



Master's Thesis

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Help please – my prescription is unavailable!

Occurrence and underlying reasons for unavailable prescriptions and the development of a protocol for Dependent Pharmacist Repeat Prescribing at Danish community pharmacies

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Motivation

I qualified as a pharmaconomist in June 2013, and, in September 2013, I started Bachelor of Science (BSc) in Pharmacy at School of Pharmaceutical Science, Copenhagen University. I have since worked at Copenhagen Sønderbro Pharmacy in both the daytime and out of hours (when the general practitioner's office was closed), first as a pharmaconomist student from 2010-2013 and then as a pharmaconomist during my pharmacy study from 2013-2018.

In my work at community pharmacy, I encountered patients who had exhausted their medication and needed a prescription refill. When this occurred out of hours, when their general practitioner was closed, our only option at the community pharmacy was to refer them to the out-of-hours medical telephone service even though we could not guarantee that they would help them. I could feel both frustration from the patients and our own frustration as pharmacy staff, because we wanted to help but could not.

In June 2017, I participated in a conference in Leiden, Holland, on '*Extended responsibilities for pharmacists in the treatment of acute & chronic condition*' where I attended a workshop and lecture regarding prescribing pharmacists. I learned a great deal about pharmacist prescribing and we worked on how we could implement it in our own countries if possible. The most noticeable aspect was that you cannot simply take a model that works in one country and project it directly towards your own. If a model works in, for example, Scotland, it is not certain that the same model can work in Denmark because there could be difference in the healthcare systems. What we can do is take the parts of the models that can be projected and work on making them into a model that could be adopted in Denmark.

This was the reason why I wanted the subject of my master's thesis to be pharmacist prescribing.

First, I wanted to examine the problem with the unavailable prescriptions. Based on my experience with patients at community pharmacies, I assumed this problem would be noticeable, but is it?

Second, I wanted to develop a solution for the patients with unavailable prescriptions out of hours so they did not become non-compliant. I wanted to use what I have learned in the workshop and work with parts of models from countries with pharmacist prescribing and then amalgamate them into something that could potentially work in Denmark. This subject had aroused my curiosity, and, luckily, I now had 9 months to work on my thesis.



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Introduction

The purpose of this study was to explore the occurrence and underlying reasons for unavailable prescriptions at Danish community pharmacies and develop a protocol which could help patients with unavailable prescriptions who met certain criteria.

I have chosen, in agreement with my supervisors, to write two drafts of scientific articles instead of the regular master's thesis report. The drafts were aimed for the International Journal of Clinical Pharmacy as short reports.

My master's thesis accounts for 52.5 ETCS, and, therefore, I should have written my thesis from 1 September 2017 to 31 August 2018. However, I have, in agreement with my supervisors, decided to hand in my thesis on 31 May, which is 3 months before the original due date.

In each article an introduction connected to the subject in the article is provided, and, therefore, I will only briefly introduce the national and international literature and the subject in this Introduction.

I have not been able to find any peer-reviewed articles regarding unavailable prescriptions, which was the field of research I wanted to make my contribution towards in the article "Unavailable Prescriptions at Danish Community Pharmacies: a study of occurrence and underlying reasons". However, I based my research on this subject on a Danish study on unavailable prescriptions, which has not been peer-reviewed. I decided to arrange a meeting with the two pharmaconomists who had performed the study to obtain their insight into the subject. They did not have any data regarding chronic medication or on which pharmaceuticals the patients were expecting on prescription. I was, therefore, very interested in acquiring data on these two subjects in my research.

Another aspect of the article "Development of a Protocol for Dependent Pharmacist Repeat Prescribing for Patients with unavailable prescriptions at Danish Community Pharmacies" was the development of a protocol for pharmacist prescribing. There were a great deal of studies on pharmacist prescribing because it has already been implemented and functioning in the UK, Canada, the USA and New Zealand [1].

Since there have been many studies on pharmacist prescribing, it was an easy choice to conduct a systemic review to find models I could use in the development of the protocol. The studies will be presented in the article "Development of a Protocol for Dependent Pharmacist Repeat Prescribing for Patients with unavailable prescriptions at Danish Community Pharmacies" and will therefore not be presented further in this introduction.



I have two aims for this master's thesis; these will be answered in each article and then summed up in the Conclusion and Perspectives for Further Research at the end of the thesis. The aims are formulated as two research questions. Originally, I had a third aim, which was to pilot test the developed protocol for pharmacist repeat prescribing. It was not possible within the set timeframe and furthermore, I could not be certain of gaining a dispensation from the Danish authority, which would be necessary for a pilot test. Therefore, I decided to reject the third aim for the thesis.

The research question for the first article “Unavailable Prescriptions at Danish Community Pharmacies: a study of occurrence and underlying reasons”

How significant is the problem with unavailable prescription at Danish Community Pharmacies? How often do unavailable prescriptions occur at Danish Community Pharmacies and what are the underlying reasons for unavailable prescriptions at Danish Community Pharmacies?

The research question connected to the second article “Development of a Protocol for Dependent Pharmacist Repeat Prescribing for Patients with unavailable prescriptions at Danish Community Pharmacies”

How could a protocol be developed for Dependent Pharmacist Repeat Prescribing to help patients unable to refill prescriptions outside their general practitioner's (GP's) opening hours with pharmacist prescribing in Denmark?

The target group for both studies are primarily Danish community pharmacies and, secondly, the Danish authorities, who have the legislative power to implement pharmacist prescribing in Denmark.



Unavailable Prescriptions at Danish Community Pharmacies: a study of the occurrence and underlying reasons

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Abstract

Background

The staff at Danish community pharmacies find dealing with the problem of unavailable prescriptions to be an increasing part of their daily work.

Objective

We conducted a study to examine the occurrence and underlying reasons for unavailable prescriptions at Danish community pharmacies.

Method

The data on unavailable prescriptions were collected in an online questionnaire by the staff at 24 community pharmacies in Denmark for three non-consecutive weeks between November 27, 2017 and January 28, 2018.

Results

In this study, 2,765 unavailable prescriptions were registered out of 194,358 prescriptions dispensed. Of the 2,765 unavailable prescriptions, 69% were regular pharmaceuticals for a chronic condition. The main reason for the unavailable prescriptions was patients expecting a new prescription after consulting a physician, mainly the patient's own GP (76%). Our results showed that patients most often requested a new prescription by later contacting a physician if they had no more medication (43%) or medication left for only one day (51%).

Conclusion

Overall, our results did not suggest frequent occurrence of unavailable prescriptions at Danish community pharmacies and the underlying reason for the unavailable prescriptions was, principally, new prescriptions from the GP.



Introduction

Prescriptions in Denmark are sent electronically to an online server (e-prescriptions) in the Joint Medicine Card (FMK)[2,3]. The FMK is a centralised database with information from across the Danish Health Sector about an individual patient's prescribed medication. Infrequently, and in special circumstances, prescriptions can be prescribed on paper [3]. E-prescriptions for pharmaceuticals categorised in the Danish dispensing group B (Appendix B) can be prescribed with refills, i.e. the patient can pick up their pharmaceuticals more than once per prescription [3].

When a prescription requested by a patient at a community pharmacy is unavailable on the online server, this is referred to as an unavailable prescription, which can be caused by: 1) a new prescription, which is not on the online server, 2) a prescription with refills, where all the refills have been used, and 3) a prescription which has expired, i.e. issued more than 2 years previously.

When a patient at the community pharmacy is unable to obtain a prescription, it is regarded as a troublesome and time-consuming problem for pharmacy staff and the healthcare system in general, because additional time is spent on retrieving the prescription. Unavailable prescriptions can also lead to patients becoming frustrated and non-compliant, as they do not receive their medication and, in a worst-case scenario, end up being hospitalised [4].

It has not been possible to find national or international peer-review studies on unavailable prescriptions.

Aim of the study

In this study, we aimed to describe the occurrence and underlying reasons for unavailable prescriptions at Danish community pharmacies.



Methods

The study was conducted in 24 Danish community pharmacies, for three non-consecutive weeks between November 27, 2017 and January 28, 2018.

Study design

The inclusion criteria for the study were patients with an unavailable prescription, who were physically present at the community pharmacy. The exclusion criteria were dose-dispensed prescriptions and patients who contacted the community pharmacy by telephone.

The pharmacies were recruited by 'The Danish Network for Research and Development of Pharmacy Practice' and private networks.

All skilled staff at the community pharmacy collected data and the online questionnaire was accessible to them at the counter terminals or on a tablet/iPad. Some community pharmacies used a paper version of the questionnaire when they were dealing with many patients, and then later registered online. Each community pharmacy had a contact person and a stand-in, who both participated in an explanatory meeting (\approx 45-60 minutes) at the community pharmacy or by Skype/telephone. A practice link to the online questionnaire was used before the data collection started and the original link was given to the community pharmacy one week before commencing the data collection process.

Data collection

The data collection instrument was a 10-item questionnaire, which covered the causes for the unavailable prescriptions:

1) The reason for the unavailable prescriptions, 2) Who should have prescribed the unavailable prescriptions (if it was a new prescription), 3) If it was regular pharmaceuticals for a chronic condition, 4) How much medication the patient had left (if it was regular pharmaceuticals for a chronic condition), 5) Which pharmaceutical should have been on the unavailable prescription, 6) Who requested a new prescription for the patient, 7) Which physician was contacted to request the prescription, 8) If the patient was able to contact the physician immediately 9) How many minutes the community pharmacy had spent on the unavailable prescriptions, and 10) Which community pharmacy registered the unavailable prescription.

If a patient had more than one unavailable prescription, a questionnaire had to be filled in for each unavailable prescription. The questionnaire was pilot tested at Copenhagen Sønderbro Pharmacy (five registrations).



Potential Medication for Dependent Pharmacist prescribing

Medication with the potential to be dependent pharmacist prescribed, providing this was to be legalised in Denmark, was set to meet three criteria in this study: 1) Regular pharmaceutical for a chronic condition belonging to the Danish dispensing group B (Appendix B) [3], 2) Medication not included in the pro.medicin.dk risk medication list [5], and 3) the registration had to be outside the GP's opening hours (4 pm to 8 am). Hereafter, registrations which met the criteria listed above will be referred to as 'Potential Medication for Dependent Pharmacist prescribing' in this study. The risk medication is defined by Pro.medicin.dk, which is a Danish database for health professionals and contains information about pharmaceuticals. The risk medication is selected based on the registered unintended events regarding the pharmaceuticals [5].

REDCap and Microsoft Excel were used for the statistical analysis.

Results were reported using descriptive statistics. Variables were categorical except the time the pharmacy staff spent on the unavailable prescriptions, which was a continuous interval variable. The continuous interval variable time consumption is shown by the mean and standard deviation.

The method for calculating the percentage of unavailable prescriptions of the total number of prescriptions distributed at the community pharmacies in the study period is shown in Appendix A.

Ethical approval

The study did not include any personally sensitive information according to the Danish Data Protection Agency.

Results

During the study period, 2,765 unavailable prescriptions were registered out of the 194,358 prescriptions dispensed over the counter at the 24 Danish community pharmacies. The unavailable prescriptions represented 1.2% (median) of the total number of prescriptions in the time period at the 24 community pharmacies (interquartile range [IQR] 1.0-1.7%; mean 1.4%, standard deviation [SD] 0.7%).

Of the 2,765 unavailable prescriptions, 1,882 (68%) were regular pharmaceuticals for a chronic condition. A total of 2,217 (80%) unavailable prescriptions were registered in the GP's opening hours from 8 am to 4 pm. The median time used on an unavailable prescription in the Danish community pharmacies was 2 minutes (IQR 1-3 minutes; mean 2.6 minutes, SD 3.4 minutes). The most noticeable differences when comparing the unavailable prescriptions in this study to all dispensations in 2016 by the Anatomical Therapeutic Chemical (ATC) Classification System, were for the medication in the cardiovascular system (C), in the dermatological (D) and the general anti-infection for systemic use (Figure 1).

