeines, medizinisches Informationsmaterial übergeben.	☐	☐	☐	☐	☐

Vielen Dank für Ihre Antworten !

40208

M. Yagicibulut, P. Eichenberger, Dr. Kurt Hersberger - Institut für Klinische Pharmazie
Pharmazentrum 0059 - Klingelbergstrasse 50 - 4056 Basel - Tel. +41 (0) 61 267 14 27

7.3 BPCS questionnaire for Germany

Pharmazeutische Betreuung in Europa Version für Deutschland

Europaweite Befragung zur Umsetzung der Pharmazeutischen Betreuung in öffentlichen Apotheken

Dieser Fragebogen sollte durch den/die Apotheker/in ausgefüllt werden, welche/r hauptsächlich für die Patientenbetreuung zuständig ist und nicht von jemandem, der vor allem in der täglichen Betriebsführung tätig ist.

Bitte benutzen Sie einen **blauen** oder **schwarzen** Kugelschreiber.

Teil A - Allgemeine Informationen

Bitte geben Sie folgende Informationen zu Ihrer Person und der Apotheke, in der Sie arbeiten:

1. a) Geschlecht: ☐ männlich ☐ weiblich b) Abschlussjahr Pharmaziestudium: ☐☐☐☐

2. a) Typ der Apotheke
   - ☐ Unabhängig
   - ☐ Apotheke ist Teil einer Kette
   - ☐ Mitglied einer Gruppierung (unabhängige Apotheke)

   b) In welchem Bundesland sind Sie tätig?
   ☐ BRB ☐ HH ☐ WL ☐ SL
   ☐ BER ☐ MVP ☐ RP ☐ THÜ
   ☐ BW ☐ NS ☐ SWH
   ☐ BAY ☐ NRW ☐ SA

3. a) Lage der Apotheke (nur eine Antwort möglich)
   - ☐ Zentrumslage (City, Fussgängerzone, Bahnhof)
   - ☐ Periphere Lage (Quartier, Aussenquartier, Nebenstrasse)
   - ☐ Dorf- oder Landapotheke
   - ☐ Apotheke in Einkaufszentrum (Center-Apotheke)

   b) Apotheke in Ärztehaus bzw. in Gesundheitszentrum (oder direkt angrenzend)
   ☐ ja ☐ nein

4. Anzahl der vollzeitbeschäftigten ApothekerInnen (VbE): ☐☐.☐ (VbE)
   (Bsp.:1 Apotheker 100% + 1 Apothekerin 80% = 180 Stellenprozente = 1.8 Vollzeitstellen)

5. Anzahl ausgebildeter MitarbeiterInnen, welche bei der Abgabe von Medikamenten mitwirken exkl. Studierende vor dem Staatexamen? ☐☐.☐ (VbE)
   (Bsp.:1 PTA 80% + 1 Pharmazie-IngenieurIn 60% = 140 Stellenprozente = 1.4 Vollzeitstellen)

6. Sind Studierende vor dem Staatsexamen angestellt? ☐ ja ☐ nein

7. Anzahl Rezepte an einem durchschnittlichen Tag? ☐☐☐

8. Nehmen Sie regelmässig an Fort- oder Weiterbildungsprogrammen teil, um Ihre fachliche Kompetenz zu erhalten oder zu verbessern? ☐ ja ☐ nein

9. Führen Sie einen Fachapothekertitel oder haben Sie einen Lehrgang in Klinischer Pharmazie absolviert?

FachapothekerIn für Offizin-Pharmazie	☐ ja	☐ nein
FachapothekerIn für Klinische Pharmazie	☐ ja	☐ nein
FachapothekerIn für Arzneimittelinformation	☐ ja	☐ nein
Lehrgang in Klinischer Pharmazie	☐ ja	☐ nein

10. Nehmen Sie an lokalen, regelmässig stattfindenden multidisziplinären Treffen z.B. mit Allgemeinärzten, Pflegefachpersonen, Sozialdiensten o.ä. teil? (z.B. Qualitätszirkel) ☐ ja ☐ nein

11. Hat Ihre Apotheke einen abgetrennten Beratungsraum? ☐ ja ☐ nein

12. Welche Apotheken-Software benutzen Sie? Name des Softwarehauses?
    - ☐ ADG ☐ VSA Software ☐ Andere, welches Softwarehaus?.....
    - ☐ Asys ☐ Pro Medisoft
    - ☐ Lauer ☐ Pharmatechnik

9704

Prof. Dr. M. Schaefer - Institut für Klinische Pharmakologie - Invalidenstrasse 115 D-10115 Berlin
Tel. +49 30 945 10 121 Fax + 49 30 945 10 141
In Zusammenarbeit mit dem Institut für Klinische Pharmazie der Universität Basel

Pharmazeutische Betreuung in Europa Seite 2 von 4

13. Kann Ihre Software folgende Anwendungen ausführen?

Führung des Dossiers (Medikationshistorie)	☐ ja	☐ nein
Speicherung von Kunden-Gesundheitsdaten	☐ ja	☐ nein
Erstellen eines Medikationsprofils (Compliance-Kontrolle)	☐ ja	☐ nein
Automatische Kontrolle auf Interaktionen bei Arzneimittelabgabe	☐ ja	☐ nein
Automatische Kontrolle auf Kontraindikationen bei Arzneimittelabgabe	☐ ja	☐ nein

14. Wenn Sie medizinische/klinische Informationen über die von Ihnen betreuten Patienten benötigen, erhalten Sie diese vom behandelndem Arzt? ☐ ja ☐ nein

15. Bieten Sie folgende Leistungen an?

Gesundheits-Screening (z.B. Blutdruck, Blutzucker, Blutlipide)	☐ ja	☐ nein
Patientenüberwachung (z.B. Blutdruck, Peak-Flow)	☐ ja	☐ nein
Hausbesuche (Patientenberatung vor Ort)	☐ ja	☐ nein
Gesundheitsförderung/-erziehung (z.B. Raucherberatung, Gewichtsreduktion)	☐ ja	☐ nein

Definition Pharmazeutische Betreuung *(Hepler und Strand)*

"Pharmazeutische Betreuung ist die konsequente Wahrnehmung der Mitverantwortung der Apothekerin/des Apothekers bei der Arzneimitteltherapie mit dem Ziel, bestimmte therapeutische Ergebnisse zu erreichen, die die gesundheitsbezogene Lebensqualität des Patienten verbessern."

Pharmazeutische Betreuung beinhaltet nicht nur die Bereitstellung von Arzneimitteln, sondern auch die Beratung zum Gesundheitszustand von Patienten und zur Pharmakotherapie. Ein weiterer Aspekt ist die Erstellung eines Betreuungsplans um zu überprüfen (Monitoring), ob spezifische therapeutische Ziele erreicht werden (z.B. Reduktion oder Eliminierung von Symptomen eines Krankheitszustandes).

