THE ROLE OF THE COMMUNITY PHARMACIST IN FALL PREVENTION

the ups and downs of implementation

MARLE GEMMEKE

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Colophon

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De rol van de openbaar apotheker bij valpreventie:
implementeren met vallen en opstaan
(met een samenvatting in het Nederlands)

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I am always doing that which I cannot do, in order that I may learn how to do it

Pablo Picasso

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Chapter 1

General Introduction

FALL RISK

The number of people aged ≥ 65 years rose from 420 million in 2000 to 720 million in 2020.[1] A longer life brings great opportunities but also challenges, e.g. a growth in age-related diseases and subsequent increase of healthcare needs.[2] One of these is the increasing number of falls worldwide.[3] The number of hospital admissions in emergency departments, due to fall-related serious injuries, increased with 13% percent from 2011 to 2020 in the Netherlands.[4] In 2021, the World Health Organization published a report to support the prevention of falls by practitioners, policymakers, managers, researchers and advocates, because the prediction is that numbers of falls will continue to rise steadily.[3]

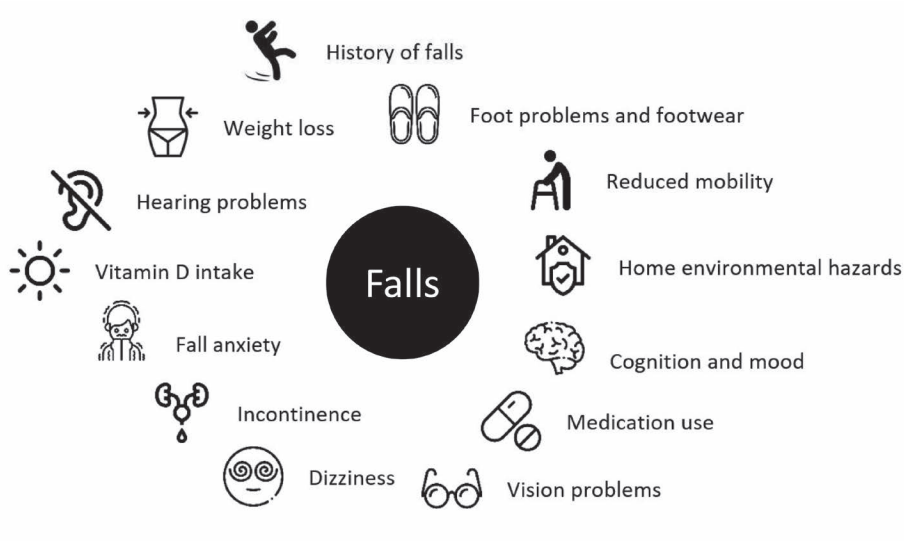

Figure 1. Fall risk factors identified from literature.[5–8]

Falls are often caused by an interaction of multiple risk factors labeled as either intrinsic or extrinsic factors. Intrinsic factors include age, gender, medical conditions, mobility, visual impairment, and medication use, while extrinsic factors include environmental hazards and footwear (Figure 1).[5–8] Falls can lead to injuries and development of fear of falling with both serious consequences, including functional decline, decreased quality of life, loss of independence, social isolation, institutionalization, and death. Furthermore, falls lead to major health care demand and subsequent high medical costs.[8,9]

Due to advanced diagnostics and treatment of medical conditions, more people are diagnosed with long-term conditions, and consequently polypharmacy – defined as routine use of at least five drugs – has increased as well.[10] Advantages of drug use are eminent, e.g. symptom relief and life prolongation, but it is also accompanied by undesirable adverse effects. Risk of adverse drug events is increased in patients who are using a high number of drugs simultaneously.[11] Other factors than polypharmacy that have been associated with advanced age, including frailty and drug metabolism changes, increase the risk of adverse drug effects as well.[12]

As an example, in 2006, the Hospital Admissions Related to Medication (HARM) – study showed 5.6% of all acute admissions in the Netherlands were medication-related and 46% of these were potentially avoidable.[13] Fractures due to medication-related falls were a frequent cause of potentially avoidable events (6.0%) in the HARM-study.[14] In follow-up research, hospital admissions related to fractures, syncope, and dizziness were frequently reported as well and related to the use of medication.[15]

FALL PREVENTION: MODIFICATION OF FALL RISK FACTORS

The strongest predictor for a fall is a previous fall. Other major risk factors include impaired balance and gait, medication use, and environmental hazards.[5–8] Some risk factors are potentially modifiable, e.g. home environments could be adapted, balance trainings could be provided, and medications could be withdrawn.

Fall risk-increasing drugs

Drugs that have been associated with an increased fall risk are called fall risk-increasing drugs (FRIDs).[16–18] The use of polypharmacy – defined as the simultaneous and chronic use of five or more drugs – has also been associated with a higher risk of falls.[19,20] As has been highlighted, the association between polypharmacy and falls is caused by the fact that the use of fall risk-increasing drugs is more common in patients with polypharmacy than in patients without polypharmacy.[20,21]

Among FRIDs, drugs acting on the central nervous system have most prominently been associated with falls.[22,17] Due to the anticholinergic and/or sedative

effects, these drugs may disturb balance by causing prolonged reaction time, sedation, postural hypotension, dizziness, and extrapyramidal side effects.[23] In particular, there is robust evidence for an association with falls and the use of antidepressants and benzodiazepines, because many studies have confirmed this link.[24] Also cardiovascular drugs, such as diuretics, antihypertensives and antiarrhythmics, have been associated with falls, but the association appears less strong.[16,22] However, due to the pharmacological drug mechanism, causing side effects as (orthostatic) hypotension, an association seems plausible.[23] At last, other drugs, e.g. hypoglycaemic agents and urinary antispasmodics, may increase fall risk.[18,25]

Potential inappropriate drug use, including FRID use in patients at risk of falls, is common in elderly, and should be avoided.[11,26] It sounds likely that deprescribing of FRIDs specifically would be effective in reducing falls. A few studies also found that the deprescribing of FRIDs is effective in reducing falls.[27,28] However, the latest insights indicate uncertainties about the effect of deprescribing of FRIDs as standalone intervention.[26,29,30] Therefore, evidence for FRID deprescribing as a standalone intervention to prevent falls is very limited.[27–29,31,32]

Yet, there remain many relevant arguments to deprescribe FRIDs. First, there is excessive evidence for including deprescribing of FRIDs in multiple component interventions targeting diverse fall risk factors.[33–35] Second, deprescribing of drugs reduces the inappropriate medication use among elderly[26], and it might also improve adherence of the drugs that are continued.[36] Third, deprescribing may even slightly decrease mortality.[26] Fourth, deprescribing undoubtedly reduces healthcare costs.[26]

FALL PREVENTION INTERVENTIONS

Two types of fall prevention interventions have often been described in literature: 1) single-target fall prevention interventions, 2) complex interventions, including multiple component fall prevention interventions and multifactorial fall prevention interventions. Interventions that target one risk factor are called single-target fall preventions, interventions that include a fixed set of at least two types of interventions are called multiple component interventions, and interventions are called multifactorial when people receive personalized selections of at least two types of interventions.[35,37]

The effectiveness of fall prevention interventions have been studied in randomized controlled trials. In general, single-target interventions appear less effective compared to complex interventions including multiple components. Only increased exercise has been associated with reduction of falls in a single target intervention.[35,37,38] Studies investigating multiple component and multifactorial interventions included combinations of fall risk assessment, exercise, medication review, psychological interventions, and home modification, as interventions. Multiple systematic reviews and meta-analyses have confirmed the effectiveness of these multiple component and multifactorial fall prevention interventions.[33,35,37–39] Therefore, due to the multicausality of falls, the key to prevention is a multidisciplinary and/or patient-centered approach, ensuring that all risk factors are targeted.[40]

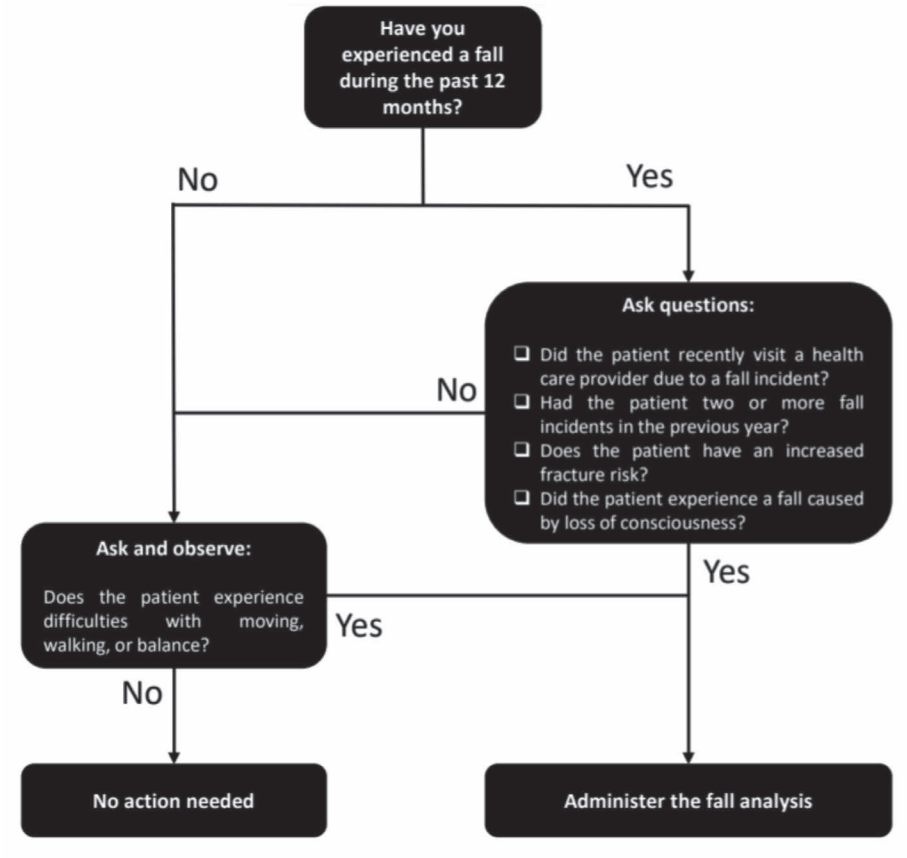

Figure 2. Short fall risk assessment described in Dutch fall prevention guideline.[41]

FALL PREVENTION GUIDELINE

The Dutch fall prevention guideline is based on international literature and recommends to screen all persons aged ≥ 65 years for fall risk by administration of a short fall risk assessment (Figure 2).[41,42] This short assessment takes only a few minutes and identifies patients with increased fall risk for who an in-depth assessment of risk factors or a "fall analysis" is needed. Diverse health care providers are experienced with conducting fall analyses, including practice nurses, home care nurses, physiotherapists, and geriatricians. According to the fall analysis, the following risk factors should be assessed in patients at fall risk: (1) history of falls, (2) mobility, (3) medication use, (4) fall anxiety, (5) cognition and mood, (6) vision, (7) dizziness, (8) incontinence, (9) hearing, (10) Activities of Daily Living, (11) home environmental factors, (12) foot problems and footwear, and (13) nutritional status and vitamin D intake.[41,42]

THE ROLE OF COMMUNITY PHARMACISTS IN FALL PREVENTION

In the last decades there has been a shift in the role of community pharmacists in primary care. Community pharmacists' tasks have been extended with tasks beyond drug dispensing and related to the provision of health services such as medication reviews.[43,44] It has been recognized that pharmacists could contribute to fall prevention as well.[45,46] To date, only few examples have been described of provision of fall prevention services by community pharmacies specifically.[47–49]

Pharmacists have expertise to ensure medication effectiveness and safety, and therefore, their involvement in fall prevention is particularly valuable by evaluation and deprescribing of FRID use.[45] However, since falls are caused by multiple factors, including for example mobility disorders and vision problems, a multifactorial approach should be recommended in fall prevention.[33] Besides providing medication reviews focused on FRID deprescribing, pharmacists can hence contribute to fall prevention in several other ways. First, pharmacists can facilitate screening of patients at increased fall risk.[49] Second, pharmacists could educate patients on the effects of fall risk-increasing drugs.[50] Third, like other health care providers, pharmacists could provide their patients general recommendations on fall prevention, such as exercise and removing home environmental hazards.[45,51] At last, pharmacists may refer patients to other

health care providers, e.g. general practitioners (GPs), home care nurses, and physiotherapists, to secure patients receive appropriate care with regard to other fall risk factors than medication.[52,53] To date, the implementation and provision of fall prevention services in community pharmacies has not been standardized.

IMPLEMENTATION OF FALL PREVENTION INTERVENTIONS / SERVICES

Effectiveness in scientific studies versus practice

The translation of effective interventions to daily clinical practice is difficult.[33,54,55] The circumstances in clinical practice differ from circumstances under which most scientific studies have been performed, for example with regard to the organization of the delivery of care, target population, timing and reimbursement. Hence, to ensure that a health service is equally effective in practice compared to scientific studies, it should be guaranteed that the service is implemented and delivered in practice similar to how it was done in the study setting.[56] It is therefore of utmost importance to study the implementation of interventions, including barriers and facilitators.[55] This kind of research has been increasingly valued because the advanced uptake of science into practice is essential to ensure that research findings will change practices and policies.[55,57]

To describe the implementation process, several frameworks have been developed to clarify what impacts research outcomes and to support the evaluation of the success of an intervention in practice (Figure 3).[58] To explain the results of implementation, so-called determinant frameworks have been developed to describe the determinants, acting as barriers or facilitators, that have impact on the outcomes of implementation.[55,58] Three frameworks are used in this thesis to explore the implementation of fall prevention services: the theoretical domains framework (TDF), the capability opportunity motivation - behaviour (COM-B) model, and the consolidated framework for implementation research (CFIR). Figure 3 shows the relation between the CFIR, the TDF and the COM-B model.

Barriers and facilitators

Complex fall prevention interventions are most effective to reduce falls, but these interventions have insufficiently been implemented in clinical practice in

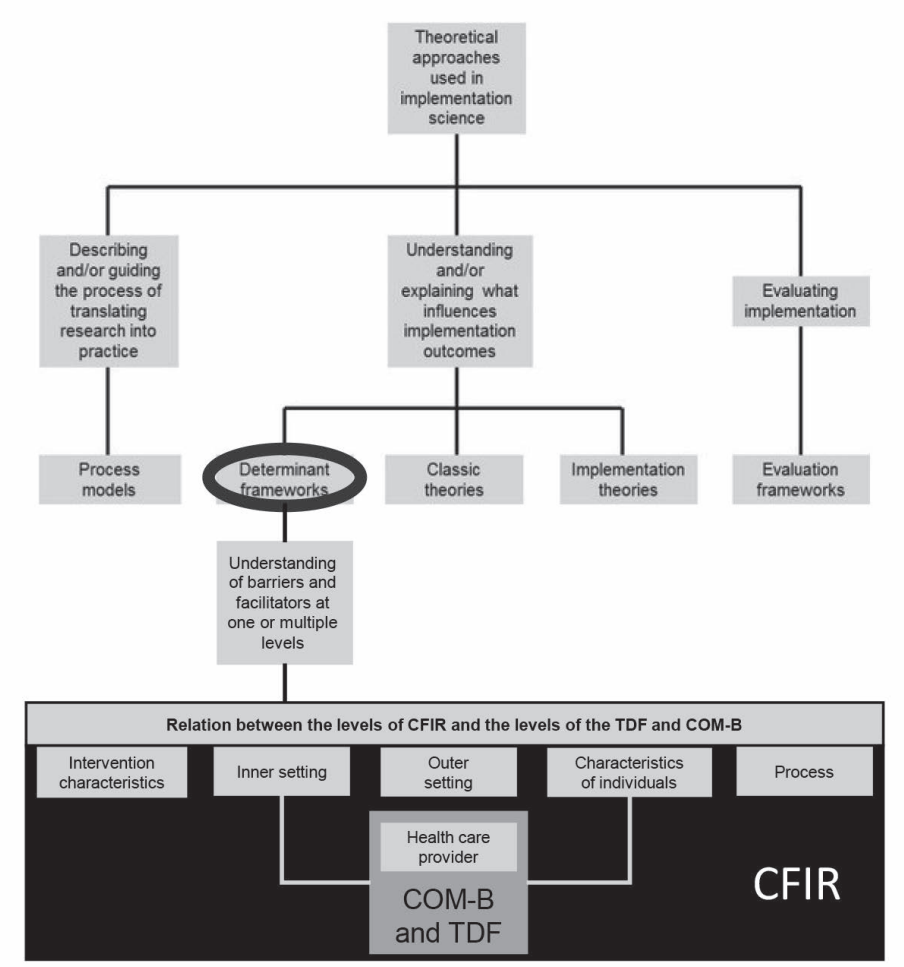

Figure 3. Three aims of the use of theoretical approaches in implementation science and the five categories of theories, models and frameworks. The figure is supplemented with an overview of levels at which the three determinant frameworks applied in this thesis focus to identify barriers and facilitators. The figure has been adapted from Nilsen et al (2015).[58]
Abbreviations: CFIR = consolidated framework for implementation research
TDF = theoretical domains framework
COM-B = capability opportunity motivation - behaviour model

ranges of settings, including at GPs, nurses, and physiotherapists.[59–62] Diverse barriers for the implementation of fall prevention services in these wide-range of settings have been identified and include: lack of time, lack of reimbursement, patient noncompliance, incomprehensible protocols for implementation, limited

staff knowledge and skills, administrative load, poor communication between involved health care providers, and lack of generalizability of research models to real-world.[54,63–65]

Besides the aforementioned barriers, pharmacists may encounter specific pharmacy-related barriers during the provision of fall prevention. These may be similar to those found for the provision of certain cognitive pharmaceutical services (CPS), such as medication review services.[57,66,67] These barriers include: collaboration with other healthcare providers, staffing, pharmacists' qualities and motivation, time management, and financial restrictions.[67–70] A common applied strategy to overcome some barriers and advance implementation is staff education.[34,68,71,72]

Better understanding of the barriers and facilitators for implementation of fall prevention in community pharmacies is essential to support the development of feasible fall prevention services and to foster its implementation in pharmacy practice.[57,73,74]

Patient engagement

Previously it has been described that patients are unfamiliar with the pharmacist as provider of public health services such as smoking cessation counselling and sexual health services. Yet, patients seem positive about the involvement of pharmacists in public health services, but they have doubts about pharmacists' abilities to encourage behavioural change.[75]

Pharmacy-led fall prevention services could also be classified as a public health service. Likewise, patients may not be used to pharmacists providing them fall prevention services and therefore, older persons might be sceptical about pharmacists' abilities to provide such services. Yet, patients could be positive about pharmacists' initiatives to provide fall prevention services. However, it could be a challenge for pharmacists to engage their patients for their fall prevention services, e.g. due to such mixed patients' perspectives.

Fall prevention only works when the target group is reached, and these people are engaged to uptake recommendations. It is often a challenge to engage older persons in fall prevention, because they often underestimate their own fall risk and need to acknowledge their own fall risk first.[76,77] Furthermore, to

older individuals, acknowledging fall risk is often experienced as a threat to their identity, or as a threat to their independence.[78,79] To engage older persons in fall prevention, the service needs to correspond with individuals' own preferences.[80]

Multidisciplinary collaboration

Fall prevention asks for a multidisciplinary approach, and due to the involvement of multiple stakeholders during implementation, it is an organizational challenge.[54] With regard to fall prevention, health care providers such as GPs, nurses, and physical therapists, acknowledge the relevance of multidisciplinary collaboration, but they have insufficient understanding of one another's role in fall prevention.[54] Health care providers of diverse disciplines, including physical therapists, occupational therapists, and podiatrists, hence previously reported to have doubts about the role and value of other disciplines – the advantages of collaboration in fall prevention were unclear to them.[81] These findings may also be applicable to the collaboration between diverse health care providers and pharmacists to prevent falls. Unfortunately, health care providers often experience difficulties with interprofessional collaboration. More knowledge is thus needed on how multidisciplinary collaboration in fall prevention can be advanced and on how community pharmacists can be involved in such multidisciplinary fall prevention collaborations.

THESIS AIM

This thesis aimed to answer the question how pharmacists can contribute to fall prevention, and how fall prevention services can be implemented, including their barriers and facilitators. Also, this thesis aimed to assess the perspectives of patients, pharmacists, and other health care providers, for the provision of pharmacy-led fall prevention services.

OUTLINE OF THIS THESIS

At first, **Chapter 2** explores how pharmacy dispensing data from the pharmacy information system could be used to identify patients at risk of falls.

Chapter 3 provides insight into patients' motivators to participate in pharmacy-led fall prevention services and their expectations of such a service.

Chapter 4 gains insight into the perceptions of primary care providers to provide fall prevention services, focusing on the role of community pharmacies. **Chapter 4.1** explores community pharmacists' experiences with providing medication-related fall prevention, including their barriers and facilitators. **Chapter 4.2** describes the experiences of primary care providers with interprofessional collaboration to prevent medication-related falls, including their barriers and facilitators, with a focus on their collaboration with community pharmacists.

In **Chapter 5** the implementation of a fall prevention service in community pharmacies is described along with in-depth evaluations. **Chapter 5.1** illustrates community pharmacists' decision-making and pitfalls during deprescribing of FRIDs in light of patient case reports. **Chapter 5.2** provides a description of the implementation process and reflects on this process by assessing pharmacists' perspectives on the implementation. **Chapter 5.3** focuses on evaluating the patient experience with the delivered fall prevention service.

In **Chapter 6** the main findings of this thesis are discussed and we reflect on the current and potential role of community pharmacists in fall prevention. Therefore, the general discussion contains recommendations for research and clinical practice. The conclusion summarizes the major findings.

AUTHOR'S CONTRIBUTION

MG conducted the literature search and wrote the first draft of the general introduction. She discussed the literature search, topics, and set-up of the introduction with her supervisors and asked for feedback on basis of drafts. During the whole process, she implemented their feedback.

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Chapter 2

Screening of patients at risk of medication-related falls

Chapter 2.1

Using pharmacy dispensing data to predict falls in older individuals

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ABSTRACT

Aim

Associations between individual medication use and falling in older persons are well-documented. However, a comprehensive risk score that takes into account individuals' overall medication use and that can be used in daily pharmacy practice is lacking. We, therefore, aimed to determine whether pharmacy dispensing records can be used to predict falls.

Methods

A retrospective cohort study was conducted using pharmacy dispensing data and self-reported falls among 3454 Dutch individuals aged ≥ 65 years. Two different methods were used to classify medication exposure for each individual: the Drug Burden Index (DBI) for cumulative anticholinergic and sedative medication exposure as well as exposure to fall risk-increasing drugs (FRIDs). Multinomial regression analyses, adjusted for age and gender, were conducted to investigate the association between medication exposure and falling classified as non-falling, single falling and recurrent falling. The predictive performances of the DBI and FRIDs exposure were estimated by the polytomous discrimination index (PDI).

Results

There were 521 single fallers (15%) and 485 recurrent fallers (14%). We found significant associations between a DBI ≥ 1 and single falling (adjusted odds ratio (aOR): 1.30 [95% confidence interval (CI): 1.02-1.66]) and recurrent falling (aOR: 1.60 [95% CI: 1.25-2.04]). The PDI of the DBI model was 0.41 (95% CI: 0.39-0.42) and the PDI of the FRIDs model was 0.45 (95% CI: 0.43-0.47), indicating poor discrimination between fallers and non-fallers.

Conclusion

The study shows significant associations between medication use and falling. However, the medication-based models were insufficient and other factors should be included to develop a risk score for pharmacy practice.

INTRODUCTION

In the Netherlands, about one-third of community-dwelling individuals aged 65 years and older experience at least one fall each year.[1] Falling leads to physical injury, increased health care consumption and impairment in social and physical activities.[2] Since the general population is aging, falling is a growing societal problem in many countries. Older individuals more often have multimorbidity and consequently use more medication (e.g. polypharmacy).[3] Although the underlying causes for falling are often multifactorial, medication use and polypharmacy increase the risk for falls in older adults.[4] Fall prevention should therefore be a major concern for healthcare providers, including pharmacists who are responsible for safe medication use. Deprescribing fall-related medications is considered an effective intervention for fall prevention.[5–8]

So-called fall risk-increasing drugs (FRIDs) have been widely associated with falls.[9–11] FRIDs belong to different pharmacological classes and increase fall risk by different mechanisms. For example, the anticholinergic and general depressant effects of psychotropic medication affect postural balance, cognition and cause sedation, which increase fall risk.[12,13] Cardiovascular medication, which lower blood pressure or decrease heart rate, often increase the risk of orthostatic hypotension.[13,14] Antidiabetic medication, antihistamines and NSAIDs belong to the group of other FRIDs.[11] Many studies have investigated the association between medication use and fall risk[9–11], but less is known about associations between combination of FRIDs and risk of falling. An exception is the use of the Drug Burden Index (DBI); a measure of an individual's total anticholinergic and sedative load, taking the dose into account.[15,16] Although different instruments for measuring anticholinergic load exist, the DBI previously showed the strongest association with fall risk.[17]

Pharmacists increasingly perform clinical medication reviews to optimize pharmacotherapy, especially in older people on polypharmacy.[18,19] Preventing medication-related falls is an important goal of clinical medication reviews[20] and an effective method to deprescribe FRIDs.[5] In order to efficiently identify individuals at increased risk of falling, a screening tool is helpful. In the pharmacy setting it would be useful to predict fall risk by a medication-based measure. Current measures are often based on more time-consuming person interviews.[21]

In this study, we aimed to determine whether medication exposure data from dispensing records can be used to predict falls in older individuals using FRIDs.

METHODS

Study design

We used data from a retrospective cohort study of individuals' self-reported fall information and information about medication use from individuals' pharmacy records. We studied the association between medication exposure and falls. In addition, we determined the discrimination ability of medication exposure to predict falls.

Setting

Data were nationwide collected with the help of pharmacists who were affiliated with a national pharmacy franchise in the Netherlands. Individuals were invited in the study in the period between August 2011 and February 2012 (Figure 1). The index date was the date the invitation letter was sent. This study was not subject to formal ethical approval as participants were not subject to procedures or were required to follow rules of behavior. Participation in the study was voluntary. All participants were carefully informed through a patient information letter and gave written informed consent before start of the study. The consent included explicit permission to use individuals' medication dispensing records. Both medication dispensing data and questionnaire data were pseudonymized.

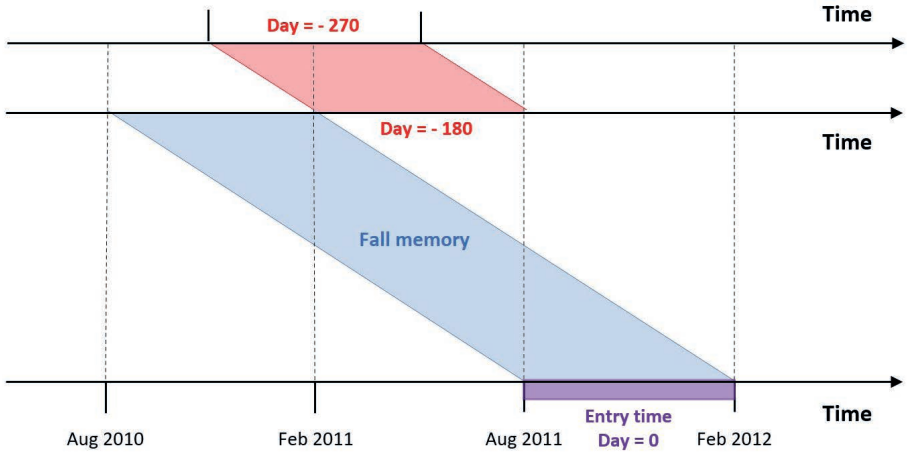

Figure 1. Study design. The index date (day = 0) was the sending date of the invitation letter. The medication use at time day = -180 was determined by analyzing the dispensed medications during the preceding 90 days.

Data sources

Individuals were all aged ≥ 65 years, using ≥ 5 different medicine of which at least 2 were FRIDs. Medication that was classified as FRIDs are listed in Supplementary information S1: Table 1. Because the included individuals were also offered a medication review and follow-up, a pre-selection was performed by the pharmacist or general practitioner to determine whether individuals were eligible for invitation. Individuals reported their fall history in a short questionnaire, which was sent along with the invitation letter. The questionnaire, collected by their community pharmacist, consisted of only two questions: "Did you experience a fall in the previous year?" and "If yes: did you experience two or more falls in the previous year?"