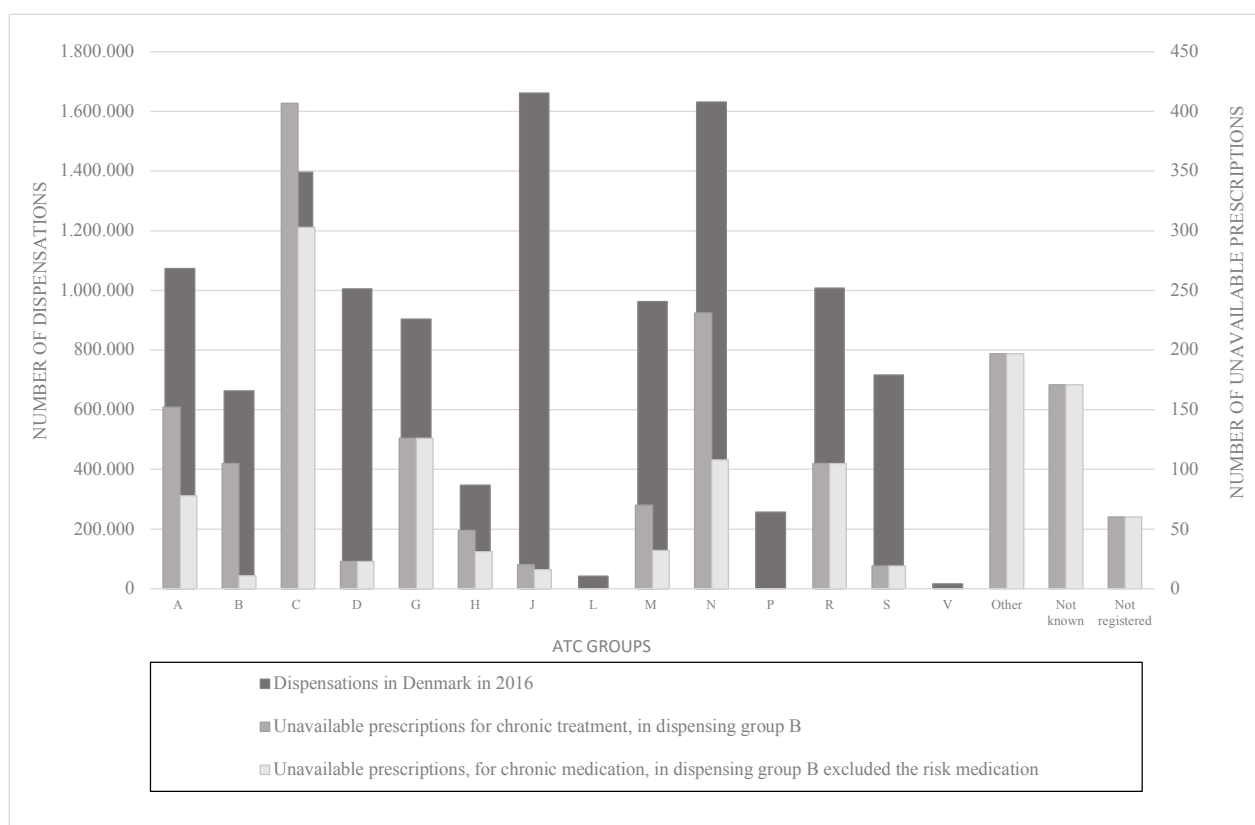


Figure 1: Bar graph of the total number of dispensations in 2016 (data from medstat.dk), the number of Unavailable Prescriptions in dispensing group B and the number of Unavailable Prescriptions in dispensing group B excluding risk medication [5] presented by ATC group.



The number of unavailable prescriptions went down in most of the ATC groups when risk medication was excluded from the regular pharmaceuticals for chronic conditions (Figure 1).

The main reason for unavailable prescriptions occurred when a patient had consulted to a physician and expected a prescription at the community pharmacy (Table 1). The GP's office was represented in significantly higher proportions in the new unavailable prescriptions (76% of physicians, 89% of secretary/registered nurse) compared to the new unavailable prescriptions from the hospital (12% of physician, 4% of secretary/registered nurse) (Table 1).

Table 1: The reasons for the unavailable prescriptions comparing all registrations to Potential Medication for Dependent Pharmacist prescribing. The categories 'The patient had been in contact with a physician' and 'The patient had been in contact with a medical secretary/registered nurse' were divided into which physician should have prescribed the new unavailable prescription in each category by number of registrations and total percentage of the category. The percentage in the table was rounded to the nearest whole number and therefore will not necessarily add to 100%.

	All registrations n =2765 (%)	Potential Medication for Dependent Pharmacist prescribing n = 207 (%)
Reasons for the unavailable prescriptions	Number of records	Number of records
The patient had been in contact with a physician	1412 (51)	56 (27)
General practitioner	1067 (76)	48 (86)
Medical specialist	108 (8)	2 (4)
Hospital doctor	169 (12)	4 (7)
Out-of-hours medical service	16 (1)	2 (4)
Other doctors	18 (1)	0 (0)
The patient did not know or the pharmacy staff forgot to ask	34 (2)	0 (0)
The patient had been in contact with a medical secretary/registered nurse	426 (15)	24 (12)
General practitioner	308 (89)	20 (83)
Medical specialist	15 (4)	1 (4)
Hospital doctor	16 (4)	3 (13)
Out-of-hours medical service	1 (0)	0 (0)
Other doctors	4 (1)	0 (0)
The patient did not know or the pharmacy staff forgot to ask	9 (2)	0 (0)
No prescription refills left on the online server	742 (27)	104 (50)
The prescription was expired i.e. prescribed more than 2 years previously	55 (2)	9 (38)
Other reasons*	123 (5)	14 (7)
The field was empty	7 (0)	0 (0)

*Other reasons for the unavailable prescription were: the patient had made an electronic request for a new prescription, a nurse had made the request for a new prescription for the patient, the patient thought that the printed prescription list from the pharmacy was a prescription, there should have been more prescription refills available to the patient, the GP had prescribed the



wrong medication, the prescription was prescribed for dose dispensing (pharmacy package the medication in a dose container with individual plastic bags for each dose), or the reason was not given.

The patients acted on the unavailable prescription by contacting the doctor later (43% of patients with no more medication and 51% of patients with sufficient medication left for one day only) and a minority were helped by the community pharmacies who requested a new prescription (9% of patients with no more medication and 4% of patients with medication left for only one day) (Appendix E).The community pharmacies helped 5% of the 73 registered unavailable prescriptions of the ‘Potential Medication for Dependent Pharmacist prescribing’ where the patient had no more medication left.



Discussion

The study showed that unavailable prescriptions occurred in approximately 1% of the patients at the Danish community pharmacies. The main reason for the unavailable prescriptions was due to physicians not prescribing the patient's medication despite being contacted by the patient. This problem was principally related to the patient's own GP.

When the GP's office is open, the patients has the possibility of contacting the GP themselves to receive a new prescription. In cases where the GP's office is unavailable to the patient, unavailable prescriptions can lead to non-compliance by the patient, which is considered time-consuming and troublesome, and may include economic consequences for the community pharmacy and the health sector in general. The time for completing the questionnaire was not tested before inviting 'The Danish Network for Research and Development of Pharmacy Practice'. The actual time-consumption was not the stated as 2-5 minutes but instead 1 minute. This pre-trial bias could be the reason why only 10 community pharmacies of the 67 community pharmacies in 'The Danish Network for Research and Development of Pharmacy Practice' subscribed to the data collection. Five of these community pharmacies added pharmacy branches to the data collection, in total eight pharmacy branches. The remaining six community pharmacies were recruited via the author's network. There was no selection bias because community pharmacies from all regions of Denmark were represented in this study.

The patterns were different in some of the ATCs (C, D and J) compared to the total counts of dispensation in 2016. The pattern of unavailable prescriptions for chronic treatment in ATC groups (D) and (J) could be due to the fact that the pharmaceuticals in (D) and (J) are often for short-term treatments. The pattern in the ATC group (C) represented the biggest problem of all ATC groups in the study and compared to the total counts of dispensation in 2016.

The primary strength of the study was that all regions of Denmark were represented and that a similar questionnaire had previously been tested. The primary limitation was that not all unavailable prescriptions were registered according to feedback from some community pharmacies. A secondary limitation was that it was not clarified with the community pharmacies if the answer "do not know" was because the patient did not know the reason for the unavailable prescription, or that the pharmacy staff forgot to ask the patient with the unavailable prescription, and therefore the staff themselves did not know. The unavailable prescriptions for regular pharmaceuticals for a chronic condition with no more refills could be caused by patients not checking their e-prescriptions online [6] before going to the community pharmacy, although further studies are required to test this hypothesis.



For 'Potential Medication for Dependent Pharmacist prescribing' 73 (35%) unavailable prescriptions were registered where the patient did not have any medication left and in 40 (55%) of these registrations the patients would call the physician later to obtain a new prescription. This study did not show if the patients obtained a new prescription in time or if they were unmedicated for a time period and thereby non-compliant. Nor did the study show why the GP's office caused the unavailable prescriptions, thus necessitating further studies on these perspectives.

Conclusion

In conclusion, our results indicate that unavailable prescriptions are not a frequently occurring phenomenon at Danish community pharmacies. The main reason for the unavailable prescriptions was new prescriptions from a physician, generally the patient's own GP. The most prominent pharmaceuticals were in the ATC group (C).



Development of a protocol for Dependent Pharmacist Repeat Prescribing for patients with unavailable prescriptions at Danish community pharmacies

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Abstract

Background

Pharmacist prescribing is not yet implemented in Denmark, but, in late 2017, a report on potential models for pharmacist prescribing in Denmark was published by the Danish Medicine Agency and the Board for Patient Safety. This could be the first step in helping patients in need of a prescription refill outside their general practitioner's (GP) opening hours.

Objective

To develop a protocol for Dependent Pharmacist Repeat Prescribing at Danish community pharmacies to help patients unable to refill prescriptions outside the GP's opening hours.

Method

Firstly, we held a meeting to get knowledge from the Research Development Team at a large community pharmacy in the Copenhagen, Denmark which has regular out of hours service. Secondly, we searched the literature and by methods found in this systemic review we then developed the protocol. Finally, an expert committee of two pharmacist to assess the protocol.

Results

The literature review produced 12 articles that fed into the protocol. In these we found three models to be used in the protocol for Dependent Repeat Prescribing. These were Patient Group Directions, Repeat Prescribing and Pharmacist Prescribing Model 3 and resulted in a protocol for Dependent Pharmacist Repeat Prescribing.

Conclusion

A pilot test has to be performed on the developed protocol to decide if repeat prescribing by pharmacists will be adopted in Denmark and it is necessary to either have authorisation from the authorities or a dispensation from the ministry for this pilot test.



Introduction

Dependent and independent pharmacist prescribing are a part of the primary healthcare sector in the UK, Australia, New Zealand, the USA and Canada [1,7]. Studies show that pharmacist prescribing can increase patients' access to medication, improve their medical treatment, and reduce the pressure on physicians, thereby giving them time to concentrate on more complicated conditions and complex treatments [1,8,9].

A report on potential models for pharmacist prescribing in Denmark was published in October 2017 by the Danish Medicine Agency and the Board for Patient Safety [7] even though pharmacist prescribing is not yet implemented in Denmark.

The out-of-hours medical telephone service in Denmark is only for patients in acute need of a physician and therefore patients who run out of their chronic medication and are in need of a prescription refill must instead contact their GP. When this happens outside the GP's opening hours it can lead to patients becoming frustrated and non-compliant, as they do not receive their medication. In a worst-case scenario, they can end up being hospitalised [4]. Pharmacists could help these patients were Dependent Pharmacist Repeat Prescribing to be implemented in Denmark.

Aim of the study

In this study, we aimed to develop a protocol for Dependent Pharmacist Repeat Prescribing at Danish community pharmacies, to help patients unable to refill prescriptions outside their GP's opening hours.



Methods

Study Design

The method for developing the protocol was consisted of firstly knowledge from the pharmacist in the research development team at Copenhagen Sønderbro Pharmacy. This knowledge was obtained by a meeting with three community pharmacists from the research development team at Copenhagen Sønderbro Pharmacy (≈ 60 minutes). We were interested in obtaining their input on a protocol to help chronic patients with prescriptions unavailable out of hours.

Secondly, we searched the literature and by models for pharmacist prescribing found in this systemic review we then developed the protocol. Finally, an expert committee of two pharmacist assessed the protocol. In order not to influence each other's judgement, the protocol was assessed individually.

The expert team consisted of one pharmacist who had an academic employment at a Danish university and one Danish proprietor pharmacist. Then the protocol was vouched for both academic content and for practical use, which was important if the protocol should be implementing at Danish community pharmacies.

The patient group for the protocol was selected based on an unpublished study by the authors of the prevalence and types of unavailable prescriptions in community pharmacies in Denmark. In this study, risk medication was excluded from the list of potential pharmaceuticals for Dependent Pharmacist prescribing. The risk medication [5] is selected based on the registered unintended events regarding the pharmaceuticals and is defined by Pro.medicin.dk, which is a Danish database for health professionals and contains information about pharmaceuticals.