Eine pharmazeutische Betreuung sollte deshalb folgende Elemente beinhalten:

- *Rücksprache mit dem Patienten, um dessen Verständnis der Pharmakotherapie abzuschätzen und arzneimittelbezogene Bedürfnisse zu erkennen.*
- *Beurteilung der Pharmakotherapie des Patienten, um potenzielle arzneimittelbezogene Probleme zu erkennen (z.B. unerwünschte Arzneimittelwirkungen, Interaktionen, schlechte Compliance).*
- *Erstellen eines Betreuungsplanes zur Überwachung der therapeutischen Ziele und zur Vermeidung neuer arzneimittelbezogener Probleme.*
- *Den Patienten über seinen Krankheitszustand aufklären (inkl. Beratung zur Gesundheitsförderung).*
- *ApothekerInnen arbeiten mit den anderen Gesundheitsberufen zusammen, um gemeinsam arzneimittelbezogene Probleme zu verhindern, zu erkennen und zu lösen.*

Teil B - Fragen zur Pharmazeutischen Betreuung

Bitte denken Sie an Ihre letzten 5 Patienten oder Kunden, welche Ihnen ein NEUES Rezept für ein Arzneimittel zur Behandlung einer chronischen Erkrankung, wie z.B. Asthma oder Diabetes vorlegten.

Bei wie vielen dieser Patienten **haben Sie folgende Aktivitäten ausgeführt?**	Anzahl Patienten
1. Der Patient wurde gebeten, seine Krankheitssituation, einschliesslich der medizinischen Probleme und Symptome zu beschreiben.	0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
2. Informationen zur Krankheitssituation des Patienten wurden schriftlich oder computergestützt in einer geeigneten Form dokumentiert, so dass sie bei meiner Abwesenheit auch von anderen MitarbeiterInnen gelesen und interpretiert werden können.	0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
3. Alle Arzneimittel, die der Patient gegenwärtig anwendet, wurden in schriftlichen oder computer-gestützten Medikationshistorien in geeigneter Form dokumentiert, so dass sie in meiner Abwesenheit auch von anderen Mitarbeitern gelesen und interpretiert werden können.	0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
4. Der Patient wurde gefragt, welche Therapieziele er mit der Arzneimitteltherapie erreichen möchte.	0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

Prof. Dr. M. Schaefer - Institut für Klinische Pharmakologie - Invalidenstrasse 115 D-10115 Berlin
Tel. +49 30 945 10 121 Fax + 49 30 945 10 141
In Zusammenarbeit mit dem Institut für Klinische Pharmazie der Universität Basel

9704

Pharmazeutische Betreuung in Europa **Seite 3 von 4**

	Anzahl Patienten
5. Die gewünschten Therapieziele des Patienten wurden für den Patienten dokumentiert.	0 1 2 3 4 5
6. Das Patienten-Dossier (Medikationshistorie) wurde auf potenzielle arzneimittelbezogene Probleme überprüft (Interaktionen, schlechte Compliance).	0 1 2 3 4 5
7. Die Arzneimitteltherapie wurde mit dem Patienten diskutiert.	0 1 2 3 4 5
8. Sich vergewissert, dass der Patient die ihm vermittelten Informationen verstanden hat.	0 1 2 3 4 5

Als nächstes möchten wir Sie bitten, an Ihre letzten 5 Patienten oder Kunden zu denken, die ein Folgerezept für ein Arzneimittel zur Behandlung einer chronischen Krankheit, wie z.B. Asthma oder Diabetes vorgelegt haben.

Bei wie vielen dieser Patienten **haben Sie folgende Aktivitäten ausgeführt?**	Anzahl Patienten
9. Der Patient wurde zum Arzneimittelgebrauch befragt (z.B. Häufigkeit/Art der Einnahme).	0 1 2 3 4 5
10. Dem Patienten wurden Fragen gestellt, um herauszufinden, ob er arzneimittelbezogene Probleme hat (Interaktionen, unerwünschte Arzneimittelwirkungen, schlechte Compliance)	0 1 2 3 4 5
11. Dem Patienten wurden Fragen gestellt, um herauszufinden, wie er die Wirksamkeit der eingenommenen Arzneimittel empfindet.	0 1 2 3 4 5
12. Dem Patienten wurden Fragen gestellt, um festzustellen ob die therapeutischen Ziele erreicht wurden.	0 1 2 3 4 5

Haben Sie bei irgendeinem dieser 10 Patienten *(5 Patienten mit neuem Rezept + 5 Patienten mit Folgerezept)* **ein arzneimittelbezogenes Problem entdeckt?**

☐ Ja Gehen Sie bitte direkt zur Frage 13.

☐ Nein, bei keinem dieser Patienten wurde ein arzneimittelbezogenes Problem erkannt, weil:

- ☐ Ich überprüfe meine Patienten nicht auf arzneimittelbezogene Probleme (weiter mit Frage 18)
- ☐ Ich überprüfe routinemässig auf arzneimittelbezogene Probleme, aber bei diesen 10 Patienten sind keine aufgetreten. (Weiter mit Frage 13 und beantworten Sie bitte die Frage auf der Basis Ihrer letzten 5 Patienten, die arzneimittelbezogene Probleme hatten).

Nun denken Sie bitte an Ihre letzten 5 Patienten oder Kunden, bei denen Sie arzneimittelbezogene Probleme entdeckt haben.

Bei wie vielen dieser Patienten **haben Sie die folgenden Aktivitäten umgesetzt?**	Anzahl Patienten
13. Arzneimittelbezogene Probleme, seien es potenzielle oder reale, wurden schriftlich oder im entsprechenden Formblatt des Computerprogramms dokumentiert	0 1 2 3 4 5
14. Für jedes identifizierte arzneimittelbezogene Problem wurde ein therapeutisches Ziel dokumentiert.	0 1 2 3 4 5
15. Es wurde eine Strategie zur Lösung (oder Vermeidung) arzneimittelbezogener Probleme in die Tat umgesetzt.	0 1 2 3 4 5
16. Der für den Patienten vereinbarte Betreuungsplan wurde umgesetzt, damit er sein therapeutisches Ziel erreichen kann.	0 1 2 3 4 5
17. Jede Intervention in den Patientenunterlagen erfolgte in einer Form, dass sie von anderen MitarbeiterInnen gelesen und interpretiert werden kann.	0 1 2 3 4 5

9704

Prof. Dr. M. Schaefer - Institut für Klinische Pharmakologie - Invalidenstrasse 115 D-10115 Berlin
Tel. +49 30 945 10 121 Fax + 49 30 945 10 141
In Zusammenarbeit mit dem Institut für Klinische Pharmazie der Universität Basel

Pharmazeutische Betreuung in Europa

Ganz allgemein, wenn Sie alle Patienten oder Kunden mit chronischen Erkrankungen berücksichtigen, die Sie in den letzten 6 Wochen gesehen haben, geben Sie bitte das Ausmass an, in dem Sie Pharmazeutische Betreuung angeboten/praktiziert haben.