Data on medication use up to four years before invitation of all participating individuals were collected from the pharmacy information systems. All pharmacies had automated dispensing records, including information on gender, date of birth, and dispensed medication. In the Netherlands the vast majority of individuals obtain all medication from the same pharmacy and thus pharmacy records represent a complete medication history for an individual person.[22] The pharmacy records contained information about dispensing data, including the names of the dispensed medications, medication doses, dose instructions, processing dates of prescriptions and dispensed amounts. The medicines in the pharmacy records were classified by Anatomical Therapeutic Chemical (ATC) groups, according to the World Health Organization (WHO) ATC classification system.[23]

Outcome definitions

The outcome was self-reported falls in the year before the invitation letter was sent, in terms of three categories: non-falling, single falling and recurrent falling.

Exposure definitions

Medication exposure was classified in two ways: the DBI for cumulative anticholinergic and sedative medication exposure (method 1) and by determining the use of individual FRID groups for each individual (method 2). For both methods medication use was determined at 180 days before the index date (time

(t) = -180 days). As individuals reported to had fallen in the 365 days before index date, we estimated medication exposure at t = -180 days was most likely to represent the actual medication use during the time of outcome. All prescriptions in the preceding 90 days before time point -180 days were used to estimate medication exposure at the time of outcome (t = -180 days). When more than one prescription of the same medication was given in the time period, the last prescription was used to assess medication exposure. Thus, medication exposure was determined from the dispensing data of t = -270 to -180 days (Figure 1).

For method 1, exposure was defined as the cumulative DBI.[15] It was calculated the same way by Meer et al. using the following formula:

$$\text{DBI} = \sum \frac{D}{D + \delta}$$

where D = prescribed daily dose and δ = the minimum recommended daily dose according to Dutch pharmacotherapeutic reference sources.[24–26] All prescription medications dispensed by the pharmacy with mild or strong anticholinergic and/or sedative (side) effects during the study period were included in the DBI calculation. For medications without exact known prescribed daily dose the daily dose was estimated. For the dose instruction "known use" the dose was estimated as once daily and the mean estimated "as needed" use depended on the prescribed maximum dose. "Over the counter" dispensed medications were not captured within the pharmacy dispensing records and were therefore not included. The DBI per medication varied between 0 and 1, depending on the daily dose.

The individuals were divided into three DBI categories: (1) DBI = 0, (2) DBI = $>$ 0 and $<$ 1, and (3) DBI $\geq$ 1. This was based on previous studies, where this highest threshold category was considered as a high anticholinergic/sedative load.[24,27,28]

For method 2, all potential FRIDs (available in Table 1 of Supplementary information S1) dispensed by the pharmacy in the period (t = -270 to -180 days) were included. Again, when more than one prescription of the same medication was given in the time period, the last prescription was used to assess medication exposure.

Data analysis

First, descriptive statistics (proportions and medians) were calculated for the three outcome groups (non-fallers, single fallers and recurrent fallers). Chi-square

and Kruskal-Wallis tests were used to assess statistically significant differences between the outcome groups. A significance level of $p < 0.05$ was considered statistically significant. Second, multinomial logistic regression analyses were conducted to investigate the predictive value of both medication exposure methods. Based on previous studies, age and gender were included as covariates to control for confounding.[2]

For method 1, the DBI was calculated per individual and the individuals were divided as per the three DBI threshold categories. The prediction model included these three DBI levels, age and gender. In addition, multinomial logistic regression analysis was performed with DBI as a continuous variable, modelled with restricted cubic splines to model a non-linear association, adjusted for age and gender. For method 2, adjusted odds ratios (aORs) for single and recurrent falling compared to non-falling were calculated for the FRIDs using unadjusted multinomial regression analyses. When there were less than 10 users of a FRID it was not added to the model. The prediction model included all other FRIDs, age and gender. The aORs and 95% confidence intervals (CIs) of all variables in the FRIDs model were estimated.

The ability of the FRIDs model (method 1) and DBI model (method 2) to predict fall risk was assessed by measures of model discrimination and calibration.[29] Model discrimination was assessed by calculating the polytomous discrimination index (PDI) for multivariate models, analogous to the area under the receiver operating characteristic curve (AUC) for binary logistic regression.[30] A PDI of 1 means perfect discrimination between the three outcomes and a PDI of 0.33 (comparable to an AUC of 0.5), indicates that the model does not discriminate between outcomes.[31] The PDI and 95% CIs were calculated by a bootstrap internal validation procedure.[32] We compared the PDI of the FRIDs model to the PDI of the DBI model to decide which model can better discriminate between categories of falling. We also analyzed the discriminative ability of a combined model, which included both DBI and FRIDs as predictors. Model calibration (i.e. the agreement between predicted risks made by the model and observed outcomes in the data) was assessed by plotting calibration curves, where a curve at a 45 degree angle from the origin indicates perfect calibration.[29]

All data were analyzed using R version 3.6.1 (R Foundation for Statistical Computing, Vienna, Austria).

Sensitivity analyses

Because the exact time of the outcome was unknown, we conducted sensitivity analyses at t = - 365 days and t = 0 days. By all means, time t = -365 days represented medication exposure before the outcome (fall). Time t = 0 represented medication exposure after the outcome (fall) and was added to illustrate the consistency of our findings. For both time points all prescriptions in the preceding 90 days were counted in the same way as described for t = -180 days.

RESULTS

As shown in Figure 2, a total of 6497 individuals from 95 pharmacies met the inclusion criteria. Pharmacists excluded 2038 individuals for invitation, because either the pharmacist or general practitioner determined these individuals were not eligible for the research project. Therefore, a total of 4459 individuals were

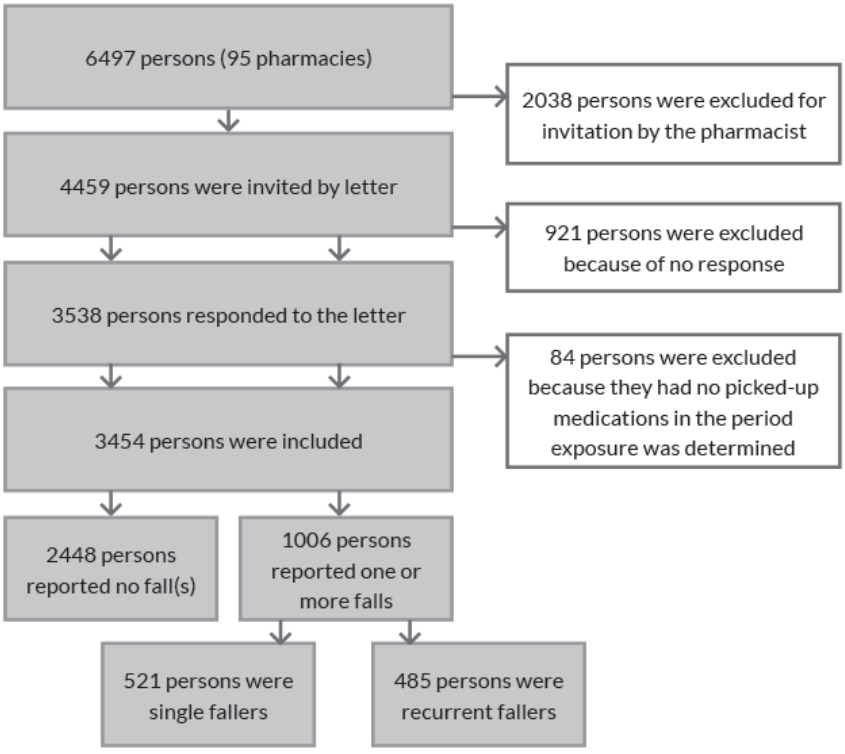

Figure 2. Flowchart of the individuals that were invited and included to the study.

Table 1. Characteristics of study population

	Non-fallers N = 2448	Single fallers N = 521	Recurrent fallers N = 485	P-value	Total N = 3454
Female gender (n, %)*	1376 (56.2%)	336 (64.5%)	301 (62.1%)	P < 0.001	2013 (58.2%)
Age (years; median [Q1-Q3])**	75 [70 – 81]	78 [72 – 84]	79 [72 – 84]	P < 0.001	76 [71 – 82]
Number of dispensed medications (median [Q1-Q3])**	7 [5 – 9]	7 [5 – 10]	7 [6 – 10]	P < 0.001	7 [5 – 9]
Number of dispensed FRIDs (median [Q1-Q3])**	3 [3 – 5]	4 [3 – 5]	4 [3 – 5]	P = 0.037	4 [3 – 5]
Number of dispensed DBI medications (median [Q1-Q3])**	1 [0 – 2]	1 [0 – 2]	1 [0 – 2]	P < 0.001	1 [0 – 2]
DBI (median [Q1-Q3])**	0.5 [0 – 1]	0.64 [0 – 1.21]	0.67 [0 – 1.33]	P < 0.001	0.51 [0 – 1.17]

Abbreviations: n = number, Q1 = first quartile, Q3 = third quartile, DBI = Drug Burden Index, FRID = fall risk-increasing drug

**differences analyzed using chi-square test*

***differences analyzed using Kruskal-Wallis test*

invited by letter. Of the 3538 individuals who responded to the letter, 84 were excluded because they did not have medication dispensed during the time exposure was determined (t= -270 days to t = -180 days), resulting in a total of 3454 individuals for analysis.

Characteristics

In Table 1 the population characteristics are summarized. Among the 3454 included individuals there were 2448 non-fallers (71%), 521 single fallers (29%) and 485 recurrent fallers (14%). Single fallers and recurrent fallers were relatively more often female and older compared to non-fallers ($p < 0.001$).

Multinomial logistic regression

For method 1, the aOR for DBI ≥ 1 was 1.30 [95% CI: 1.02–1.66] and 1.60 [95% CI: 1.25–2.04] respectively for single falling and recurrent falling. The aOR for DBI = > 0 and < 1 was 1.00 [95% CI: 0.79–1.25] and 1.00 [95% CI: 0.78–1.27] respectively for single falling and recurrent falling. *For method 2,* The FRIDs that were included in the model along with age and gender, are shown in Table 2. The following FRIDs showed significant association with recurrent falling in the multinomial model: selective serotonin reuptake inhibitors (SSRIs) (aOR: 2.49 [95% CI: 1.69–3.65]), antiepileptics (aOR: 2.16 [95% CI: 1.37–3.40]), codeine (aOR: 1.67 [95% CI: 1.04–2.66]), urinary spasmodics (aOR: 1.78 [95% CI: 1.07–2.98]) and antivertigo drugs (aOR: 1.70 [95% CI: 1.01–2.85]). The aORs for the other predictors can be found in Table 2. The crude ORs for FRIDs can be found in Supplementary information S1.

Internal validation and predictive performance

The DBI model had a PDI of 0.41 (95% CI: 0.39-0.42) and the FRIDs model had a PDI of 0.45 (95% CI: 0.43-0.47). A model with age and gender only had a PDI of 0.39 (95 CI %:0.38-0.41). This indicates that neither model could discriminate well between non-fallers, single fallers and recurrent fallers. Modelling of DBI as a continuous variable did not improve the PDI (0.41 [95% CI: 0.40-0.43]). Adding DBI to the model with FRIDs did not improve model discrimination (PDI [95% CI]: 0.45 [0.43-0.47]). Model calibration was good for all models, but the model with FRIDs as a predictor slightly underestimated fall risk in higher-risk individuals.

Table 2. A comparison of the predictive performance of the three models to predict falls and the odds ratios of all included predictors.

Predictors	**Model1: age + gender**	
	aOR [95% CI] for single falling	*aOR [95% CI] for recurrent falling*
Age (per year)	**1.04 [1.03 – 1.06]**	**1.05 [1.04 – 1.07]**
Female sex	**1.30 [1.07 – 1.59]**	1.14 [0.93 – 1.40]
Predictors	**Model2: age + gender + DBI**	
	aOR [95% CI] for single falling	*aOR [95% CI] for recurrent falling*
Age (per year)	**1.04 [1.03 – 1.06]**	**1.05 [1.04 – 1.07]**
Female sex	**1.30 [1.06 – 1.58]**	1.13 [0.92 – 1.39]
0 < DBI < 1	1.00 [0.79 – 1.25]	1.00 [0.78 – 1.27]
DBI ⩾ 1	**1.30 [1.02 – 1.66]**	**1.60 [1.25 – 2.04]**
Predictors	**Model3: age + gender + FRIDs**	
	aOR [95% CI] for single falling	*aOR [95% CI] for recurrent falling*
Age (per year)	**1.04 [1.03 – 1.06]**	**1.05 [1.04 – 1.07]**
Female sex	**1.26 [1.01 – 1.56]**	1.05 [0.84 – 1.31]
SSRI	**1.58 [1.04 – 2.41]**	**2.49 [1.69 – 3.65]**
TCA	1.21 [0.72 – 2.02]	1.37 [0.82 – 2.31]
Antiepileptics	1.27 [0.76 – 2.14]	**2.16 [1.37 – 3.40]**
Loop-diuretics	1.25 [0.94 – 1.64]	1.11 [0.83 – 1.49]
Benzodiazepines	0.92 [0.73 – 1.67]	0.84 [0.65 – 1.08]
Digoxin	1.03 [0.66 – 1.61]	0.98 [0.60 – 1.60]
Nitrates + ivabradine	0.86 [0.63 – 1.89]	1.25 [0.93 – 1.69]
Thiazides	0.89 [0.71 – 1.12]	0.95 [0.76 – 1.20]
Aldosteron antagonists	**1.73 [1.14 – 2.64]**	0.95 [0.55 – 1.63]
Beta-blocking agents	1.15 [0.95 – 1.42]	1.09 [0.88 – 1.34]
Calcium channel blockers	0.91 [0.74 – 1.14]	0.89 [0.71 – 1.11]
RAAS-inhibitors	0.94 [0.77 – 1.16]	0.95 [0.77 – 1.18]
Insulin	0.57 [0.30 – 1.09]	1.27 [0.78 – 2.08]
Sulfonylurea derivatives	1.06 [0.78 – 1.44]	1.14 [0.84 – 1.55]
Alpha blockers	1.05 [0.73 – 1.52]	0.69 [0.46 – 1.04]
Strong opiates	0.86 [0.47 – 1.60]	1.14 [0.64 – 2.04]
Codeine	**1.97 [1.28 – 3.01]**	**1.67 [1.04 – 2.66]**
Tramadol	**2.06 [1.34 – 3.18]**	1.42 [0.86 – 2.33]
Antihistamines	1.06 [0.68 – 1.64]	1.08 [0.68 – 1.70]
Statins	0.77 [0.62 – 0.94]	0.95 [0.77 – 1.18]
NSAIDs	1.08 [0.76 – 1.52]	1.26 [0.89 – 1.77]
Urinary antispasmodics	1.50 [0.89 – 2.55]	**1.78 [1.07 – 2.98]**
Antivertigo drugs	0.87 [0.47 – 1.63]	**1.70 [1.01 – 2.85]**
Dipyridamole	0.99 [0.64 – 1.55]	1.39 [0.94 – 2.06]

Abbreviations: aOR = adjusted odds ratio, DBI = Drug Burden Index, SSRI = selective serotonin reuptake inhibitor, TCA = tricyclic antidepressant, RAAS-inhibitors = renin-angiotensin-aldosterone system inhibitors, NSAID = non-steroidal anti-inflammatory drug, CI = confidence interval

Sensitivity analyses

At t = -365 days, the DBI model had a PDI of 0.40 (95% CI: 0.39-0.42) and the FRIDs model had a PDI of 0.45 (95% CI: 0.43-0.46), compared to a PDI of 0.39 (95% CI: 0.37-0.41) for the model with age and gender only. At t = 0 days, the DBI model had a PDI of 0.41 (95% CI: 0.39-0.42) and the FRIDs model had a PDI of 0.45 (95% CI: 0.43-0.47), compared to a PDI of 0.39 (95% CI: 0.38-0.41) for the model with age and gender only. The results of the sensitivity analyses are available in Supplementary information S2 and Supplementary information S3.

DISCUSSION

This study shows that although medication exposure defined by both use of FRIDs and the DBI are associated with an increased risk of falling, the discriminative ability of the predictive models incorporating these factors is poor and therefore seems to be of no use as a standalone screening tool.

Although studies have investigated associations between medication use and falls[9–11], the predictive performance of individuals' complete medication regimen on falls have not been well investigated. Furthermore, many currently used fall risk assessment tools, including a diversity of fall risk factors, appear to have low predictive validity. Although the range of factors included in the fall risk assessment tools is large, accuracy is mostly unsatisfactory.[33,34] Tools with a small number of predictors are suboptimal for predicting falls. A previous study showed low predictive performance for medication exposure on falls.[35] Eventually Tiedemann et al. developed a fall risk assessment tool with reasonable predictive power (a total AUC of 0.72) for primary care, but this tool included several other potential determinants in addition to medication (e.g. visual function, tactile sensitivity, mobility tests and fall history).[35] This suggests that augmenting medication-based models with non-medication-based factors should improve the discriminative ability. This would however be a very labor intensive exercise, which is not feasible in daily clinical care.

Most previous studies investigating the association between medication use and falls compared individuals who had at least one fall to individuals who did not fall.[36] In this study, the strongest associations between medication and falling

were seen in individuals who had recurrent falls. For those with a DBI ≥ 1, the odds of a single fall were 30% greater while the odds of recurrent falls were 60% greater. This is in line with the notion that single falling could be a coincidence and that recurrent fallers are particularly at risk.[37]

Strengths

A strength of this study is that we investigated both single fallers and recurrent fallers. Guidelines recommend an extensive multifactorial fall risk assessment for individuals who report recurrent falls in the past year. However, for individuals who report a single fall only a quick screening on gait and balance is recommended to determine whether a multifactorial fall risk assessment is necessary.[38] Recurrent falls more often lead to loss of independence and fear of falling.[36] Therefore, recurrent falling seems a better predictor of a subsequent fall than experiencing one fall.

Another strength of this study is it classified medication exposure in different ways to examine its predictive performance on falls. The advantage of a predictive model based on FRIDs is that it covers all known medications that have been associated with falls in the literature. The use of DBI to predict fall risk is advantageous in that it takes into account dosing effects. Additionally, the DBI combines effects of different medicines related to falls and can easily be expressed in a single number. On the other hand, a disadvantage for using the DBI is that all medication with anticholinergic and sedative characteristics are considered as equivalent.[39] The DBI as a measurement might be improved if the strength of the anticholinergic and sedative load were to be taken into account. Due to their varying pharmacological actions, not all FRIDs contribute to the DBI. While cardiovascular FRIDs may also cause falling (e.g. through orthostasis or bradycardia), they often do not have anticholinergic or sedative properties and, therefore, do not contribute to the DBI.

Self-reported falls were used to determine the outcome. A strength of the questionnaire was its shortness. Moreover, individuals did not need to remember exactly when the fall happened. However, a weakness of self-report was that individuals might forgot the experience of a fall. When the experience of a fall had low impact, individuals might reported not to had experienced a fall.

Limitations

The major limitation of our data was that the exact time of the fall was unknown. We considered that the medication use at time 180 days before the index date was most representative for the medication use at time of fall. Moreover, sensitivity analyses were conducted for the medication use at 365 days before index date and for the medication use at index date. Both times showed similar results. Sensitivity analyses only showed minor discrepancies regarding significances of associations between individual FRIDs and falls. However, the trend of the associations were similar over all sensitivity analyses. Most medication could be considered as chronic and did not change appreciably over the year preceding the self-reported fall(s). In this study we also included medications that were prescribed with use as needed. We reasoned "as needed" medications could trigger a fall in particular, because a sudden increase in the drug burden might actually be associated with a higher risk compared to chronic exposure. However, we do not know whether individuals were exposed to "as needed" medication at the time of falling. Therefore, there could have been an overestimation of medication exposure. Another limitation of the study is the generalizability of the models. The individuals in this study were selected on basis of both polypharmacy and the use of at least one cardiovascular or centrally acting FRID. In 2014 the prevalence of polypharmacy in Dutch individuals above 65 years was 25-30%.[40] The mean medication use of the individuals in this study, thus, may be higher compared to real world data. Due to the high mean medication use the included individuals could have been more fragile. Yet, the fall incidence of approximately one-third was similar to the fall incidence that is usually reported in the general population.[1]

Another limitation of our data was that it was collected between August 2011 and February 2012. However, prescribing patterns of most FRIDs did not change appreciably. Only the use of strong opiates and to a lesser extent gabapentinoids has increased in the past 5-10 years.[41] We expect that small shifts that have occurred in individual medication use are unlikely to affect sums of exposure in the general population, as measured by the DBI. Furthermore, we do not think there is evidence that specific FRIDs have evidently strong associations with falls and that these could be used as a standalone predictor on itself.

At last, in this study was not controlled for other confounders than age and gender. Comorbidities might have affected our results.[38] However, we decided not to

include these confounders in our models. Firstly, because we corrected for the use of other medication in the FRIDs model. Comedication may be considered a proxy for some comorbidities. More importantly, the aim of the study was to investigate whether pharmacy dispensing data could be used to predict falls and information on comorbidity is usually not available in pharmacy information systems.

Implications

For community pharmacists, to efficiently identify individuals who are at increased risk of falling, a sensitive medication-based screening tool with a limited number of additional predictors would be ideal. History of falls is a strong fall risk predictor.[42] Measurements of physical performance and mobility, such as the Short Physical Performance Battery (SPPB) or gait speed, are strong fall risk predictors as well.[42] The disadvantage of mobility tests is that these are very time-consuming and cannot easily be implemented in pharmacies. On the basis of the combination of an age $\geq$ 65 years, exposure to FRIDs and fall history the pharmacist should be able to select individuals with increased fall risk and using medication that potentially cause this increased risk. Evaluating the medication use in these individuals should be a priority for them. Ideally, the information on FRIDs should be integrated in the pharmacy information system as has been done for the DBI.[43] As a start, pharmacists should ask older individuals frequently about fall history and record their responses. We recommend to integrate a fall alert in the pharmacy information system for individuals who have experienced a fall before. When new FRIDs are prescribed the pharmacist is then alarmed to discuss the problem and alternatives with the individual and prescriber.

Conclusion

This study shows significant associations between DBI and falling, and the use of FRIDs and falling. We attempted to build a dispensing data-based fall prediction model. The predictive value of such a model seems insufficient for use in clinical pharmacy practice. The addition of non-medication based factors presumably improves the model. In the meantime, we suggest community pharmacists to screen for use of FRIDs among older individuals in combination with asking individuals about their fall history. Incorporating a fall warning signal in the pharmacy information system for individuals who have experienced a fall before could also help to prevent inappropriate medication use in these individuals.

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AUTHOR'S CONTRIBUTION

MG analysed the data and wrote the first draft of the manuscript. She was supported with the DBI analyses by KT and RP supported with the development of the statistical model and computing predictive performances. She interpreted the results with help of her supervisors. She also performed the literature search and implemented the contribution of co-authors and external reviewers up to final publication. During the whole process, she implemented input and feedback from her supervisors and other contributors to this study.

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SUPPLEMENTARY INFORMATION S1: SUPPLEMENTARY DATA

Table 1. List of FRIDs

Group	Medications
Cardiovascular	Antiarrhythmic drugs
	Nitrates and other vasodilators for the treatment of angina pectoris
	Diuretics
	Beta-blocking agents
	Calcium channel blockers
	Alpha-blocking agents
	Other antihypertensives
	Dipyridamole
Psychotropics	Opiates and opioids
	Benzodiazepines
	Anxiolytics
	Hypnotics
	Lithium
	Antidepressants
	Neuroleptics and antipsychotics
	Vertigo drugs
	Anti-epileptics
Others	Oral antidiabetics and insulin
	Indomethacin
	Urinary antispasmodics
	Muscle relaxants, e.g. baclofen
	Antihistaminic drugs

Table 2. Univariate analyses of the association of individual medication use on falls.

Medication group	Non-fallers (n, %)	Single fallers (n, %)	Crude odds ratio [95% CI]	Recurrent fallers (n, %)	Crude odds ratio [95% CI]
Antidepressants users	218	69	1.56 [1.17 – 2.08]	76	1.90 [1.43 – 2.51]
Antidepressants non-users	2230	452		409	
SSRI users	101	32	1.53 [1.01 – 2.29]	44	2.32 [1.60 – 3.35]
SSRI non-users	2347	489		441	
TCA users	78	20	1.21 [0.73 – 1.99]	20	1.30 [0.79 – 2.15]
TCA non-users	2370	501		465	
Antipsychotics users	32	5	0.73 [0.28 – 1.89]	7	1.11 [0.49 – 2.52]
Antipsychotics non-users	2416	516		478	
Benzodiazepines + related drugs users	529	125	1.15 [0.92 – 1.43]	109	1.05 [0.83 – 1.33]
Benzodiazepines + related drugs non-users	1919	396		376	
Anti-epileptics users	71	20	1.34 [0.81 – 2.22]	30	2.21 [1.42 – 3.42]
Anti-epileptic non-users	2377	501		455	
Digoxin users	102	30	1.41 [0.92 – 2.14]	23	1.15 [0.72 – 1.82]
Digoxin non-users	2346	491		462	
Other anxiolytics users	7	0	0.10 [0.00 – 7474.88]	1	0.72 [0.09 – 5.88]
Other anxiolytics non-users	2441	521		484	
Nitrates + ivabradine users	278	57	0.96 [0.71 – 1.30]	72	1.36 [1.03 – 1.80]
Nitrates + ivabradine non-users	2171	464		413	
Thiazides users	795	144	0.79 [0.64 – 0.98]	140	0.84 [0.68 – 1.04]
Thiazides non-users	1653	377		345	
Loop-diuretics users	339	107	1.61 [1.26 – 2.05]	86	1.34 [1.03 – 1.74]
Loop-diuretics non-users	2109	414		399	

Aldosteron-antagonists users	95	39	2.00 [1.36 – 2.95]	18	0,95 [0.57 – 1.60]
Aldosteron-antagonists non-users	2353	482		467	
Beta-blocking agents users	1214	268	1.08 [0.89 – 1.30]	242	1.01 [0.83 – 1.23]
Beta-blocking agents non-users	1235	253		243	
Other potassium-sparing diuretics users	15	2	0.62 [0.14 – 2.74]	1	0.34 [0.04 – 2.54]
Other potassium-sparing diuretics non-users	2433	519		484	
Calcium channel blockers users	763	146	0.86 [0.70 – 1.06]	136	0.86 [0.89 – 1.07]
Calcium channel blockers non-users	1685	375		349	
RAAS-inhibitors (ACE inhibitors, ATII-antagonists, aliskiren) users	1510	300	0.84 [0.70 – 1.02]	281	0.86 [0.70 – 1.04]
RAAS-inhibitors non-users	938	221		204	
Alfablocker users	224	45	0.94 [0.67 – 1.31]	31	0.68 [0.46 – 1.00]
Alfablocker non-users	2224	476		454	
Oral antidiabetics users	636	116	0.82 [0.65 – 1.02]	123	0.97 [0.77 – 1.21]
Oral antidiabetics non-users	1812	405		362	
Metformin users	548	96	0.78 [0.62 – 1.00]	107	0.98 [0.78 – 1.24]
Metformin non-users	1900	425		378	
Sulfonylurea derivates users	305	59	0.90 [0.67 – 1.21]	61	1.01 [0.75 – 1.36]
Sulfonylurea derivates non-users	2143	462		424	
Insulin users	91	11	0.55 [0.30 – 1.05]	22	1.23 [0.76 – 1.98]
Insulin non-users	2357	510		463	
Strong opiates users	56	14	1.18 [0.65 – 2.14]	17	1,55 [0.89 – 2.69]
Strong opiates non-users	2392	507		468	

Tramadol users	80	33	2.00 [1.32 – 3.04]	22	1.41 [0.87 – 2.28]
Tramadol non-users	2368	488		463	
Codeine users	85	34	1.94 [1.29 – 2.92]	26	1.58 [1.00 – 2.47]
Codeine non-users	2363	487		459	
Urinary antispasmodics users	61	20	1.56 [0.94 – 2.61]	22	1,86 [1,13 – 3,06]
Urinary antispasmodics non-users	2387	501		463	
Baclofen users	2	2	4.71 [0.66 – 33.54]	1	2.53 [0.23 – 27.92]
Baclofen non-users	2446	519		484	
Antihistaminics users	118	27	1.08 [0.70 – 1.66]	25	1.07 [0.69 – 1.67]
Antihistaminics non-users	2330	494		460	
NSAIDs users	205	47	1.08 [0.78 – 1.51]	49	1.23 [0.89 – 1.71]
NSAIDs non-users	2243	474		436	
Antivertigo drugs users	57	13	1.07 [0.58 – 1.97]	23	2.09 [1.27 – 3.42]
Antivertigo drugs non-users	2391	508		462	
Dipyridamole users	141	26	0.86 [0.56 – 1.32]	37	1.35 [0.93 – 1.97]
Dipyridamole non-users	2308	495		448	
Lithium users	7	4	2.71 [0.79 – 9.28]	2	1.43 [0.30 – 6.96]
Lithium non-users	2442	517		483	
Class I antiarrhythmica users	41	9	1.03 [0.50 – 2.14]	8	0.99 [0.46 – 2.11]
Class I antiarrhythmica non-users	2408	512		477	
Opiates (strong opiates, codeine and tramadol) users	215	70	1.61 [1.21 – 2.15]	56	1.36 [0.99 – 1.85]
Opiates (strong opiates, codeine and tramadol) non-users	2233	451		429	
Statin users	1382	239	0.65 [0.54 – 0.79]	251	0.83 [0.68 – 1.01]
Statin non-users	1067	282		234	

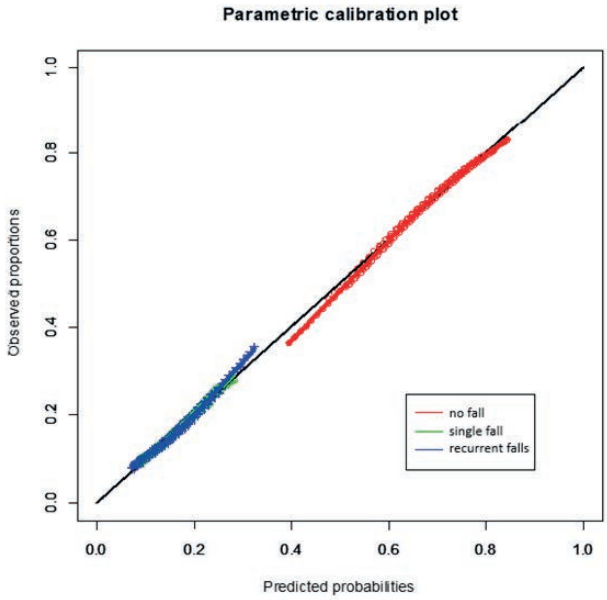

Figure 1. Calibration plot of the DBI model

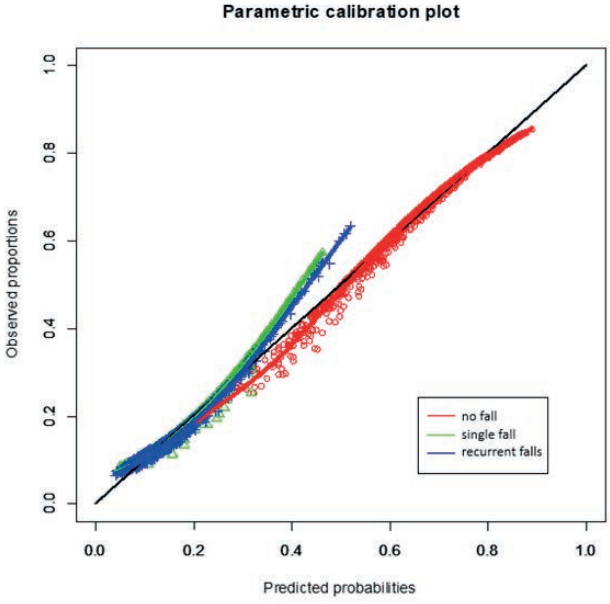

Figure 2. Calibration plot of the FRIDs model

SUPPLEMENTARY INFORMATION S2: ANALYSES AT T=-365 DAYS

Table 1. Characteristics of study population at t = -365 days.