We included the risk medication in dispensing group B [3] in the protocol because diabetes patients otherwise would not receive their insulin or patients with high blood pressure would not receive ramipril. We evaluated that pharmacists could manage to repeat-prescribe providing the medication belonged to dispensing group B.



Search Strategy

We performed the literature search as a systematic review of relevant studies about pharmacist prescribing and protocols for pharmacist prescribing.

We searched the electronic databases PubMed and EMBASE (Appendix F).

The search terms in PubMed included (((Guideline* OR Recommendation*)) OR (“Guideline” [Publication Type] OR “Practice Guideline” [Publication Type] OR “Health Planning Guideline” [Mesh] OR “Guidelines ad Topic” [Mesh] OR “Guideline Adherence” [Mesh])) AND (((“Prescribing Pharmacist” OR “Prescribing pharma*”) OR (“independent prescribing*” OR “Dependent prescribing*”))). The search included the filter English language and, subsequently, the filter ‘published in the last 5 years’ was added to narrow the search because of the many articles in the short timeframe for the study (n=438).

The search terms in EMBASE included (((guideline.mp or exp practice guideline)) OR ((guideline* or Protocol*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word])) AND (((“Prescribing Pharmacist” or “Prescribing pharma*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word]) OR ((“independent Prescribing*” or “Dependent prescribing*”).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word]))) This search included no filters and gave 59 studies.



Results

The research development team at Copenhagen Sønderbro Pharmacy suggested that pharmacists who would get authorized to repeat prescribe should have a certificate in conducting medication reviews by Pharmakon [10], which is an internationally recognized education and development centre for pharmaceutical practice.

A total of 497 articles were retrieved from the database search and two additional studies were included from the beginning of the study (Figure 1). After screening and assessment of eligibility we included 12 studies regarding pharmacist prescribing. Of these five were reviews regarding pharmacist prescribing [11–15], two studied the competency of prescribing pharmacists [16,17], four were individual studies of pharmacist prescribing [9,18–20], and one was a guide for implementation of supplementary prescribing in England [8].

Two additional studies were included before we began the database search because we found them relevant for the study. One was a report on potential models for pharmacist prescribing in Denmark [7] and one a Danish commentary on the status of pharmacist prescribing outside Denmark [1]. Through the systematic review, we found three models in four of the fourteen studies in the systemic review. The remaining twelve studies were included to back up the protocol and describe which improvements we could be expected in the Danish healthcare if the protocol was implemented in Danish community pharmacies based on experience from other countries. The models used in the protocol (Figure 3) for Dependent Repeat Prescribing was: A) Patient Group Directions, B) Repeat Prescribing, and C) Pharmacist Prescribing Model 3, given this name because it was the third model in the report on potential models for pharmacist prescribing in Denmark. We combined relevant parts of each of the three models to form the protocol (Figure 2).

A. Dependent Prescribing Model: Patient Group Directions [12]

The Patient Group Directions are written directions for dependent pharmacist prescribing signed by the independent prescriber (typically a physician) and the prescribing pharmacist. The recipients are a patient group defined in the written direction and it does not require individual patient referral from a physician. Specific requirements have to be met for the Patient Group Directions to apply and should include: 1) medication or class of medication, 2) dosage form(s), 3) applicable dosage or maximum dosage, 4) route of administration, 5) frequency of dosing, 6) minimum/maximum period for administration, 7) relevant warnings, 8) restriction on quantity, 9) circumstances where the medication can and cannot be supplied,



10) when further advice should be sought, 11) follow-up actions, 12) records kept, and 13) valid period for the Patient Group Directions [12].

B. Dependent Prescribing Model: Repeat Prescribing [12,13]

Repeat prescribing is a medication-refill service by a pharmacist in a clinic associated with a medical centre [13]. The recipients are patients who have exhausted their prescribed pharmaceutical before their next physician appointment [12] and need a new continuing prescription [13]. The pharmacist assesses the patient and therapy and decides to: 1) advise the patient to consult the attending physician if there are problems with compliance, disease control and/or side effects, 2) write a refill prescription for dispensing the medication at a community pharmacy, or 3) refill the medication in a sufficient quantity to last until the next appointment [12,13].

C. Pharmacist Prescribing Model 3 [7]

The pharmacist can dispense a pharmaceutical to a patient without a prescription under certain conditions if the medical treatment was initiated by a physician [7]. Relevant scientific societies should have a say regarding which pharmaceutical the Pharmacist Prescribing Model 3 should include, the contraindications the pharmacist checks and the comprehensiveness of the pharmacist prescribing [7]. In Denmark, pharmacists are not a registered health care profession and cannot obtain such an authorisation to practice as in most other countries [21]. The pharmacist has to have the appropriate educational background to obtain an authorisation to prescribe by following the Pharmacist Prescribing Model 3. Authorised pharmacists would be able to prescribe the pharmaceuticals from the Danish dispensing group B (Appendix B) in the smallest package size according to a special checklist or guidelines for the model [7]. The checklist and guidelines should be maintained up to date. It should be clear when the pharmacist should not prescribe and instead refer the patient to a physician. The pharmacist can only prescribe the pharmaceutical one time according to the model and a technical solution must ensure that a patient cannot go to another pharmacy and obtain another prescription from a pharmacist. The community pharmacy has to document the pharmacist prescribing and inform the patient's physician [7] and, additionally, the pharmacist prescribing has to be documented in the patient's FMK [2,3]. The FMK is a centralised database with information from across the Danish Health Sector about an individual patient's prescribed medication. The authorised prescribing pharmacist should also have access to the patient's medical record.



The developed Protocol for Dependent Pharmacist Repeat Prescribing was assessed as suitable for being implemented at Danish community pharmacies by the two pharmacists in the expert committee, in consensus.

Patient's consent is a model requirement in 'Pharmacist Prescribing Model 3'. A patient's consent of supplementary prescribing is needed if the pharmacist should handle the patients' treatment according to the protocol [8], this is according to the guide for implementation of supplementary prescribing/dependent prescribing by The National Health Service (NHS) in England. This guide has been functioning since 2015 in England [8]. The developed protocol therefore states, that the pharmacist has to ensure the patient's consent to assess the patient's therapy in the FMK [2,3] and thereby perform the Pharmacist Repeat Prescribing.

According to the developed protocol, the treatment has to be initiated by a physician (Figure 2, Figure 3). This decision was, besides 'Pharmacist Prescribing Model 3', based on a study regarding prescribing pharmacist competency, where it was stated that they neither feel competent nor comfortable diagnosing or performing physical examinations [16]. The competency to perform the Dependent Pharmacist Repeat Prescribing is required by pharmacist through the certificate in medication reviews [10], which includes test case studies and using the theory in practise. The use of case studies and testing theory in practice has been previously used to educate prescribing pharmacists [14,17]. Pharmacists feel competent checking contraindications [19] but a pharmacist who had acquired the certificate in medication reviews has even more experience by the three essay assignments and one case assignment describing the performance of a medication review. Furthermore, to get the certificate in medication reviews the pharmacist has performed a minimum of 5 medication reviews in practice. A similar way of using problem-based curriculum has been adopted for medical students and their ability to prescribe was subsequently improved [15].

A qualitative study from Canada [18] found that most pharmacists ensured continuity of prescriptions and obtained approval from the doctor the next day before they did repeat prescribing; therefore, the only difference between before and after pharmacist repeat prescribing was implemented was the procedure. For dependent pharmacist prescribing can function it is important for the prescribing pharmacist to co-operate with physicians in a team-based collaboration. Collaboration between healthcare professionals by delegation of authority is used in Denmark, but not prescribing authority. This delegated authority is seen in hospitals where a nurse has authority to close a smaller skin wound by suture by following a written guideline [22]. Collaboration between pharmacist and physician has been proven to give physicians more time with patients when they trust the pharmacists to follow written protocols and thereby assist the



patients in need of a refill prescription. A study from the USA showed dependent prescribing pharmacists handling refill prescriptions in medical centres improved the prescription refill management process and released an additional 20-40 minutes per day for the physician to see patients [9]. The pharmacists started by handling the refill request, processed it and then the physician co-signed it [9]. Today, the pharmacists independently manage the refill prescriptions and thereby help the patients reach the clinical goals set by the physicians by following treatment guidelines [9].



Discussion

This study showed that it was possible to develop a protocol for Dependent Pharmacist Repeat Prescribing and it was assessed as suitable to be implemented in Denmark, by a pharmacist expert committee. The models could not be directly applied to Danish community pharmacies. Instead we combined relevant parts of three models to form the protocol. The developed protocol cannot be used in Danish community pharmacies at present because pharmacist prescribing is not yet allowed in Denmark.

Dependent pharmacist prescribing by protocol is a delegation of a prescribing authority from an independent prescriber (usually a physician) or an institutional board to a pharmacist by a formal agreement where the activities the pharmacist may perform are described in a written guideline/protocol approved by the independent prescriber [11,12]. The developed protocol for Dependent Pharmacist Repeat Prescribing cannot be pilot tested because it is not legal for a physician to delegate their authorisation to prescribe pharmaceuticals [22] in Denmark. A possibility for pilot testing the protocol could be that the Danish Medicine Agency delegated an authority to prescribe according to the developed protocol at Copenhagen Sønderbro Pharmacy. Another possibility for pilot testing the protocol for Dependent Pharmacist Repeat Prescribing could be if a medication for chronic treatment in the FMK were to be categorised by the authorities as suitable for Dependent Pharmacist Repeat Prescribing. In Denmark, pharmaceuticals prescribed by a physician in the FMK [2] without an end date for the treatment are already categorised as a chronic treatment for the patient [23] but not regarded as a prescription comparable to the prescriptions on the online server. The protocol will need to be pilot tested before rolling it out in other Danish community pharmacies. If the protocol were to be used at all community pharmacies in Denmark simultaneously, a solution has to be developed to ensure that patients do not get Dependent Pharmacist Repeat Prescribing additional times by going to different community pharmacies. This problem would be solved if a field for pharmacists to register prescribing was developed in the FMK. Then pharmacist could note the repeat prescribing in the patient's FMK and then both physicians and other health professionals would be informed when checking the patient's medication.

A pharmacist with the certificate in medication reviews [10] has been trained in checking FMK and contraindications in the patient's medication. Besides the acquired certificate in medication reviews pharmacist could be educated in some problem cases in repeat prescribing to train the protocol. It could be a requirement that the pharmacist should pass these problem cases before managing the Dependent Pharmacist Repeat Prescribing.



Pharmacists are educated to check for contraindications, which is part of their regular workflow at community pharmacies when dispensing medication, and a study has shown that pharmacists feel competent checking contraindications [19]. Further studies are, however, needed of the Danish community pharmacists' views of pharmacist prescribing and their competency regarding pharmacist prescribing.

The developed protocol could potentially give the out-of-hours medical telephone service in the capital region (1813) and doctors on duty in Denmark more time for acute patients. It can also minimise non-compliance by helping chronic patients at the community pharmacies with a limited supply to manage until their GP's office re-opens. Further studies have to be conducted on how much time the out-of-hours medical telephone service Denmark actually spends helping chronic patients with repeat prescriptions.

If Denmark follows same development regarding refill prescribing as seen in countries where pharmacist prescribing is allowed, this could lead to pharmacists handling the treatment of chronic patients by following treatment guidelines through a team-based collaboration between the physician and the prescribing pharmacist. However, further studies have to be performed to evaluate how the pharmacists and the physicians could collaborate on treating chronic patients within the Danish health care system.

Patients in chronic treatment cannot simply stop taking their medication; therefore, it would be better to help the patients in chronic treatment with medication in dispensing group B [3] through Dependent Pharmacist Repeat Prescribing. We decided to include the risk medication in the protocol because nowadays pharmacists can help chronic patients out of hours with, for example, insulin and beta-2-agonists in emergency incidents and then subsequently gain approval from the physician. This resembles the method used in community pharmacies in Canada and, therefore, it could be just a change in procedure if we followed the same development. In case pharmacist repeat prescribing was to be legislated further studies will be needed to examine how often pharmacists continue prescriptions in Danish community pharmacies.