	nie	selten	manchmal	oft	immer
18. Wie oft haben Sie versucht, diesen Patienten Pharmazeutische Betreuung anzubieten?	☐	☐	☐	☐	☐
19. Wie oft haben Sie sich ganz bewusst entschieden und sich aktiv bemüht, diesen Patienten Pharmazeutische Betreuung anzubieten?	☐	☐	☐	☐	☐

Ganz allgemein, wenn Sie alle Patienten berücksichtigen, die Sie in den letzten 2 Wochen gesehen haben, geben Sie bitte an, welche der folgenden Aktivitäten Sie wie oft umgesetzt haben. Bei Fragen, die sich mit Kommunikation beschäftigen, meinen wir diejenige Kommunikation, die der/die Apotheker/in auslöst.

	nie	selten	manchmal	oft	immer
20. Konsultation mit anderen ApothekerInnen in meiner Apotheke bezüglich schwieriger oder ungewöhnlicher Patientenprobleme.	☐	☐	☐	☐	☐
21. Weiterleitung an andere ApothekerInnen, wann immer es im Interesse des Patienten am besten war.	☐	☐	☐	☐	☐
22. Empfehlung zum Arztbesuch, falls erforderlich.	☐	☐	☐	☐	☐
23. Information an den behandelnden Arzt bezüglich der Arzneimitteltherapie des Patienten, sowohl Verbesserungen als auch Verschlechterungen.	☐	☐	☐	☐	☐
24. Anregung einer Diskussion mit dem behandelnden Arzt, wann immer ich glaubte, einer seiner Patienten hätte ein oder könnte ein arzneimittelbezogenes Problem bekommen.	☐	☐	☐	☐	☐
25. Dem Arzt wurde eine schriftliche Zusammenfassung der Medikationshistorie des Patienten sowie Informationen über etwaige sich daraus ableitende Probleme zur Verfügung gestellt, wenn diesem Patienten ein Arztbesuch empfohlen wurde.	☐	☐	☐	☐	☐
26. Patienten wurden an geeignete Selbsthilfegruppen weiter verwiesen.	☐	☐	☐	☐	☐

Wenn Sie noch immer an alle Patienten denken, die Sie in den letzten 2 Wochen gesehen haben, geben Sie bitte an, wie oft Sie die folgenden Aktivitäten umgesetzt haben.

	nie	selten	manchmal	oft	immer
27. Die Patientenberatung erfolgte an einem ungestörten Ort (Beratungsraum/ -ecke)	☐	☐	☐	☐	☐
28. Jede Verschreibung, welche Sie selbst ausgeführt haben, wurde durch eine zweite Person überprüft, bevor das Arzneimittel an den Patienten abgegeben wurde.	☐	☐	☐	☐	☐
29. Es wurden geeignete Informationsdienste genutzt, z.B. persönliche Bibliotheken oder externe Arzneimittelinformationsdienste (Micromedex, toxikologischer Auskunftsdienst o.a.), falls dies zur Unterstützung notwendig war.	☐	☐	☐	☐	☐
30. Die Patienten wurden nach Ihrer Zufriedenheit gefragt, um meine Dienstleistung beurteilen zu können.	☐	☐	☐	☐	☐
31. Ich habe daran gedacht, an Weiterbildungsprogrammen teilzunehmen, um meine fachliche Kompetenz zu erhalten und zu verbessern.	☐	☐	☐	☐	☐
32. Ich habe anhand der klinischen Ergebnisse der Patienten meine Arbeit bewertet.	☐	☐	☐	☐	☐
33. Wichtige Kopien von relevanten Patienteninformationen wurden an berechtigte BerufskollegInnen vermittelt, damit sie spezifische arzneimittelbezogene Probleme lösen können.	☐	☐	☐	☐	☐
34. Den Patienten wurde allgemeines, medizinisches Informationsmaterial übergeben.	☐	☐	☐	☐	☐

Vielen Dank für Ihre Antworten !

9704

Prof. Dr. M. Schaefer - Institut für Klinische Pharmakologie - Invalidenstrasse 115 D-10115 Berlin
Tel. +49 30 945 10 121 Fax + 49 30 945 10 141
In Zusammenarbeit mit dem Institut für Klinische Pharmazie der Universität Basel

7.4 PCNE classification for drug-related problems; version 5.01

PCNE Classification for Drug related problems

(revised 01-05-06 vm)
V5.01

Contact: jwfvmil@planet.nl

This classification should be referred to as 'The PCNE Classification V 5.01'

Introduction

During the working conference of the Pharmaceutical Care Network Europe in January 1999, a classification scheme was constructed for drug related problems (DRPs). The classification is part of a total set of instruments. The set consists of the classification scheme, reporting forms and cases for training or validation. The classification system is validated and adapted regularly. The current version is V5. It is compatible with previous versions although new items have been added. The numbering of existing items has not been changed.
The classification is for use in research into the nature, prevalence, and incidence of DRPs and also as a process indicator in experimental studies of Pharmaceutical Care outcomes. It is also meant to help health care professionals to document DRP-information in the pharmaceutical care process.
The hierarchical classification is based upon similar work in the field, but it differs from existing systems because it separates the problems from the causes. The following definition is the basis for the classification:

A Drug-Related Problem is an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes.

The basic classification now has 6 primary domains for problems, 6 primary domains for causes and 5 primary domains for Interventions.
However, on a more detailed level there are 21 grouped sub domains for problems, 33 grouped sub domains for causes and 17 grouped sub domains for interventions. Those sub domains can be regarded as explanatory for the principal domains.
In 2003 a scale has been added to indicate if or to what extend the problem has been solved.

Zuidlaren, May 2006

N.B. In this version 5.01 an extra Cause is added: *C4.10 Patient takes food that interacts with drugs* and an extra Outcome *O0.0 Outcome not known.*

PCNE Classification scheme for Drug-Related Problems V5.01 -Page 1
The Basic Classification

	Code V5.01	Primary domains
Problems	**P1**	**Adverse reaction(s)** Patient suffers from an adverse drug event
	P2	**Drug Choice Problem** Patient gets or is going to get a wrong (or no drug) drug for his/her disease and/or condition
	P3	**Dosing problem** Patient gets more or less than the amount of drug he/she requires
	P4	**Drug Use Problem** Wrong or no drug taken/administered
	P5	**Interactions** There is a manifest or potential drug-drug or drug-food interaction
	P6	**Other**
Causes	**C1**	**Drug/Dose Selection** The cause of the DRP can be related to the selection of the drug and/or dosage schedule
	C2	**Drug Use Process** The cause of the DRP can be related to the way the patient uses the drug, in spite of proper dosage instructions (on the label)
	C3	**Information** The cause of the DRP can be related to a lack or misinterpretation of information
	C4	**Patient/Psychological** The cause of the DRP can be related to the personality or behaviour of the patient.
	C5	**(Pharmacy) Logistics** The cause of the DRP can be related to the logistics of the prescribing or dispensing mechanism
	C6	**Other**
Interventions	**I0**	**No intervention**
	I1	**At prescriber level**
	I2	**At patient (or carer) level**
	I3	**At drug level**
	I4	**Other**
Outcome of intervention	**O0**	**Outcome intervention unknown**
	O1	**Problem totally solved**
	O2	**Problem partially solved**
	O3	**Problem not solved**

PCNE Classification scheme for Drug-Related Problems V5.01 -Page 2
The Detailed Classification-1

The Problems
Each problem should be coded separately, but there may be more causes or interventions to one problem.