	Non-fallers N = 2402	Single fallers N = 522	Recurrent fallers N = 469	P-value	Total N = 3393
Female gender (n, %)*	1350 (56.2%)	340 (65.1%)	289 (61.6%)	P < 0.001	1979 (58.3%)
Age (years; median [Q1-Q3])**	75 [70 – 81]	78 [72 – 84]	79 [72 – 84]	P < 0.001	76 [71 – 82]
Number of dispensed medications (median [Q1-Q3])**	6 [5 – 8]	7 [5 – 9]	7 [5 – 10]	P < 0.001	7 [5 – 9]
Number of dispensed FRIDs (median [Q1-Q3])**	3 [3 – 5]	4 [3 – 5]	4 [4 – 5]	P = 0.027	4 [3 – 5]
Number of dispensed DBI medications (median [Q1-Q3])**	1 [0 – 1]	1 [0 – 2]	1 [0 – 2]	P < 0.001	1 [0 – 2]
DBI (median [Q1-Q3])**	0.5 [0 – 1.00]	0.5 [0 – 1.17]	0.667 [0 – 1.25]	P < 0.001	0.50 [0 – 1.03]

Abbreviations: n = number, Q1 = first quartile, Q3 = third quartile, DBI = Drug Burden Index, FRID = fall risk-increasing drug

**differences analyzed using chi-square test*

***differences analyzed using Kruskal-Wallis test*

Table 2. A comparison of the predictive performance of the three models to predict falls and the odds ratios of all included predictors at t = -365 days.

Predictors	**Model1: age + gender**		
	aOR [95% CI] for single falling	*aOR [95% CI] for recurrent falling*	**PDI [95% CI]**
Age (per year)	**1.04 [1.03 – 1.05]**	**1.05 [1.04 – 1.07]**	**0.39 [0.37 – 0.41]**
Female sex	**1.37 [1.12 – 1.67]**	1.15 [0.94 – 1.42]	
Predictors	**Model2: age + gender + DBI**		
	aOR [95% CI] for single falling	*aOR [95% CI] for recurrent falling*	**PDI [95% CI]**
Age (per year)	**1.04 [1.03 – 1.06]**	**1.05 [1.04 – 1.07]**	**0.40 [0.39 – 0.42]**
Female sex	**1.26 [1.12 – 1.66]**	1.11 [0.90 – 1.37]	
0 < DBI < 1	0.83 [0.66 – 1.04]	1.12 [0.85 – 1.37]	
DBI ⩾ 1	1.08 [0.85 – 1.37]	**1.67 [1.31 – 2.17]**	
Predictors	**Model3: age + gender + FRIDs**		
	aOR [95% CI] for single falling	*aOR [95% CI] for recurrent falling*	**PDI [95% CI]**
Age (per year)	**1.04 [1.02 – 1.05]**	**1.05 [1.03 – 1.06]**	**0.45 [0.43 – 0.46]**
Female sex	**1.28 [1.03 – 1.60]**	1.03 [0.82 – 1.29]	
SSRI	1.41 [0.90 – 2.22]	**2.35 [1.56 – 3.53]**	
TCA	1.39 [0.83 – 2.31]	**1.70 [1.03 – 2.81]**	
Antiepileptics	1.47 [0.84 – 2.55]	**1.73 [1.01 – 2.97]**	
Loop-diuretics	**1.33 [1.01 – 1.75]**	1.26 [0.94 – 1.70]	
Benzodiazepines	0.85 [0.67 – 1.09]	0.81 [0.63 – 1.05]	
Digoxin	1.03 [0.65 – 1.62]	1.00 [0.60 – 1.65]	
Nitrates + ivabradine	1.01 [0.74 – 1.40]	**1.41 [1.04 – 1.93]**	
Thiazides	0.91 [0.72 – 1.13]	0.94 [0.75 – 1.19]	
Aldosteron antagonists	**1.81 [1.17 – 2.30]**	0.80 [0.44 – 1.45]	
Beta-blocking agents	1.08 [0.89 – 1.32]	1.06 [0.86 – 1.31]	
Calcium channel blockers	0.94 [0.76 – 1.17]	0.86 [0.68 – 1.09]	
RAAS-inhibitors	1.03 [0.84 – 1.27]	1.03 [0.83 – 1.28]	
Insulin	0.48 [0.24 – 0.97]	1.36 [0.83 – 2.24]	
Sulfonylurea derivatives	0.86 [0.62 – 1.19]	1.22 [0.90 – 1.66]	
Alpha blockers	0.82 [0.56 – 1.22]	0.75 [0.50 – 1.13]	
Strong opiates	1.12 [0.57 – 2.20]	1.47 [0.78 – 2.79]	
Codeine	**1.63 [1.04 – 2.54]**	**1.88 [1.20 – 2.95]**	
Tramadol	0.99 [0.59 – 1.66]	0.88 [0.50 – 1.53]	
Antihistamines	0.84 [0.52 – 1.36]	0.99 [0.61 – 1.60]	
Statins	0.71 [0.58 – 2.38]	0.78 [0.62 – 0.97]	
NSAIDs	0.92 [0.64 – 1.30]	1.14 [0.80 – 1.61]	
Urinary antispasmodics	1.31 [0.72 – 2.38]	1.50 [0.84 – 2.70]	
Antivertigo drugs	0.84 [0.43 – 1.65]	**2.05 [1.22 – 3.43]**	
Dipyridamole	1.22 [0.80 – 1.87]	**1.65 [1.11 – 2.45]**	

Abbreviations: aOR = adjusted odds ratio, DBI = Drug Burden Index, PDI = polytomous discrimination index, SSRI = selective serotonin reuptake inhibitor, TCA = tricyclic antidepressant, RAAS-inhibitors = renin-angiotensin-aldosterone system inhibitors, NSAID = non-steroidal anti-inflammatory drug, CI = confidence interval

SUPPLEMENTARY INFORMATION S3: ANALYSES AT T=0

Table 1. Characteristics of study population

	Non-fallers N = 2485	Single fallers N = 533	Recurrent fallers N = 488	P-value	Total N = 3506
Female gender (n, %)*	1399 (56.3%)	348 (65.3%)	306 (62.3%)	P < 0.001	2053 (58.6%)
Age (years; median [Q1-Q3])**	75 [70 – 81]	78 [72 – 84]	79 [72 – 84]	P < 0.001	76 [71 – 82]
Number of dispensed medications (median [Q1-Q3])**	7 [6 – 9]	7 [6 – 9]	8 [6 – 11]	P < 0.001	7 [6 – 9]
Number of dispensed FRIDs (median [Q1-Q3])**	3 [3 – 5]	4 [3 – 5]	4 [3 – 5]	P = 0.027	4 [3 – 5]
Number of dispensed DBI medications (median [Q1-Q3])**	1 [0 – 2]	1 [0 – 2]	1 [1 – 2]	P < 0.001	1 [0 – 2]
DBI (median [Q1-Q3])**	0.57 [0 – 1.17]	0.67 [0 – 1.21]	0.68 [0.12 – 1.47]	P < 0.001	0.67 [0 – 1.17]

Abbreviations: n = number, Q1 = first quartile, Q3 = third quartile, DBI = Drug Burden Index, FRID = fall risk-increasing drug

**differences analyzed using chi-square test*

***differences analyzed using Kruskal-Wallis test*

Table 2. A comparison of the predictive performance of the three models to predict falls and the odds ratios of all included predictors at t = 0 days.

Predictors	**Model1: age + gender**		
	aOR [95% CI] for single falling	*aOR [95% CI] for recurrent falling*	**PDI [95% CI]**
Age (per year)	**1.04 [1.03 – 1.06]**	**1.05 [1.04 – 1.07]**	**0.39 [0.38 – 0.41]**
Female sex	**1.37 [1.12 – 1.66]**	1.19 [0.97 – 1.46]	
Predictors	**Model2: age + gender + DBI**		
	aOR [95% CI] for single falling	*aOR [95% CI] for recurrent falling*	**PDI [95% CI]**
Age (per year)	**1.04 [1.03 – 1.05]**	**1.05 [1.04 – 1.07]**	**0.41 [0.39 – 0.42]**
Female sex	**1.34 [1.10 – 1.63]**	**1.14 [0.93 – 1.39]**	
0 < DBI < 1	1.16 [0.92 – 1.46]	1.20 [0.93 – 1.54]	
DBI ⩾ 1	1.26 [1.00 – 1.61]	1.72 [1.34 – 2.21]	
Predictors	**Model3: age + gender + FRIDs**		
	aOR [95% CI] for single falling	*aOR [95% CI] for recurrent falling*	**PDI [95% CI]**
Age (per year)	**1.04 [1.02 – 1.05]**	**1.05 [1.04 – 1.07]**	**0.45 [0.43 – 0.47]**
Female sex	**1.30 [1.05 – 1.62]**	1.03 [0.83 – 1.29]	
SSRI	1.23 [0.80 – 1.91]	**2.50 [1.72 – 3.66]**	
TCA	1.12 [0.68 – 1.84]	1.54 [0.95 – 2.49]	
Antiepileptics	1.25 [0.76 – 2.07]	**1.79 [1.13 – 2.84]**	
Loop-diuretics	1.20 [0.92 – 1.58]	**1.48 [1.12 – 1.95]**	
Benzodiazepines	0.97 [0.77 – 1.23]	0.89 [0.69 – 1.13]	
Digoxin	1.03 [0.67 – 1.56]	0.83 [0.51 – 1.34]	
Nitrates + ivabradine	1.10 [0.81 – 1.47]	1.20 [0.89 – 1.60]	
Thiazides	0.97 [0.78 – 1.21]	1.16 [0.92 – 1.46]	
Aldosteron antagonists	1.30 [0.86 – 1.96]	0.89 [0.54 – 1.43]	
Beta-blocking agents	1.15 [0.94 – 1.40]	1.04 [0.85 – 1.28]	
Calcium channel blockers	1.01 [0.82 – 1.25]	0.88 [0.70 – 1.10]	
RAAS-inhibitors	0.96 [0.79 – 1.18]	0.92 [0.74 – 1.14]	
Insulin	**0.48 [0.25 – 0.94]**	1.01 [0.61 – 1.68]	
Sulfonylurea derivatives	1.09 [0.81 – 1.47]	1.18 [0.87 – 1.61]	
Alpha blockers	1.05 [0.73 – 1.50]	0.78 [0.52 – 1.16]	
Strong opiates	0.89 [0.52 – 1.54]	1.53 [0.95 – 2.46]	
Codeine	**1.92 [1.23 – 3.00]**	**1.89 [1.17 – 3.04]**	
Tramadol	1.39 [0.90 – 2.12]	**1.57 [1.03 – 2.40]**	
Antihistamines	1.12 [0.74 – 1.69]	1.25 [0.82 – 1.91]	
Statins	**0.74 [0.60 – 0.91]**	0.97 [0.78 – 1.21]	
NSAIDs	1.15 [0.85 – 1.56]	1.17 [0.85 – 1.61]	
Urinary antispasmodics	1.15 [0.67 – 2.00]	1.78 [1.09 – 2.91]	
Antivertigo drugs	0.90 [0.50 – 1.64]	**1.82 [1.12 – 2.98]**	
Dipyridamole	1.07 [0.70 – 1.63]	**1.64 [1.13 – 2.39]**	

Abbreviations: aOR = adjusted odds ratio, DBI = Drug Burden Index, PDI = polytomous discrimination index, SSRI = selective serotonin reuptake inhibitor, TCA = tricyclic antidepressant, RAAS-inhibitors = renin-angiotensin-aldosterone system inhibitors, NSAID = non-steroidal anti-inflammatory drug, CI = confidence interval

Chapter 3

Older patients' needs and expectations of pharmacy-led fall prevention services

Chapter 3.1

Pharmacy fall prevention services for the community-dwelling elderly: patient engagement and expectations

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ABSTRACT

Medication use is an important risk factor for falls. Community pharmacists should therefore organize fall prevention care; however little is known about patients' expectations of such services. This qualitative study aims to explore the expectations of community-dwelling older patients regarding fall prevention services provided by community pharmacies. Telephone intakes, followed by three focus groups, were conducted with 17 patients, who were aged ≥75 years, used at least one fall risk-increasing drug (FRID), and were registered at a community pharmacy in Amsterdam, the Netherlands. Some time of the focus groups was spent on playing a game involving knowledge questions and activities to stimulate discussion of topics related to falling. Data were collected between January 2020 and April 2020, and all focus groups were audiotaped and transcribed verbatim. The precaution adoption process model (PAPM) was applied during data analysis. Patients who had already experienced a fall more often mentioned that they took precautions to prevent falling. In general, patients were unaware that their medication use could increase their fall risk. Therefore, they did not expect pharmacists to play a role in fall prevention. However, many patients were interested in deprescribing. Patients also wanted to be informed about which medication could increase fall risk. In conclusion, although patients initially did not see a role for pharmacists in fall prevention, their perception changed when they were informed about the potential fall risk-increasing effects of some medications. Patients expected pharmacists to focus on drug-related interventions to reduce fall risk, such as deprescribing.

INTRODUCTION

One third of people aged 65 years and older fall at least once each year.[1] Given the potentially serious consequences of falls, including physical injury and increased use of health services, the prevention of falls is of utmost importance.[2] Furthermore, people who experience a fall incident often develop a fear of falling, which leads to limitations in daily activities with social withdrawal, functional decline and reduced mobility. A fear of falling also increases fall risk.[3]

Falling is a multifactorial problem, and medication use is an important, potentially modifiable risk factor.[4,5] Since one of the core tasks of community pharmacists is to ensure safe medication use and prevent medication-related problems, they should play a prominent role in reviewing the use of fall risk-increasing drugs (FRIDs).[6,7] Apart from this, pharmacists can provide information on other modifiable risk factors, such as exercise, diet, and a safe home environment.

Prevention programmes should align with patients' preferences to ensure patient engagement. Therefore, the expectations of patients must be taken into account during the development of interventions.[8,9] Fall prevention programmes previously failed because of a mismatch between the views of healthcare providers and those of their patients regarding fall risk assessment. Patients did not accept their individual fall risk assessment by nurses.[10] Moreover, patients had diverse reasons for not wanting to participate in an exercise-based fall prevention programme delivered by community care staff (e.g. patients being too busy, already doing exercise, being too old, experiencing a fear of new things or falling, and disliking exercise).[11] Most importantly, since patients often underestimate their own fall risk, they are not motivated to enrol in fall prevention programmes.[12,13] Furthermore, patients' autonomy must be maintained during such programmes to keep them engaged.[9]

Patients' needs and expectations regarding fall prevention programmes delivered by community pharmacies have not been studied before. More knowledge is needed on how patients would like pharmacists to approach them for fall prevention interventions and what the intervention programmes should look like. In this qualitative study, we investigated the engagement of community-dwelling older people in fall prevention, focusing on fall prevention services conducted by community pharmacies.

METHODS

Study setting and population

A qualitative study was conducted consisting of short telephone intakes followed by focus group discussions. One researcher (MG) selected patients from the pharmacy information system of a community pharmacy in Amsterdam, and another researcher (OJ) invited them to participate in the focus groups.

The following inclusion criteria were used for selection of patients:

- Age ≥ 75 years;
- Simultaneous use of at least five drugs, with at least one being a FRID (either cardiovascular or psychotropic);[14–16]
- Community-dwelling;
- Physically and mentally able to attend the focus group in the community health centre;
- Proficient in Dutch.

Patients were invited by telephone, and after verbal consent, a telephone intake followed. They were briefly asked about their fall experiences and interest in fall prevention (see below). Thereafter, an information letter and consent form were sent by postal mail to their addresses. All participants provided written informed consent before the start of the focus group discussions. All data were collected between January 2020 and April 2020.

The study was approved by the institutional review board of the Division of Pharmacoepidemiology and Clinical Pharmacology, the Department of Pharmaceutical Sciences, Utrecht University. Results were reported according to the consolidated criteria for reporting qualitative research (COREQ) guidelines (Supplementary information S1).[17]

Telephone intakes

Semi-structured telephone intakes of approximately 30 minutes were performed with participants prior to conducting the focus groups. These intakes aimed to obtain individual fall-related background information, such as previous fall experiences, applied precautions to reduce fall risk, and interest in pharmacy

fall prevention services. The researcher (OJ) used a topic list (Table 1) for the telephone intake and completed a structured form immediately after each intake.

Focus groups

Participants were divided into three focus groups, resulting in five to seven participants per session. The duration of each session was 1.5 to 2 hours. The first focus group was chaired by an experienced pharmacy practice researcher (EK) while two another researchers (MG and OJ) were second listeners, who occasionally stimulated group discussion and took field notes. The second and third focus groups were chaired by OJ, while MG was the second listener during these focus groups and EK took field notes during the second focus group. All focus groups were audiotaped and transcribed verbatim afterwards, and all patients received a short report with the main findings of the focus groups. Data saturation was discussed after the third focus group.

A topic list was made to guide the focus groups (Table 1). First, the findings from the telephone intakes were briefly discussed in the focus groups. Thereafter, additional topics derived from findings of the intakes, the first focus group session and the literature (Table 2), were addressed in those groups.

The group discussion was followed by a game of DobbelFit.[18] The DobbelFit game – created by VeiligheidNL, a Dutch organization that aims to prevent accidents and improve safety nationwide – has been developed for healthcare professionals to play together with patients. During the game, patients are challenged to perform simple exercises to improve their balance. Furthermore, the game contains a quiz element with questions on issues such as potential fall risk factors, the benefits of calcium and vitamin D supplementation, and medication-related fall risk. The game was adapted for the focus groups by removing non-pharmacy-related questions and by reducing the number of exercise challenges. In the second and third focus groups, the number of knowledge questions was also reduced and replaced by statements about fall prevention. These statements (Table 1) were included to enhance data collection.

Data analysis

All audio recordings of the focus groups were transcribed verbatim. The intake forms and focus group transcripts were imported into NVivo version 12 software,

Table 1. The topic list used in the telephone intakes and the topics and statements addressed during the focus groups.

TELEPHONE INTAKES	
Topic	**Examples of questions**
Fall experiences	Did you fall in the past?
	Are you afraid of falling?
Precautions	What are your solutions to reduce fall risk?
Interest in fall prevention service	Are you interested in a fall prevention program from pharmacists?
FOCUS GROUPS	
Topic	**Examples of questions**
Fall experiences	Did you fall in the past, and are you afraid of falling?
Precautions	What are your solutions to reduce fall risk?
Needs and wants	What are your needs for fall prevention services in general?
	What are your experiences with fall prevention services from other health care providers?
Expectations from pharmacists	How could pharmacists contribute to fall prevention in your opinion?
	What do you expect from pharmacists in fall prevention?
Topic	**Statements**
Precautions	I make sure there are no objects on the floor to prevent from stumbling over them.
Interest in fall prevention service	I am interested in fall prevention services by pharmacists.
Expectations from pharmacists	My pharmacist should inform me, when I start using a new drug, about potential fall risk-increasing adverse effects.
	My pharmacist should ask me regularly, preferably every three months, about my recent fall history.
	My pharmacist should help me with finding solutions I can do myself to reduce my fall risk, including environmental adjustments (e.g., removing carpets, sufficient lighting).
	My pharmacist should inform me about calcium and vitamin D intake to strengthen my bones.
	My pharmacists should inform me about mobility and balance exercises to stay fit and vital.
Deprescribing	I think one or more of the drugs I use can be discontinued because I am using them daily for long time now.
	I wish my pharmacist checks, in agreement with me, which of my drugs increase fall risk and whether I still need them.
Information about fall prevention/drugs	Statement 1: I search for information on the internet about solutions to reduce my fall risk. or Statement 2: I ask my health care provider for tips and recommendations to reduce my fall risk.
	When I am dizzy and I think my medication caused this, I prefer reading patient information leaflets to consulting my pharmacist.

Abbreviations: precaution adoption process model (PAPM)

Table 2. Scientific foundation of topics addressed during interviews and focus groups.

Topic	Scientific foundation
Fall experiences	Acceptance of fall risk impairs the personal identities of older patients.[19] However, by experiencing a fall, personal fall risk may be acknowledged.[20] Therefore, previous fall experiences trigger behavioural changes and engage patients in fall prevention activities.[21]
Precautions	The importance of being careful is often recognized by older people. They avoid certain activities, and precautions are taken, even by patients who deny experiencing a fear of falling.[19] Exploration of the precautions taken provides information about the established engagement in fall prevention.
Interest in fall prevention service	Patients have reported that the necessity of fall prevention activities is associated with ageing. It may be disturbing for older patients to belong to the group who is in need of these activities.[20] Their interest in a fall prevention service indicates whether they are already engaged.
Needs and wants regarding fall prevention service	Older people may experience asking for help in fall prevention as a loss of their independence. However, a fall can seriously impair their independence.[19] When patients recognize that prevention services could also protect their independence, this could enhance their engagement.
Expectations from pharmacists	Patients often do not know who should be approached for support in fall prevention.[21] When they are unaware that their pharmacist could be consulted, it is unlikely that they will ask for the pharmacist's assistance. Therefore, higher established expectations from pharmacists could be related to enhanced patient engagement.
Deprescribing	Deprescribing aids in the prevention of adverse drug reactions, including increased fall risk. It has been reported that patients sometimes think their medication might no longer be necessary for the treatment of their disease(s).[22] Therefore, many may be interested in deprescribing and would like to know more about its advantages and disadvantages. Pharmacists can facilitate the deprescribing process, for example by conducting medication reviews.
Information about fall prevention / drugs	For behavioral changes the understanding of fall risk is essential. Patients are often unaware of potentially modifiable risk factors.[21] Enhanced patients' knowledge contributes to patient engagement in fall prevention.

and participants' names were replaced by a study code to ensure their anonymity. The transcripts were coded independently by two researchers (OJ and MG), and discrepancies in coding were discussed with EK until consensus was reached. Deductive coding was used – the codes were based on the topic list. A number of additional codes were identified during transcription (inductive coding).

Interpretation of the data

The precaution adoption process model (PAPM) was used in the data analysis.[23] This model has often been used to describe patients' decision-making processes in a wide range of situations, including HPV vaccination[24,25], treatment for osteoporosis[26], and the screening for diverse cancers.[27,28] The PAPM consists of seven stages, representing all stages of taking precautions to reduce risk, and it was considered as the most appropriate model to assess fall preventive health behaviour. In contrast to other health behaviour theories and models, the PAPM includes the stage at which patients are not yet aware of a threat or a risk. In the case of fall prevention, this applies to patients who are not afraid of falling and therefore have not (yet) taken precautions. The PAPM also investigates behavioural changes and patients' reasons for engaging.

RESULTS

Background characteristics

In total, 218 patients aged 75 years or older using five chronic medications were identified from the pharmacy information system. Of these, 35 patients were purposely selected by the researcher/pharmacist (MG) and invited to participate. The reason for this selection was that they were known to visit/contact the pharmacy regularly and were thus able to independently attend the focus group session in the community health centre. Twenty participants agreed to participate, but just before start of the focus groups three of them cancelled. Therefore, 17 participants attended the focus groups (Figure 1). The reasons for cancellation were having other appointments and not feeling well enough. All participants met the inclusion criteria, except for one woman of 69 years. Her husband, who met the inclusion criteria, was originally invited, but she participated instead of him. This woman's views were comparable with the overall findings, and she had experienced multiple falls.

Slightly more women (52.9%) than men participated, and the mean age of the participants was 82.1 years (standard deviation [sd] = 4.9 years). Most participants (58.8%) reported at least one fall incident (Table 3). During the third focus group, no new topics were addressed, and the research team concluded that data saturation was achieved.

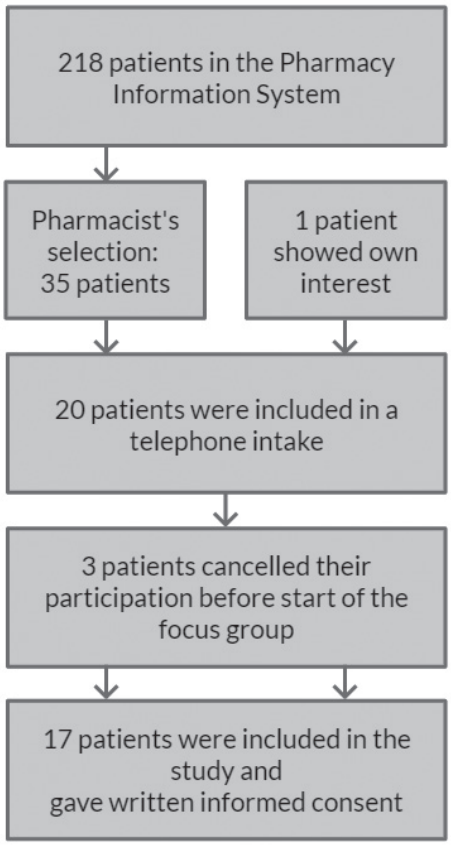

Figure 1. Flowchart of the inclusion of patients in the study.