It is both a strength and limitation of the study that a research development team from Copenhagen Sønderbro Pharmacy has been included in the development of the protocol, because they have experience with out-of-hours patients. This is primarily a strength because we do not think that the difference in the protocol would be changed significantly by including opinions from pharmacists working in other community pharmacies than the piloting pharmacy. If the transferability of the protocol needs to be strengthened, then a study could be performed with pharmacists in focus groups evaluating the protocol



before a pilot test. An additional strength to the study is that the dependent prescribing models Patient Group Direction and Repeat Prescribing are implemented and functioning in other Western countries. A limitation to the developed protocol is that dispensation from the Danish authorities has to be given to pilot test the protocol because the chronic medication in registered in FMK is not approved as a prescription for pharmacist prescribing in Denmark and that pharmacist prescribing is not allowed in Denmark. Another limitation of the study is that no scientific societies within the field of medication e.g. ‘The Organization of Danish Medical Societies’ (LVS) have been consulted about their views on the protocol.



Conclusion

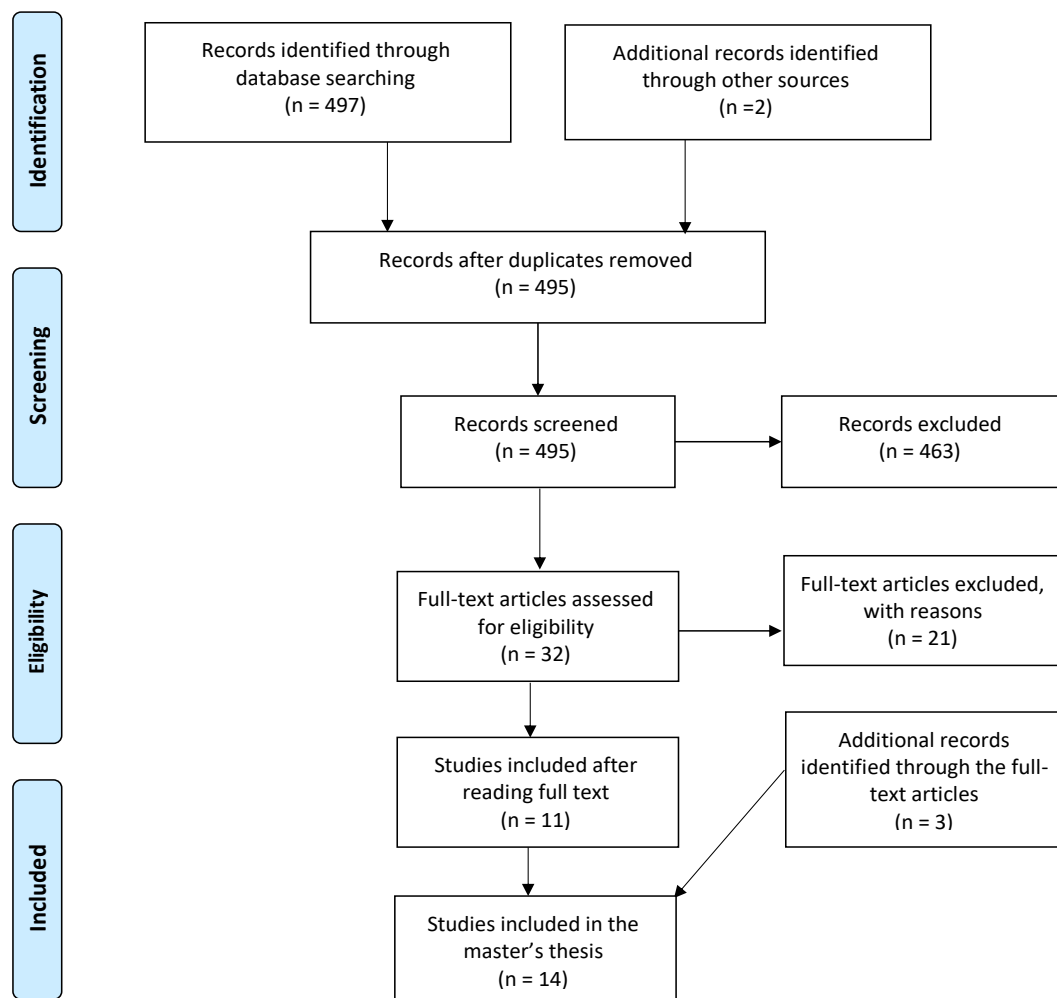
We developed a protocol for Pharmacist Repeat Prescribing outside GPs' opening hours based on three models found in the systemic review and the knowledge from the research development team at Copenhagen Sønderbro Pharmacy

The protocol has to be pilot tested before we can actually conclude whether this guiding framework developed based on the literature will be implemented in Denmark. A pilot test cannot be performed unless pharmacist prescribing is allowed in Denmark or if a dispensation for Dependent Pharmacist Repeat Prescribing is approved by the Danish Medicine Agency.

Figures



PRISMA 2009 Flow Diagram



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

Figure 1: The Prisma Flow Diagram for the Literature.



Dependent Prescribing Model: Patient Group Directions (PGD)

[12]

PGD is a written direction to dependent pharmacist prescribing signed by the independent prescriber (physician) and the prescribing pharmacist. The PGD should include: 1) active component or class of medicine, 2) dosage form(s), 3) applicable dosage or maximum dosage, 4) route of administration, 5) frequency of dosing, 6) minimum/maximum period for administration, 7) relevant warnings, 8) restriction on quantity, 9) circumstances where the medicine can and cannot be supplied, 10) when further advice should be sought, 11) follow-up actions, 12) records kept, 13) valid period for the PGD

Dependent Prescribing Model – Repeat Prescribing

(RP) [12,13]

RP is a medication-refill service by a pharmacist in a clinic associated with a medical centre. The pharmacist assesses the patient and therapy and decides to write a refill prescription for dispensing at a community pharmacy

Model 3 of the Report on Possible Models for Pharmacist Prescribing in Denmark (M3) [7]

Relevant scientific societies should have a say on which pharmaceuticals the M3 should include, the contraindications the pharmacist ensures, and the comprehensiveness of the pharmaceutical prescribing. In Denmark, pharmacists are not registered health care providers unlike in other most other countries.

The recipients are a patient group defined in the written direction and do not require individual referral from a physician.
Specific requirements have to be met before the PGD applies.

The recipients are patients who have exhausted their prescribed pharmaceutical before their next physician's appointment and need a new continuing prescription. The pharmacist assesses the patient and therapy and decides to: 1) advise the patient to consult the attending physician if problems with compliance, disease control and/or side-effects exist, 2) refill the medication with a sufficient quantity to last until the next appointment.

Research development team from Copenhagen Sønderbro Pharmacy

Pharmacists authorised to Dependent Pharmacist Repeat Prescribe have to be a certified to perform medication reviews (a certificate is valid for 3 years).
The patient has to give their consent for the pharmacist to logon to the FMK*.

The authors

A patient with an unavailable prescription has to meet the following conditions: A) Regular pharmaceutical for a chronic condition, B) The pharmaceutical belongs to the Danish dispensing group B**, and C) The patient is at the community pharmacy in the time period 4 pm to 8 am, when the General Practitioner's (GP) office is closed.

The pharmaceutical has to be prescribed without an end date and thereby classify as a regular pharmaceutical for a chronic condition. The refill prescription for the requested pharmaceutical has been previously prescribed to the patient by a physician and dispensed at a community pharmacy. The pharmaceutical has to be registered in the patient's FMK* at least 2 months before the date for the pharmaceutical repeat prescribing to ensure that the patient has completed a control check-up by the GP (often one month after starting the treatment).

The pharmacist can dispense a pharmaceutical to a patient without a prescription under certain conditions if the medical treatment was initiated by a physician. The pharmacist has to receive the appropriate education to obtain an authorisation to prescribe by M3. Pharmacists would be able to prescribe the pharmaceuticals from the Danish dispensing group B** in the smallest package size according to a special checklist or guideline for M3. It should be stated when the pharmacist should not prescribe and instead refer the patient to a physician. The checklist and guidelines should be maintained and kept up to date. The pharmacist can only prescribe the pharmaceutical once without a prescription and a technical solution must ensure that a patient cannot go to another pharmacy and obtain the pharmaceutical without prescription. The community pharmacy has to document the pharmaceutical prescribing and inform the patient's physician. The pharmacist prescribing has to be documented in the patient's FMK*. The authorised prescribing pharmacist should have access to the patient's medical record and should have a duty to keep the medical record.

Figure 2: The protocol for Dependent Pharmacist Repeat Prescribing at Copenhagen Sønderbro Pharmacy was made from three different models. The resulting protocol is within the rectangle surrounded by the 2 lines. The model was made from the 2 models for pharmacist prescribing outside Denmark (shown in circles) and the Danish model for potential pharmacist prescribing (shown in the rectangle). Additionally, the authors own elements and elements from the pharmacists at Copenhagen Sønderbro Pharmacy were included to the protocol (shown in two rectangles). * The FMK is a centralised database with information from across the Danish Health Sector about an individual patient's prescribed medication. ** See Appendix B for list of pharmaceuticals



Protocol for Dependent Pharmacist Repeat Prescribing at Danish community pharmacies (1 of 2)

Pharmacist authorized to Dependent Pharmacist Repeat Prescribe

- Certified medicine reviewer (a certificate is valid 3 years) [10]

Inclusion and Exclusion criteria for Dependent Pharmacist Repeat Prescribing at Danish Community Pharmacies

Inclusion criteria for repeat prescribing

A patient with an unavailable prescription in following conditions:

- Regular pharmaceutical for a chronic condition
- The pharmaceutical belongs to the Danish dispensing group B [3]
- The patient is at the community pharmacy in the time period 4 pm to 8 am, or when the General Practitioner's office is closed

Exclusion criteria for repeat prescribing

A patient with an unavailable prescription in following conditions

- The pharmaceutical is for a short-term treatment
- The pharmaceutical belongs to the Danish dispensing group A, AP4, AP4BG, AP4NB, BEGR, NBS [3]
- The patient is at the community pharmacy in the time period 8 am to 4 pm, or when the General Practitioner's office is open

If the patient meets the inclusion criteria then the patients has to sign a consent before the pharmacist can assess the patient's therapy and decide if:

- Then the patient has to consult the physician to get a prescription refill if there are problems with compliance, disease control and/or side-effects
- Refill the medication with the smallest package size

1. Guideline – Checklist before prescribing

- 1.1. The patient signs their consent which is the permission to logon to the patient's personal medicine card (FMK) [2].
- 1.2. The pharmacist logs on to the patient's FMK and controls:
 - 1.2.1. **The pharmaceutical**
 - 1.2.1.1. The requested pharmaceutical has previously been prescribed to the patient without an end date and thereby classify as a regular pharmaceutical for a chronic condition.
 - 1.2.1.2. A refill prescription for the requested pharmaceutical has been prescribed before to the patient by a physician and dispensed at a community pharmacy
 - 1.2.1.3. The requested pharmaceutical has to be registered in the patient's FMK at least 2 months before the date for the pharmaceutical repeat prescribing to secure that the patient has completed a control check-up at the GP (often 1 month after starting the treatment)

Figure 3: The developed protocol for Dependent Pharmacist Repeat Prescribing



Protocol for Dependent Pharmacist Repeat Prescribing at Danish community pharmacies (2 of 2)

1.2.2. Compliance

- 1.2.2.1. The pharmacist should ensure that the patient is compliant by checking:
 - 1.2.2.1.1. the patient has collected the refill prescriptions for the pharmaceutical according to the prescribed dose in FMK.
 - 1.2.2.1.2. the prescribed dose on the FMK matches the dose stated by the patient

1.2.3. Contraindications

- 1.2.3.1. The patient's FMK should be checked by the pharmacist for contraindications to the requested pharmaceutical.

2. Guideline – Pharmacist Repeat Prescribing or not

- 2.1. If the pharmaceutical matches without contraindications and the patient is compliant then the pharmacist can:
 - 2.1.1. refill the prescribed pharmaceutical with the smallest package size
 If not, then the pharmacist has to:
 - 2.1.2. inform the patient to consult their GP to get a prescription refill

3. Guideline – Documentation after the patient has left the pharmacy

- 3.1. The pharmacist has to document the pharmacist prescribing and inform the patient's physician about it. The documented information also applies if no pharmaceutical prescription is chosen but, in this case, the pharmacist has to inform the physician about the reasons for not prescribing.
 - 3.1.1. This is done by sending a correspondence message to the patient's physician. Correspondence message is a text-based communication standard for secure communication from one journal system to another where the patient identification is automatically applied.
 - 3.1.1.1. A template correspondence message has to be filled and sent:
 - 3.1.1.1.1. if the pharmacist chooses to repeat prescribe.
 - 3.1.1.1.2. if the pharmacist chooses not to repeat prescribe.

- 3.2. The pharmacist has to ensure that the patient cannot go to another pharmacy and obtain another Dependent Pharmacist Repeat Prescription before consulting the physician.
 - 3.2.1. This could be documented in the patient's FMK [2] if it, in the future, could be possible to make a "pharmacist note".
 - 3.2.2. This is not a problem if only one community pharmacy will test the protocol for a trial period.