Primary Domain	Code V5.01	Problem
1. Adverse reactions Patient suffers from an adverse drug event	**P1.1** **P1.2** **P1.3**	Side effect suffered (non-allergic) Side effect suffered (allergic) Toxic effects suffered
2. Drug choice problem Patient gets or is going to get a wrong (or no drug) drug for his/her disease and/or condition	**P2.1** **P2.2** **P2.3** **P2.4** **P2.5** ***P2.6***	Inappropriate drug (not most appropriate for indication) Inappropriate drug form (not most appropriate for indication) Inappropriate duplication of therapeutic group or active ingredient Contra-indication for drug (incl. Pregnancy/breast feeding) No clear indication for drug use *No drug prescribed but clear indication*
3. Dosing problem Patient gets more or less than the amount of drug he/she requires	**P3.1** **P3.2** **P3.3** **P3.4**	Drug dose too low or dosage regime not frequent enough Drug dose too high or dosage regime too frequent Duration of treatment too short Duration of treatment too long
4. Drug use problem Wrong or no drug taken/administered	**P4.1** **P4.2**	Drug not taken/administered at all Wrong drug taken/administered
5. Interactions There is a manifest or potential drug-drug or drug-food interaction	**P5.1** **P5.2**	Potential interaction Manifest interaction
6. Others	**P6.1** **P6.2** **P6.3** **P6.4**	Patient dissatisfied with therapy despite taking drug(s) correctly Insufficient awareness of health and diseases (possibly leading to future problems) Unclear complaints. Further clarification necessary Therapy failure (reason unknown)

PCNE Classification scheme for Drug Related Problems V5.01 -Page 3
The Detailed Classification-2

The Causes

N.B. One problem can have more causes

Primary Domain	Code V5.01	Cause
1. Drug/Dose selection The cause of the DRP is related to the selection of the drug and/or dosage schedule	**C1.1**	Inappropriate drug selection
	C1.2	Inappropriate dosage selection
	C1.3	More cost-effective drug available
	C1.4	Pharmacokinetic problems, incl. ageing/deterioration in organ function and interactions
	C1.5	Synergistic/preventive drug required and not given
	C1.6	Deterioration/improvement of disease state
	C1.7	New symptom or indication revealed/presented
	C1.8	Manifest side effect, no other cause
2. Drug use process The cause of the DRP can be related to the way the patient uses the drug, in spite of proper dosage instructions (on the label)	**C2.1**	Inappropriate timing of administration and/or dosing intervals
	C2.2	Drug underused/ under-administered
	C2.3	Drug overused/ over-administered
	C2.4	Therapeutic drug level not monitored
	C2.5	Drug abused (unregulated overuse)
	C2.6	Patient unable to use drug/form as directed
3. Information The cause of the DRP can be related to a lack or misinterpretation of information	**C3.1**	Instructions for use/taking not known
	C3.2	Patient unaware of reason for drug treatment
	C3.3	Patient has difficulties reading/understanding Patient Information Form/Leaflet
	C3.4	Patient unable to understand local language
	C3.5	Lack of communication between healthcare professionals
4. Patient/Psychological The cause of the DRP can be related to the personality or behaviour of the patient.	**C4.1**	Patient forgets to use/take drug
	C4.2	Patient has concerns with drugs
	C4.3	Patent suspects side-effect
	C4.4	Patient unwilling to carry financial costs
	C4.5	Patient unwilling to bother physician
	C4.6	Patient unwilling to change drugs
	C4.7	Patient unwilling to adapt life-style
	C4.8	Burden of therapy
	C4.9	Treatment not in line with health beliefs
	C4.10	Patient takes food that interacts with drugs
5. Logistics The cause of the DRP can be related to the logistics of the prescribing or dispensing mechanism	**C5.1**	Prescribed drug not available (anymore)
	C5.2	Prescribing error (only in case of slip of the pen)
	C5.3	Dispensing error (wrong drug or dose dispensed)
6. Others	**C6.1**	Other cause; specify
	C6.2	No obvious cause

PCNE Classification scheme for Drug-Related Problems V5.01 -Page 4
The Detailed Classification-3

The Interventions
N.B. One problem can lead to more interventions

Primary Domain	Code V5.01	Intervention
No intervention	**I0.0**	No Intervention
1. At prescriber level	**I1.1**	Prescriber informed only
	I1.2	Prescriber asked for information
	I1.3	Intervention proposed, **approved** by Prescriber
	I1.4	Intervention proposed, **not approved** by Prescriber
	I1.5	Intervention proposed, outcome unknown
2. At patient/carer level	**I2.1**	Patient (medication) counselling
	I2.2	Written information provided only
	I2.3	Patient referred to prescriber
	I2.4	Spoken to family member/caregiver
3. At drug level	**I3.1**	Drug changed to ….
	I3.2	Dosage changed to ….
	I3.3	Formulation changed to …..
	I3.4	Instructions for use changed to …..
	I3.5	Drug stopped
	I3.6	New drug started
4. Other intervention or activity	**I4.1**	Other intervention (specify)
	I4.2	Side effect reported to authorities

Outcome of intervention
N.B. One problem (or the combination of interventions) can only lead to one level of solving the problem

Primary Domain	Code V5.01	Outcome of intervention
0. Not known	**O0.0**	Outcome intervention not known
1. Solved	**O1.0**	Problem totally solved
2. Partially solved	**O2.0**	Problem partially solved
3. Not solved	**O3.1**	Problem not solved, lack of cooperation of patient
	O3.2	Problem not solved, lack of cooperation of prescriber
	O3.3	Problem not solved, intervention not effective
	O3.4	No need or possibility to solve problem

7.5 Data sheet to document drug-related problems

PCNE Klassifizierung für arzneimittelbezogene Probleme *Assistenzjahr 06/07*

Jahrgang: ☐☐☐☐ ☐ männlich ☐ weiblich Medikament(e): _____

A Probleme

1. Unerwünschte Arzneimitelwirkung(en) (UAW)
- ☐ Leiden an einer (nicht allergischen) UAW
- ☐ Leiden an einer (allergischen) UAW
- ☐ Leiden an toxischen Effekten

2. Problem der Arzneimittelauswahl (Arzneimittel = AM)
- ☐ Ungeeignetes/nicht am besten geeignetes AM für Indikation
- ☐ Ungeeignete/nicht am besten geeignete Arzneiform (AF) f. Indikation
- ☐ Unangebrachte Verdopplung der therapeut. Gruppe/Wirkstoff
- ☐ Kontraindikation für Arzneimittel (inkl. SS/Stillen)
- ☐ Keine klare Indikation für die Anwendung des Arzneimittels
- ☐ Kein Arzneimittel verschrieben trotz klarer Indikation