Table 3. Background characteristics of the patients in the focus groups and telephone intakes

	Patients N = 17
Female gender (N, %)	9 (52.9%)
Age in years (mean [sd])	82.1 [4.9]
Multidose drug dispensing system (N, %)	4 (23.5%)
≥ 1 fall experience(s)† (N, %)	10 (58.8%)
Number of dispensed medications (median, [Q1-Q3])	8 [6 – 9]
Number of dispensed FRIDs (median, [Q1-Q3])	3 [2 – 5]

†An estimation of the past 10 years on the basis of what patients said during the intakes and focus groups.
Abbreviations: fall risk-increasing drug (FRID), standard deviation (sd), number (N), first quantile (Q1), third quantile (Q3).

The PAPM

The PAPM consists of seven stages of patients' decision-making to act on fall prevention. Stage 1 (unawareness) and Stage 2 (non-engagement) of the model were combined in the analyses, as both describe stages in which patients are not taking precautions to prevent a fall. Stage 3 (undecided about acting) refers to the decision-making between acting and non-acting on fall prevention, and Stage 4 (decided not to act) represents non-acting behaviour. Stage 5 (decided to act), Stage 6 (acting), and Stage 7 (maintenance) describe acting behaviour and were also combined during analyses. Furthermore, the PAPM stage transitions were identified and analysed.

Participants were in different stages of the PAPM (Figure 2). Furthermore, they were sometimes found in one PAPM stage for certain behaviours, but in different stages for other behaviours. Table 4 summarizes participants' views on the main codes and the related PAPM stages from the focus groups and intakes.

Unawareness and non-engagement (PAPM Stages 1 and 2)

Patients' perceived fall risk seemed to influence their engagement in fall prevention activities; specifically, a low perceived fall risk was often co-reported with a low interest in fall prevention. Four patients perceived no risk of falling and were consequently not interested in participating in fall prevention programmes. Those who were not interested in fall prevention services also indicated that they were not taking precautions to reduce fall risk. They stated that they were healthy, exercised, and/or walked a lot. Although exercising could be seen as a precaution to prevent falls, these patients explicitly mentioned that they were not taking precautions to prevent falls. One patient who perceived no risk even expected that healthcare providers would agree that he was not at risk:

"I don't think pharmacist employees feel the need to ask me about these things [recent fall incidents]."
Man, 84 years (Patient 4)

Cognitive pharmaceutical services (CPS) are pharmaceutical services that offer provision of information and counselling to enable patients to take responsibility for their own care and correct medication use.[29] Although many patients were

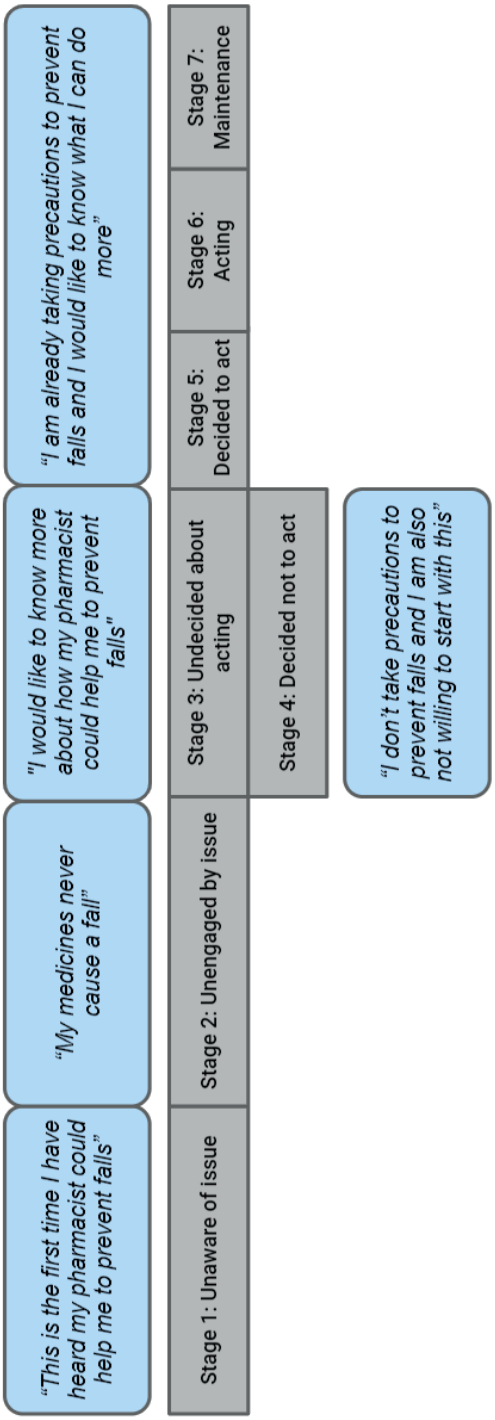

Figure 2. The application of the precaution adoption process (PAPM) model on possible thoughts or beliefs of patients during their decision-making in fall prevention.

positive about such CPS for older people, some patients had doubts about how pharmacists could contribute to fall prevention. They were also surprised that they were approached by the pharmacy to participate in this research:

"You are the first pharmacy employee who is asking me about this. But I'm interested in all kinds of advice. However, I don't have any fall experiences."
Man, 84 years (Patient 4)

Many patients were unaware of the fact that medication use could increase fall risk. This was also seen during the DobbelFit game. Participants' understanding of fall-related drug side effects varied: some patients had little understanding, while others were able to relate side effects to fall risk. This was reflected in patients' answers to the focus group moderator's question regarding whether diuretics and hypnotics could increase fall risk:

"I use diuretics, and because of that, I have to pee five times in a night. But I don't think this increases risk of falling."
Woman, 83 years (Patient 7)

"When the blood pressure decreases, this is possible. That's my gut feeling; I am not an expert."
Man, 76 years (Patient 10)

"Yes, when blood pressure decreases, you can become dizzy. But I don't fall because of that."
Woman, 83 years (Patient 7)

Undecided about acting (PAPM Stage 3)

Patients in this stage were undecided about acting on fall prevention. Informing them about fall risks seemed to aid in the decision-making process. Patients would like to receive more attention and appreciated receiving information from pharmacists about the potential fall risk-increasing effects of drugs:

"Yes, [informing about fall risk-increasing drug effects] is definitely a good thing. It is part of prevention, and therefore, it is good. Yet, I don't know what I will do with the information."
Man, 84 years (Patient 17)

Table 4. Participants' views on topics.

PAPM stage	Codes	Responses N = 17
Unaware	*No interest in service*	Follows directions of drug use carefully without problems (N = 1)
	Medication and fall risk	Indicates that medication use did not cause the fall(s) (N = 7)
	Deprescribing wants	Believes withdrawal is unnecessary in cases without complaints (N = 1)
Unengaged	*No interest in service*	Perceives no fall risk and is therefore not interested (N = 4)
	Deprescribing wants	Believes his/her medication is necessary and cannot be withdrawn (N = 3)
Undecided about acting	*Interest in service*	Shows interest and wants to know more (N = 7)
	Medication and fall risk	Has doubts about how a pharmacist could help (N = 4)
	Information search	Looks for information on the world wide web, and in magazines, or consults friends/family (N = 9)
		Reads patient information leaflet (N = 7)
		Consults general practitioner or pharmacist (N = 8)
Decided not to act	*No interest in service*	Believes pharmacy employees are not capable enough (N = 1)
Decided to act	*Interest in service*	Clearly displays interest in service (N = 4)
	Deprescribing wants	Hopes/wants medication to be withdrawn (N = 10)
Acting	*Precautions*	Is already taking precautions (home safety, walking aid, avoidance of certain activities) (N = 14)
Stage transitions	*Fall anxiety*	Reports fall anxiety (N = 5)
		Not afraid, but careful (N = 6)

Abbreviations: precaution adoption process model (PAPM)

Most patients stated that they primarily tried to solve health-related problems by themselves. They would search the internet for information about fall prevention or drugs. Articles in popular press were valued as well. They would subsequently consult relatives, neighbours, or friends. Only when patients could not solve healthcare problems on their own, they would consult a healthcare provider:

"First, I would try to investigate the problem on my own. When this does not work, I ask someone who is having the same problem as me, and I ask how he is experiencing it. […] When I cannot solve it myself, then I approach a healthcare provider."
Man, 86 years (Patient 11)

Some patients said that they read patient information leaflets when they received the initial dispensing of a new drug. They expected that patient information leaflets contained relevant information about the fall risk-increasing side effects of drugs:

"When I experience side effects such as dizziness, I would read the patient information leaflet instead of consulting the pharmacy. For example, it is 10 PM and I feel dizzy due to medication, then I read the patient information leaflet. […] It is written by an expert."
Man, 82 years (Patient 16)

However, patient information leaflets were not appreciated by all participants. The abundant description of side effects and the small font size, caused some patients to immediately throw those leaflets into the bin. They had a preference for leaflets with a larger font size and more succinct information.

Furthermore, patients were undecided or doubtful about pharmacy fall prevention services. Many patients emphasized the role of the general practitioner (GP) in keeping them well informed. They often preferred to consult their GP first about fall prevention as well as about drug information:

"When I feel dizzy, I won't approach the pharmacy, but the general practitioner. […]. Even when my drugs cause my dizziness..."
Man, 83 years (Patient 8)

Decided not to act (PAPM Stage 4)

Although many patients considered that part of their medication was superfluous, not all patients were interested in deprescribing. They either believed that in the absences of drug complaints, withdrawal efforts were unnecessary or believed their medications were essential to treat their disease(s):

"I have never been recommended this [deprescribing medication], since I cannot miss anything. I have a stent in my heart. I have thyroid problems. I need to use antihypertensive drugs."
Woman, 83 years (Patient 7)

Although patients were positive regarding pharmacists regularly asking about recent fall incidents, they did not expect or want to receive lifestyle recommendations from pharmacists. Furthermore, patients mentioned receiving limited attention from pharmacists and hence thought that pharmacists would not have enough time to organize fall prevention care:

"I think it would be positive [pharmacists making recommendations about home safety], but every day hundreds of patients are entering the pharmacy. Will they be able to ask about it every time? I can't picture that."
Man, 82 years (Patient 16)

Apart from pharmacists, patients also experienced receiving limited attention from doctors, including GPs. A few patients thought there might even be a relationship between age and the efforts of healthcare providers. When patients experience limited attention, it may hold them to continue consulting their healthcare providers about fall prevention:

"I have this feeling that there is not a lot of interest. When I enter the GP practice, I see her looking at the clock. And this is in particular the case with elderly."
Man 84 years (Patient 17)

Acting (PAPM Stages 5, 6, and 7)

Engagement with fall prevention was particularly evident in patients who were already taking precautions. For patients who had experienced a fall, precautions were related to the cause of the fall (e.g. careful on stairs when having fallen from stairs). Precautions most often focused on improving home safety and included the following: removing obstacles from the floor to keep the house neat, covering sharp edges with softer material, and avoiding walking in socks or slippers. Other precautions were also mentioned, such as avoiding certain activities, use of a walking aid, and participating in a community centre fall prevention programme:

"I participated in a fall prevention programme of the community centre. I learned not to walk with hands in pockets on the street, so you can always catch yourself when you fall. It was very good and interesting."

Woman, 81 years (Patient 2)

"I don't cycle anymore because of that problem. I would not like to get hospitalized again."
Woman, 79 years (Patient 9)

On the other hand, several patients perceived being at low risk of falling because of their daily exercises. All patients emphasized that daily exercises were important for their overall health status and for maintaining their fitness. Therefore, daily exercise alone could also be seen as some form of engagement with fall prevention:

"[…] I landed like a frog on the floor on my both feet and hands. I did not break anything. I was only a little hurt. That was because I exercise. When you are stiff you are more likely to break something."
Woman, 81 years (Patient 2)

Apart from the precautions, most patients also said that they would like their medication to be reviewed. Some patients already even hoped that some medication could be withdrawn. In their opinion, the pharmacist could play an important role here:

"I'm using the same medicines for over 25 years now and I think half can be withdrawn... […] The pharmacist and cardiologist should collaborate and think of a sort of drug tapering system for me."
Man, 85 years (Patient 6)

PAPM stage transitions

PAPM stage transitions were often triggered by the experience of a fall. Patients who had frequently fallen had developed fall anxiety or were more careful. A woman started taking precautions (e.g., using a walking cane, going out for a walk less) after she had experienced a fall:

"I am very busy, and I am member of many committees […]. Since my pelvic fracture, I am afraid to fall again. I used to walk to the square back and forth, but I don't do that anymore."
Woman, 88 years (Patient 3)

At that time, she was possibly unaware that her decision to avoid activities for fear of falling may lead to functional decline, and subsequently increased fall

risk. In the telephone intake, this woman was highly engaged; she mentioned being interested in all forms of help to prevent falls because she did not want to fall again. Furthermore, another patient experienced fall anxiety after a fall and consequently adapted his home environment:

"I am a little afraid of falling after I fell. I removed the carpets straight away. [...] I have laminate flooring now."
Man, 85 years (Patient 6)

As noted, patients were often unaware about the fall-related side effects of medication. Hence, with regard to this topic, they were found in PAPM Stage 1. However, some indicated that informing them about these effects would trigger them to engage in deprescribing, corresponding to PAPM Stage 5:

"When the pharmacy tells me I lose balance due to medication, then I would ask for an alternative."
Man, 86 years (Patient 11)

DISCUSSION

Patients are at different stages of engagement in in fall prevention activities, ranging from being unaware of fall risks to being highly active in the prevention of falls. Therefore, they have different needs and expectations. In particular, patients who had previously experienced a fall were more inclined to prevent future falls and displayed interest in pharmacy fall prevention services.

Our findings confirm previous results demonstrating that older patients often underestimate their fall risk and are therefore not engaged in fall prevention activities.[12,13,30] Furthermore, it has been reported that patients who have experienced a previous fall are more inclined to acknowledge their fall risk.[9]

Regardless of the stage of engagement, patients were unaware of the existence of FRIDs. Fall risk as an adverse effect of medication was often not acknowledged by patients, and it seemed to impact the level of engagement in a pharmacy fall prevention service. In the literature, patients' belief that their medication is necessary and beneficial is an important barrier for deprescribing.[31] In our study, a few patients also mentioned the necessity of medication, and this was served as an argument to not be engaged in a medication review focused on reducing fall risk.

Patients wished to be informed by the pharmacist about how their medication use may increase their fall risk (e.g., at the first dispensing of a new drug). They also expected patient information leaflets to contain this information. Our findings correspond with earlier findings that patients are positive about being educated about their safety. Despite this, informing patients might not always be sufficient for actual behavioural changes.[32]

From the patient perspective, pharmacists' fall prevention interventions should focus on deprescribing and providing information about how medication may enhance fall risk. Informing patients could facilitate engagement when they are in PAPM Stage 1 or 2 (unawareness/non-engagement) and support their decision-making when they are in PAPM Stage 3. Many patients in our study were also interested in targeted interventions, which suggests that these patients were already in PAPM Stage 5 (decided to act). Specifically, these patients indicated being interested in deprescribing. They may be concerned about the high number of drugs, wondering whether all drugs were still necessary. Additionally, it has been shown that patients' drug knowledge is often poor, but crucial for involvement in decision-making.[33] Deprescribing interventions presumably will be more successful when patients have increased drug risk awareness. Earlier findings suggest that when patients are not experiencing side effects and are not concerned about future harm, they may not see the benefit of drug withdrawal.[34] However, a previous study also found that over 90% of older patients would like to try medication withdrawal, as long as the prescriber agrees.[35] This corresponds to our findings: although not all patients were engaged in fall prevention in general, many still showed interest in deprescribing.

Patients who had experienced a fall tended to acknowledge their fall risk more often and were, consequently more frequently found in PAPM Stages 5, 6, or 7 than the others. As a side note, PAPM stages were not consistent for all aspects of fall prevention activities, as individual patients were sometimes found in different PAPM stages for different fall prevention activities. Overall, these patients were consciously adapting precautions, including reducing home environmental hazards, avoiding outdoor activities (walking, cycling), and using a walking aid (e.g., walking stick or walker). Although most of these precautions were helpful in preventing falls, avoidance of activities can have adverse effects. A strong fear of falling has been associated with functional decline, social withdrawal, decreased quality of life, increased risk of falling, and institutionalization.[3] Thus, the adapted precautions because of fall anxiety may not always be beneficial for

fall prevention. On the plus side, a fear of falling indicates patients are more or less engaged and hence should at least be found in PAPM Stage 3.

Patients were sceptical about whether pharmacists could organize fall prevention, mentioning that pharmacists and other healthcare providers do not have enough time to do so. Furthermore, because of limited time, they expected pharmacists to focus primarily on medication safety. Despite this, patients reported that they would like to receive more attention from their health care providers.

Strengths and limitations

An important strength of this study was the combination of the telephone intakes and focus group which provided comprehensive data. The telephone intakes ensured that the perspectives of all patients, particularly those who were more reluctant to speaking in groups, were investigated. Data from the intakes were used as input for the set-up of the focus groups. In these groups patients were encouraged to respond to discussions or complement one another's opinions. In particular, the use of the DobbelFit game during the focus groups was innovative, contributed to a relaxed atmosphere, and was appreciated by the participants. The PAPM supported the data analyses, as it helped to identify the stages and engagement triggers of patients. Despite the PAPM being applied retrospectively, during data analysis, the model fitted the data well and enhanced interpretability.

The major limitation of this study was the generalizability of findings. First, all participants were from one single pharmacy in the suburb area of Amsterdam. However, the organization of health care may differ in a strongly urbanized environment compared to small villages. It is challenging for health care providers to establish strong relationships with patients in the larger health care centres of cities. Therefore, satisfaction about health care is generally higher in rural populations.[36] Since patients' ideas about strong relationships with health care providers might differ in a village, their needs and expectations about health services, including fall prevention, might also differ. Second, participants needed to be able to visit the pharmacy. Therefore, the frailest patients with physical disabilities were not included in our study. Third, only polypharmacy patients were included. However, deprescribing may also be relevant for patients who are using FRIDs but do not fall in the polypharmacy category. Fourth, because participants needed to be able to communicate in Dutch, all participants were native Dutch speakers. However, differences could be expected among patients

from ethnic minorities. Since their primary health care use and health literacy may differ, they would possibly engage less with pharmacists and may have an impaired ability to find and understand fall prevention information.[37] Fifth, the focus group design might have led to an overrepresentation of the views of more dominant participants. For this reason, the focus group moderators attempted to allow all participants to raise their voices. Lastly, our study has not repeated some subgroup viewpoints demonstrated in previous studies. For example, previous studies found that a fear of falling, and subsequent engagement in fall prevention, was also found in patients without fall experiences.[38] Furthermore, another subgroup has also been identified in studies, but not in our work. This group covers patients with many fall experiences but who consider themselves to be "non-fallers", and who neither experience fall anxiety nor are engaged in fall prevention.[19] With the exception of those viewpoints, our findings correspond to earlier findings from other studies, which strengthens the idea the perspectives are applicable to most patients.

Implications

Pharmacists should spend more time on fall prevention (e.g., screening of patients at risk and informing them about fall prevention). For example, it could be part of medication reviews, and pharmacists should inform patients about the risk of using a FRID at first dispensing. Patients could then engage in fall prevention, and their awareness about fall-related drug risks would increase. Pharmacists should focus particularly on deprescribing interventions to reduce fall risk in older patients. For risk factors other than medication use, pharmacists could inform and refer patients to other health care providers; they should hence collaborate with GPs and other health care providers, which is a recommended approach for successful fall prevention.[39]

Pharmacy fall prevention care should specifically be provided to patients using FRIDs and those who have reduced mobility (e.g., patients who are using a walking aid or standardly request their medication to be home-delivered). Pharmacists could consider organizing educational group sessions about fall prevention for these patients. In these sessions evidence-based effective interventions should be addressed, including the deprescribing of FRIDs[40,41], the relevance of exercising, and home environmental recommendations.[42]

In addition to informing patients orally or in group sessions, providing written information should be adequate as well. Patients most often preferred to read or search for information about falls and drugs themselves rather than consulting their health care provider. A previous study revealed that patients were passive in consulting their caregiver, because they thought their health professionals would inform them if there was a problem. In contrast, caregivers often mentioned being reactive in providing information.[43] Encouragement from health practitioners is important for patients to participate in fall prevention activities.[30] Therefore, the information provided in patient information leaflets should be complete, with a section on fall-related side effects. Future research should investigate whether educating patients on the relationship between medication and fall risk increases their engagement in fall prevention services offered by pharmacists.

Conclusion

Although patients were initially doubtful about the role of pharmacists in fall prevention, this changed when they were informed about the potential fall risk-increasing effects of some medications. Interest came mainly from patients who had experienced a fall. Furthermore, patients expected pharmacists to focus on drug-related interventions to reduce fall risk, such as deprescribing. Finally, patients wanted to be well informed, both orally and in writing, about FRID effects.

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AUTHOR'S CONTRIBUTION

Conceptualization and data collection were performed by MG, EK and OJ. MG analysed the data, performed the literature search, and wrote the original draft. She implemented the contribution of co-authors and external reviewers up to final publication. During the whole process, she implemented input and feedback from her supervisors.

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SUPPLEMENTARY INFORMATION S1: CONSOLIDATED CRITERIA FOR REPORT-ING QUALITATIVE STUDIES (COREQ): 32-ITEM CHECK-LIST

Table 1. Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No	Item	Guide questions/description	Check?
		Domain 1: Research team and reflexivity	
		Personal Characteristics	
1.	Interviewer/ facilitator	Which author/s conducted the interview or focus group?	The telephone intakes were conducted by OJ and focus groups were conducted by OJ, MG and EK.
2.	Credentials	What were the researcher's credentials? E.g. PhD, MD	The credentials can be found in the authors' list.
3.	Occupation	What was their occupation at the time of the study?	OJ was a master student pharmacy, MG was a specialist in community pharmacy and PhD student, EK was an experienced researcher.
4.	Gender	Was the researcher male or female?	OJ was male, MG and EK were female.
5.	Experience and training	What experience or training did the researcher have?	EK was experienced with interviews and guiding focus groups, while OJ and MG were not experienced with focus groups.
		Relationship with participants	
6.	Relationship established	Was a relationship established prior to study commencement?	MG and OJ were both employed in the pharmacy. Therefore, with some patients a relationship was established prior to the study. Furthermore, OJ personally invited patients by telephone and had built a relationship during this conversation of approximately 30 minutes before the patients attended the focus groups.
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	OJ introduced himself at telephone invitation and informed the participants about the research goal. Before start of the focus groups the research team introduced themselves and informed the patients again. The patients were also informed by a patient information letter enclosed to the informed consent form.

		Relationship with participants (Continued)	
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	MG was a pharmacist and OJ was a master pharmacy student. Their interest was how a future fall prevention service by pharmacists could be implemented, which corresponds to the wishes of the(ir) patients. Also, they were interested whether the DobbelFit could be recommended to pharmacists to play with their patients to enhance engagement for fall prevention.
		Domain 2: study design	
		Theoretical framework	
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	The Precaution Adoption Process Model was used to analyse the data and underpin the study.
		Participant selection	
10.	Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Participants were selected on basis of the Pharmacy Information System (PIS). Pharmacist (MG) made a pre-selection of patients. This pre-selection was mainly based on patients of who was known they were able to visit the pharmacy and who were able to communicate in Dutch.
11.	Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	The participants were approached by telephone.
12.	Sample size	How many participants were in the study?	17 participants were included in the entire study.
13.	Non-participation	How many people refused to participate or dropped out? Reasons?	3 participants cancelled their participation: 2 participants planned another activity at the same time and 1 participant was not feeling well.
		Setting	
14.	Setting of data collection	Where was the data collected? *e.g.* home, clinic, workplace	The data were collected in a room of the community health centre at the location of the pharmacy.
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	There were no-other attendees besides the participants and researchers.

		Setting (Continued)	
16.	Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	The background characteristics of the participants are reported in Table 1. All participants were residents of Amsterdam.
		Data collection	
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	The questions, prompts and guides were provided by the authors, but not pilot tested.
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	There were no repeat interviews.
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	The research team used audio-recording during the focus groups.
20.	Field notes	Were field notes made during and/or after the interview or focus group?	Field notes were made during the intakes and focus groups.
21.	Duration	What was the duration of the interviews or focus group?	The durations of the intakes and focus groups were respectively approximately 30 minutes and 2 hours.
22.	Data saturation	Was data saturation discussed?	Data saturation was discussed after the third focus group.
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	A summary of the findings of the focus groups was returned to participants for comment and/or correction.
		Domain 3: analysis and findings	
		Data analysis	
24.	Number of data coders	How many data coders coded the data?	OJ and MG coded the data and EK was consulted for discrepancies.
25.	Description of the coding tree	Did authors provide a description of the coding tree?	The mentioned topics were used in the coding tree.
26.	Derivation of themes	Were themes identified in advance or derived from the data?	Themes were determined in advance of the data, but also derived from the data. The PAPM was applied during data analysis.
27.	Software	What software, if applicable, was used to manage the data?	The data were analysed using NVivo version 12 software.
28.	Participant checking	Did participants provide feedback on the findings?	Participants did not provide feedback on the findings. One participant showed his interest in the DobbelFit game after the focus group had taken place.

		Reporting	
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number	Participant quotations were presented to illustrate the findings. All quotations were identified by participation number.
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	The research theme believes there was consistency between the presented data and the findings.
31.	Clarity of major themes	Were major themes clearly presented in the findings?	The PAPM was used during data analyses and to identify major themes. The related topics were presented.
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Diverse cases were described and also minor themes (e.g. opinions of single participants) were mentioned.

Abbreviations: PAPM = precaution adoption process model, EK = Ellen Koster, MG = Marle Gemmeke, OJ = Obaid Janatgol.

Chapter 4

Primary care providers' perceptions to provide fall prevention services

Chapter 4.1

Community pharmacists' perceptions on providing fall prevention services: a mixed-methods study

Marle Gemmeke, Ellen S. Koster, Eline A. Rodijk, Katja Taxis, Marcel L. Bouvy

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ABSTRACT

Background

Pharmacists may contribute to fall prevention particularly by identifying and deprescribing fall risk-increasing drugs (FRIDs) in patients with high fall risk.

Objective

To assess community pharmacists' perceptions on providing fall prevention services, and to identify their barriers and facilitators in offering these fall prevention services including deprescribing of FRIDs.

Setting

A mixed-methods study was conducted with Dutch pharmacists.

Method

Quantitative (ranking statements on a Likert scale, survey) and qualitative data (semi-structured interviews) were collected. Out of 466 pharmacists who were invited to participate, 313 Dutch pharmacists ranked statements, about providing fall prevention, that were presented during a lecture, and 205 completed a survey. To explore pharmacists' perceptions in-depth, 16 were interviewed. Quantitative data were analysed using descriptive statistics. All interviews were audiotaped and transcribed verbatim. The capability opportunity motivation - behaviour (COM-B) model was applied to interpret and analyse the findings of qualitative data.

Main outcome measure

Community pharmacists' views on providing fall prevention.

Results

Pharmacists stated that they were motivated to provide fall prevention. They believed they were capable of providing fall prevention by FRID deprescribing. They perceived limited opportunities to contribute. Major barriers included insufficient multidisciplinary collaboration, patient unwillingness to deprescribe FRIDs, and lack of time. Facilitators included goal-setting behaviour, financial compensation, and skilled communication.

Conclusion

Despite the complex decision-making process in medication-related fall prevention, community pharmacists are motivated and feel capable of providing fall prevention. Opportunities for pharmacists to provide fall prevention services should be enhanced, for example by implementing multidisciplinary agreements.