Conclusion and perspectives for further research

Conclusion

In this Conclusion I have aimed to answer the two research questions stated in the Introduction. First, the problem with unavailable prescriptions at Danish community pharmacies was examined.

How significant is the problem of unavailable prescriptions at Danish community pharmacies? How often do unavailable prescriptions occur at Danish Community Pharmacies and what are the underlying reasons for unavailable prescriptions at Danish Community Pharmacies?

In conclusion, the results did not suggest frequent occurrence of unavailable prescriptions at Danish community pharmacies. Approximately 1% of the patients at Danish community pharmacies had an unavailable prescription. The unavailable prescriptions were typically caused by new prescriptions which the patient's own GP should have prescribed because the patient had contacted them. The medication in the cardiovascular system (C) in the Anatomical Therapeutic Chemical (ATC) Classification System was the most prominent of the unavailable prescriptions defined as potential medication for Dependent Pharmacist prescribing.

Secondly, a solution for patients with unavailable prescriptions out-of-hours should be developed.

How could a protocol be developed for Dependent Pharmacist Repeat Prescribing to help patients unable to refill prescriptions outside their general practitioner's (GP's) opening hours with pharmacist prescribing in Denmark?

To sum up, a protocol for Dependent Pharmacist Repeat Prescribing was developed by the knowledge from the research development team at Copenhagen Sønderbro Pharmacy and the models found in the systemic review.

However, before I can actually conclude whether this guiding framework developed based on the literature will be implemented in Denmark, a pilot test of the protocol has to be performed.

A pilot test cannot be performed unless a dispensation for the protocol is approved by the Danish Medication Agency or pharmacist prescribing is implemented in Denmark.



Perspectives for Further Research

It would be interesting to again conduct a study of the occurrence of unavailable prescriptions but with greater numbers of attending community pharmacies to see if the problem would be the same with approximately 1% of all prescriptions. A parameter which could be added to the study was that the staff at the community pharmacies should evaluate how effective they were at registering the unavailable prescriptions. This would be ideal to have as a parameter when we process the data because some pharmacies could have a higher percentage of patients with unavailable prescriptions than others.

Further studies are needed to determine the reasons why the GPs did not prescribe the prescription after the patient had been in contact with them. It would be interesting to examine the reason for the unavailable prescriptions at the GPs' offices. In this regard, I believe it to be the procedure for when the GP puts the prescriptions on the online server or if the patient is not informed correctly of when they should expect the prescription available. My assumptions can, however, only be confirmed or denied if a new study is conducted to examine the reason for the unavailable prescriptions from the GP.

The most prominent ATC group was medication for the cardiovascular system, and it would thus be interesting to perform a qualitative study regarding why patients taking this medication had the highest potential to have an unavailable prescription and if they are compliant.

Canadian pharmacist continued prescriptions and awaited the physician's approval the next day so when Canada implemented pharmacist repeat prescribing pharmacists viewed it as only a change of procedure. Therefore it could be interesting to conduct a study of pharmacists in Danish community pharmacies' continuation of prescriptions, including how often prescriptions are continued and the reasons behind this.

There is great success with team collaborations between prescribing pharmacists and physicians outside Denmark. Therefore, a qualitative study could be conducted on Danish pharmacists and physicians regarding team-based collaboration for potential pharmacist prescribing to chronic patients in Denmark. At the same time, it would be interesting to interview chronic patients to receive their opinions regarding pharmacist prescribing because pharmacist need the patient's consent to prescribe.



My intention was to save the out-of-hours medical telephone service some of the calls from patients regarding prescription refills but realise that further studies have to be performed to confirm how many inquiries the out-of-hours telephone service in Denmark and doctors on duty receive regarding prescription refills. Another interesting parameter in a new study could to reveal how many of the inquiries regarding prescriptions refills are being help with a prescription even though prescribing refills it is not according to the guideline of the out-of-hours medical telephone service and doctors on duty in Denmark.

I was unable to determine if Danish community pharmacists feel ready for pharmacist prescribing, and therefore it would be necessary to obtain Danish community pharmacists' views in performing pharmacist prescribing in relation to their own competency regarding pharmacist prescribing.

If the developed protocol were to be pilot tested, then a new study will be necessary, including a dispensation to test the protocol for pharmacist prescribing being implemented in Denmark. My estimate is that it will not be long before some degree of pharmacist prescribing will be implemented. I also think that it would also be interesting to study the potential for a pharmacist field in the FMK because it could solve the problem of obtaining the information for the pharmacist prescribing to other pharmacies and the physicians.

There is a great deal of potential for further research after this thesis and I hope that someone will conduct further studies in Denmark in this, for me, exiting subject – pharmacist prescribing.



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Appendix

Appendix A – Equation to calculate the percentage of unavailable prescriptions from the total number of prescriptions

Equation 1: The calculation of the percentage of unavailable prescriptions. The number of prescribed medication packages in the data collection period included the package to patients who had their medication delivered, but they were not included in the study – therefore they had to be subtracted. The delivery fee indicated how many patients received a delivery in the period and this delivery fee was multiplied by 2.51 (the number of medications delivered to each patient outside the pharmacy, data from Association of Danish Pharmacies) to obtain the number of prescriptions delivered in the period. The number of prescribed medication packages was subtracted the prescriptions delivered by the pharmacy. *In the period of the data collection at the individual pharmacy.

$$\text{Percentage of unavailable prescriptions} = \left(\frac{\text{number of unavailable prescriptions}^*}{(\text{number of prescribed medication packages sold at the pharmacy}^* - (\text{number of delivery fees}^* \times 2,51))} \right) \times 100 \%$$





Appendix B – Definitions of the Danish Dispensing Groups used in the study

“Unavailable Prescriptions at Danish community pharmacies: a study of occurrence and underlying reasons “

- **Dispensing group »AP4«** can only be dispensed once per prescription and has to be subject to special monitoring, according to §4 in the legislation regarding reimbursement of pharmaceuticals in Denmark [3].
- **Dispensing group »A«** can only be dispensed once per prescription but can be divided into multiple dispensations in smaller package sizes until the number of tablets/capsules etc. prescribed on the prescription is reached [3].
- **Dispensing group »B«** can only be dispensed once per prescription unless the physician prescribes refills on the prescription with time interval between refills [3].
- **Dispensing group »HA«** and **»HF«** are pharmaceuticals which do not need a prescription, but dispensing group **»HA«** can only be sold at the pharmacies [3].
- **Dispensing group »NB-S«** can only be dispensed to hospitals or to a patient if prescribed by a medical specialist approved by the Danish Medicine Agency. For each pharmaceutical in this dispensing group, the Danish Medicine Agency decides which medical specialists can prescribe the pharmaceutical [3].





Appendix C – The online questionnaire used in the study used in the study “Unavailable Prescriptions at Danish Community Pharmacies: a study of occurrence and underlying reasons” (in Danish)

30/4/2018Forekomsten af manglende recepter på danske apoteker

Ændre skriftstørrelsen: [ikon] [ikon]

Forekomsten af manglende recepter på danske apoteker

Venligst udfyld nedenstående spørgeskema.

På forhånd tak!

Hvad er årsagen til, at recepten mangler?

☐ Kunden har haft kontakt til LÆGE og forventede en ny recept på receptserveren, men der er ingen ny recept
☐ Kunden har haft kontakt til LÆGESEKRETÆR og forventede en ny recept på receptserveren, men der er ingen ny recept
☐ Der er ikke flere udleveringer på recepten
☐ Recepten er udløbet, dvs. den er over 2 år gammel
☐ Anden årsag

nulstil

Tilhører den manglende recept et præparat i fast behandling?

☐ Ja ☐ Nej

nulstil

Skriv navnet på det lægemiddel, som kunden mener at mangle recept på (vælg lægemidlet på listen).

Hvis ikke lægemidlet er en valgmulighed. Vælg feltet "Andet" og skriv selv lægemiddelnavnet.

Hvis kunden ikke ved hvilket lægemiddel der mangler recept på, vælg da "Ved ikke" på listen

Hvem rekvirerer en ny recept?

☐ Apoteket
☐ Kunden kontakter lægen nu
☐ Kunden kontakter lægen senere
☐ Kunden afventer og ser om recepten kommer senere
☐ Ved ikke

nulstil

30/4/2018Forekomsten af manglende recepter på danske apoteker

Vælg Apotek

☐ København Sønderbro Apotek
☐ Otterup Apotek
☐ Sønderø Apotek
☐ Frederikssund Apotek
☐ Bolbro Apotek
☐ Tarup Apotek
☐ Korup Apotek
☐ Odense Ørnen Apotek
☐ Nørresundby Apotek
☐ Vejen Apotek
☐ Egtved Apotek
☐ Viborg Løve Apotek
☐ Grenaa Apotek
☐ Aalborg Løve Apotek
☐ Vojens Apotek
☐ Lindholm Apotek
☐ Solsidens Apotek
☐ Vodskov Apotek
☐ Albertslund Apotek
☐ Vallensbæk Apotek
☐ Friheden Apotek
☐ Brøndby Strand Apotek
☐ Apoteket Frihedens Butikcenter
☐ Hvidovre Stationsapotek

nulstil

indsend



Appendix D – The online questionnaire used in the study “Unavailable Prescriptions at Danish Community Pharmacies: a study of occurrence and underlying reasons” with explanation (in Danish)

30/4/2018 Forekomsten af manglende recepter på danske apoteker /Endre skriftstørrelsen: 1 1

Forekomsten af manglende recepter på danske apoteker

Venligst udfyld nedenstående spørgeskema.
På forhånd tak!

Hvad er årsagen til, at recepten mangler?

- ☐ Kunden har haft kontakt til LÆGE og forventede en ny recept på receptserveren, men der er ingen ny recept
- ☐ Kunden har haft kontakt til LÆGESEKRETÆR og forventede en ny recept på receptserveren, men der er ingen ny recept
- ☐ Der er ikke flere udleveringer på recepten
- ☐ Recepten er udløbet, dvs. den er over 2 år gammel
- ☐ Anden årsag

nulstil

Spørgsmålet om "Hvor meget medicin kunden havde tilbage i hjemmet" skulle kun udfyldes hvis svaret var ja til at præparatet var i fast behandling.

Tilhører den manglende recept et præparat i fast behandling? ☒ Ja ☐ Nej nulstil

Hvor meget medicin har kunden tilbage i hjemmet?

- ☐ Kunden har ikke mere medicin
- ☐ Kunden har medicin til 1 dag
- ☐ Kunden har medicin til 2 dage
- ☐ Kunden har medicin til mere end 2 dage
- ☐ Ved ikke

nulstil

Skriv navnet på det lægemiddel, som kunden mener at mangle recept på (vælg lægemidlet på listen).

Hvis ikke lægemidlet er en valgmulighed. Vælg feltet "Andet" og skriv selv lægemiddelnavnet.

Hvis kunden ikke ved hvilket lægemiddel der mangler recept på, vælg da "Ved ikke" på listen

<https://open.syd.dk/redcap/survey/?n=CAJJJEJKA> 1/3

30/4/2018 Forekomsten af manglende recepter på danske apoteker

Hvem rekvirerer en ny recept?

- ☒ Apoteket
- ☒ Kunden kontakter lægen nu
- ☒ Kunden kontakter lægen senere
- ☐ Kunden afventer og ser om recepten kommer senere
- ☐ Ved ikke

nulstil

Hvis det var svaret var et af de 3 markeret med en rød prik skulle følgende 2 spørgsmål besvares i spørgeskemaet

Hvilken læge kontaktes angående receptfornyelse?

- ☐ Kundens egen praktiserende læge
- ☐ Speciallæge
- ☐ Sygehus
- ☐ Vagtlæge
- ☐ Anden læge
- ☐ Ved ikke

nulstil

Kan lægen kontaktes nu?