3. Dosierungsproblem
- ☐ Dosierung zu niedrig oder Intervall zu lang
- ☐ Dosierung zu hoch oder Intervall zu kurz
- ☐ Behandlungsdauer zu kurz
- ☐ Behandlungsdauer zu lang

4. Arzneimittelanwendungsproblem
- ☐ Arzneimittel überhaupt nicht genommen/verabreicht
- ☐ Falsches Arzneimittel genommen/verabreicht
- ☐ Falsche/ungeeignete Anwendungsweise des AM (z.B.Halbieren ohne Rille)
- ☐ Falscher/ungeeigneter Anwendungs-/ Einnahmezeitpunkt

5. Interaktionen
- ☐ Mögliche Interaktion
- ☐ Manifeste Interaktion

6. Sonstige
- ☐ Patient ist trotz korrekter AM-Anwendung unzufrieden mit der Therapie
- ☐ Unzulängliches Bewusstsein über Gesundheit und Krankheiten (was möglicherweise zu zukünftigen Problemen führt)
- ☐ Unklare Beschwerden, weitere Abklärung nötig
- ☐ Therapieversagen (Grund unbekannt)

7. Keine Abgabe möglich
- ☐ Ärztliche Verordnung kann nicht ausgeführt werden

B Ursachen

1. Wahl des Arzneimittels / der Dosierung
- ☐ Unpassende Arzneimittelauswahl
- ☐ Unpassende Dosierungsauswahl
- ☐ Kosteneffektiveres Arzneimittel verfügbar
- ☐ Pharmakokinetische Probleme inkl. Alter / Verschlechterung von Organfunktionen und Interaktionen (IA)
- ☐ Synergist./vorbeugendes AM erforderlich und nicht gegeben
- ☐ Verschlechterung/Verbesserung des Krankheitszustandes
- ☐ Neues Symptom oder neue Indikation entdeckt/vorliegend
- ☐ Manifeste UAW, keine andere Ursache

2. Prozess der Arzneimittelanwendung
- ☐ Zeitpunkt Verabreichung und/oder Dosierungsintervall ungeeignet
- ☐ Zu geringe Arzneimittelanwendung/-verabreichung
- ☐ Zu hohe Arzneimittelanwendung/-verabreichung
- ☐ Therapeutischer Arzneimittelspiegel nicht überwacht
- ☐ Arzneimittel missbräuchlich eingenommen
- ☐ Patient ist nicht in der Lage, Arzneimittel(form) wie verordnet einzunehmen

3. Information
- ☐ Anweisungen zu Gebrauch/Einnahme nicht bekannt
- ☐ Patient ist sich nicht über den Grund der AM-Behandlung im Klaren
- ☐ Patient hat Schwierigkeiten, die Patienteninformation / den Packungsprospekt zu lesen/verstehen
- ☐ Patient versteht die Landessprache nicht
- ☐ Mangelnde Kommunikation zwischen den Heilberufen

4. Patient / Psychisch
- ☐ Patient vergisst Gebrauch/Einnahme des Arzneimittels
- ☐ Patient hat Bedenken gegenüber Arzneimitteln
- ☐ Patient vermutet unerwünschte Arzneimittelwirkung
- ☐ Arzneimittel wird nicht von der Krankenkasse übernommen bzw. Patient ist nicht bereit, Kosten zu übernehmen
- ☐ Patient will keinen Arzt belästigen
- ☐ Patient ist nicht bereit, Arzneimittel zu wechseln
- ☐ Patient ist nicht bereit, seinen Lebensstil anzupassen
- ☐ Therapiebelastung ("zu viele Medikamente")
- ☐ Behandlung ist nicht im Einklang mit den Gesundheitsüberzeugungen
- ☐ Patient nimmt Lebensmittel zu sich, die IA mit AM hervorrufen

5. (Apotheke) Logistik
- ☐ Verschriebenes AM nicht verfügbar (aH, Lieferengpass, ausländ. Produkt)
- ☐ Verordnungsfehler (nur im Fall eines Schreibfehlers)
- ☐ Abgabefehler / Austauschfehler

6. Sonstige
- ☐ Keine klare Ursache ☐ Sonstige Ursache: _____

Verschreibungsqualität
- ☐ Unleserliche Verordnung
- ☐ Medikamentenname unklar, obwohl leserlich
- ☐ Arzneiform unklar/fehlend, falls mehrere verfügbar
- ☐ Stärke unklar/fehlend, falls mehrere verfügbar
- ☐ Packungsgrösse und/oder Therapiedauer unklar/fehlend
- ☐ Fehlende/unklare Dosierungs- / Anwendungsanweisung
- ☐ Fehlende Verordnung notwendiger Applikationshilfen

C Interventionen

1. Keine Intervention
- ☐ Keine Intervention

2. Auf Arzneimittelebene
- ☐ Arzneimittel geändert
- ☐ Dosierung geändert
- ☐ Arzneiform geändert
- ☐ Anwendungsinstruktionen geändert
- ☐ Arzneimittelanwendung gestoppt
- ☐ Mit neuem Arzneimittel begonnen
- ☐ Abzugebende Menge angepasst

3. Auf Patienten- / Pfleger-Ebene
- ☐ Patienten (Medikations)-Beratung
- ☐ Nur schriftliche Information zur Verfügung gestellt
- ☐ Patient an den Verschreiber verwiesen
- ☐ Mit Familienangehörigen / Pflegeperson gesprochen
- ☐ Patient um zusätzliche Information gebeten
- ☐ Zusatzinformation aus Patientendossier der Apotheke

4. Auf Verschreiberebene
- ☐ Verschreiber nur informiert
- ☐ Verschreiber um Information gebeten
- ☐ Intervention vorgeschlagen, vom Verschreiber übernommen
- ☐ Intervention vorgeschlagen, vom Verschreiber abgelehnt
- ☐ Intervention vorgeschlagen, Ergebnis nicht bekannt

5. Sonstige Intervention oder Aktivität
- ☐ UAW an eine Behörde gemeldet
- ☐ Konsultation von Fachliteratur inkl. Arzneimittelkompendium
- ☐ Konsultation von Kollegen / Arzneimittel-Informationsdienst / Tox-Zentrum
- ☐ Sonstige Intervention: _____

D Ergebnis der Intervention
- ☐ Ergebnis (noch) unbekannt
- ☐ Problem vollständig gelöst
- ☐ Problem teilweise gelöst
- ☐ Problem nicht gelöst aus Mangel an Kooperation des Patienten
- ☐ Problem nicht gelöst aus Mangel an Kooperation des Verschreibers
- ☐ Problem nicht gelöst, Intervention nicht effektiv
- ☐ Keine Notwendigkeit oder Möglichkeit, das Problem zu lösen

35776

Institut für Klinische Pharmazie - Pharmaceutical Care Research Group - Klingelbergstrasse 50 - 4056 Basel

Bei Fragen: Tel. 061 267 15 29 oder patrick.eichenberger@unibas.ch

7.6 Structured interview guide for home visits

Protokoll „Hausbesuch bei Patienten mit chronischer Erkrankung"

Patienteninformationen

Name/Vorname: _____

Adresse: _____

PLZ/Ort: _____

Telefon (Privat): _____

Telefon (Geschäft): _____

Mobile: _____

E-Mail: _____

Einverständniserklärung der Patient/in

Ich bin damit einverstanden, dass der/die Apotheker/in mich zu Hause besucht und mein Medikamenten-Management untersucht, um die Pharmakotherapie möglichst optimal gestalten zu können. Es werden keine Informationen an den/die Ärztin weitergeleitet, wenn der/die Patient/in nicht einwilligt.