INTRODUCTION

Worldwide, one third of community-dwelling persons aged 65 years and older falls at least annually.[1,2] The number of falls is growing due to increased life expectancy and aging of the general population.[2] Serious consequences of falls include traumatic brain injury, fractures, functional decline, decreased quality of life, and death.[3] Falling is a multifactorial problem caused by many underlying factors, such as mobility and vision problems[4], and medication use has also often been associated with increased fall risk. For example, fall risk-increasing drugs (FRIDs) include cardiovascular and psychotropic drugs because of their potential to cause fall-related side effects.[5–7] Hence, prevention of falls is gaining attention among community pharmacists.[8–10]

Community pharmacists have frequent contact with patients and may have the opportunity to identify those with high fall risk. This is because pharmacists may recognize medication-related falls and could therefore play an important role in fall prevention.[11,12] Deprescribing of FRIDs may be effective in reducing falls[13,14]; so far, community pharmacists have contributed to fall prevention by performing medication reviews to reduce side effects as dizziness and sedation.[15,16] Pharmacists could also refer patients to other healthcare providers, for example general practitioners (GPs), physiotherapists, and home care nurses.[17] Finally, like other healthcare providers, pharmacists can provide general advice on fall prevention, for example lifestyle recommendations.[4,8]

The Medical Research Council Framework guides the development and evaluation of complex interventions, and consists of four phases: development, feasibility/piloting, evaluation, and implementation. Understanding the changes in processes of an intervention is a key element of implementation.[18] Several barriers repeatedly arose during implementation of fall prevention programmes in different healthcare settings. For example, older persons are often not aware of their fall risk and therefore not engaged in fall prevention. Furthermore, lack of time of healthcare professionals is an important barrier.[19–21] Awareness about the importance of fall prevention varies among healthcare providers.[22] Due to the multicausality of falls, decision-making regarding how to prevent falls is often complex; therefore, fall prevention benefits from a multidisciplinary approach. In practice, organizing well-tuned co-operative fall prevention care is challenging, and a lack of guidance and training hinders healthcare providers' provision of fall prevention.[20,21] Fall prevention is consequently less integrated into daily routines than other preventive measures, such as cancer screenings.[20]

In Ohio, most pharmacists believed they can contribute to safe FRID use in patients with high fall risk.[23] In another previous study the majority of community pharmacists in Montreal thought they should conduct medication reviews with patients with high fall risk, but only a minority reported actually being involved. Likewise, pharmacists in this study were less involved than they wished in other fall prevention services, including fall risk assessment, provision of information/ recommendations to patients, and referral to fall prevention programs.[24] Therefore, despite all the efforts, few community pharmacist-led fall prevention services are implemented in practice thus far and the barriers and facilitators for implementation remain unclear. The current state of community pharmacist-led services of fall prevention should, therefore, be examined including pharmacist's thoughts about barriers and facilitators. Such information is the foundation for initiating behavioural change among pharmacists in practice, in order to provide fall prevention care, and it is needed to implement pharmacist-led fall prevention services in the future.[25]

Aim of the study

In this mixed-methods study, we aimed (1) to assess community pharmacists' perceptions on providing fall prevention services and (2) to identify the barriers and facilitators in providing these fall prevention services, including the deprescribing of FRIDs.

Ethics approval

The study protocol was approved by the Institutional Review Board of the Division of Pharmacoepidemiology and Clinical Pharmacology, Utrecht University (reference number UPF2002).

METHOD

Design, setting and participants

A mixed methods study was conducted combining quantitative and qualitative data collection methods. Participants were invited to participate in this study during five regional meetings of the Royal Dutch Pharmacists Association (Koninklijke Nederlandse Maatschappij ter bevordering der Pharmacie, [KNMP]) which were organized to educate and inform community pharmacists about

fall prevention. The regional meetings were part of the routine educational programme offered by the KNMP for their members in all five regions spread across the Netherlands. Pharmacists enrolled voluntarily in the meetings, which all were held in February 2020.

Quantitative and qualitative data

Pharmacists' overall perspectives were primarily investigated by quantitative methods: statement rankings during an interactive lecture, and a survey. To investigate their in-depth perspectives, qualitative interviews were conducted. Figure 1 summarizes how quantitative and qualitative data were collected and analysed, as described in the sections below.

The results were reported according to the consolidated criteria for reporting qualitative research (COREQ) guidelines (see Supplementary Information S1).[26]

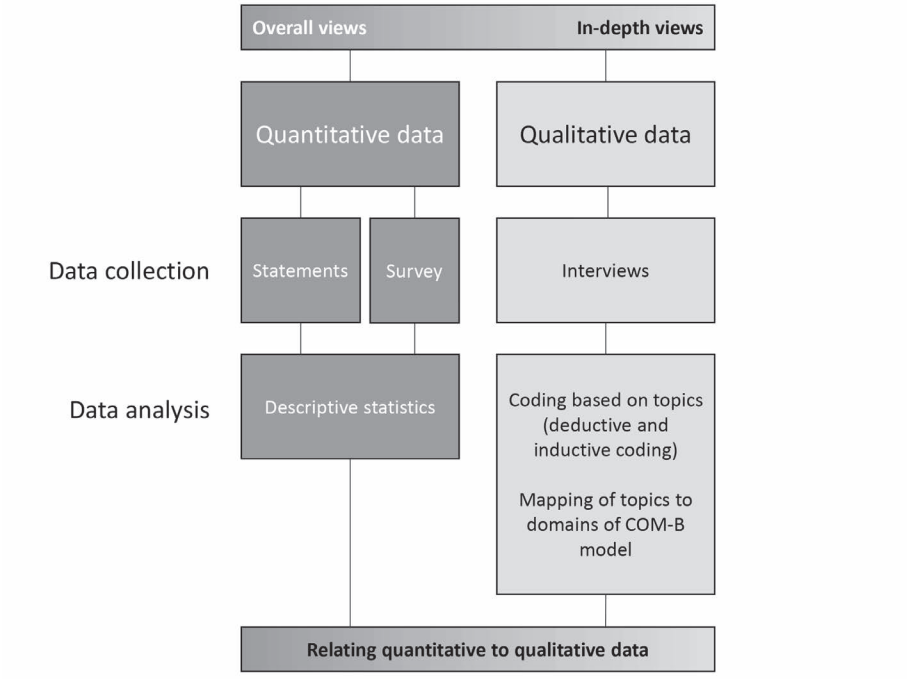


Figure 1. Application of quantitative methods (statement rankings and survey) and a qualitative method (interviews) to investigate the overall and in-depth perspectives of pharmacists. The capability opportunity motivation - behaviour (COM-B) model was applied to qualitative data. Quantitative data and qualitative data were related to each other by linking findings by means of the topics.
Abbreviations: COM-B = capability opportunity motivation - behaviour model

Quantitative data collection

Statements

During the five regional meetings, pharmacists participating in the lectures were asked to rate nine statements on the fall prevention activities of community pharmacists and their need for further implementation of fall prevention on a Likert scale from 1 (totally disagree) to 10 (totally agree) (see Supplementary Information S2 for the content of statements). Examples of statements were as follows: "I have enough knowledge to recognize FRIDs" and "At the moment, I contribute to fall prevention". Through discussion, the research team developed the statements, which were based on literature findings, until they all agreed on sufficient applicability.[9,10,17] The presentation software Mentimeter (www.mentimeter.com) was employed to display the statements and record the responses. Pharmacists in the audience used their smartphones to rank the statements, and they were asked for permission to use the responses for research purposes after the lecture.

Survey

After the lecture pharmacists were immediately invited to complete a paper-based survey (see Supplementary Information S2 for the content of the survey). The survey was in Dutch and comprised of 26 questions. The topics were: current fall prevention activities of pharmacists, fall risk assessment during medication review, needs for assistance for further implementation of fall prevention, and needs for a guideline to deprescribe FRIDs. Topics were based on literature findings, and through discussion, the research team developed the survey until they all agreed on sufficient applicability.[9,10,17] The survey also collected background information, including age, gender, and years of work experience. The types of questions varied: statements (using a Likert scale from 1 to 5), open sections, and multiple choice questions. All responses were processed anonymously.

Qualitative data collection

In the survey, pharmacists could indicate their interest in an interview with a master student-researcher (ER) to explain their perceptions on pharmacist-led fall prevention. By means of interviewing, we obtained in-depth information regarding the community pharmacists' perspective on fall prevention services,

including barriers and facilitators in establishing such services in practice. The interviews were held between April 2020 and June 2020 by telephone. All participants provided verbal informed consent, and all interviews were audio recorded. The interviews were guided by a topic list that included the following topics: knowledge of FRIDs, deprescribing, multidisciplinary collaboration, and helpful tools for deprescribing (see Supplementary Information S2). Topics were identified based on literature, themes that arose out of the survey, and themes that emerged during short talks with community pharmacists about fall prevention during the regional meetings of the KNMP.[9,10,17] The topic list was evaluated after the first three interviews, and only a few questions were slightly adjusted. Data saturation was determined after 16 interviews on the basis of whether new findings emerged in the last three interviews.

Data management and analysis

Quantitative data

Participants who did not give permission to use their answers to the statements ranked during the presentation were excluded from the analyses. Answers from written surveys were entered in Microsoft Office Excel® 2019. Then, descriptive statistics, including frequencies, medians and interquartile range were calculated. All analyses were performed using R version 3.6.3 software.

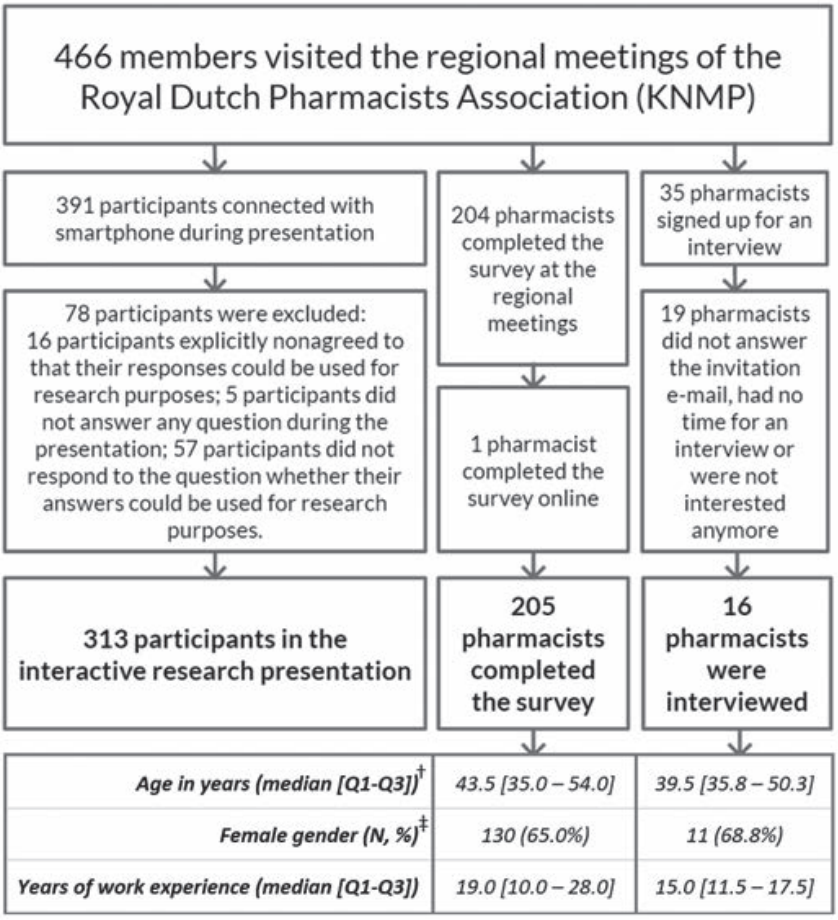
Qualitative data

All audio recordings of the interviews were transcribed verbatim and imported into NVivo version 12 software. All interviews were anonymized by replacing participants' names with participant numbers. The audio recordings and transcripts were stored on a virtual protected server only accessible to the research team.

The capability opportunity motivation - behaviour (COM-B) model was applied to analyse and interpret the qualitative data.[27,28] The COM-B model is a widely used behavioural change theory and therefore a suitable framework to identify needs to change.[29] The COM-B model has been used to describe healthcare providers' dependencies to express a desired behaviour.[27,28] According to the COM-B system, pharmacists will provide fall prevention when the following conditions are met:

- Capability: pharmacists need to have the knowledge and skills to provide fall prevention care and deprescribe FRIDs.

- Opportunity: pharmacists need to have time, and knowledge about their patients' fall risks, and the (deprescribing) activities should be affordable.
- Motivation: pharmacists should be motivated to implement fall prevention care and the deprescribing of FRIDs in daily practice.[27,28]



Age in years (median [Q1-Q3])†	*43.5 [35.0 – 54.0]*	*39.5 [35.8 – 50.3]*
Female gender (N, %)‡	*130 (65.0%)*	*11 (68.8%)*
Years of work experience (median [Q1-Q3])	*19.0 [10.0 – 28.0]*	*15.0 [11.5 – 17.5]*

Figure 2. Flowchart and background characteristics of responders to the statements during the interactive research presentation, survey and inclusion of pharmacists in interviews.
†Five pharmacists did not share background characteristics, but completed the survey
‡One pharmacist did not share his/her years of working experience
Abbreviations: Q1 = first quartile, Q3 = third quartile, N = number

The interviews were coded by a postgraduate student researcher (MG) and reviewed by an experienced postgraduate researcher (EK). A topic list, prepared

in advance, was used to guide the coding (deductive coding). During the coding process, a number of additional topics were identified (inductive coding), and possible discrepancies were resolved through discussion. Pharmacists quotations for implementing fall prevention care were deductively linked to the related domains of the COM-B model by one researcher (MG) and checked by two researchers (EK, MB). Possible discrepancies were resolved through discussion.

RESULTS

Background characteristics

The five regional meetings were attended by 466 members of the KNMP and all of them were invited to participate. As illustrated in Figure 2, data from 313 participants who responded during the lecture were analysed.

In total, 205 pharmacists completed the survey and 16 of them participated in a telephone interview (Figure 2). Most were female (65.0% and 68.8% in the survey and interviews, respectively). The median work experience was 19 years [Q1–Q3: 10.0–28.0 years] for the survey and 15 years [Q1–Q3: 11.5–17.5 years] for the interviews. The duration of the interviews varied between 20 and 35 minutes.

Overall perspectives (quantitative data)

Table 1 and Table 2 show pharmacists' responses to the statements in the interactive lecture and survey, as clustered and described below.

Knowledge and skills

Community pharmacists believe they could contribute to fall prevention. The survey results indicate that most pharmacists believe they are able to identify patients with high fall risk, but some have experienced difficulties with this. Furthermore, pharmacists reported that they already suggest medication modifications when patients report falls during medication reviews. Pharmacists believe they have sufficient knowledge to recognize FRIDs. In the survey, only 36% of the pharmacists reported a need for more knowledge or training. However, pharmacists mentioned needing a guideline for the deprescribing of FRIDs. On the other hand, because of the complexity of deprescribing, they revealed doubt about whether this would help them.

Collaboration

In the survey, pharmacists expressed the need for increased multidisciplinary collaboration in fall prevention (73%). Collaboration with GPs, home care providers, physiotherapists and geriatricians was found to be especially important. Most pharmacists (71%) did not have specific multidisciplinary agreements about fall prevention yet. For those who had multidisciplinary agreements, these were most often concluded with GPs (91%), followed by physiotherapists (44%) and home care nurses (42%). Based on the findings, collaboration with GPs seems to be best-organized, since pharmacists reported discussing fall prevention mainly in collaborative medication reviews with GPs. Fall prevention was rarely discussed outside the scope of medication reviews.

Time and reimbursement

Pharmacist believe that community pharmacists are responsible for fall prevention, and they hence reported that they aim to spend more time and attention on fall prevention. In the survey, the majority of pharmacists (67%) reported not having enough time for fall prevention activities. Moreover, 71% of pharmacists reported that they need financial compensation for fall prevention in order to provide certain care.

Identification of patients

Fall prevention starts with the identification of patients at risk of falling. To a lesser extent, pharmacists also consider that the identification of patients with high fall risk belongs to be a task of community pharmacists. The survey showed that most pharmacists ask patients about fall history in medication reviews, but they less frequently, proactively ask patients about fall history during other regular encounters. The same is true for pharmacy technicians. Both pharmacists and technicians rarely discuss risk factors for falling with patients.

In-depth perspectives (qualitative data)

Figure 3 illustrates the most important identified topics of the interviews and their mapping to the domains of the COM-B model. In Table 3, pharmacists' quotes are related to the COM-B model and topics.

Table 1. Pharmacists' responses to statements during the interactive lecture and in the survey.

Interactive lecture (statement rankings on a Likert scale *from completely disagree (0) to completely agree (10)*)			**Survey (statement rankings on a Likert scale *from disagree (1) to agree (5)*)**		
Nº	**Statement**	**Median [Q1-Q3]**	**Nº**	**Statement**	**Median [Q1-Q3]**
S1	Community pharmacists can contribute to fall prevention	8 [7-10]	**S1**	I proactively ask patients about fall history (at the counter or on a telephone call)	2 [2-3]
S2	I have enough knowledge to recognize FRIDs	8 [7-9]	**S2**	The pharmacy technicians proactively ask patients about fall history	2 [1-2]
S3	I have the capabilities to recognize patients with high fall risk	6 [5-7]	**S3**	I experience difficulties recognizing patients with high fall risk	3 [2-4]
S4	At the moment, I contribute to fall prevention	4 [1-6]	**S4**	I experience difficulties starting a conversation with patients about the effects of their medication use on their fall risk	2 [2-3]
S5	I discuss fall prevention at medication reviews	8 [6-10]	**S5**	I ask about fall history when I perform a medication review	4 [3-5]
S6	Beyond medication reviews, I discuss fall prevention	2 [0-5]	**S6**	When I perform a medication review, I suggest medication modifications if I know the patient has fall experiences	4 [3-5]
S7	I have enough time to organize fall prevention care	4 [2-6]	**S7**	I am going to spend more time and attention on fall prevention in my daily practice	4 [3-4]
S8	Recognizing patients with fall risk belongs to one of the tasks of community pharmacists	6 [5-8]	**S8**	I discuss with patients their risk factors for falling	2 [1-3]
S9	Fall prevention care belongs to tasks of community pharmacists	7 [5-8]	**S9**	The pharmacy technicians discuss patients' risk factors for falling with them	2 [1-2]
			S10	I need a guideline that supports me with deprescribing FRIDs	4 [3-4]
			S11	A guideline that supports me to deprescribe FRIDs is not going to help me, because deprescribing should be tailored to individual patient circumstances	3 [2-4]

Table 2. Findings of survey questions related to multidisciplinary agreements about fall prevention and pharmacists' needs for contributing to fall prevention

Question	Answer	N (%)
Do you have multidisciplinary agreements about fall prevention? N = 205	Yes	43 (21%)
	No	146 (71%)
	No response	16 (8%)
If you have multidisciplinary agreements about fall prevention, with whom? N = 43	General practitioner	39 (91%)
	Physiotherapist	19 (44%)
	Home care	18 (42%)
	Elderly care physician	11 (26%)
	Dietician	5 (12%)
	Geriatrician	3 (7%)
	Other†	6 (14%)
What are your needs to be able to do more in fall prevention? N = 192	Multidisciplinary collaboration	140 (73%)
	Reimbursement	137 (71%)
	Time	128 (67%)
	Training for pharmacist technicians	120 (63%)
	Patient information material	112 (58%)
	A guideline to deprescribe FRIDs	97 (51%)
	More knowledge / training	70 (36%)

Abbreviations: N = number, FRID = fall risk-increasing drug
†Psychologist, community project/social team, occupational therapist, optician and district nurse were mentioned in the survey

Capability

In the interviews, pharmacists mentioned that their involvement in fall prevention should primarily cover the safe use of FRIDs in patients with high fall risk. Interviewed pharmacists mentioned that they are often unaware that patients have fallen, because patients do not report this.

Knowledge

In the interviews, all pharmacists mentioned that deprescribing is often possible. However, only a limited number of drugs are deprescribed easily, such as alpha-blockers for the treatment of benign prostatic hyperplasia. For most drugs, deprescribing is seen as a tedious process and pharmacists reported some knowledge gaps about FRIDs and limited proper deprescribing schemes.

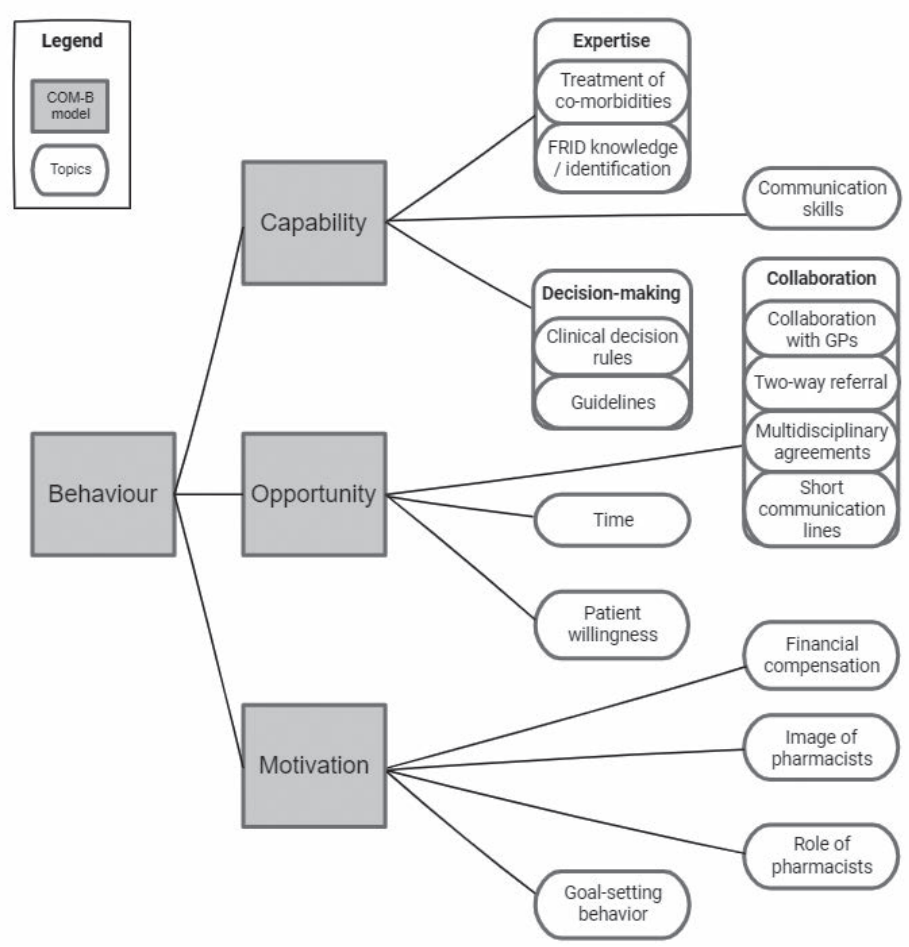


Figure 3. The topics of the interviews mapped to the domains of the capability opportunity motivation - behaviour (COM-B) model[28,29]

Cognitive and interpersonal skills

Interviewed pharmacists considered the inability to convince patients about the relevance of deprescribing as a major barrier, specifically for psychotropic drugs, including benzodiazepines. Pharmacists mentioned applying some effective strategies, such as the taper guidelines, encouraging patients to use benzodiazepines for only a short time, and sending letters to invite patients for consultation to support drug cessation. Effective communication skills are deemed necessary to motivate patients to cease benzodiazepines.

Decision-making

Pharmacists stated that the complexity of patients' morbidities and drug treatment strongly influences decisions about deprescribing. They mentioned being unsure about the consequences for underlying treated diseases after deprescribing. Furthermore, they mentioned that both GPs and pharmacists prefer to carefully adjust medication in patients whose medication has been stable for a long-time.

Some pharmacists indicated that the pharmacy's decision support systems sometimes facilitate the identification of medication-related problems. Pharmacists mentioned they wish for a clear decision-guiding overview of fall risk-increasing drugs on a set webpage. One pharmacist explained that in practice there is limited time to search for information in guidelines.

Multidisciplinary collaboration

Pharmacists mentioned that collaborative initiatives are helpful, such as regular reviews of older patients in multidisciplinary teams. Other healthcare providers sometimes initiate these collaborative fall prevention initiatives. For pharmacists, recognizing such initiatives is seen as important in order to join them. They stated that satisfying multidisciplinary collaboration is built through hard work, trust, and a time investment. Yet, pharmacists described experiencing some difficulties in collaboration, for example when they tried to convince GPs about the relevance of deprescribing in patients with high fall risk.

Opportunity

Multidisciplinary collaboration and agreements

In interviews, pharmacists emphasized the importance of having agreements with healthcare providers concerning fall prevention. They mentioned that every healthcare provider's role should ideally be captured in a fall prevention guideline. Regarding the collaboration with GPs, pharmacists mentioned that this collaboration is better organized with practices close to the pharmacy or in the same building. Pharmacists also reported that GPs are often reluctant to deprescribe, citing GPs' dislike of time-consuming interventions and a potential lack of knowledge on deprescribing as reasons.

Supportive infrastructure for referral and communication may help pharmacists to organize multidisciplinary fall prevention care. Some pharmacists proposed having short communication lines supporting referral from other healthcare providers to pharmacists, and vice versa.

Patient willingness and co-operation

Patient willingness to deprescribe medication was often mentioned as paramount for successful deprescribing. Moreover, interviewed pharmacists highlighted that this willingness to deprescribe FRIDs was dependent on the type of medication – patients were often unwilling to cease psychotropic drugs, benzodiazepines in particular.

Moreover, pharmacists stated that patients rarely report falls, do not relate medication use to their falls and seldom suggest medication deprescribing themselves. Pharmacists said that they only knew patients' needs when they asked them directly. They also mentioned that patients could be afraid of medication deprescribing, for example, because their medication is stable, and they are afraid that modification will increase their morbidity risk.

Motivation

Role and image of pharmacists

In the interviews, pharmacists mentioned that they see for themselves mainly a fall prevention role in the evaluation of FRID use. Some pharmacists reported they have the impression that their expertise in fall prevention, and especially in FRIDs, is not always valued by both patients and GPs. Furthermore, these pharmacists feel they have to convince patients and GPs of this expertise. Many interviewed pharmacists lack concrete agreements with GPs about goals and each other's role in fall prevention.

Identification of patients with high fall risk

Since medication reviews are a core business of pharmacists, this is seen as an important starting point for the identification of patients with high fall risk and the provision of fall prevention care. One interviewed pharmacist mentioned that pharmacists' accessibility to patients could facilitate the identification of patients with high fall risk.

Table 3. Pharmacists' quotes that describe the barriers and facilitators for implementing fall prevention care, linked to the topics, and the domains of the capability opportunity motivation – behaviour (COM-B) model.