- ☐ Ja
- ☐ Nej
- ☐ Ved ikke

(Dvs. har lægen/sygehuset åbent nu så kunden/apoteket kan få fat i ham/hende)

nulstil

Hvor meget tid har du brugt på kunden med den manglende recept? (angiv helt tal i minutter)

tidsforbrug i minutter

<https://open.syd.dk/redcap/survey/?n=CAJJJEJKA> 2/3

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30/4/2018 Forekomsten af manglende recepter på danske apoteker

Vælg Apotek

- ☐ København Sønderbro Apotek
- ☐ Otterup Apotek
- ☐ Sønderø Apotek
- ☐ Frederikssund Apotek
- ☐ Bolbro Apotek
- ☐ Tarup Apotek
- ☐ Korup Apotek
- ☐ Odense Ørnen Apotek
- ☐ Nørresundby Apotek
- ☐ Vejen Apotek
- ☐ Egtved Apotek
- ☐ Viborg Løve Apotek
- ☐ Grenaa Apotek
- ☐ Aalborg Løve Apotek
- ☐ Vojens Apotek
- ☐ Lindholm Apotek
- ☐ Solsidens Apotek
- ☐ Vødskov Apotek
- ☐ Albertslund Apotek
- ☐ Vallensbæk Apotek
- ☐ Friheden Apotek
- ☐ Brøndby Strand Apotek
- ☐ Apoteket Frihedens Butikcenter
- ☐ Hvidovre Stationsapotek

nulstil

indsend



Appendix E – Additional Tables with distributions of data from the study “Unavailable Prescriptions at Danish Community Pharmacies: a study of occurrence and underlying reasons”

Table 2: Distribution of the unavailable prescriptions (UPs) for how many pharmaceuticals the patient had left in their medication stock and who requested a new prescription). The risk medications are defined by Pro.medicin.dk, which is a Danish database for health professionals which contains information about pharmaceuticals. The risk medication is selected based at the registered unintended events regarding the pharmaceuticals [5]. The percentage in the table was rounded to the nearest whole number and therefore the percentages will not necessarily add up to 100%.

		All registrations n =2765 (%)	Regular pharmaceuticals for a chronic condition n =1882 (%)	Regular pharmaceuticals for a chronic condition, excluding risk medication n = 1352 (%)	Potential Medication for Dependent Pharmacist prescribing n = 207
The patients' personal medication stock of the requested pharmaceutical	Who requested a new prescription				
The patient had no more of the medication left		n = 526 (19)	n = 526 (28)	n = 526 (28)	n = 73 (35)
	The pharmacy	47 (9)	47 (9)	47 (9)	4 (6)
	The patient contacts the doctor immediately at the community pharmacy	177 (34)	177 (34)	177 (34)	19 (26)
	The patient will contact the doctor later	225 (43)	225 (43)	225 (43)	40 (55)
	The patient is waiting to see if	57 (11)	57 (11)	57 (11)	5 (7)

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	the prescription will be available later				
	The patient did not know or the pharmacy staff forgot to ask	17 (3)	17 (3)	17 (3)	5 (7)
	The field was empty	3 (1)	3 (1)	3 (1)	0 (0)
The patient had medication left for 1 day		n =138 (5)	n =138 (7)	n =138 (7)	n = 22 (11)
	The pharmacy	6 (4)	6 (4)	6 (4)	0 (0)
	The patient contacts the doctor immediately at the community pharmacy	30 (22)	30 (22)	30 (22)	3 (14)
	The patient will contact the doctor later	70 (51)	70 (51)	70 (51)	17 (77)
	The patient is waiting to see if the prescription will be available later	26 (19)	26 (19)	26 (19)	1 (5)
	The patient did not know or the pharmacy staff forgot to ask	5 (4)	5 (4)	5 (4)	1 (5)
	The field was empty	1 (1)	1 (1)	1 (1)	0 (0)



Table 3: Distribution of the Unavailable Prescriptions (UPs) in Danish dispensing groups (Appendix A), additionally divided into ATC groups and active ingredients. The risk medications are defined by Pro.medicin.dk, which is a Danish database for health professionals and contains information about pharmaceuticals. The risk medication is selected based at the registered unintended events regarding the pharmaceuticals [4] The percentage in the table was rounded to the nearest whole number and therefore the percentage will not necessarily add up to 100%.

			All registrations n =2765 (%)	Regular pharmaceuticals for a chronic condition n =1882 (%)	Regular pharmaceuticals for a chronic condition excluding risk medication n = 1352 (%)	Regular pharmaceuticals for a chronic condition, excluding risk medication and outside the GP's opening hours (4 pm to 8 am) n = 323 (%) <i>Potential Medication for Dependent Pharmacist prescribing</i> n = 207 (%)
Dispensing group	ATC group	Active ingredient	Number of records	Number of records	Number of records	Number of records
AP4	N - Nervous system		n = 104 (4)	n = 75 (4)	n = 22 (2)	n = 7 (2)
			n = 88 (85)	n = 70 (93)	n = 17 (77)	n = 5 (71)
		Buprenorphine	3 (3)	3 (4)	0 (0)	0 (0)
		Fentanyl	2 (2)	2 (3)	0 (0)	0 (0)
		Ketobemidone and antispasmodics	1 (1)	1 (1)	0 (0)	0 (0)
		Lisdexamfetamine	1 (1)	1 (1)	1 (6)	0 (0)
		Methadone	3 (3)	3 (4)	0 (0)	0 (0)
		Methylphenidate	17 (19)	16 (23)	16 (94)	5 (100)
		Morphine	20 (23)	12 (17)	0 (0)	0 (0)
		Oxycodone	8 (9)	7 (10)	0 (0)	0 (0)
		Tramadol	33 (38)	25 (36)	0 (0)	0 (0)
	R - Respiratory system		n = 16 (15)	n = 5 (7)	n = 5 (23)	n = 2 (29)
		Codeine	7 (44)	5 (100)	5 (100)	2 (100)
		Opium derivatives and expectorants	9 (56)	0 (0)	0 (0)	0 (0)
A			n = 53 (2)	n = 38 (2)	n = 31 (2)	n = 9 (3)
	L - Antineoplastic and		n = 5 (9)	n = 4 (11)	n =1 (3)	n =1 (11)

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	immunomodulating agents	Azathioprine	1 (20)	1 (25)	1 (100)	1 (100)
		Methotrexate	4 (80)	3 (75)	0 (0)	0 (0)
	N - Nervous system		n = 48 (91)	n = 34 (89)	n = 30 (97)	n = 8 (89)
		Alprazolam	4 (8)	4 (12)	4 (13)	1 (13)
		Bromazepam	2 (3)	1 (3)	1 (3)	1 (13)
		Chlordiazepoxide	1 (2)	1 (3)	1 (3)	1 (13)
		Diazepam	7 (15)	3 (9)	3 (10)	0 (0)
		Donepezil	4 (8)	4 (12)	0 (0)	0 (0)
		Lorazepam	1 (1)	1 (3)	1 (3)	0 (0)
		Melatonin	3 (6)	2 (6)	2 (7)	0 (0)
		Oxazepam	7 (15)	5 (15)	5 (17)	1 (13)
		Zolpidem	5 (10)	3 (9)	3 (10)	1 (13)
		Zopiclone	14 (29)	10 (29)	10 (33)	3 (38)
B			n = 1675 (61)	n = 1307 (69)	n = 852 (63)	n = 207 (64)
	A - Alimentary tract and metabolism		n = 160 (10)	n = 152 (12)	n = 78 (9)	n = 16 (8)
		Esomeprazole	5 (3)	5 (3)	5 (6)	0 (0)
		Glimepiride	5 (3)	5 (3)	5 (6)	0 (0)
		Insulin (human)	5 (3)	5 (3)	0 (0)	0 (0)
		Insulin aspart	12 (8)	12 (8)	0 (0)	0 (0)
		Insulin degludec	3 (2)	3 (2)	0 (0)	0 (0)
		Insulin glargine	4 (3)	4 (3)	0 (0)	0 (0)
		Insulin glulisine	1 (1)	1 (1)	0 (0)	0 (0)
		Lansoprazole	11 (7)	10 (7)	10 (13)	3 (19)
		Linagliptin	1 (1)	1 (1)	1 (1)	0 (0)
		Liraglutide	4 (3)	4 (3)	4 (5)	0 (0)
		Mesalazine	2 (1)	2 (1)	2 (3)	0 (0)
		Metformin	50 (31)	49 (32)	0 (0)	0 (0)
		Omeprazole	9 (6)	9 (6)	9 (12)	2 (13)
		Pantoprazole	40 (25)	34 (22)	34 (44)	11 (69)
		Repaglinide	1 (1)	1 (1)	1 (1)	0 (0)
		Sitagliptin	3 (2)	3 (2)	3 (4)	0 (0)
		Sulfasalazine	2 (1)	2 (1)	2 (3)	0 (0)

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		Vildagliptin	2 (1)	2 (1)	2 (3)	0 (0)
B - Blood and blood-forming organs			n = 111 (8)	n = 105 (8)	n = 11 (1)	n = 2 (1)
		Acetylsalicylic acid	37 (33)	35 (33)	0 (0)	0 (0)
		Apixaban	11 (10)	11 (10)	0 (0)	0 (0)
		Clopidogrel	16 (14)	16 (15)	0 (0)	0 (0)
		Cyanocobalamin	6 (5)	5 (5)	5 (46)	0 (0)
		Dabigatran etexilate	4 (4)	4 (4)	0 (0)	0 (0)
		Dipyridamole	4 (4)	3 (3)	3 (27)	1 (50)
		Folic acid	1 (1)	1 (1)	0 (0)	0 (0)
		Hydroxocobalamin	4 (4)	3 (3)	3 (27)	1 (50)
		Rivaroxaban	3 (3)	3 (3)	0 (0)	0 (0)
		Ticagrelor	4 (4)	4 (4)	0 (0)	0 (0)
		Warfarin	21 (19)	20 (19)	0 (0)	0 (0)
C - Cardiovascular system			n = 432 (26)	n = 407 (31)	n = 303 (36)	n = 62 (30)
		Amlodipine	57 (13)	57 (14)	57 (19)	10 (16)
		Atenolol	2 (1)	2 (0)	2 (0)	0 (0)
		Atorvastatin	45 (10)	43 (11)	43 (14)	14 (23)
		Bendroflumethiazide and potassium	41 (10)	40 (10)	40 (13)	4 (7)
		Bisoprolol	9 (2)	9 (2)	9 (3)	2 (3)
		Candesartan	4 (1)	3 (1)	3 (1)	0 (0)
		Carvedilol	5 (1)	5 (1)	5 (2)	2 (3)
		Digoxin	1 (0)	1 (0)	0 (0)	0 (0)
		Diltiazem	1 (0)	1 (0)	1 (0)	0 (0)
		Doxazosin	1 (0)	1 (0)	1 (0)	0 (0)
		Enalapril	33 (8)	33 (8)	33 (11)	10 (16)
		Eplerenone	2 (1)	1 (0)	1 (0)	0 (0)
		Felodipine	4 (1)	4 (1)	4 (1)	1 (2)
		Fluocortolone	11 (3)	3 (1)	3 (1)	1 (2)
		Furosemide	22 (5)	20 (5)	20 (7)	4 (7)
		Hydrocortisone	4 (1)	0 (0)	0 (0)	0 (0)
		Lercanidipine	5 (1)	5 (1)	5 (2)	1 (2)

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		Lisinopril	3 (1)	3 (1)	3 (1)	1 (2)
		Losartan	43 (10)	42 (10)	42 (14)	7 (11)
		Metoprolol	39 (9)	36 (9)	0 (0)	0 (0)
		Nebivolol	1 (0)	1 (0)	1 (0)	0 (0)
		Nifedipine	1 (0)	1 (0)	1 (0)	0 (0)
		Perindopril	2 (1)	2 (1)	2 (1)	1 (2)
		Pravastatin	2 (1)	1 (0)	1 (0)	0 (0)
		Propranolol	3 (1)	3 (1)	3 (1)	2 (3)
		Ramipril	23 (5)	22 (5)	0 (0)	0 (0)
		Rosuvastatin	9 (2)	9 (2)	9 (3)	1 (2)
		Simvastatin	45 (10)	45 (11)	0 (0)	0 (0)
		Spironolactone	9 (2)	9 (2)	9 (3)	0 (0)
		Trandolapril	3 (1)	3 (1)	3 (1)	1 (2)
		Verapamil	2 (1)	2 (1)	2 (1)	0 (0)
	D - Dermatologicals		n = 54 (3)	n = 23 (2)	n = 23 (3)	n = 6 (3)
		Betamethasone	6 (11)	5 (22)	5 (22)	2 (33)
		Clindamycin and Benzoyl Peroxide	1 (2)	1 (4)	1 (4)	0 (0)
		Clobetasol	4 (7)	2 (9)	2 (9)	1 (17)
		Econazole and Triamcinolonacetone	1 (2)			
		Fusidic acid	3 (6)	1 (4)	1 (4)	1 (17)
		Hydrocortisone butyrate	23 (43)	7 (30)	7 (30)	1 (17)
		Hydrocortisone and miconazole	5 (9)	1 (4)	1 (4)	0 (0)
		Ketoconazole	4 (7)	3 (13)	3 (13)	1 (17)
		Mometasone	7 (13)	3 (13)	3 (13)	0 (0)
	G – Genito-urinary system and sex hormones		n = 134 (8)	n = 126 (10)	n = 126 (15)	n = 36 (17)
		Alfuzosin	3 (2)	3 (2)	3 (2)	1 (3)
		Desogestrel	7 (5)	7 (6)	7 (6)	3 (8)
		Desogestrel and ethinylestradiol	1 (1)	1 (1)	1 (1)	0 (0)