Name: _____ Vorname: _____

Ort, Datum _____ Unterschrift: _____

Betreuende/r Apotheker/in

Name: _____ Vorname: _____

Ort, Datum _____ Unterschrift: _____

Startzeit: _____

Version 30. Dezember 2009 / pe Stempel der Apotheke:

1. Sozialanamnese

1.1 Geburtsdatum: **1.2 Geschlecht:** männlich ☐ weiblich ☐	**1.3 Muttersprache:** Deutsch ☐ Französisch ☐ Italienisch ☐ Englisch ☐ Türkisch ☐ Serbokroatisch ☐ andere ☐ _____
1.4 Anzahl Personen im Haushalt: alleine ☐ mehrere: ☐ Anzahl: _____	**1.5 Kinder (bis 12 Jahre):** nein ☐ ja ☐ Anzahl: _____
1.6 Aktuelle berufliche Tätigkeit:	

2. Allgemeine Fragen

2.1a.) Welche aktuelle(n) Erkrankung(en) werden medikamentös therapiert?

☐ DM Typ2 ☐ Hypertonie ☐ Hypercholesterinämie ☐ KHK ☐ Andere:_____

2.1b.) Seit wann leben Sie mit Diabetes? _____

2.1c.) Kennen Sie die Schweizerische Diabetes- Gesellschaft? ☐ Ja ☐ Nein

2.2 Bekannte Allergien? Nein ☐ Ja ☐ , welche? _____	
2.3 Wo werden die Medikamente aufbewahrt? Badezimmer ☐ Küche ☐ Schlafzimmer ☐ Wohnzimmer ☐ Andere ☐ _____ **2.4 Ist ein separater Medikamentenschrank bzw. ein separates Medikamentenabteil in einem Schrank vorhanden?** Ja ☐ Nein ☐ **2.5 Falls Frage 1.5 mit Ja beantwortet:** Sind die Medikamente in Reichweite von Kindern aufbewahrt? Ja ☐ nein ☐	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Patient aufklären ☐ Anderes:
2.6 Nehmen Sie Medikamente ein, welche Sie selbst gekauft haben? (OTC) Ja ☐ nein ☐ keine Angabe ☐ Wenn ja, welche?	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Abklären wegen Interaktionen ☐ Auf Gefahren hinweisen ☐ Anderes:
2.7. Nehmen Sie pflanzliche / homöopathische Produkte ein? Ja ☐ nein ☐ keine Angabe ☐ Wenn ja, welche?	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Abklären wegen Interaktionen ☐ Auf Gefahren hinweisen ☐ Anderes:

2.8 Sind Medikamente zu Hause vorhanden, obwohl sie gar nicht mehr gebraucht werden? a) OTC Ja ☐ nein ☐ keine Angabe ☐ wenn ja, welche? b) Rx Ja ☐ nein ☐ keine Angabe ☐ wenn ja, welche? **2.9 Sind verfallene Medikamente vorhanden?** Ja ☐ nein ☐ keine Angabe ☐	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Medikamente zurückbringen ☐ Medikamente entsorgen ☐ Anderes:
2.12 Sind Medikamente von mehreren Personen in diesem Haushalt vorhanden? Ja ☐ nein ☐ keine Angabe ☐ **2.13 Falls mehrere Personen im Haushalt leben: Wie erkennen Sie Ihre Medikamente?** ☐ Medikamente sind mit Namen angeschrieben ☐ Medikamente sind allen bekannt ☐ Separater Aufbewahrungsort ☐ Anderes: _____	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Medikamente kennzeichnen ☐ Separater Aufbewahrungsort vorschlagen ☐ Anderes:

3. Fragen betreffend Medikation

3.1a.) Bereiten Sie alle Ihre Medikamente selber zur Einnahme vor? Ja ☐ nein ☐ keine Angabe ☐ Wenn nein, welche nicht? **3.1b.) Wo beziehen Sie Ihre Medikamente?** ☐ Ich hole sie selber in der Apotheke ab ☐ Jemand holt sie für mich in der Apotheke ab ☐ Ich bekomme sie von meinem Arzt ☐ Versandapotheke ☐ Anderes: _____	**Interventionsbedarf:** ☐ Nein ☐ Ja
3.2 Haben Sie irgendwelche Probleme, Ihre Medikamente einzunehmen? (Schlucken grosser Tabletten, Öffnen einer Flasche, ...) Ja ☐ nein ☐ keine Angabe ☐ Wenn ja, welche?	**Interventionsbedarf:** ☐ Nein ☐ Ja
3.3 Seit Sie das Medikament einnehmen, traten irgendwelche Veränderungen im oder am Körper oder andere Probleme auf, deren Ursache Ihnen unklar erscheint (Nebenwirkungen)? Ja ☐ nein ☐ keine Angabe ☐ Wenn ja, welche ? Kommentar:	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Rücksprache Arzt ☐ Anderes:

3.4 a.) Nutzen Sie eine Erinnerungshilfe zur Medikamenten-Einnahme? (z.B. Wecker, Tagesdispenser oder Wochendispenser (Dosette®)) Ja ☐ nein ☐ keine Angabe ☐ Wenn ja, welche? Wenn nein, wieso nicht? **b.) Würden Sie gerne eine Dosierungshilfe wie Dosette® erhalten?** Ja ☐ nein ☐ keine Angabe ☐	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Vorschlag für Dosette® ☐ Anderes:
3.5 Falls eine Dosette® benutzt wird: a) Sind alle Tabletten in der Dosette® vorhanden oder nur ein Teil? ☐ alle ☐ nur _____ _____ b) Haben alle Tabletten in der Dosette® Platz? Ja ☐ nein ☐ d) Sind die Tabletten mit Blister in der Dosette®? Ja ☐ nein ☐ beides ☐	**Interventionsbedarf:** ☐ Nein ☐ Ja
3.6 Wissen Sie, was ein Generikum ist? Ja ☐ nein ☐ keine Angabe ☐ **3.7 Bei Originalpräparaten: Wissen Sie, dass es davon auch Generika gibt?** (Frage im Voraus vorbereiten!) a) Präparat 1:_____ Ja ☐ nein ☐ b) Präparat 2:_____ Ja ☐ nein ☐ c) Präparat 3:_____ Ja ☐ nein ☐ d) Präparat 4:_____ Ja ☐ nein ☐ **3.8 Bei Generika: Wissen Sie, dass es ein Generikum ist?** (Frage im Voraus vorbereiten!) a) Präparat 1:_____ Ja ☐ nein ☐ b) Präparat 2:_____ Ja ☐ nein ☐ c) Präparat 3:_____ Ja ☐ nein ☐ d) Präparat 4:_____ Ja ☐ nein ☐	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Patient informieren ☐ Anderes:

3.9 Compliance: Unabhängig ihres Verhaltens haben gewisse Patienten Mühe, ihre Medikamente täglich wie verordnet einzunehmen. Gerne würden wir nun wissen, wie es bei Ihnen aussieht. Wie oft sind Ihnen folgende Ereignisse **in den letzten 3 Monaten** passiert? a) Sie haben vergessen Ihre Medikamente einzunehmen: ☐ ja ☐ nein b) Sie waren nachlässig bei der Einnahme Ihrer Medikamente: ☐ ja ☐ nein c) Sie haben aufgehört Ihre Medikamente einzunehmen, weil es Ihnen besser ging: ☐ ja ☐ nein d) Sie haben weniger Ihrer verschriebenen Medikamente eingenommen, weil es Ihnen schlechter ging: ☐ ja ☐ nein	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Patient informieren ☐ Patient motivieren ☐ Dosierungshilfe empfehlen ☐ Anderes:
3.10 Was machen Sie, wenn Sie einmal vergessen würden das Medikament zu nehmen? (mehrere Antworten möglich) ☐ Einnahme später ☐ Nächste Einnahme doppelt ☐ Wird nie vorkommen ☐ Es kommt darauf an ☐ Arzt oder Apotheker fragen ☐ Packungsbeilage lesen ☐ Anderes: _____ **3.11 Ist es schon vorgekommen, dass Sie zu wenig Medikamente mit in die Ferien nahmen?** Ja ☐ nein ☐ **3.12 a) Beziehen Sie alle Medikamente aus der gleichen Apotheke?** ☐ Ja, meistens (90-100%) ☐ manchmal (50-90%) ☐ nein (< 50%) ☐ keine Angabe **b) Wenn Sie einmal ein Medikament (auch selbst gekauft) anderswo beziehen (z.B. andere Apotheke, Zahnarzt): Erwähnen Sie dabei, dass Sie eine chronische Erkrankung haben?** ja ☐ nein ☐	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Patient informieren ☐ Anderes: **Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Patient ansprechen auf Diabetes-Pass ☐ Anderes:

3.13 Haben Sie die Packungsbeilagen Ihrer Medikamente gelesen? Ja ☐ nein ☐ **b) Was wissen Sie über mögliche Nebenwirkungen Ihrer Medikamente?** _____ _____ _____ _____ _____	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Patient informieren ☐ Anderes:
3.14 Haben Sie Bedenken gegenüber Ihrer Medikamente aufgrund der Nebenwirkungen? Ja ☐ nein ☐	**Interventionsbedarf:** ☐ Nein ☐ Ja: ☐ Patient informieren ☐ Anderes:
3.15 Was würden Sie tun, falls Sie Nebenwirkungen hätten oder vermuten, dass es sich um eine Nebenwirkung handelt? ☐ Einnahme stoppen ☐ Tiefere Dosierung ☐ Arzt fragen ☐ Apotheker fragen ☐ Anderes: _____	**Interventionsbedarf:** ☐ Nein ☐ Ja
3.16 Was wissen Sie über mögliche Probleme bei der Einnahme von anderen Medikamenten oder Nahrungsmitteln? (Wechselwirkungen) _____ _____ _____ _____ _____	**Interventionsbedarf:** ☐ Nein ☐ Ja

Endzeit: _____

Dauer des Gesprächs

Angaben des Patienten: Aktuelle Medikation (inkl. OTC, pflanzliche Präparate, Reservemedikamente etc.)

	Arzneimittel (Name, Stärke)	Arzt	Dosierung, Häufigkeit (vor/mit/nach dem Essen)	Dauer der Einnahme (Therapiedauer)	Grund (Diagnose od. Therapieziel)
A					
B					
C					
D					
E					
F					
G					
H					
J					
K					
L					
M					

4. Nach dem Besuch auszufüllen:

4.1 a) Sind Interaktionen möglich? (gemäss History und Angaben des Patienten)

Ja ☐ nein ☐

4.1 b) Welche? (Vermerk interagierende Medikamente + Schweregrad)

4.2 Hat der Patient ein Dauerrezept und holt die Medikamente nicht ab? (vgl. Patientendossier)

Ja ☐ nein ☐

Wenn ja, welche?

Interventionsbedarf: Ja ☐ nein ☐

Wenn ja, welchen? ☐ Rücksprache Arzt ☐ Patient aufklären ☐ Anderes:

4.3 Sind zwei oder mehr Medikamente (in der gleichen galenischen Form) mit demselben Wirkstoff vorhanden (z.B. Generika)?

Ja ☐ nein ☐ Wenn ja, welche?

Interventionsbedarf: Ja ☐ nein ☐

Wenn ja, welchen? ☐ Rücksprache Arzt ☐ Patient aufklären ☐ Anderes:

4.4 Bewusstsein über potentielle Interaktionen vorhanden? (Siehe Frage 3.16)

Ja ☐ nein ☐ keine Angabe ☐

4.5 Wusste der Patient von jedem Medikament, warum er es einnehmen muss?

(„Aktuelle Medikation" S.8) Ja ☐ nein ☐ keine Angabe möglich ☐, weil _____

4.6 Konnte der Patient sagen, wie viel und wie oft er von jedem Medikament einnehmen soll?

(„Aktuelle Medikation" S.8) Ja ☐ nein ☐ keine Angabe möglich ☐, weil _____

Therapieempfehlung (zum Schema auf Seite 8)

4.4 Falls nötig, welche Anpassungen sollten am aktuellen Therapieschema durchgeführt werden?

Handlungen:

☐ Patient informieren

☐ Therapieschema anpassen

☐ Kontakt mit Arzt aufnehmen: _____

☐ Dosette abgeben

☐ Motivation für Compliance fördern

☐ Anderes: _____

Curriculum vitae

Personal data

Name	Patrick Marc Eichenberger
Date of Birth	26 September 1979
Place of Origin	Lenzburg (AG)
E-Mail	patrick.m.eichenberger@bluewin.ch