COM-B	Barrier/Facilitator	Topic
Capability	*Pharmacist 6, 59-year-old woman* *"Yes, it is always very complex, because most patients do not have just one problem but have 10 problems. These all intervene with each other. As a pharmacist, you try to determine, 'what if we try this or this.'"* (barrier)	Expertise: Treatment of co-morbidities
	Pharmacist 10, 50-year-old man *"When I provided the medication for a nursing home with elderly people, none of them was using antihypertensives anymore at a certain moment. […] These patients were sitting in their chair all day, had rarely any exercise, and deprescribing antihypertensives was necessary to prevent hypotension."* (facilitator)	Expertise: FRID recognition
	Pharmacist 8, 29-year-old woman *"We worked hard for it. […]. We have always invested in the relationship. We have accessible contact. We use WhatsApp; we call; we see each other a lot. We organize meetings six times a year to make agreements about prescribing. And once a year, we have a social event."* (facilitator)	Collaboration: Collaboration with GPs
	Pharmacist 3, 36-year-old woman *"I think it is most important whether patient himself is willing. Patient motivation is most important, because otherwise you can change what you want, but maybe you create chaos and they lose their trust."* (barrier)	Patient willingness
	Pharmacist 16, 35-year-old woman *"I used to go to the GP with all my suggestions based on clinical decision rules." (facilitator)*	Decision-making: Clinical decision rules
	Pharmacist 7, 59-year-old man *"I ask the patient, 'When did you fall? At what time? How did it happen? Did you use medication and at what time?' […] It is difficult, but I try to investigate whether there is a link with the medication or not. Sometimes you don't know, because patients can also be dizzy because of other reasons."* (facilitator)	Decision-making

COM-B	Barrier/Facilitator	Topic
	Pharmacist 8, 29-year-old woman *"After the Royal Dutch Pharmacists Association regional meeting, we decided to organize a fall prevention week. […] I am sure my pharmacy technicians are not regularly asking patients about fall history at the moment. I also doubt if they have the confidence to do that. So, before organizing this week, I will organize a training for the pharmacy technicians. Then they know what they are talking about and why it is important."* (facilitator)	Expertise
Opportunity	*Pharmacist 12, 40-year-old woman* *"Yes, I think it is a missed opportunity [when GPs are not collaborating]. Not only for me, but for healthcare in general. […] I think we [pharmacists] are trained more by nature to look for collaboration opportunities. We are also more dependent, and GPs are often more autonomous."* (barrier)	Collaboration: Collaboration with GPs
	Pharmacist 10, 50-year-old man *[Replies to the observation that the collaboration seems to work well]: "Yes, that is in particular with the practice directly in the building. Outside it is a bit more difficult. Also there has been a switch of GPs working in the building. Some older GPs left and younger GPs came instead. I notice that there is lots of interest among younger GPs to work with us to improve healthcare for the patients."* (facilitator)	Collaboration: Collaboration with GPs
	Pharmacist 4, 35-year-old woman *"The physiotherapist already had a fall prevention programme […]. In the district we made agreements about it, and we receive money for the organization of this integrated primary care service."* (facilitator)	Collaboration: Multidisciplinary agreements
	Pharmacist 2, 51-year-old woman *"Sometimes the general practice nurse visits patients at home and finds all kinds of medication boxes. Well, nowadays we use 'siilo-app', that all healthcare providers use to communicate. Thus, then I receive a siilo-app in which the general practice nurse recommends me to visit the patient."* (facilitator)	Collaboration: Short communication lines
	Pharmacist 11, 33-year-old woman "There are also a lot of older people who say, 'I don't want anything to change, suppose something happens to me.'" (barrier)	Patient willingness

COM-B	Barrier/Facilitator	Topic
Motivation	*Pharmacist 5, 49-year-old man* *"When you want to make a good fall assessment, it takes a lot of time. This should not happen in the pharmacy, but together with the GP. Someone who can examine a bit more, like the stand-up-and-go test."* (barrier)	Identification of patients with high fall risk
	Pharmacist 1, 36-year-old man *"I would recommend to colleagues to promote what you do and how you do it. For example, write an article in the neighbourhood newspaper about it."* (facilitator)	Image of pharmacists
	Pharmacist 15, 39-year-old woman *"Well, the pharmacy technicians also need to do more with fall prevention. It would be nice if they could have some support, for example a course or information. Because at this moment, they are not going to ask about it, because they don't know what to say when the patient answers."* (barrier)	Expertise
	Pharmacist 8, 29-year-old woman *"I have doubts about if physicians are waiting for this [fall prevention]. But who knows, maybe we are able to present it sexy, and it will succeed. But we shall see then [at the multidisciplinary team meeting]."* (barrier)	Collaboration: Collaboration with GPs
	Pharmacist 8, 29-year-old woman *"Fall prevention often means the withdrawal of drugs. And the business model of the pharmacy is based on the number of drugs dispensed. Thus, every drug you don't dispense is a missed income."* (barrier)	Financial compensation
	Pharmacist 14, 38-year-old woman *"In the regional elderly care work group, our pharmacists participate, which is a good thing. [...] But I don't really know what agreements they have made. So probably the agreements are not very concrete."* (barrier)	Goal-setting behaviour
	Pharmacist 1, 36-year-old man *"For the withdrawal of antidepressants, we sent letters on 11-12-2019. Our aim was that 5% of the patients who received a letter would contact the GP or pharmacy within 3 months. However, this day (17-04-2020), we only received three replies. That is not much. We sent 126 letters."* (facilitator)	Goal-setting behaviour

COM-B	Barrier/Facilitator	Topic
	Pharmacist 2, 51-year-old woman *"Deprescribing is also an ethical discussion. What happens when the blood pressure increases and someone gets hospitalized or dies and was not treated according to the guidelines."* (barrier)	Decision-making: Guidelines
	Pharmacist 10, 50-year-old man *"By asking patients about the consequences of falls. And let them realize that they lose confidence because of falls. That is very obvious: they become afraid when they have experienced a few falls, which impairs them. They go out less, become isolated. […] I make them realize that there could be a link with the medication use."* (facilitator)	Patient willingness
	Pharmacist 8, 29-year-old woman *"At the moment, there will be financial compensation for fall prevention; I am sure every pharmacist will start with it."* (facilitator)	Financial compensation
	Pharmacist 11, 33-year-old woman *"With the use of clinical decision rules these kinds of topics are also identified, and it increases your own knowledge."* (facilitator)	Decision-making: Clinical decision rules
	Pharmacist 3, 36-year-old woman *"Those patients just want to have their drugs on the bedside table. They need to take it for themselves. I am not going to change that. […] I ask everything out, and in case of the benefit of the doubt, I will let the lady keep using it."* (barrier)	Patient willingness

Abbreviations: GP = general practitioner

Goal-setting behaviour

Few interviewed pharmacists set concrete goals for the provision of fall prevention, for example regarding the number of benzodiazepines that could be deprescribed annually. Furthermore, many interviewed pharmacists aim to provide a pre-determined number of medication reviews weekly or annually. They also evaluate whether they have reached these targets, which supported deprescribing.

Financial compensation

Some interviewed pharmacists believe that reimbursement is necessary as a motivator for pharmacists to implement fall prevention in daily practice.

DISCUSSION

In this mixed-methods study, we found that pharmacists are motivated to provide fall prevention services, but their capability differs. They have had diverse opportunities to provide fall prevention, with key facilitators being efficient collaboration and establishment of multidisciplinary agreements. Pharmacists indicated that major barriers were patient's unwillingness to cease medication, the complexity of deprescribing, limited goal-setting behaviour, a lack of time, and a lack of financial compensation. It has previously been reported that pharmacists believe they should be involved in fall prevention; however, only a minority have actually been involved.[24] We showed similar results and gained insights in facilitators and barriers which are essential to know to foster further implementation of fall prevention.

Pharmacists believe they have the capability to contribute to fall prevention; in particular, they think their role in fall prevention should cover the monitoring of FRID use. Pharmacists mentioned that they already regularly suggest deprescribing of antihypertensives, antidepressants, and benzodiazepines. However, pharmacists reported that they did not always succeed in deprescribing FRIDs. In our study, barriers and facilitators for FRID deprescribing, including pharmacists being uncertain about harms and benefits of drug deprescribing, corresponded to barriers and facilitators in studies investigating deprescribing for other reasons.[30] Drug deprescribing could be facilitated by step-wise dose-reductions with in-between evaluations.[30]

Deprescribing was perceived to be the most difficult for psychotropic drugs such as benzodiazepines. While pharmacists used a variety of communication skills to engage patients in FRID deprescribing, they reported that patients were often unwilling to cease benzodiazepines. Pharmacists could sometimes convince them by offering guidance and by increasing awareness about drug risks. Large variation in patients' willingness to deprescribe drugs has previously been reported.[31,32] For example, some patients owe their healthiness to their medication use and are, therefore, suspicious when it comes to deprescribing. An important aspect that facilitated patients' decision-making in deprescribing was trust in their healthcare providers.[31,32]

Limited multidisciplinary collaboration, especially with GPs, was one of the most important barriers cited for the implementation of fall prevention in community pharmacies. This includes problems with convincing GPs about the importance, GPs having no time for pharmacists, and weak relationships with GPs from remote practices. Few pharmacists had multidisciplinary agreements about fall prevention. A lack of structured agreements regarding the referral of patients has previously been reported as a major barrier to pharmacists' multidisciplinary collaboration, while pharmacists' experience and confidence have been identified as facilitators for effective communication and collaboration with other healthcare providers.[33] In our study, pharmacists mentioned that efficient multidisciplinary care regarding fall prevention and deprescribing require hard work and a substantial time investment. Pharmacists had the impression that patients and other healthcare providers often did not clearly recognize the role of pharmacists in fall prevention. It has been reported previously that healthcare providers might even misunderstand pharmacists' roles.[33]

Lastly, pharmacists' opportunity and motivation to provide fall prevention care were counteracted by a lack of both time and reimbursement. These findings correspond to previous findings emphasizing a need for reimbursement to motivate pharmacists to implement time-consuming pharmaceutical care interventions, such as fall prevention.[24,34]

Strengths and weaknesses

The major strength of this study was the combination of both quantitative and qualitative methods for data collection, which enabled us to gain in-depth insight into the perspectives of pharmacists. We achieved sufficient participant response

rates to the statements and the survey. These data were collected at the KNMP regional meetings, which were attended by diverse groups of Dutch community pharmacists. The demographics of the pharmacists who completed the survey and participated in the interviews correspond to those of the Dutch pharmacist population[35], thus implying that we were able to include a representative sample. Yet, non-participating pharmacists who are not interested in fall prevention might be underrepresented and may hold other views and opinions. Therefore, community pharmacists' motivation and capability to provide fall prevention services might be overestimated.

Another strength was the application of the COM-B model to interpret the qualitative data. The theoretical framework supported the identification of pharmacists' needs to increase their capability, opportunity and motivation. For example, based on the findings from the COM-B, pharmacists thought they mainly require stronger opportunity.[28,29] A limitation of the study was that only the analysis of the data and not the design was based on this theoretical framework. Data collection would presumably have been more targeted when the behavioural change theory was applied in advance, during the design of the study.

Implications

First, pharmacists see improved multidisciplinary collaboration as a key facilitator for contributing effectively to fall prevention. In particular, multidisciplinary agreements should be formulated wherein the roles and tasks of pharmacists are stated. Overarching national agreements on pharmacists' contribution to fall prevention would be supportive as well, and these individuals should ideally receive financial compensation for their contribution to fall prevention care. Second, pharmacists should demonstrate their motivation to participate in fall prevention care. They should define targets with regard to deprescribing, for example of benzodiazepines, to achieve success. Lastly, pharmacists could enhance their own capability by undertaking educational trainings, applying guidelines related to deprescribing, and becoming more experienced with providing fall prevention care. Additional clinical decision rules to support deprescribing may also facilitate fall prevention.

Future studies should investigate how pharmacists could improve multidisciplinary collaboration regarding fall prevention. Furthermore, actual implementation of

fall prevention services in community pharmacies should be conducted and evaluated.

Conclusion

Community pharmacists deem themselves capable of providing fall prevention services, and they are motivated to do so, particularly by deprescribing FRIDs. However, they perceive the decision-making of FRID deprescribing as complex due to the difficulties in weighing fall risk against treatment benefit for individual patients. Pharmacists believe they could provide better fall prevention services in collaboration with other disciplines.

ACKNOWLEDGEMENTS

We would like to thank all pharmacists who participated in this study for their valuable insights.

AUTHOR'S CONTRIBUTION

The concept/protocol of the study was written by MG, ER, and EK. MG analysed the data, performed the literature search, and wrote the original draft. She implemented the contribution of co-authors and external reviewers up to final publication. During the whole process, she implemented input and feedback from her supervisors.

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SUPPLEMENTARY INFORMATION S1: CONSOLIDATED CRITERIA FOR REPORTING QUALITATIVE STUDIES (COREQ): 32-ITEM CHECKLIST

Table 1. Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No	Item	Guide questions/ description	Check?
		Domain 1: Research team and reflexivity	
		Personal Characteristics	
1.	Interviewer/ facilitator	Which author/s conducted the interview or focus group?	The interviews were conducted by a Master student-researcher (ER).
2.	Credentials	What were the researcher's credentials? E.g. PhD, MD	Data were collected by Master student-researcher ER. Data were analysed by postgraduate student researcher MG. Analyses were checked, reviewed and supervised by experienced postgraduate researchers EK, KT and MB.
3.	Occupation	What was their occupation at the time of the study?	ER was a Master Pharmacy student. MG was a postgraduate student researcher. EK, KT and MB were experienced postgraduate researchers.
4.	Gender	Was the researcher male or female?	ER was female.
5.	Experience and training	What experience or training did the researcher have?	ER had little experience with interviewing, since she completed a Master pharmacy course in qualitative research. She was supervised by MG and EK. EK was experienced with performing qualitative research.
		Relationship with participants	
6.	Relationship established	Was a relationship established prior to study commencement?	At the KNMP regional meetings ER met few pharmacists who participated in the interviews afterwards, but no strong relationship was already built.
7.	Participant knowledge the interviewer	What did the participants know of about the researcher? e.g. personal goals, reasons for doing the research	The participants were informed about the research by the presentation during the KNMP regional meeting, by completing the survey and received an invitation e-mail with information about the topics of the interview.

		Relationship with participants (Continued)	
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	The interviewer was a Master Pharmacy student and her main interest was to investigate the needs and wants of pharmacists with regard to deprescribing of FRIDs and multidisciplinary collaboration.
		Domain 2: study design	
		Theoretical framework	
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	The COM-B system and TDF were used to analyse the data and underpin the study.
		Participant selection	
10.	Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Participants could sign up for an interview by the use of a reply coupon in the survey.
11.	Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Participants were approached by e-mail. The interview was either by telephone or video-call.
12.	Sample size	How many participants were in the study?	16 pharmacists were interviewed.
13.	Non-participation	How many people refused to participate or dropped out? Reasons?	19 pharmacists signed up for the interview but did not participate eventually.
		Setting	
14.	Setting of data collection	Where was the data collected? *e.g.* home, clinic, workplace	Pharmacists were either at their workplace or at home. The interviewer was at her home.
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	No, but pharmacists could be interrupted by questions of their technicians.
16.	Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Relevant background characteristics of pharmacists were described in Figure 2.
		Data collection	
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	The questions, prompts and guides were provided by the authors, but not pilot tested.

		Data collection (Continued)	
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	There were no repeat interviews.
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	The interviewer used audio-recording during the interviews.
20.	Field notes	Were field notes made during and/or after the interview or focus group?	Field notes were made during the interview. The interview was transcribed verbatim directly afterwards.
21.	Duration	What was the duration of the interviews or focus group?	The durations of the interviews were 20-35 minutes.
22.	Data saturation	Was data saturation discussed?	Data saturation was discussed after 16 interviews.
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	Pharmacists were offered to request their transcript. One pharmacist requested the transcript, but had no comments. A summary of the findings of the interviews was returned to participants by publication in a national pharmacy magazine.
		Domain 3: analysis and findings	
		Data analysis	
24.	Number of data coders	How many data coders coded the data?	The data was coded by one researcher (MG) and the linking of quotes to the TDF domains was reviewed by two researchers (EK, MB)
25.	Description of the coding tree	Did authors provide a description of the coding tree?	The topics are described in the methods section. The data was analysed using the COM-B model and TDF.
26.	Derivation of themes	Were themes identified in advance or derived from the data?	The topic list was prepared in advance. The COM-B system and TDF were applied during data analysis.
27.	Software	What software, if applicable, was used to manage the data?	NVivo version 12 software was used to analyse the data.
28.	Participant checking	Did participants provide feedback on the findings?	Participant did not provide feedback on the findings.

		Reporting	
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number	Participant quotations were presented to illustrate the findings. All quotations were identified by participation number.
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	The research theme believes there was consistency between the presented data and the findings.
31.	Clarity of major themes	Were major themes clearly presented in the findings?	The COM-B system and TDF were used during data analyses to present the themes clearly.
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Diverse cases were described and also minor themes (e.g. opinions of single participants) were mentioned.

Abbreviations: FRID = fall risk-increasing drug, KNMP = Royal Dutch Pharmacists Association, COM-B model = capability opportunity motivation - behaviour model, TDF = theoretical domains framework

SUPPLEMENTARY INFORMATION S2: QUESTIONS ADDRESSED IN THE INTERACTIVE LECTURE AND SURVEY, AND TOPICS ADDRESSED IN THE INTERVIEWS

Table 2. Questions/statements addressed in the interactive lecture and survey, and topics addressed in the interviews.

	Statements (Likert scale disagree (0) to agree (10))
Lecture	Community pharmacists can contribute to fall prevention
	I have enough knowledge to recognize FRIDs
	I have the capabilities to recognize patients with high fall risk
	At the moment I contribute to fall prevention
	I discuss fall prevention at medication reviews
	Beyond medication reviews I discuss fall prevention
	I have enough time to organize fall prevention care
	Recognizing patients with fall risk belongs to one of the tasks of community pharmacists
	Fall prevention care belongs to tasks of community pharmacists
	Statements (Likert scale never (1) to always (5))
Survey	When I perform a medication review, I suggest medication modifications if I know the patient has fall experiences
	I ask about fall history when I perform a medication review
	Proactively I ask patients about fall history (at the counter or in a telephone call)
	The pharmacy technicians proactively ask patients about fall history
	I discuss with patients their risk factors for falling
	The pharmacy technicians discuss patients' risk factors for falling with them
	Statements (Likert scale disagree (1) to agree (5))
	I experience difficulties with the recognition of patients with high fall risk
	I experience difficulties with starting a conversation with patients about the effects of their medication use on their fall risk
	I need a guideline that supports me with deprescribing FRIDs
	A guideline that supports me to deprescribe FRIDs is not going to help me, because deprescribing should be tailored to individual patient circumstances
	I am going to spend more time and attention to fall prevention in my daily practice
	Questions
	Do you have multidisciplinary agreements about fall prevention? (Yes/No) If you have multidisciplinary agreements about fall prevention, with whom? (▫general practitioner, ▫physiotherapist, ▫home care, ▫nursing home physician, ▫dietician, ▫geriatrician, ▫other)

	What are your needs to be able to do more in fall prevention? (▫multidisciplinary collaboration; ▫reimbursement; ▫time; ▫training for pharmacy technicians; ▫patient information material; ▫guideline to deprescribe FRIDS; ▫more knowledge/training)
	Topics
Interviews	• Role of pharmacists • Current contribution and activities • Capabilities of pharmacists • Knowledge • Needs of pharmacists • Multidisciplinary collaboration

Chapter 4.2

Perspectives of primary care providers on multidisciplinary collaboration to prevent medication-related falls

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ABSTRACT

Background

The causes of falls are often multifactorial. The prevention of falls hence benefits from a multidisciplinary approach. As people who fall are generally older and users of polypharmacy who frequently visit pharmacies, pharmacists may contribute to fall prevention.

Objective

This study aims to explore the perceptions of primary care providers on multidisciplinary collaboration in fall prevention especially with pharmacists.

Methods

Two focus groups were held with each of the following health disciplines: physiotherapists, home care nurses, and practice nurses. A topic list was developed based on the capability opportunity motivation - behaviour (COM-B) model and the theoretical domains framework (TDF). Focus groups were audiotaped and transcribed verbatim. Data were collected between March and June 2021.

Results

Six online focus groups were held with in total 17 physiotherapists, 14 home care nurses, and 15 practice nurses. Participants reported to collaborate interdisciplinary to prevent falls, but they had very limited collaboration with community pharmacists regarding fall prevention. Participants had limited knowledge on fall risk-increasing drugs. This contributed to their low awareness of the potential role of pharmacists in fall prevention. Other reasons for poor collaboration in fall prevention were lack of agreements with pharmacists, limited coordination and communication. Participants were open to more collaboration with pharmacists and believed this could potentially improve patient outcomes.

Conclusions

Multidisciplinary agreements, including with community pharmacists, could support role clarification, communication, and, thus, coordination of fall prevention.

INTRODUCTION

Falling is a multifactorial problem and individual fall risk factors may vary, e.g. mobility and balance disorders, medication use, and home environmental hazards.[1] The solution to this ever-growing problem is thus in hands of diverse health care providers.[2,3]

A multidisciplinary fall prevention team for older people living in the community should involve care givers with complementary expertise such as general practitioners (GPs), nurses, physiotherapists, and pharmacists.[4,5] Pharmacist may especially contribute as people who fall are generally older and have a high incidence of multimorbidity, and subsequent complex drug therapy.[6] Pharmacists can identify inappropriate drug use in older persons, including fall risk-increasing drugs (FRIDs). Hence, pharmacists may improve medication safety, for example by providing medication reviews aimed at deprescribing of FRIDs.[5,7,8] Furthermore, pharmacists may contribute to the identification of patients who are at risk of falls and may refer patients to other health care providers or give general education on fall prevention.[5,9]

In current practice, however, the actual involvement of pharmacist in fall prevention appears to be limited.[10,11] Pharmacists themselves expect that multidisciplinary collaboration would enable them to better contribute to fall prevention.[11] However, the role of pharmacists in fall prevention may be unclear to other primary care providers.[12] To date, the collaboration among primary care providers on how to prevent medication-related falls has not been explored, in particular the collaboration with pharmacists.

Collaboration with pharmacists is, in general, appreciated among disciplines. For example, GPs appreciate pharmacists' support with identification of medication-related problems and pursue stronger relationships with pharmacists in order to improve prescribing and patient care, particularly for older patients.[13] Previous studies showed that multidisciplinary care that included pharmacists improved patient outcomes in patients with chronic conditions such as hypertension, diabetes, and asthma.[14–18] In nursing home teams pharmacists' involvement in case conferences was appreciated and improvements in drug therapy were recognized.[19] Likewise, clinical medication reviews by pharmacists with care home residents resulted in adaptation of patients' medication use and even a reduction of falls.[20]

This study aims to explore the perceptions of primary care providers on multidisciplinary collaboration in fall prevention especially with pharmacists.

METHODS

Study design and setting

A qualitative study using online focus groups was conducted in three groups of health care providers: practice nurses, home care nurses, and physiotherapists. In the Netherlands, these providers have an essential role in fall prevention. Practice nurses are the executives of fall prevention in the general practices, due to limited time of GPs.[21] All data were collected between March and June 2021.

Participants

Health care providers were approached by posting invitations on LinkedIn pages, and by e-mailing national and regional health care organisations and cooperations. Health care providers of the following disciplines were included: practice nurses, home care nurses, and physiotherapists. Two focus groups were performed with participants of each discipline. Health care providers of different disciplines were not mixed to prevent dominance of disciplines due to potential social hierarchic influences. Because it was expected that findings would overlap between disciplines, for each discipline data saturation was determined after the second focus group. Saturation was based on the lack of new themes in the second focus group. Saturation was also based on overlapping themes between the focus groups with different disciplines.

Data collection

Prior to the focus groups background information of the participants was obtained (Supplementary information S1). The focus groups were held in an online setting: ZOOM. There were 5 to 9 participants per session. The duration of each session was 1.5 hours. The focus groups were chaired by the main researcher (MG), a community pharmacist with previous experience in conducting focus groups. A second researcher (EK) was present at each focus group to stimulate group discussion occasionally and to take field notes. All focus groups were audio-taped and transcribed verbatim. Participants received a summary of the transcript of the focus group for correction, and were asked to return comments within a week.

A topic list was made to guide the focus groups (Table 1). The semi-structured questions of the topic list were based on the capability opportunity motivation - behaviour (COM-B) model and theoretical domains framework (TDF). The topics of the questions were also based on findings of a previous study of the research team, investigating pharmacists' perceptions on providing fall prevention. Main finding of this study was that pharmacists wished collaboration would be improved, including clarification of roles (e.g., for screening and referral).[11] The interview guide was evaluated after the first focus group to make small adjustments in case data collection would benefit from this.

The COM-B model describes that behavioural changes, needed for the implementation of services, could be categorized in persons' capability, opportunity and motivation, and has been widely used in implementation science.[22] To define the content of the COM-B components, domains of the TDF were mapped to the COM-B model as has been recommended previously. The TDF contains 14 domains that are important to achieve behaviour change of health care providers. These domains were used as input for questions related to each domain of the COM-B model.[23,24]

Data analysis

Focus group transcripts were imported in NVivo version 12 software. Two researchers (MG and EK) independently coded all transcripts. Any coding discrepancies were discussed with MB to reach consensus. A mix of inductive and deductive coding was used. Inductive coding was used, based on the domains of the COM-B model and TDF, and the related topics from the topic list (Table 1). Subtopics that could be related to the theoretical frameworks were derived during the coding process. Therefore, additional codes were deductively identified and added. Health care providers' capabilities, opportunities, and motivations for multidisciplinary collaboration in fall prevention were qualitatively described: overlapping findings were summarized, incongruent opinions were highlighted, and the framework domains were illustrated by quotations.

Ethics and privacy

The study was approved by the institutional review board of the Division of Pharmacoepidemiology and Clinical Pharmacology, Department of Pharmaceutical Sciences, Utrecht University. Results were reported according to

Table 1. Design of topic list to guide the focus groups, based on the theoretical domains framework (TDF) and capability opportunity motivation - behaviour (COM-B) model.

Questions of topic list mapped to COM-B and TDF			
COM-B	***Topics***	***Example of questions***	***TDF***
Capability	*Identification of use of FRIDs*	Do you recognize medication as risk factor for falls?	*Knowledge*
	Communication	What is your experience with communication with pharmacists?	*Cognitive and interpersonal skills*
	Screening patients at fall risk	What do you do when you presume a patient's medication use is a risk factor for falling?	*Memory, attention and decision processes*
	Initiating collaboration	What could you do to improve fall prevention collaboration with pharmacists?	*Behavioural regulation*
Opportunity	*Collaboration experiences*	How is your position related to pharmacist's position and what is the impact of this on the collaboration?	*Social influences*
	Agreements / Coordination	What kind of agreements support the collaboration in medication-related fall prevention?	*Environmental context and resources*
Motivation	*Role (un)clarity*	What role should pharmacists have in a multidisciplinary fall prevention collaboration?	*Social/ Professional Role and Identity*
	Potential results	What tasks could pharmacists perform in a multidisciplinary fall prevention collaboration?	*Beliefs about capabilities*
	Potential results	Are there any emotional factors influencing you to collaborate with pharmacists (e.g., stress)?	*Emotion*
	Potential results	When would you refer a patient to the pharmacist to prevent falls?	*Intentions*
	Potential results	What goals would you like to be defined in a multidisciplinary fall prevention collaboration?	*Goals*
	Expectations	What difference do you think it makes when pharmacists are involved in fall prevention?	*Beliefs about consequences*
	Expectations	Do you think financial compensation is needed for multidisciplinary fall prevention collaboration?	*Reinforcement*
	Expectations	How much confidence do you have in collaboration with pharmacists to prevent falls?	*Optimism*

the COnsolidated criteria for REporting Qualitative research (COREQ) guidelines (Supplementary information S2).[25] Participants' anonymity was ensured by replacing their names by a study code in all data.

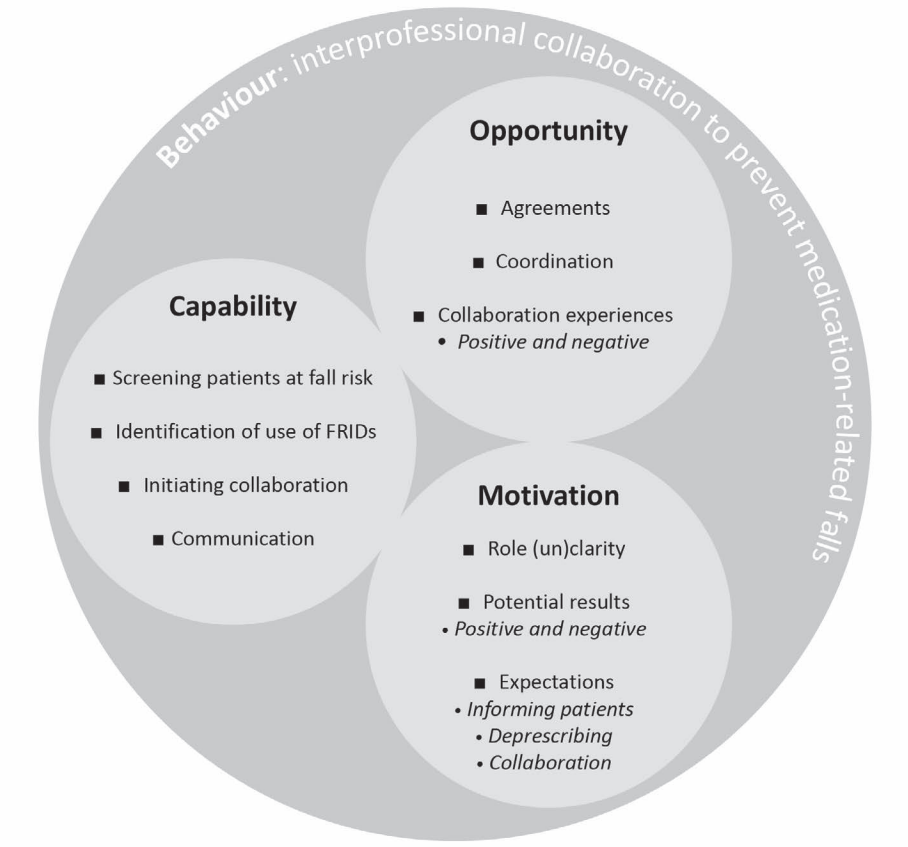

Figure 1. An overview of how the topics of the focus groups are categorized into the domains of the capability opportunity motivation - behaviour (COM-B) model.

RESULTS

Six focus groups were held with in total 46 participants (17 physiotherapists, 14 home care nurses, 16 practice nurses; Table 2). In each focus group participated five to nine participants. Figure 1 represents an overview of the identified main topics according to the COM-B model. In Table 3, participants' quotations are related to the COM-B model and topics.