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		Drospirenone and ethinylestradiol	3 (2)	3 (2)	3 (2)	3 (2)
		Dutasteride	1 (1)	1 (1)	1 (1)	0 (0)
		Estradiol	29 (22)	29 (23)	29 (23)	6 (17)
		Finasteride	2 (2)	2 (2)	2 (2)	0 (0)
		Levonorgestrel and ethinylestradiol	56 (42)	53 (42)	53 (42)	19 (53)
		Medroxyprogesterone	1 (1)	1 (1)	1 (1)	0 (0)
		Mirabegron	3 (2)	3 (2)	3 (2)	0 (0)
		Norethisterone	4 (3)	4 (3)	4 (3)	2 (6)
		Norgestimate and ethinylestradiol	5 (4)	5 (4)	5 (4)	0 (0)
		Sildenafil	6 (5)	4 (3)	4 (3)	1 (3)
		Solifenacin	1 (1)	1 (1)	1 (1)	1 (3)
		Tadalafil	2 (2)	0 (0)	0 (0)	0 (0)
		Tamsulosin	7 (5)	6 (5)	6 (5)	3 (8)
		Terazosin	1 (1)	1 (1)	1 (1)	0 (0)
		Tolterodine	2 (2)	2 (2)	2 (2)	0 (0)
	H - Systemic hormonal preparations		n = 61 (4)	n = 49 (4)	n = 31 (4)	n = 7 (3)
		Levothyroxine sodium	30 (49)	30 (61)	30 (97)	7 (100)
		Prednisolone	28 (46)	17 (35)	0 (0)	0 (0)
		Prednisone	1 (2)	1 (2)	1 (3)	0 (0)
		Thiamazole	1 (2)	1 (2)	0 (0)	0 (0)
		Triamcinolone	1 (2)	0 (0)	0 (0)	0 (0)
	J - General anti-infectives for systemic use		n = 188 (11)	n = 20 (2)	n = 16 (2)	n = 2 (1)
		Aciclovir	16 (40)	8 (40)	8 (50)	2 (100)
		Amoxicillin	9 (5)	2 (5)	0 (0)	0 (0)
		Amoxicillin and enzyme inhibitor	2 (1)	0 (0)	0 (0)	0 (0)
		Ampicillin	1 (1)	0 (0)	0 (0)	0 (0)
		Azithromycin	8 (4)	0 (0)	0 (0)	0 (0)
		Ciprofloxacin	4 (2)	3 (15)	3 (19)	0 (0)

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		Clarithromycin	2 (1)	0 (0)	0 (0)	0 (0)
		Dicloxacillin	9 (5)	0 (0)	0 (0)	0 (0)
		Erythromycin	1 (1)	0 (0)	0 (0)	0 (0)
		Fluconazole	5 (3)	0 (0)	0 (0)	0 (0)
		Lymecycline	2 (1)	2 (10)	2 (13)	0 (0)
		Nitrofurantoin	1 (1)	0 (0)	0 (0)	0 (0)
		Phenoxymethylpenicillin	74 (39)	1 (5)	0 (0)	0 (0)
		Pivmecillinam	43 (23)	0 (0)	0 (0)	0 (0)
		Roxithromycin	2 (1)	0 (0)	0 (0)	0 (0)
		Sulfamethizole	4 (2)	0 (0)	0 (0)	0 (0)
		Tetracycline	1 (1)	0 (0)	0 (0)	0 (0)
		Trimethoprim	3 (2)	0 (0)	0 (0)	0 (0)
		Valaciclovir	1 (1)	1 (5)	0 (0)	0 (0)
	M - Musculo-skeletal system		n = 99 (6)	n = 70 (5)	n= 32 (4)	n= 8 (4)
		Alendronic acid	21 (21)	21 (30)	21 (66)	5 (63)
		Allopurinol	5 (5)	5 (7)	5 (16)	1 (13)
		Baclofen	2 (2)	2 (3)	2 (6)	0 (0)
		Chlorzoxazone	3 (3)	1 (1)	1 (3)	1 (13)
		Dexibuprofen	2 (2)	2 (3)	0 (0)	0 (0)
		Diclofenac	4 (4)	3 (4)	0 (0)	0 (0)
		Etodolac	3 (3)	1 (1)	0 (0)	0 (0)
		Febuxostat	1 (1)	1 (1)	1 (3)	0 (0)
		Ibandronic acid	1 (1)	1 (1)	1 (3)	0 (0)
		Ibuprofen	49 (49)	27 (39)	0 (0)	0 (0)
		Ketorolac	1 (1)	1 (1)	1 (3)	1 (13)
		Naproxen	7 (7)	5 (7)	0 (0)	0 (0)
	N - Nervous system		n = 263 (16)	n = 231 (18)	n= 108 (13)	n= 40 (19)
		Amitriptyline	4 (2)	3 (1)	3 (3)	1 (3)
		Atomoxetine	7 (3)	6 (3)	6 (6)	4 (10)
		Citalopram	15 (6)	13 (6)	13 (12)	5 (13)

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		Clomipramine	2 (1)	2 (1)	2 (2)	1 (3)
		Duloxetine	11 (4)	10 (4)	10 (9)	1 (3)
		Eletriptan	1 (0)	1 (0)	1 (1)	1 (3)
		Escitalopram	7 (3)	6 (3)	6 (6)	0 (0)
		Fluoxetine	1 (0)	1 (0)	1 (1)	0 (0)
		Gabapentin	14 (5)	13 (6)	0 (0)	0 (0)
		Imipramine	2 (1)	2 (1)	2 (2)	0 (0)
		Lamotrigine	13 (5)	13 (6)	0 (0)	0 (0)
		Levetiracetam	2 (1)	2 (1)	2 (2)	1 (3)
		Levodopa and decarboxylase inhibitor	8 (3)	7 (3)	7 (6)	3 (8)
		Levodopa, decarboxylase inhibitor and COMT inhibitor	2 (1)	2 (1)	2 (2)	1 (3)
		Lithium	2 (1)	2 (1)	2 (2)	0 (0)
		Mirtazapine	7 (3)	7 (3)	7 (6)	5 (13)
		Nortriptyline	1 (0)	1 (0)	1 (1)	0 (0)
		Olanzapine	1 (0)	1 (0)	1 (1)	0 (0)
		Oxcarbazepine	1 (0)	1 (0)	0 (0)	0 (0)
		Paracetamol	94 (36)	73 (32)	0 (0)	0 (0)
		Paroxetine	1 (0)	1 (0)	1 (1)	0 (0)
		Perphenazine	1 (0)	1 (0)	1 (1)	0 (0)
		Pramipexole	5 (2)	5 (2)	0 (0)	0 (0)
		Pregabalin	4 (2)	3 (1)	3 (3)	2 (5)
		Quetiapine	16 (6)	16 (7)	0 (0)	0 (0)
		Sertraline	22 (8)	22 (10)	22 (20)	8 (20)
		Sumatriptan	7 (3)	5 (2)	5 (5)	2 (5)
		Valproic acid	3 (1)	3 (1)	3 (3)	1 (3)
		Venlafaxine	8 (3)	8 (4)	8 (7)	4 (10)
		Vortioxetine	1 (0)	1 (0)	1 (1)	0 (0)
	P – Antiparasitic products		n = 8 (1)	n = 0 (0)	n = 0 (0)	n = 0 (0)
		Mebendazole	6 (75)	0 (0)	0 (0)	0 (0)

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		Metronidazole	2 (25)	0 (0)	0 (0)	0 (0)
R - Respiratory system			n = 120 (7)	n = 105 (8)	n = 105 (12)	n = 23 (11)
		Budesonide	6 (5)	6 (6)	6 (6)	1 (4)
		Desloratadine	3 (3)	2 (2)	2 (2)	2 (9)
		Fexofenadine	2 (2)	2 (2)	2 (2)	1 (4)
		Fluticasone	12 (11)	12 (11)	12 (11)	3 (13)
		Fluticasone furoate	4 (3)	4 (4)	4 (4)	0 (0)
		Fluticasone and Azelastine	3 (3)	2 (2)	2 (2)	0 (0)
		Formoterol	4 (3)	4 (4)	4 (4)	3 (13)
		Indacaterol	1 (1)	1 (1)	1 (1)	0 (0)
		Mometasone	10 (8)	7 (7)	7 (7)	0 (0)
		Montelukast	2 (2)	2 (2)	2 (2)	1 (4)
		Olodaterol	2 (2)	1 (1)	1 (1)	0 (0)
		Promethazine	6 (5)	6 (6)	6 (6)	0 (0)
		Salbutamol	22 (18)	18 (17)	18 (17)	4 (17)
		Salmeterol	3 (3)	3 (3)	3 (3)	0 (0)
		Terbutaline	26 (21)	22 (21)	22 (21)	6 (26)
		Tiotropium bromide	13 (11)	13 (12)	13 (12)	2 (9)
S - Sensory organs			n = 45 (3)	n = 19 (2)	n = 19 (2)	n = 5 (2)
		Chloramphenicol	17 (38)	3 (16)	3 (16)	1 (20)
		Dexamethasone	2 (4)	0 (0)	0 (0)	0 (0)
		Fusidic acid	8 (18)	0 (0)	0 (0)	0 (0)
		Latanoprost	3 (7)	3 (16)	3 (16)	1 (20)
		Olopatadine	3 (7)	3 (16)	3 (16)	1 (20)
		Prednisolone	1 (2)	1 (5)	1 (5)	0 (0)
		Tafluprost	1 (2)	1 (5)	1 (5)	1 (20)
		Timolol and Bimatoprost	1 (2)	1 (5)	1 (5)	0 (0)
		Timolol and Dorzolamide	2 (1)	1 (5)	1 (5)	0 (0)
		Timolol and Latanoprost	4 (9)	4 (21)	4 (21)	1 (20)

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		Timolol and Tafluprost	1 (2)	1 (5)	1 (5)	0 (0)
		Tobramycin	1 (2)	0 (0)	0 (0)	0 (0)
		Travoprost	1 (2)	1 (5)	1 (5)	1 (5)
HA	A - Alimentary tract and metabolism		n = 23 (1)	n = 20 (1)	n = 5 (0)	n = 0 (0)
			n = 17 (74)	n = 15 (75)	n = 0 (0)	n = 0 (0)
		Potassium chloride	17 (100)	15 (100)	0 (0)	0 (0)
	B - Blood and blood-forming organs		n = 1 (4)	n = 1 (5)	n = 1 (20)	n = 0 (0)
		Ferrous sulphate	1 (100)	1 (100)	1 (100)	0 (0)
	C - Cardiovascular system		n = 5 (22)	n = 4 (20)	n = 4 (80)	n = 0 (0)
Isosorbide mononitrate		5 (100)	4 (100)	4 (100)	4 (100)	
HF			n = 21 (1)	n = 14 (1)	n = 14 (1)	n = 2 (1)
	A - Alimentary tract and metabolism		n = 6 (29)	n = 3 (21)	n = 3 (21)	n = 1 (50)
		Macrogol, combinations	5 (83)	3 (100)	3 (100)	1 (100)
		Sodium picosulfate	1 (17)	0 (0)	0 (0)	0 (0)
	G – Genito-urinary system and sex hormones		n = 1 (5)	n = 0 (0)	n = 0 (0)	n = 0 (0)
		Clotrimazole	1 (100)	0 (0)	0 (0)	0 (0)
	P - Antiparasitic products		n = 1 (5)	n = 1 (5)	n = 1 (7)	n = 0 (0)
		Quinine	1 (100)	1 (100)	1 (100)	0 (0)
	R - Respiratory system		n = 5 (24)	n = 4 (29)	n = 4 (29)	n = 1 (50)
		Acrivastine	1 (20)	1 (100)	1 (100)	0 (0)
		Cetirizine	2 (40)	2 (50)	2 (50)	0 (0)
		Loratadine	2 (40)	2 (50)	2 (50)	1 (100)
	S - Sensory organs		n = 8 (38)	n = 6 (43)	n = 6 (43)	n = 0 (0)
		Artificial tears and other indifferent preparations	5 (63)	4 (66)	4 (66)	0 (0)
		Cromoglicic acid	2 (25)	1 (17)	1 (17)	0 (0)
		Ketotifen	1 (13)	1 (17)	1 (17)	0 (0)
NBS			n = 2 (0)	n = 0 (0)	n = 0 (0)	n = 0 (0)
	G – Genito-urinary system and		n = 2 (0)	n = 0 (0)	n = 0 (0)	n = 0 (0)