Education and Professional Life

February 2006 – May 2010	PhD thesis at the Pharmaceutical Care Research Group, University of Basel. Supervision: Prof. Dr. Kurt E. Hersberger, Prof. Dr. Dr. Stephan Krähenbühl
	Thesis topic: *Pharmaceutical care practice – Drug-related problems and opportunities for new services*
	Assistant in university courses of pharmaceutical care IT support of the Pharmaceutical Care Research Group Author in the framework of i.m@il-Offizin
December 2005 – June 2009	Employed as deputy pharmacist at the "TopPharm Leonhards Apotheke" in Zurich
November 2005	Swiss federal diploma in pharmacy
	MSc ETH in Pharmaceutical Sciences
2004 – 2005	Practical year at the "TopPharm Leonhards Apotheke", Zurich
April 2004 – September 2004	Master thesis at the Swiss Federal Institute of Technology (ETH) Zürich and the University of Basel. Supervision: Prof. Dr. Gerd Folkers, Prof. Dr. Beat Ernst
	Thesis topic: *Multimedia-based and didactical processing of the topic HIV*
October 2000 – November 2005	Studies in pharmacy at the Swiss Federal Institute of Technology (ETH) Zurich
July 1999	Matura, main subject latin (type B)
August 1995 – July 1999	Alte Kantonsschule Aarau (AG)

Additional Courses

2009	ESCP-GSASA: European Symposium in Clinical Pharmacy and Association of Swiss agency and hospital pharmacists, Geneva (Switzerland), 4-6 November
	PCNE Working symposium on drug-related problems and medication review, Geneva (Switzerland), 2-3 November
	Advanced Study Centre: Course in Clinical pharmacy for geriatric patients, Bruderholz (Switzerland), 24-25 September
	medArt – Die internistische Fortbildung der anderen Art, 15-19 June
2008	ESCP: European Symposium in Clinical Pharmacy, Dubrovnik (Croatia), 22-24 October
	FIP Congress in Basel (Switzerland), 29 August - 4 September
2007	ESCP: European Symposium in Clinical Pharmacy, Istanbul (Turkey), 24-26 October
	Seminar in Pharmaceutical Care, Bonn (Germany), 6- 8 September
	PCNE Working Conference, Gothenburg (Sweden), 21 - 24 February
2006	ESCP: European Symposium in Clinical Pharmacy, Vienna (Austria), 25-27 October
	“Slice of Life” - Meeting for Medical Multimedia Developers and Educators in Lausanne (Switzerland), 4-5 July

Publications

Eichenberger P, Haschke M, Lampert ML, Hersberger KE. Home visits of diabetes type 2 and solid organ transplant patients reveal opportunities for pharmaceutical care. Pharm World Sci; submitted

Hughes C, Hawwa A, Scullin C, Sondergaard B, Bernsten C, Anderson C, da Costa F, Bjornsdottir I, De Wulf I, Hersberger KE, Cordina M, Schaefer M, Henman M, Tully M, Eichenberger P, Westerlund T, Foulon V, McElnay JC. Provision of pharmaceutical care by community pharmacists: a comparison across Europe. Pharm World Sci 2010; published online 11 May 2010: doi 10.1007/s11096-010-9393-x

Eichenberger P, Lampert ML, Kahmann Vogel I, van Mil JWF, Hersberger KE. Classification of drug-related problems with new prescriptions using a modified PCNE classification system. Pharm World Sci 2010;32:362-72

Hersberger KE, Eichenberger P, Arnet I. Polymedikations-Check. pharmaJournal 2010;4:20-22

Eichenberger P. Zostavax®: Impfung gegen Gürtelrose. i.mail-Offizin 2009;2

Eichenberger P. Sonnenschutz. i.mail-Offizin 2008;12

Eichenberger P. Noroviren. i.mail-Offizin 2008;3

Eichenberger P. Akuter Myokardinfarkt. i.mail-Offizin 2007;19

Eichenberger P. Haltbarkeit von flüssigen und halbfesten Arzneimitteln. i.mail-Offizin 2007;13

Eichenberger P. Duloxetin (Cymbalta®). i.mail-Offizin 2007;3

Eichenberger P. Polonium und Radioaktivität. i.mail-Offizin 2006;23

Eichenberger P. Epistaxis. i.mail-Offizin 2006;16

Renggli V, Eichenberger P. Therapiemöglichkeiten bei rezidivierendem Herpes labialis. i.mail-Offizin 2006;10

Oral presentations and workshops

Eichenberger P, Hersberger KE. The simple medication review. PCNE Working Symposium, Geneva, Switzerland, 3rd November 2009

Eichenberger P. Classification of drug-related problems with new prescriptions using a modified PCNE classification system. PCNE Working Symposium, Geneva, Switzerland, 2nd November 2009

Eichenberger P, Yagicibulut M, Mittag M, Schaefer M, Hersberger KE. Provision of pharmaceutical care by Swiss community pharmacists. 35th ESCP Symposium on Clinical Pharmacy, October 18-21 2006, Vienna, Austria, abstract PC-227

Posters and poster presentations

Eichenberger P, Lampert ML, Slejska B, Haschke M, Hersberger KE. Opportunities for pharmaceutical care in patients after transplantation. 37th ESCP Symposium on Clinical Pharmacy, October 22-24 2008, Dubrovnik, Croatia. Abstract in Pharm World Sci 2009;31:298

Eichenberger P, Lampert ML, Vogel Kahmann I, Mengiardi S, van Mil JWF, Hersberger KE. Drug-related problems with new prescriptions - prevalence, nature and management in community pharmacies. 36th ESCP Symposium on Clinical Pharmacy, October 25-27 2007, Istanbul, Turkey. Abstract in Pharm World Sci 2008;30:668

Hersberger KE, Bodenmann T, Mengiardi S, Eichenberger P, Zemp Stutz E, Frey Tirri B. Emergency contraception: change of user's profile 2003-2006. 36th ESCP Symposium on Clinical Pharmacy, October 25-27 2007, Istanbul, Turkey. Abstract in Pharm World Sci 2008;30:706

Eichenberger P, Mittag M, Schaefer M, Hersberger KE. Provision of pharmaceutical care by Swiss and German community pharmacists. 5th PCNE Working Conference, February 21-24 2006, Gothenburg, Sweden. Abstract in Pharm World Sci 2007;29:714

Eichenberger P, Yagicibulut M, Mittag M, Schaefer M, Hersberger KE. Provision of pharmaceutical care by Swiss community pharmacists. 35th ESCP Symposium on Clinical Pharmacy, October 18-21 2006, Vienna, Austria, abstract PC-227

Lectures

During my studies I followed courses of the following lecturers:

Aebi M, Altmann KH, Altorfer H, Ametamey S, Amrhein N, Badertscher M, Baltisberger M, Borschberg HJ, Boutellier U, Bruppacher R, Drewe J, Eberle AN, Ernst B, Falch B, Folkers G, Gander B, Gertsch J, Glockshuber R, Gruissem W, Hardt WD, Haschke M, Heilmann J, Hennecke H, Hersberger KE, Hess C, Inäbnit P, Jaun B, Kraehenbuehl S, Kraemer SD, Lampert ML, Meier C, Meister E, Merkle HP, Möhler H, Neri D, Pervushin K, Pregosin PS, Rentsch K, Rudolf U, Schibli R, Scholer A, Schubiger PA, Stoffer D, Vogel Kahmann I, Werner S, Wiedemeier P, Wolfer DP, Wunderli-Allenspach H