Table 2. Focus group participants' background characteristics

Discipline / Group	Physiotherapists N = 17	Home care nurses N = 14	Practice nurses N = 15
Age in years (median [Q1 – Q3])	40.0 (31.5 – 53.0)	41.0 (27.0 – 49.8)	50.0 (33.0 – 54.0)
Female gender (N, %)	13 (76.5%)	14 (100%)	15 (100%)
Years of work experience (median [Q1 – Q3])	15.0 (9.5 – 30.0)	17.0 (5.0 – 21.3)	22.0 (10.0 – 33.0)
Recent collaboration in fall prevention with pharmacists (N, %)	2 (11.8%)	1 (7.1%)	7 (46.7%)

Capability

Theme: Identification of FRIDs (TDF: knowledge)

Home care nurses, practice nurses and physiotherapists ask their patients about FRID use in an unstructured way. Most participants, however, felt they had insufficient knowledge about FRIDs. For example, a home care nurse stated that her colleagues were not able to identify fall-related side effects of drugs. Only one home care nurse mentioned to discuss the necessity of patients' medication every three months with the practice nurse. Practice nurses generally reported to have more attention for other fall risk factors than medication use, but some mentioned they tried to avoid strict blood pressure control in elderly or they mentioned to warn patients for dehydration symptoms at hot days. Physiotherapists reported to have basic knowledge on medication and could identify some FRIDs, but they realised they had insufficient expertise. As an example, physiotherapists reported that they often do not take any action after the identification of FRIDs.

Theme: Screening patients at fall risk (TDF: memory, attention and decision processes)

As home care nurses visit patients at home, see how patients perform their activities of daily living, communicate with relatives, and have basic knowledge about risk factors for falling, they were considered to be in the best position to identify patients with an increased fall risk. Because physiotherapists have expertise on identification of mobility problems, participants thought they can

identify patients at risk of falling. However, it was reported that their role in early signalling is limited, because most patients are referred to them by other health care providers. For early identification all health care providers have opportunities, particularly nurses and GPs, but potentially also community pharmacists. Practice nurses mentioned they have more time than GPs for fall prevention and hence have more opportunities to signal fall risk. Home care nurses and practice nurses also mentioned to collaborate extensively with each other to assess fall risk.

Theme: Initiating collaboration (TDF: behavioural regulation)

Physiotherapists, practice nurses and home care nurses reported that multidisciplinary collaboration to prevent falls is common practice. Particularly, they collaborate with each other, GPs, and occupational therapists. Other disciplines, as dieticians and elderly care physicians, were also mentioned. Practice nurses mentioned that their time and activities for fall prevention partly depend on the focus of the GP.

All participants reported that when they question drug safety in individuals, they generally contact the GP. Most physiotherapists mentioned that they have never collaborated with pharmacists. The extent to which home care nurses collaborate with pharmacists varied. With regard to fall prevention, however, home care nurses did not mention collaboration with the pharmacist. Practice nurses reported more extensive collaboration with pharmacists, seven of them reported recent contact with the pharmacist about fall prevention.

Theme: Communication (TDF: cognitive and interpersonal skills)

Frequent communication was seen as most important to achieve multidisciplinary collaboration. However, physiotherapists reported they barely communicate with pharmacists. One physiotherapist indicated a need for clearer agreements about the manner of communication with pharmacists.

Communication experiences with pharmacists among home care nurses and practice nurses varied, and some mentioned to experience difficulties. For example, it was mentioned that pharmacists are often unable to solve drug-related issues and refer home care nurses to the general practice. All home care nurses, with exception to one, mentioned that community pharmacists do not warn them when a new FRID is prescribed. They hoped that pharmacists would

Table 3. Health care providers' quotes that describe their perspectives on collaborating interprofessional to prevent medication-related falls, linked to the topics and the domains of the capability opportunity motivation – behaviour (COM-B) model.

COM-B	Topic	Perspective
Capability	Identification of use of FRIDs	"*In my opinion, FRID identification stops after the observation. I mean, I know that certain medication increases fall risk, but when do I need to take action on this? [...] I think physiotherapists need more guidance on this.*" Physiotherapist 5, 27-year-old man
		"*I notice colleagues have a lack of knowledge: what are the medicines that increase fall risk? Is it a diuretic, or the opiates, or an antihypertensive? Which one increases fall risk and which combination?*" Home care nurse 6, 34-year-old woman
		"*When patients report a fall, we always try to find out whether something has recently changed that causes their falls, and this could sometimes also be a tablet that just has been started or stopped.*" Practice nurse 7, 33-year-old woman
	Screening patients at fall risk	"*When I think someone has an increased fall risk, I report this to the practice nurse, but maybe it would be smart to approach the pharmacy directly. However, I think for everyone it is unknown which route you should take.*" Physiotherapist 3, 33-year-old woman
		"*With regard to signalling, I think the difference is that we see people in their own situation. A physiotherapist sees them and trains them, but often in an exercise room, and not often at home. And we also see patients in all kinds of actions, while a physiotherapist is focused on a training. Hence, I think we have a wider picture of patients' fall risks.*" Home care nurse 14, 53-year-old woman
		"*I think the GP primarily investigates the problems of patients. There is a problem and for that reason he sees a patient. As practice nurses, we often visit patients at home and we are more proactive. We examine them for other diseases, such as diabetes or something else, and because we have a wider picture, we also screen for falls.*" Practice nurse 8, 50-year-old woman

COM-B	Topic	Perspective
	Initiating collaboration	*"I think it is most important that you have a conversation with the local pharmacy, or the local GP, because otherwise you may be guided by own assumptions. Whereas, a GP may welcome direct contact between physiotherapist and pharmacy, because it could relieve him."* Physiotherapist 5, 27-year-old man
		"I have the impression that pharmacists work, more or less, as a soloist. Recently, we had a pharmacist replacement in the region. We, hence, hope it will improve now. The previous pharmacist stated very clear: 'this is my piece of work, and what I want to do.' He did not want to go along with all other changes. He thought that was out of his scope. We hope it is going to improve now." Home care nurse 2, 49-year-old woman
		"I learn about elderly care that you need to be alert when patients are using more than five kinds of drugs, and that you should examine what can be deprescribed. In my experience, the physicians respond to this: 'well, it is going fine'. […] And I am sometimes so tired of this. I think why do we have such agreements, but are GPs experiencing difficulties with this." Practice nurse 1, 65-year-old woman
		"When I think about a multidisciplinary collaboration, then I do think about pharmacists, but to date I did not collaborate with them." Physiotherapist 12, 28-year-old woman
	Communication	*"Maybe, when one experiences more communication during education, this will lead to more results in the work field."* Physiotherapist 9, 44-year-old man
		"The communication lines with the pharmacist are very short, as well as the communication lines between the pharmacist and GP. The GP and pharmacists annually perform a medication check. And when I have doubts, I ask the
		pharmacist: 'could you check this for me?' and the day after, I got a message in return: 'yes, we checked it', and, 'it is fine as it is', or, 'we need to change something'." Home care nurse 14, 53-year-old woman
		"Pharmacists know where to find me when they have questions about patients – then, we have very short lines. It is going well, but you need to go after it actively. It is not coming spontaneously from

COM-B	Topic	Perspective
		all other pharmacies, with exception to the two with who we collaborate very well." Practice nurse 12, 57-year-old woman
Opportunity	Agreements	*"In the past I participated in a multidisciplinary project to get everyone together, a dietician, a GP, a practice nurse, and a pharmacist. And you notice, that when you don't make agreements anymore, it bogs down. And you lose contact with another."* Physiotherapist 17, 40-year-old woman
		"I work in a city with on estimation fifteen different pharmacies in the city, and of them we have most extensive collaboration with one pharmacy, and this pharmacist is always present in our multidisciplinary team meetings. And even when we discuss a patient of another pharmacy, he still advices and we listen to his recommendations. This is a collaboration agreement in the city." Practice nurse 6, 31-year-old woman
	Coordination	*"I think there is limited coordination of medication use; it is neither coordinated by GPs nor by pharmacists […]. And collaboration, which includes much more than medication, is a search in primary care."* Physiotherapist 11, 50-year-old man
		"I notice collaboration with pharmacists generally works well, but not in the field of fall prevention. And when we notice medication-related problems, we prefer to discuss this with the GP." Home care nurse 11, 52-year-old woman
		"The GP should also know, then, that physiotherapists directly contact the pharmacy. This may be clarified by making agreements about when physiotherapists can call pharmacists, for example, in case of certain
		complaints. Probably, there are GPs who like that." Physiotherapist 8, 37-year-old woman
	Collaboration experiences: positive	*"Once we were able to organize a multidisciplinary team meeting, and back then it was very useful. It helps to understand who is doing what, and to create same mindsets."* Physiotherapist 16, 56-year-old woman

COM-B	Topic	Perspective
		"My experience with the pharmacist there was directly, at start, very good. She approached me herself when I was working there for three months to have an introductory meeting. She is hence easily accessible in case of issues." Home care nurse 11, 52-year-old woman
		"In our health care centre works a pharmacist who is also doing: 'less is more'; he tries to describe as much as possible. Thus, with this pharmacist I sometimes have interesting discussions." Physiotherapist 5, 27-year-old man
	Collaboration experiences: negative	*"I got this feeling that pharmacists are available when they can earn money, but otherwise, you don't hear from them."* Home care nurse 3, 27-year-old woman
		"*In my experience, pharmacists are doing many things out of own initiative, which is fine, but they now and then forget to include the general practitioner in the process."* Practice nurse 9, 33-year-old woman
		"Previously, I have worked for ten years at a different place. The collaboration with the pharmacists was much warmer back then. It just all went easier. You asked something or you discussed a plan with each other, and it was done. But when you need to wrestle with the pharmacy to accomplish thing, it is not fun." Practice nurse 11, 52-year-old woman
		"We have a big network, including GPs, home care, and other disciplines. But indeed, we don't have professional contacts with pharmacists. However, to me, medication is an important point of attention." Physiotherapist 11, 50-year-old man
		"In the past I collaborated with pharmacists, multidisciplinary, and we investigated if we could start the collaboration again, but in my
		experience, it always dilutes… it is difficult to find each other." Physiotherapist 17, 40-year-old woman

COM-B	Topic	Perspective
Motivation	Role (un)clarity	*"Maybe it is on our end, that we do not know well for what things we should contact the pharmacy. Everything concerning medication goes through the GP. The GP has the ultimate responsibility. Possibly, when we would know better for what things we can approach the pharmacy, this would improve our collaboration."* Home care nurse 2, 49-year-old woman
		"In particular, I think it is a task of the pharmacist that he screens when someone is using many medications, are those all still necessary? And then discuss this with the physician." Home care nurse 11, 52-year-old woman
		"I think it is important to be clear on who is doing what, and who is making decisions about what. The physician is prescribing and not the pharmacist, he is just delivering prescriptions." Practice nurse 5, 54-year-old woman
		"When I look at our medication reviews, the pharmacist has sufficient knowledge about medication, and we see the patient frequently and have the latest labs. So together, in case someone falls or has hypotension, I
		can imagine there is a role for the pharmacist in fall prevention." Practice nurse 4, 47-year-old woman
		"Yes, in my view, the role of pharmacists is still pretty unclear, or actually not unclear, it is invisible." Physiotherapist 13, 55-year-old man
	Potential results: positive	*"I would appreciate it if pharmacists would inform us about when a patient is using FRIDs, or when a patient starts using a FRID. […] Then I could adapt my care plan, and evaluate this medication use."* Home care nurse 2, 49-year-old woman
		"I worked in an intramural setting and there, when the elderly care physician became involved, then many drugs were deprescribed. And, as a consequence, often people flourished afterwards." Physiotherapist 7, 44-year-old woman
		"I think for pharmacists it is very important that they review which medications someone is using.
		[…] There is no-one who has the total overview of these medications. […] I think more attention could be spent on this." Home care nurse 13, 40-year-old woman

COM-B	Topic	Perspective
	Potential results: negative	*"I don't know what the value is of us approaching pharmacists directly. Because I still have this feeling that GPs control the medication use."* Physiotherapist 2, 29-year-old woman
		I think, how difficult is it for the pharmacist to concretize whether patients may fall because of their medication, especially when they are using it for long term." Practice nurse 1, 65-year-old woman
	Expectations: informing patients	*"In particular, I would like to see improvements with regard to pharmacists' involvement in fall prevention, and them informing patients. And that pharmacists feel and take responsibility."* Home care nurse 13, 40-year-old woman
		"There are also many older patients who come and move outside, and fall with the bike or whatever. I think there are gains to be made here, thus that pharmacies name side effects and warn patients more often about this, and not only about whether or not to drive." Practice nurse 15, 32-year-old woman
	Expectations: deprescribing	*"I often notice patients visiting the GPs again and again, and every time they are prescribed another medicine. I think, if there was collaboration with pharmacists, there could be an extra screening on this. […] In my opinion: 'less is more'. There are major gains to be gained there, I hope."* Physiotherapist 7, 44-year-old woman
		"Fall prevention is, of course, a multifactorial problem and I think you can see it in two ways. By this I mean, as someone who is doing the overarching analysis, and as someone who can zoom into one or few risk factors. And when I think about the last one, then I think the pharmacist is the right person to conduct medication reviews, in order to reduce fall risk-increasing drug use." Physiotherapist 5, 27-year-old man
		"I believe the recommendation is that people who are using medicines for osteoporosis for over five years, they can stop using it. And sometimes I see patients who are using it for ten years. […] I think why did no one react on this. I suppose that a pharmacist sees this prescription come by every time." Practice nurse 1, 65-year-old woman

COM-B	Topic	Perspective
	Expectations: collaboration	*"I think it is good if pharmacists would educate home care nurses about medication. And, also, educate patients in a plain way. Not only by the use of a written patient information leaflet, but by explaining the medication risks clearly to patients."* Home care nurse 9, 54-year-old woman
		"In my experience, which is also my conviction, it is not achievable to organize such meetings. [...] The agendas don't permit it and the financiering is not arranged in primary care. This is much more a barrier in secondary care than in primary care. Privacy law hinders immensely." Physiotherapist 11, 50-year-old man
		"Collaboration with other parties is far more accessible, we have visited each other much more often. Possibly, this is because we need each other more often. I certainly think the pharmacist could get a position in this." Home care nurse 3, 27-year-old woman

Abbreviations: GP = general practitioner

start informing them about this, because this would aid them to detect drug-related problems. One practice nurse was very satisfied with how pharmacists communicated issues of patients with her.

Furthermore, a few physiotherapists suggested that increased interprofessional education would result in more collaboration in practice. Nurses mentioned they would like to be educated by pharmacists about FRIDs.

Opportunity

Theme: Agreements (TDF: environmental context and resources)

Participants mentioned fall prevention is generally regionally organized. One physiotherapist mentioned that national or regional agreements on collaboration in fall prevention, would facilitate implementation of fall prevention. Participants often already participated in multidisciplinary meetings to discuss patient cases. Pharmacists, however, were often not involved in these multidisciplinary meetings. On the other hand, practice nurses mentioned to have recurring multidisciplinary meetings with pharmacists on other topics e.g., to discuss medication reviews, but they did not specifically focus on fall prevention during these meetings.

Theme: Coordination (TDF: environmental context and resources)

Participants mentioned that coordination is often lacking in fall prevention. Interestingly, sometimes physiotherapists or home care nurses informally took on a coordinating role. However, most of them believed this role should be assigned to the general practice as the general practice has most collaboration partners and has the ability to refer patients. In accordance, practice nurses felt they were often the coordinator, but some reported to have limited time to fulfil this task. Practice nurses stated that the starting point is to appoint a care coordinator for each individual patient e.g., a practice nurse, home care nurse or admiral nurse.

Physiotherapists and home care nurses mentioned to contact general practices when they had doubts about patients' medication use. For most physiotherapists and home care nurses, in these particular cases, pharmacists' potential contribution was unclear. For example, they did not know if GPs discussed these cases with pharmacists. In fact, physiotherapists assumed they could not refer patients to pharmacists themselves.

Theme: Collaboration experiences (TDF: social influences)

Physiotherapists mentioned they collaborated with many disciplines, but only a few mentioned collaboration with pharmacists. Physiotherapists who had collaborated with pharmacists generally appreciated this. Home care nurses more frequently collaborated with pharmacists, but seldomly discussed fall-related medication problems with pharmacists. Some nurses had positive experiences with pharmacists, whilst others had not. For example, few nurses experienced that for pharmacists it is a trigger to collaborate when money can be earned, and they did not understand that pharmacists were more driven by financial purposes than the intrinsic motivation to provide good care. Some practice nurses indicated that collaboration with pharmacists has improved over the years.

Participants primarily discussed issues with regard to pharmacotherapy with GPs. One physiotherapist mentioned she was reluctant to approach GPs about medication-related issues, as she assumed GPs might think that pharmacotherapy would be none of her business.

Motivation

Theme: Role (un)clarity (TDF: social/professional role and identity)

All physiotherapists, practice nurses and home care nurses were of the opinion that they had a role in fall prevention. Physiotherapists believed to have an essential role in the assessment of mobility problems regarding fall risk. Nurses reported to have a role in patients' complete fall risk assessment.

Nurses especially saw a role for pharmacists in signalling of medication-related problems and education of patients about fall-related side effects. Some home care nurses thought pharmacists could have an essential role in reviewing medication. Some practice nurses reported to conduct such medication reviews with pharmacists. Participants, however, were of the opinion that geriatricians have better understanding of FRID deprescribing than GPs and pharmacists. Some home care nurses mentioned that the role division regarding medication-related issues between general practitioners and pharmacists was unclear to them.

The role of pharmacists was mostly unclear to physiotherapists. Most physiotherapists barely knew whether and how frequently pharmacists performed

medication reviews, how frequently pharmacists collaborate with GPs, and how collaboration between pharmacists and GPs looks like.

Theme: Potential results (TDF: beliefs about consequences)

With regard to medication use in older patients, physiotherapists thought patients often benefit from deprescribing. However, in their opinion, both pharmacists and GPs don't pay enough attention to this. Home care nurses agreed that coordination of deprescribing is often lacking, and believed this needs more attention from pharmacists. They believed necessity of medication should be checked periodically in older adults. Practice nurses indicated that such medication reviews were periodically performed, but also underlined that GPs had ultimate prescribing responsibility and pharmacists were dependent on them.

Nurses believed that involving pharmacists in fall prevention primarily could contribute to patients' awareness of fall-related drug side effects. Apart from that, home care nurses specifically would appreciate to be informed by pharmacists about start and adaption of medications.

Theme: Expectations (TDF: optimism)

Medication was seen as an important risk factor for falls, and therefore, participants agreed pharmacists have potential to contribute to fall prevention.

Physiotherapists did not know what they could expect from pharmacists, and how the relationship between pharmacists and GPs looks like. One physiotherapist mentioned that she expected collaboration between GPs and pharmacists could be improved. Physiotherapists were open for collaboration with pharmacists, however, generally believed structural multidisciplinary team meetings with pharmacists would not be feasible.

Since most nurses already collaborated with pharmacists generally, they had more expectations from pharmacists. Yet, they believed collaboration with pharmacists could be improved. Additionally, they believed pharmacists could be more involved in fall prevention, for example, by educating patients about their medication.

DISCUSSION

Physiotherapists, home care and practice nurses frequently collaborate with one another to prevent falls, although clear coordination in fall prevention is often lacking. Medication receives limited attention as risk factor for falls. Consequently, collaboration with community pharmacists on fall prevention is sparse. Limited knowledge on the potential contribution of pharmacists and lack of structural meetings with pharmacists are important reasons for this. Despite this, all participating primary care providers were open to more collaboration with community pharmacists to prevent medication-related falls. They believed this collaboration could lead to improved patient outcomes.

Previous identified reasons for limited collaboration among primary care providers, excluding pharmacists, in fall prevention were role unclarity and limited communication.[3,26] In our study, we found that primary care providers also had limited collaboration with pharmacists and similar reasons were identified. Poor interprofessional collaboration in fall prevention results in fragmented care.[3,26]

Primary care providers valued collaboration in general and, hence, also hoped that the collaboration with pharmacists in fall prevention would improve. Physiotherapists, home care and practice nurses already collaborated with one another in fall prevention, except with pharmacists. Participating primary care providers mentioned they lacked knowledge on when collaboration or referral to community pharmacists was beneficial. Previous studies showed that by enhancing the knowledge of one another's skills and tasks, relationships between community pharmacists and general practitioners could be improved, e.g. by interprofessional education.[27,28]

Previous studies investigating interprofessional collaboration, emphasized the importance of communication and coordination of care, e.g. by a coordinator or by use of rules and protocols.[27,29] Participating primary care providers in our study underlined the relevance of communication and well-coordinated fall prevention care as well. Participants mentioned that their degree of communication with primary care providers was dependent on the collaboration partner and ranged from limited to extensive. Communication with community pharmacists was, in particular, often lacking. Likewise, participants reported limited attention for patients' medication use, potentially resulting in unnecessary high exposition to FRIDs by the elderly population at fall risk.

The value of interprofessional collaboration in fall prevention has previously been expressed by various health care providers, such as GPs, nurses, occupational therapists and physiotherapists.[3,26,30,31] However, perspectives on the role of community pharmacists in such collaborations had not been studied yet. In our study, participants expressed their motivation to collaborate with other primary care providers, including pharmacists, to provide fall prevention care. However, collaboration with pharmacists in fall prevention was very limited. Their current reluctance to collaborate with pharmacists seemed to be especially related to unclarity of pharmacists' role in fall prevention. In accordance with previous studies, participants reported that better understanding of one another's role was needed to improve the collaboration and communication.[27,32,33]

Participants expected from community pharmacists to contribute to fall prevention by screening of patients at fall risk, performing medication reviews, deprescribing, and patient education on fall-related drug side effects. Altogether, they predicted that this contribution of pharmacists would lead to safer use of FRIDs in patients at fall risk. Although the effectiveness of interprofessional collaboration on improving patient outcomes is mostly unclear, studies have shown positive contributions of involving pharmacists in a range of settings.[34] For example, physician-pharmacist collaboration has shown to improve blood pressure control and diabetes control.[35–37] In other settings, including fall prevention, enhanced interprofessional collaboration may have similar positive effects on patient outcomes.

With regard to medication-related fall prevention, participants thought patients would benefit from deprescribing. Some thought community pharmacists could take more responsibility to check rationales for prescribed FRID combinations. Likewise, community pharmacists previously mentioned to be less involved than they wished in fall prevention. They particularly emphasized the need of GP's co-operation with regard to deprescribing.[11] However, GPs may be reluctant to deprescribe FRIDs. Deprescribing is often seen as a time-consuming intervention, as it requires involvement of patients, and, moreover, prescribers may be concerned about consequences of deprescribing.[11,38]

Strengths and limitations

The major strength of this study was the parallel inclusion of three different health disciplines in focus group sessions. This enabled us to distinct viewpoints

that were specific for disciplines from viewpoints that were similar for all disciplines. Furthermore, the focus group design allowed participants to share experiences and react on each other; this supported the identification of overlapping and distinct perspectives. We also achieved sufficient participant rates in the focus group sessions. However, a limitation was that perspectives of some collaboration partners in fall prevention were not studied, including GPs, occupational therapists, and dieticians. Since we found some overlap of perspectives among the three included disciplines, these perspectives are possibly also generalizable to other primary care providers.

Another strength was the application of the theoretical frameworks during the study design and analysis. By support of the COM-B model and the TDF the major needs could be identified to increase primary care providers capability, opportunity, and motivation to collaborate in medication-related fall prevention.[22–24]

Implications

First, coordination of fall prevention should be enhanced e.g., by concluding agreements among all relevant primary care providers, stimulating the clarification of the role of each provider including the pharmacist. For example, fall prevention guidelines for health care providers including pharmacists are available in the United States, but lacking in many other countries.[5] Second, by paying more attention to interprofessional education the communication among primary care providers, including community pharmacists, could be improved.[39,40] At last, community pharmacists have to be their own advocate by their contributions in fall prevention e.g., by screening for fall risk at medication reviews and subsequent referral or deprescribing.

Conclusions

Primary care providers are motivated and feel capable to collaborate with one another, including community pharmacists, to prevent falls. Currently, coordination of fall prevention care, and medication-related fall prevention in particular, is lacking. Formulation of agreements with one another, including community pharmacists, could support role clarification, communication, and, thus, coordination of medication-related fall prevention.

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AUTHOR'S CONTRIBUTION

The concept/protocol of the study was written by MG. MG analysed the data, performed the literature search, and wrote the original draft. She implemented the contribution of co-authors during the whole process.

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SUPPLEMENTARY INFORMATION S1: SURVEY AND INTAKE FORM

Table 1. Intake form, completed by focus group participants prior to the focus groups

Questions
Participant characteristics (profession, age, gender, years of work experience)
What is your current contribution to fall prevention?
Which patients do you provide fall prevention?
With whom do you collaborate to provide fall prevention?
What is the role of the pharmacist in fall prevention, according to you?
What is your experience with collaborating with pharmacists to prevent falls?
Did you collaborate with pharmacists to prevent falls in the past 6 months?

SUPPLEMENTARY INFORMATION S2: CONSOLIDATED CRITERIA FOR REPORTING QUALITATIVE STUDIES (COREQ): 32-ITEM CHECKLIST

Table 1. Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No	Item	Guide questions/description	Check?
		Domain 1: Research team and reflexivity	
		Personal Characteristics	
1.	Interviewer/ facilitator	Which author/s conducted the interview or focus group?	EK and MG
2.	Credentials	What were the researcher's credentials? E.g. PhD, MD	EK is PhD, MG is PharmD
3.	Occupation	What was their occupation at the time of the study?	Both researchers, and MG was part-time community pharmacist
4.	Gender	Was the researcher male or female?	Female
5.	Experience and training	What experience or training did the researcher have?	Both researchers were experienced with focus group research.
		Relationship with participants	
6.	Relationship established	Was a relationship established prior to study commencement?	Only by e-mail contact
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	Participants were informed about the research by invitation letter.
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Researchers introduced themselves during the focus group sessions. They reported their reasons and interests in the research topic to the participants.
		Domain 2: study design	
		Theoretical framework	
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	The COM-B model and TDF were used to underpin the study.

		Participant selection	
10.	Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Participants were approached by contacting healthcare organisations and posting invitations on LinkedIn.
11.	Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Participants were approached by e-mail.
12.	Sample size	How many participants were in the study?	6 focus groups were performed with 5-9 participants each.
13.	Non-participation	How many people refused to participate or dropped out? Reasons?	-
		Setting	
14.	Setting of data collection	Where was the data collected? *e.g.* home, clinic, workplace	The data was collected in an online setting.
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	No
16.	Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Participants' background characteristics were obtained by a survey prior to the focus groups.
		Data collection	
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	The interview guide was not pilot tested, but after the first focus group evaluation of the interview guide took place.
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	No
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	Yes, audio-recording was be used to collect the data.
20.	Field notes	Were field notes made during and/or after the interview or focus group?	No
21.	Duration	What was the duration of the interviews or focus group?	The duration of the total focus group session was 1.5 hours.
22.	Data saturation	Was data saturation discussed?	Data saturation was discussed after the second focus group of each discipline, and after all six focus groups.
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	A summary of the findings was returned to participants for comment and/or correction.

		Domain 3: analysis and findings	
		Data analysis	
24.	Number of data coders	How many data coders coded the data?	Two researchers (MG and EK) independently coded all transcripts
25.	Description of the coding tree	Did authors provide a description of the coding tree?	The coding tree was developed on basis of the theoretical frameworks
26.	Derivation of themes	Were themes identified in advance or derived from the data?	Themes were identified in advance, but additional themes were derived from the data as well.
27.	Software	What software, if applicable, was used to manage the data?	NVivo software version 12 was used to manage the data.
28.	Participant checking	Did participants provide feedback on the findings?	-
		Reporting	
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number	Participant quotations were presented to illustrate the findings.
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	-
31.	Clarity of major themes	Were major themes clearly presented in the findings?	-
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	-

Abbreviations: COM-B model = capability opportunity motivation - behaviour model, TDF = theoretical domains framework

Chapter 5

Implementation of a pharmacy-led fall prevention service

Chapter 5.1

Deprescribing of fall risk-increasing drugs in community pharmacy: a case series

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Manuscript in preparation for submission

ABSTRACT

Community pharmacists play an essential role in the prevention of medication-related falls. We describe three cases of older polypharmacy patients who used at least one FRID and received a medication review as part of a pharmacist-led fall prevention service. These cases illustrate pharmacists' decision-making and pitfalls during deprescribing of fall risk-increasing drugs (FRIDs). In two out of three cases, FRIDs were successfully deprescribed, but the pharmacist's intervention led to withdrawal symptoms in a complicated case. Factors that facilitated deprescribing were: patient engagement, pharmacist communication skills, knowledge about FRIDs, and good multidisciplinary collaboration. Deprescribing requests thoughtful decision-making, incorporating patient-centred shared-decision making, and clear communication with physicians. Collaboration is necessary to make agreements e.g. about the monitoring of withdrawal symptoms.