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	sex hormones	Choriogonadotropin alfa	1 (50)	0 (0)	0 (0)	0 (0)
		Follitropin alfa	1 (50)	0 (0)	0 (0)	0 (0)
Not known	Not known	Not known	n = 359 (13)	n = 171 (9)	n = 171 (13)	n = 42 (13)
Not registered	Not registered	Not registered	n = 125 (5)	n = 60 (3)	n = 60 (4)	n = 9 (3)
Other	Other	Other	n = 403 (15)	n = 197 (11)	n = 197 (15)	n = 47 (15)





Appendix F – Screenshots of the literature search on the databases PubMed and Embase

A screenshot of the literature search on the database PubMed:

The search included the filters (Publication dates: 5 years and Languages: English)

History [Download history](#) [Clear history](#)

Search	Add to builder	Query	Items found	Time
#14	Add	Search (((Guideline* OR Protocol* OR Recommendation*)) OR ("Guideline" [Publication Type] OR "Practice Guideline" [Publication Type] OR "Health Planning Guidelines"[Mesh] OR "Guidelines as Topic"[Mesh] OR "Guideline Adherence"[Mesh])) AND (((Prescribing Pharmacist" OR "Prescribing pharma*") OR ("independent prescribing" OR "Dependent prescribing*")) Filters: published in the last 5 years; English	438	06:22:48
#13	Add	Search (((Guideline* OR Protocol* OR Recommendation*)) OR ("Guideline" [Publication Type] OR "Practice Guideline" [Publication Type] OR "Health Planning Guidelines"[Mesh] OR "Guidelines as Topic"[Mesh] OR "Guideline Adherence"[Mesh])) AND (((Prescribing Pharmacist" OR "Prescribing pharma*") OR ("independent prescribing" OR "Dependent prescribing*")) Filters: published in the last 10 years; English	674	06:22:08
#12	Add	Search (((Guideline* OR Protocol* OR Recommendation*)) OR ("Guideline" [Publication Type] OR "Practice Guideline" [Publication Type] OR "Health Planning Guidelines"[Mesh] OR "Guidelines as Topic"[Mesh] OR "Guideline Adherence"[Mesh])) AND (((Prescribing Pharmacist" OR "Prescribing pharma*") OR ("independent prescribing" OR "Dependent prescribing*")) Filters: English	1036	06:21:56
#11	Add	Search (((Guideline* OR Protocol* OR Recommendation*)) OR ("Guideline" [Publication Type] OR "Practice Guideline" [Publication Type] OR "Health Planning Guidelines"[Mesh] OR "Guidelines as Topic"[Mesh] OR "Guideline Adherence"[Mesh])) AND (((Prescribing Pharmacist" OR "Prescribing pharma*") OR ("independent prescribing" OR "Dependent prescribing*"))	1093	06:21:22
#10	Add	Search ((Guideline* OR Protocol* OR Recommendation*)) OR ("Guideline" [Publication Type] OR "Practice Guideline" [Publication Type] OR "Health Planning Guidelines"[Mesh] OR "Guidelines as Topic"[Mesh] OR "Guideline Adherence"[Mesh])	1002659	06:21:04
#9	Add	Search (("Prescribing Pharmacist" OR "Prescribing pharma*") OR ("independent prescribing" OR "Dependent prescribing*"))	4701	06:20:42
#8	Add	Search Guideline* OR Protocol* OR Recommendation*	999831	06:20:03
#7	Add	Search "Guideline" [Publication Type] OR "Practice Guideline" [Publication Type] OR "Health Planning Guidelines"[Mesh] OR "Guidelines as Topic"[Mesh] OR "Guideline Adherence"[Mesh]	188739	06:19:09
#6	Add	Search "Guideline" [Publication Type] OR "Practice Guideline" [Publication Type] OR "Health Planning Guidelines"[Mesh] AND "Guidelines as Topic"[Mesh] AND "Guideline Adherence"[Mesh]	89	06:18:39
#5	Add	Search "Guideline" [Publication Type] AND "Practice Guideline" [Publication Type] AND "Health Planning Guidelines"[Mesh] AND "Guidelines as Topic"[Mesh] AND "Guideline Adherence"[Mesh] Schema: all	0	06:18:20
#4	Add	Search "Guideline" [Publication Type] AND "Practice Guideline" [Publication Type] AND "Health Planning Guidelines"[Mesh] AND "Guidelines as Topic"[Mesh] AND "Guideline Adherence"[Mesh]	0	06:18:19
#2	Add	Search "independent prescribing" OR "Dependent prescribing"	774	06:16:18
#1	Add	Search "Prescribing Pharmacist" OR "Prescribing pharma"	4009	06:15:26

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A screenshot of the literature search on the database Embase:

▼ Search History (8)					View Saved	
<input type="checkbox"/>	# ▲	Searches	Results	Type	Actions	Annotations
<input type="checkbox"/>	1	guideline.mp. or exp practice guideline/	476346	Advanced	Display Results More ▼	
<input type="checkbox"/>	2	(guideline* or Protocol*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word]	1131834	Advanced	Display Results More ▼	
<input type="checkbox"/>	3	("Independent Prescriber" or "Dependent Prescriber").mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word]	57	Advanced	Display Results More ▼	
<input type="checkbox"/>	4	("Prescribing Pharmacist" or "Prescribing pharma").mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word]	178	Advanced	Display Results More ▼	
<input type="checkbox"/>	5	("Independent prescribing" or "Dependent prescribing").mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word]	175	Advanced	Display Results More ▼	
<input type="checkbox"/>	6	4 or 5	333	Advanced	Display Results More ▼	
<input type="checkbox"/>	7	1 or 2	1156952	Advanced	Display Results More ▼	
<input type="checkbox"/>	8	6 and 7	59	Advanced	Display Results More ▼	

Combine with:



Appendix G – Checklist for the protocol for Dependent Pharmacist Repeat Prescribing in Danish community pharmacies, “Development of a protocol for Dependent Pharmacist Repeat Prescribing for patients with unavailable prescriptions at Danish community pharmacies”

The Pharmacist authorised to Dependent Repeat Prescribe has to be a certified medication reviewer (a certificate is valid 3 years) [10]

Checklist for whether the patient with an unavailable prescription is in the target patient group for the protocol

- ☐ Regular pharmaceutical for a chronic condition
- ☐ The pharmaceutical belongs to the Danish dispensing group B [3]
- ☐ The patient is at the community pharmacy in the time period 4 pm to 8 am, or when the general practitioner's office is closed

Information about the patient:

CPR number:

Name:

Address:

Telephone number:



Checklist before prescribing

- ☐ The patient signs their consent, which is the permission to log on to the patient's personal medication card (FMK). The signed consent has to be attached.

The pharmacist logs on to the patient's FMK and controls:

The pharmaceutical

- ☐ The requested pharmaceutical has to be prescribed without an end date and thereby classify as a regular pharmaceutical for a chronic condition.
- ☐ A refill prescription for the requested pharmaceutical has been prescribed before to the patient by a physician and dispensed at a community pharmacy.
- ☐ The requested pharmaceutical has to be registered in the patient's FMK at least 2 months before the date for the pharmaceutical's repeat-prescribing to ensure that the patient has completed a control check-up at the GP (often one month after starting the treatment).

Compliance – The pharmacist should evaluate if the patient is compliant by checking that:

- ☐ the patient has collected the refill prescriptions for the pharmaceutical according to the prescribed dose in FMK.
- ☐ the prescribed dose on the FMK matches the dose stated by the patient.

Contraindications

- ☐ The patient's FMK should be checked by the pharmacist for contraindications to the requested pharmaceutical.

Guideline – Pharmacist Repeat Prescribing or not

If the pharmaceutical matches without contraindications and the patient is compliant and in the patient target group then the pharmacist either (Mark only one box below with the action taken by the pharmacist):

- ☐ refills the prescribed pharmaceutical with the smallest package size, or
- ☐ advises the patient to consult the attending physician to get a prescription refill



Guideline – Documentation after the patient has left the pharmacy

The pharmacist has to document the pharmacist prescribing and inform the patient's physician about the pharmacist prescribing. The documented information also applies if no pharmacist prescribing prescription is chosen but, in this case, the pharmacist has to inform the physician about the reasons for not prescribing.

This is done by sending a correspondence message to the patient's physician. A correspondence message is a text-based communication standard for secure communication from one journal system to another where the patient identification is automatically applied.

A template correspondence message has to be filled and sent to:

Write the information for the patient's physician:

Name:

Authorisation ID:

Address:

Telephone number:

(Mark only one box below with the action taken by the pharmacist):

- ☐ A correspondence message was sent to the patient's physician because the pharmacist repeat-prescribed
- ☐ A correspondence message was sent to the patient's physician because if the pharmacist did not repeat-prescribe but instead referred the patient to the physician.

The pharmacist has to ensure that the patient cannot go to another pharmacy and obtain another pharmaceutical prescription before consulting the physician by making a note in the patient's FMK.



Appendix H – Co-author declarations for the articles in the thesis

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Medforfattererklæring

Såfremt en videnskabelig artikel, der ønskes bedømt, er udarbejdet i samarbejde med andre forfattere end dig selv, udfærdiges en medforfattererklæring for det pågældende værk.
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Medforfattererklæringen gælder følgende artikel
Unavailable prescriptions at Danish community pharmacies: A study of occurrence and underlying reasons

Artiklens status (sæt kryds)	
1. Artiklen er upubliceret	<input checked="" type="checkbox"/>
2. Artiklen er indsendt til følgende tidsskrift	<input type="checkbox"/>
3. Artiklen er antaget til publicering i tidsskriftet	<input type="checkbox"/>

Omfanget af den studerendes bidrag til artiklen:	
A. Har bidraget til samarbejdet (0-33%)	
B. Har bidraget i væsentlig omfang (34-66%)	
C. Har i alt overvejende grad udført dette arbejde selvstændigt (67-100%)	
Erklæring om de enkelte elementer	
	Omfang (A, B, C)
1. Formulering i idéfasen af den basale videnskabelige problemstilling ud fra teoretiske spørgsmål, der ønskes afklaret, herunder sammenfatning af problemstillingen til spørgsmål, der skønnes at kunne besvares gennem udførelsen af analyser, respektive konkrete forsøg eller undersøgelser	C
2. Planlægning af forsøgene/analyser og udformning af undersøgelsesmetodikken på en sådan måde, at de under punkt 1 stillede spørgsmål med rimelighed kan forventes besvaret, herunder metodevalg og selvstændig metodeudvikling	C
3. Involvering i gennemførelsen af analysearbejdet	C
4. Præsentation, fortolkning og diskussion af de opnåede resultater, som de optræder i artiklen	C

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Medforfattererklæringen gælder følgende artikel	
Development of a protocol for Dependent Pharmaceutical Repeat Prescribing for patients with unavailable prescriptions at Danish community pharmacies	

Artiklens status (sæt kryds)	
1. Artiklen er upubliceret	X
2. Artiklen er indsendt til følgende tidsskrift	
3. Artiklen er antaget til publicering i tidsskriftet	

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B. Har bidraget i væsentlig omfang (34-66%)		
C. Har i alt overvejende grad udført dette arbejde selvstændigt (67-100%)		
Erklæring om de enkelte elementer		Omfang (A, B, C)
1.	Formulering i idéfasen af den basale videnskabelige problemstilling ud fra teoretiske spørgsmål, der ønskes afklaret, herunder sammenfatning af problemstillingen til spørgsmål, der skønnes at kunne besvares gennem udførelsen af analyser, respektive konkrete forsøg eller undersøgelser	C
2.	Planlægning af forsøgene/analyser og udformning af undersøgelsesmetodikken på en sådan måde, at de under punkt 1 stillede spørgsmål med rimelighed kan forventes besvaret, herunder metodevalg og selvstændig metodeudvikling	C
3.	Involvering i gennemførelsen af analysearbejdet	C
4.	Præsentation, fortolkning og diskussion af de opnåede resultater, som de optræder i artiklen	C

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Den studerende	
Dato:	Underskrift:
30/5 2018	