BACKGROUND

Multimorbidity and polypharmacy is increasingly common in older people.[1,2] Globally, interest for improving appropriate polypharmacy is growing.[3] Therefore, community pharmacists make clinical decisions to improve patients' medication use more and more often, e.g. during medication reviews.[4–6] Pharmacists may prevent adverse drug reactions, including medication-related falls, by deprescribing of fall risk-increasing drugs (FRIDs).[7–11]

Reluctance to deprescribing is common both among patients and health care providers. Health care providers fear causing harm with deprescribing.[12] Deprescribing is a complex process that needs a careful assessment of its benefits and harms.[13–15] Patients may be reluctant to deprescribing due to physical or psychological dependency.[16] Generally, deprescribing is considered to be more successful when a good medical assessment, patient engagement, and follow-up monitoring, are ensured.[17]

There is little known of pharmacists' decision-making during deprescribing.[5,6] Case reports could provide more insight in this process. The aim of this paper was therefore to illustrate the decision-making, including the barriers and facilitators, during deprescribing of FRIDs.

SETTING

Three cases were purposively selected from patients who participated in a community pharmacy-led fall prevention service implementation study. The design of this fall prevention service is described in Chapter 5.2 and comprised of a fall risk screening and consultation by the pharmacy technician, and a medication review by the pharmacist. Older patients were invited to participate in this service who were aged ≥ 70 years, and were using at least five drugs concurrently, of which at least one FRID. Pharmacy technician gathered information about patients' disorders, experiences with medication, and potential adverse events. The pharmacist used this information to perform a medication review.

Three cases were selected to highlight different aspects of pharmacists' role in deprescribing. The cases differ from each other in successfulness, medication use, intervention targets, patient autonomy and engagement, and collaboration partners.

THE CASE OF MRS. GRAY

Mrs. Gray (75 years) reported three falls in the past year. She scored 26.25 on the Short Falls Efficacy Scale – International (Short FES-I) which indicates a high concern of falling.[18,19] She had reduced mobility and used a walker. Her previous falls occurred at home, when getting up at night for the toilet. She reported dizziness on a daily basis, particularly in the morning. Mrs. Gray was known with angina pectoris, hypertension, asthma, osteoporosis, hypothyroidism, hypercholesterolemia, incontinence, small intestine polyps, gonarthrosis and low back pain (Table 1). Most invalidating was her low back pain radiating to her legs. Back surgery had been unsuccessful. She underwent three knee surgeries in 2012 and 2013. Mrs. Gray wore glasses and mentioned to eat 10 liquorice sweets daily. Homecare was provided to Mrs. Gray three times a day. Mrs. Gray was a non-smoker and non-drinker. Her husband died of Covid-19 in April 2020.

She used several analgesics, including high-doses of oxycodone, pregabalin, nortriptyline, and paracetamol (Table 1). Mrs. Gray used controlled-release oxycodone 40mg in the morning, 80mg in the evening, and 20mg before night. She indicated that she additionally took 10mg of immediate-release oxycodone as needed, not more than three times a day. Oxazepam was started in August 2020 for anxiety after the death of her husband.

Table 1. Details of the conditions and prescribed medicines of Mrs. Gray, and the most recent laboratory results and blood pressure values.

Medication use details of Mrs. Gray		
Medication use at t = 0 days	**Medication use at t = 170 days**	**Indication**
Oxycodone 80 mg CR q.h.s	-	Low back pain
Oxycodone 40 mg CR q.d.	-	Low back pain
Oxycodone 20 mg IR q.h.s prn	-	Low back pain
Oxycodone 10 mg tablets Prn	-	Low back pain
Metoprolol succinate 100 mg CR tablets q.d.	Metoprolol succinate 100 mg CR tablets q.d.	Angina pectoris
Levothyroxine 112 mcg tablets q.d.	Levothyroxine 112 mcg tablets q.d.	Hypothyroidism

Isosorbide Mononitrate 25 mg capsules q.d.	Isosorbide Mononitrate 25 mg capsules q.d.	Angina pectoris
Pregabalin 75 mg capsules q.h.s	Pregabalin 75 mg capsules q.h.s	Neuropathic pain
Nortriptyline 50 mg tablets q.h.s	Nortriptyline 50 mg tablets q.h.s	Neuropathic pain
Simvastatin 20 mg tablets q.h.s	Simvastatin 20 mg tablets q.h.s	Hypercholesterolemia
Paracetamol 500 mg tablets ii, t.i.d.	Paracetamol 500 mg tablets ii, t.i.d.	Low back pain
Omeprazole 40 mg capsules b.i.d.	Omeprazole 40 mg capsules b.i.d.	Gastroprotection
Acetylsalicylic acid 80 mg tablets q.d.	Acetylsalicylic acid 80 mg tablets q.d.	Angina pectoris
Calcium/Vitamin D 500mg/800 International Units tablets q.d.	Calcium/Vitamin D 500mg/800 International Units tablets q.d.	Osteoporosis
Oxazepam 10 mg tablets t.i.d. prn	Oxazepam 10 mg tablets t.i.d. prn	Anxiety
An hydrophilic ointment Prn	An hydrophilic ointment prn	Dry skin
Carbomer 2mg/g eye gel t.i.d.	Carbomer 2mg/g eye gel t.i.d.	Dry eyes
Polyethylene glycol 3350 plus electrolytes 13.7 g sachets q.d. prn	Polyethylene glycol 3350 plus electrolytes 13.7 g sachets q.d. prn	Constipation
-	Fentanyl transdermal patches 100 mcg/hour q.3.d.	Low back pain
-	Fentanyl transdermal patches 12 mcg/hour q.3.d.	Low back pain
-	Fentanyl sublingual tablets 200 mcg q.4.h. prn	Low back pain

Details of laboratory results

Description	Unit	Result	Reference value
eGFR (MDRD-equation)	ml/min/1,73 m2	> 60	> 60
HbA1c (IFCC)	mmols/mol	40	< 48
Total cholesterol	mmol/L	3.8	< 5

HDL-cholesterol	mmol/L	1.5	> 1.0
LDL-cholesterol	mmol/L	1.5	< 2.6
Natrium	mmol/L	135	135 – 145
Kalium	mmol/L	4.9	3.5 – 5.1
TSH	mU/l	3.9	0.4 – 4.0
Details of physical measurements			
Description	**Unit**	**Result**	**Reference value**
Systolic	mm Hg	150	< 150
Diastolic	mm Hg	85	70 – 90
Length	cm	168	-
Weight	Kg	85	-
BMI	Kg/m^2	30.1	< 28

Abbreviations: CR = controlled release; eGFR: Estimated glomerular filtration rate; HbA1c: Hemoglobin A1c; IFCC: International Federation of Clinical Chemistry; TSH: Thyroid-Stimulating Hormone; BMI: Body Mass Index; LDL: low-density lipoprotein; HDL: high-density lipoprotein

Pharmacist intervention

The community pharmacist and GP agreed that the high-dose of oxycodone was probably most important regarding her fall risk. In order to mitigate the oxycodone-induced side effects the pharmacist proposed opioid rotation followed by tapering. All oxycodone tablets were changed into fentanyl patches and fentanyl sublingual tablets. The equivalent dose of the applied fentanyl patchers (75 mcg/h) was 120 mg/d controlled release oxycodone. The immediate-release "as needed" oxycodone of 10mg were replaced by fentanyl sublingual tablets of 200mcg.

Outcome

After the opioid rotation the dose of fentanyl increased gradually. Mrs. Gray also restarted oxycodone 5 mg four times a day. Eventually, she used a higher dose of opioids compared to before rotation without better pain control. In addition, she felt sick, confused and nauseous and hence domperidone 10mg, three times a day was prescribed.

Opioid rotation is potentially effective to reduce side effects from opioids[20], but evidence supporting its effectiveness is limited and the intervention should be performed carefully.[21,22] According to Mrs. Gray, she was not informed well about

the opioid rotation prior to the intervention. Mrs. Gray used doses of opioids that suggest dependency and maybe opioid-induced hyperalgesia. She should have been monitored more closely and agreements should have been made with her GP to prevent a further increase in opioid dose. Due to the death of her husband, she lived alone, and could not rely on family members for social support. Maybe Mrs. Gray's case was too complicated to deal with in primary care.

THE CASE OF MR. EVANS

Mr. Evans (72 years) fell off his bike a few times in the past year. He also had cognitive problems due to a cerebral infarction. Mrs. Evans is his informal caregiver. She mentioned Mr. Evans slept a lot and that she often has to wake him in the afternoon. Mr. Evans also had a history of cerebral infarction and a percutaneous coronary intervention (PCI). He was in addition diagnosed with hypertension, diabetes mellitus type II, hypercholesterolemia, and constipation. (Table 2) He felt regularly depressed, suffers from panic attacks and chronic pain. Mr. Evans drank one glass of alcohol daily and he did not smoke.

For his panic disorder Mr. Evans used clomipramine and his chronic pain was treated with fentanyl transdermal. Constipation probably resulting from the use of fentanyl and clomipramine was treated with macrogol.

Pharmacist intervention

The drowsiness of Mr. Evans at a relative low dose of clomipramine was remarkable. Therefore the pharmacist advised genotyping. It appeared that Mr. Evans was an intermediate metabolizer of CYP2D6 (*2/*4) and CYP3A4 (*1/*22) which explains the strong effects of the low dose of clomipramine.[23–25] The community pharmacist, GP, and geriatrician agreed on deprescribing of clomipramine and starting with calcium and vitamin D supplementation.

Outcome

The clomipramine was stepwise withdrawn in three months, first by halving the dose and subsequently by administrating it every other day. Mr. Evans did not fall off his bike again and for the first time in 2-3 years he woke up by need for psychotropic medications. Factors that seemed to facilitate the deprescribing process were good communication with both physicians and caregiver.26

Table 2. Details of the conditions and prescribed medicines of Mr. Evans and the most recent laboratory results and blood pressure values.

Medication use details of Mr. Evans			
Medication use at t = 0 days		**Indication**	
Fentanyl transdermal patches 12 mcg/hour q.3.d.		Chronic pain	
Insulin glargine 300E/ml subcutaneous injections q.d.		Diabetes Mellitus type II	
Macrogol plus electrolytes 13.7 g sachets t.i.d. prn		Constipation	
Metformin 1000mg tablets b.i.d.		Diabetes Mellitus type II	
Clopidogrel 75mg tablets q.d.		Stroke and PCI	
Amlodipine 5mg tablets q.d.		Hypertension	
Simvastatin 40mg tablets q.d.		Hypercholesterolemia	
Clomipramine 10mg tablets q.d.		Anxiety disorder	
Details of laboratory results			
Description	**Unit**	**Result**	**Reference value**
eGFR (MDRD-equation)	ml/min/1,73 m2	> 60	> 60
HbA1c (IFCC)	mmols/mol	56	< 48
Total cholesterol	mmol/L	4.0	< 5
HDL-cholesterol	mmol/L	1.2	> 1.0
LDL-cholesterol	mmol/L	2.4	< 2.6
Natrium	mmol/L	139	135 – 145
Kalium	mmol/L	4.3	3.5 – 5.1
Details of physical measurements			
Description	**Unit**	**Result**	**Reference value**
Systolic	mm Hg	145	< 150
Diastolic	mm Hg	75	70 – 90
Length	cm	170	-
Weight	Kg	94	-
BMI	Kg/m^2	32.5	< 28

Abbreviations: eGFR: Estimated glomerular filtration rate; HbA1c: Hemoglobin A1c; IFCC: International Federation of Clinical Chemistry; BMI: Body Mass Index; PCI: percutaneous coronary intervention; LDL: low-density lipoprotein; HDL: high-density lipoprotein

THE CASE OF MR. JOHNSON

Mr. Johnson (74 years) scored 15 points on the Short FES-I, indicating high concern of falling.[18,19] The last time he fell was two years ago. He thought he

was most at risk of falling during cycling. He was known with angina pectoris, hypercholesterolemia, hypertension, and a history of myocardial infarction, for which he was under treatment of a cardiologist. He complained about experiencing insomnia every night. He used 2 glasses of alcohol per day, and did not smoke.

Table 3. Details of the conditions and prescribed medicines of Mr. Johnson and the most recent laboratory results and blood pressure values.

Medication use details of Mr. Johnson			
Medication use at t = 0 days			**Indication**
Acetylsalicylic acid 80 mg tablets q.d.			Myocardial infarction; Angina pectoris
Isosorbide Mononitrate 60 mg capsules q.d.			Angina pectoris
Polyethylene glycol 3350 plus electrolytes 13.7 g sachets b.i.d. prn			Constipation
Metoprolol succinate 100 mg CR tablets q.d.			Myocardial infarction; Angina pectoris
Omeprazole 40mg capsules q.d.			Gastroprotection
Pravastatin 20mg tablets q.d.			Hypercholesterolemia
Zolpidem 5mg tablets q.h.s. prn			Sleep disorder
Details of laboratory results			
Description	**Unit**	**Result**	**Reference value**
eGFR (MDRD-equation)	ml/min/1,73 m2	> 60	> 60
Total cholesterol	mmol/L	4.3	< 5
HDL-cholesterol	mmol/L	1.6	> 1.0
LDL-cholesterol	mmol/L	2.2	< 2.6
Natrium	mmol/L	141	135 – 145
Kalium	mmol/L	4.0	3.5 – 5.1
Details of physical measurements			
Description	**Unit**	**Result**	**Reference value**
Systolic	mm Hg	139	< 150
Diastolic	mm Hg	71	70 – 90
Length	cm	187	-
Weight	Kg	100	-
BMI	Kg/m^2	28.6	< 28

Abbreviations: CR = controlled release; eGFR: Estimated glomerular filtration rate; BMI: Body Mass Index; PCI: percutaneous coronary intervention; LDL: low-density lipoprotein; HDL: high-density lipoprotein

Mr. Johnson used zolpidem on a daily basis. Mr. Johnson reported absence of adverse effects and a desire to continue using zolpidem. He described that he felt dizzy when standing up fast. His blood pressure was 139/71 mmHg.

Pharmacist intervention

The pharmacist and GP discussed that since Mr. Johnson seemed to be dependent on the zolpidem, it was unlikely to achieve success with deprescribing. The cardiologist agreed on halving the dose of the metoprolol. The cardiologist planned a 24-hour blood pressure measurement. Calcium and vitamin D supplementation were also started.

Outcome

Mr. Johnson was satisfied about the scrutinous review of his medication and the collaboration between his physicians and the pharmacist. However, he did not notice any improvement in dizziness after the medication adaptations.

DISCUSSION

The discussed cases illustrate the complexity of decision-making when deprescribing of FRIDs. Factors that facilitated the deprescribing process were: patient engagement, communication skills, role of care giver, pharmacists' knowledge about FRIDs, and multidisciplinary collaboration.

The cases indicate that community pharmacists are capable to propose a wide-range of interventions to reduce medication-related fall risk. These cases illustrate that community pharmacists' interventions are often safe and effective. However, the cases also stress the importance of thoughtful decision-making processes, incorporating well-tuned collaboration with physicians, good communication with patients, and close monitoring of withdrawal symptoms. When this does not take place properly undesired effects may occur, such as in case 1.

In line with previous findings, patient engagement seemed of major importance in these cases to succeed with deprescribing.[26–28] In the first case, patient engagement and monitoring of the deprescribing process was lacking. In the second case, the caregiver was engaged in deprescribing and medication was successfully withdrawn. In the third case, the patient was open to deprescribing

of preventive cardiovascular medication, but declined tapering of medication to which he was psychologically dependent.

To ensure patient engagement, patients need to have trust and confidence in their health care providers.[26,29] Health care providers should provide sufficient information to their patients about the harms and benefits of their medication.[30] Previously, patients and caregivers indicated that the success of deprescribing is dependent on the provided patient support during the process.[31] In line with this, our cases revealed that good communication is crucial for deprescribing. Studies on patient engagement in deprescribing are sparse, even though it has deemed to be essential.[31,32] In some cases, patients have insufficient understanding of their medication use in order to decide on deprescribing. In such situations, caregivers may have an essential role.[26] In clinical practice, the process of engaging patients also seems to be hindered by a lack of time.[13,27]

The cases indicate that well-organized multidisciplinary collaboration, including role clarity and clear communication, in deprescribing is essential. Besides the medication review with the general practitioner, collaboration with other physicians may be crucial as well e.g., to make agreements about monitoring. Involvement of other disciplines could also facilitate deprescribing. Home care nurses and practice nurses often got a better picture of patient's beliefs of medication.[33] Also, nurses could support with the monitoring of withdrawal symptoms during deprescribing.[34,35] Collaboration with physiotherapists could contribute to the screening of patients at risk of falls.[36]

In the cases, community pharmacists showed their confidence and knowledge to initiate deprescribing of FRIDs. Community pharmacist who were involved in the cases, recently completed an online deprescribing training (Chapter 5.2). Literature suggests that an important barrier for deprescribing is health care providers' lack of knowledge to decide on deprescribing of FRIDs, resulting in health care providers being reluctant with deprescribing.[12,37] Training and dissemination of knowledge on FRID deprescribing among community pharmacists might be essential to advance its implementation in practice.[37]

Related to this, the decision-making on deprescribing of FRIDs in practice might also be facilitated by FRID deprescribing tools, such as the so-called Screening Tool of Older Persons Prescriptions in older adults with high fall risk

(STOPPFall).[38] Other validated tools, including the Beer's criteria and STOPP/START, could support the screening for inappropriate prescribing as well. In addition, specifically more guidance on how to deprescribe FRIDs is desirable e.g., easily implementable deprescribing regimens.[39,40] Deprescribing guidelines for various kinds of drugs have been proposed in the last few years.[41–43] Yet, the implementation and knowledge dissemination of these guidelines in clinical practice takes time.[44]

Recommendations for clinical practice

Shared decision-making, including clear explanation of risks and benefits of deprescribing and guidance with withdrawal, is crucial for effective deprescribing.[26] Moreover, public awareness on deprescribing should be increased to promote the patient engagement in deprescribing.[45] At last, pharmacists also need more communication training to understand how to engage patients in their interventions.[46] Opportunities to improve collaboration should be stimulated, such as interprofessional education and concluding of agreements to clarify roles.[47–49]

Conclusion

Community pharmacists' involvement is crucial to conduct deprescribing of FRIDs, which is facilitated by patient engagement, knowledge about FRIDs, and good multidisciplinary collaboration. To improve collaboration and shared decision-making, community pharmacists should be sufficiently trained in communication skills.

AUTHOR'S CONTRIBUTION

MG selected the cases and collected additional data about the cases if needed, by contacting patients/pharmacists. She performed the literature search and wrote the original draft. During the whole process, she implemented input and feedback from her co-authors.

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Chapter 5.2

Establishing a community pharmacy-based fall prevention service – an implementation study

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ABSTRACT

Background

Community pharmacists are increasingly motivated to provide fall prevention services, but this is not yet common practice.

Objective

The aim of this study was to evaluate the implementation of a community pharmacy fall prevention service.

Methods

A fall prevention service, consisting of a fall risk screening and assessment including a medication review, was implemented in pharmacies. A preparative online training was provided to the pharmacy team. Included patients were aged ≥ 70 years, using ≥ 5 drugs of which ≥ 1 fall risk-increasing drug. The implementation process was quantitively assessed by registering medication adaptations, recommendations, and referrals. Changes in fear of falling and patient scores on a knowledge test were documented at one month follow-up. Qualitative evaluation of the implementation took place by conductance of semi-structured interviews with pharmacists before and after the project, based on the consolidated framework of implementation research (CFIR).

Results

Nine pharmacies implemented the project and in total 91 fall consultations were performed. Medication was adapted of 32 patients and 23 were referred. Patients' fear of falling was significantly higher at follow-up ($p = 0.047$) and patients' knowledge test scores did not differ ($p = 0.86$). Pharmacists experienced the following barriers: lack of time, absence of staff, and limited multidisciplinary collaboration. Facilitators were: training, motivated staff, patient engagement, and project scheduling. Pharmacists desired a less time-consuming intervention.

Conclusion

The service resulted in a substantial number of interventions and might therefore be useful, but many barriers were identified that hamper the sustained implementation of the service.

INTRODUCTION

Pharmacy practice research is an evolving field of science, investigating the provision of pharmaceutical care.[1,2] Fall prevention is an example of an important health topic that is gaining pharmacists' interest.[3,4] Currently, falling among older people is an escalating problem, due to increased life expectancy, aging of the population, people living longer at home, and the serious consequences of falls.[5] The structural implementation of pharmaceutical care services, including fall prevention care, in routine practice is warranted in order to improve patient outcomes.[1,2]

Effective multiple component fall prevention interventions target common modifiable fall risk factors, including impaired mobility, medication use, and home environmental hazards.[6] Despite the fact that multiple component fall prevention interventions have shown to be effective, implementation of these interventions in daily clinical practice is difficult, as circumstances in clinical practice differ from those in research settings with respect to e.g. timing, funding and target population.[7–9] It is thus essential to gain more insight into the implementation process, including its barriers and facilitators.[9]

Nowadays, the provision of fall prevention care is not common in daily practice of community pharmacies in the Netherlands. Previously, pharmacists indicated that, despite their current limited contribution, they are motivated to contribute to fall prevention.[10] Pharmacists could contribute to fall prevention by recognizing and modifying the use of fall risk-increasing drugs (FRIDs), identifying patients at risk of falls, and improving their collaboration with regard to fall prevention with general practitioners (GPs), home care nurses, and physiotherapists e.g., by referring patients.[6,11–13] Deprescribing of FRIDs, preferably alongside interventions targeting other fall risk factors, is an effective component of the multifactorial falls evaluation in older patients.[14]

Even though pharmacists believe their involvement in fall prevention is highly relevant, their current contributions seem disappointing.[10,15] Pharmacists should therefore be supported to successfully implement fall prevention services in their daily practice, in order to advance sustained implementation. However, pharmacy staff's experiences, including their barriers and facilitators, with regard to the provision of such services are currently unknown.

Based on previous findings[6,13,16], we developed a new community pharmacy fall prevention service. The aim of the current study was to evaluate the potential benefit of this service and to describe the barriers and facilitators for the implementation of a community pharmacy fall prevention service.

METHODS

Study design

An implementation study was conducted in 10 Dutch community pharmacies. In the Netherlands, pharmacy technicians are the first point of contact for patients.[17] Pharmacy technicians could hence contribute to the provision of fall prevention in community pharmacies.

The implementation of the intervention was assessed both quantitatively and qualitatively. The planned duration of the implementation project was three months. Data were collected between September 2020 and September 2021.

Participating pharmacists

Pharmacists affiliated with the Utrecht Pharmacy Practice Network for Education and Research (UPPER) were informed about the study by an online newsletter and could sign-up accordingly.[18] Participating pharmacists and pharmacy technicians received an invitation letter and all of them gave oral informed consent before start of the study. Pharmacists were asked to share their background characteristics, including age, gender, and years of work experience.

Fall prevention service

The fall prevention service consisted of 1) a fall risk screening and 2) a fall consultation to assess modifiable fall risk factors with accompanying interventions conducted by the pharmacy technician and 3) a quick medication check and 4) a comprehensive medication review if needed by the pharmacist. The implementation of the service was facilitated by providing pharmacy staff a preparative online training and a toolkit. (Figure 1) The toolkit consisted of a screening aid for patients at risk of falls, a manual to assess fall risk, a manual to refer patients and provide them personalized recommendations, and resources to perform medication reviews.

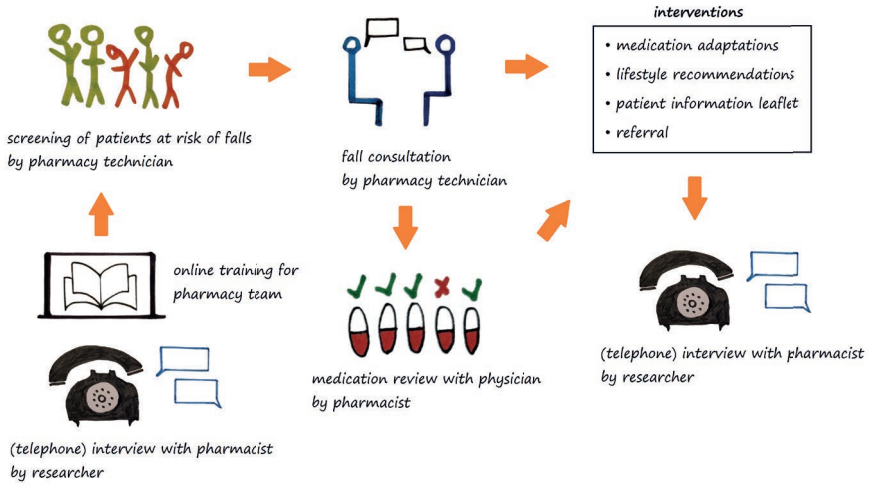


Figure 1. Overview of the steps of the implementation research, including the steps of the fall prevention service.

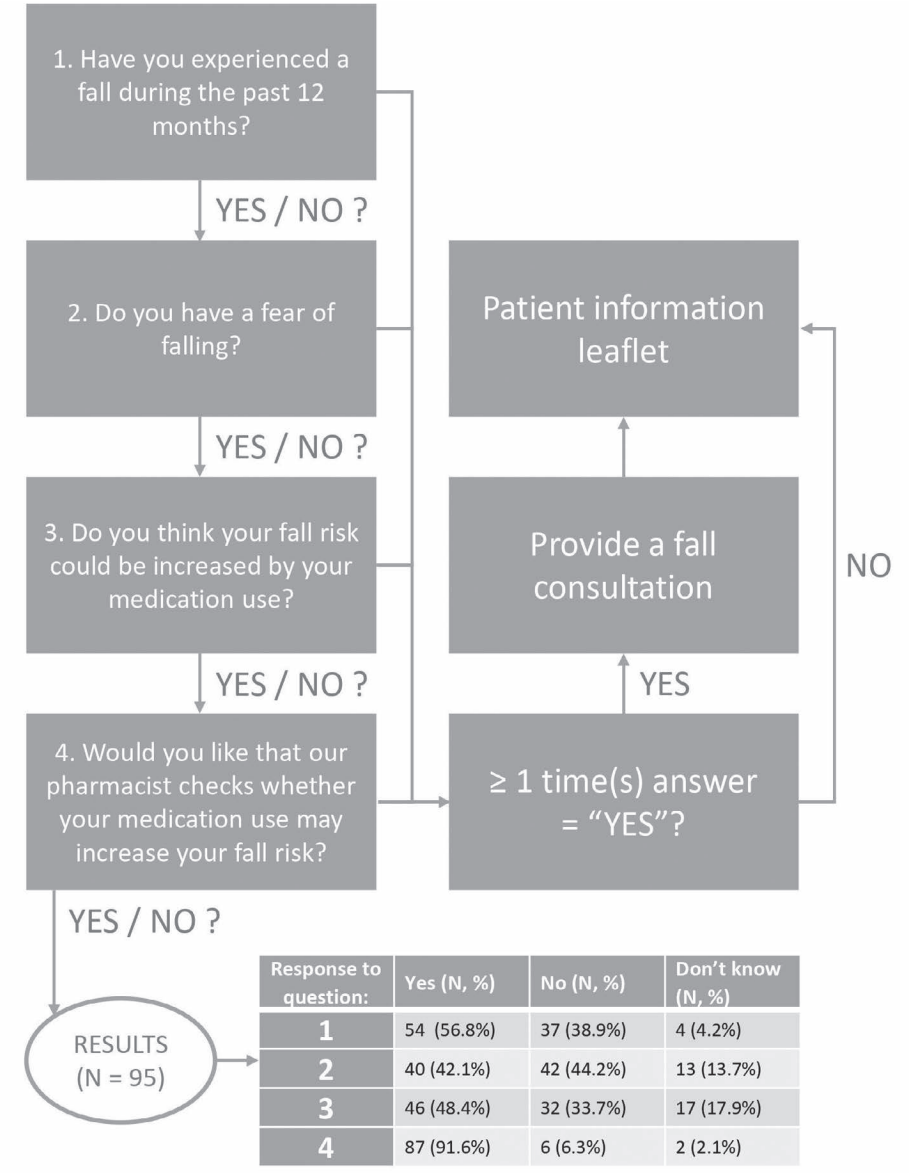
Inclusion criteria

Patients meeting the following criteria were eligible for the intervention: aged ≥ 70 years, using ≥ 5 drugs simultaneously of which ≥ 1 classified as FRID.[19–21] Upon receiving signed informed consent, a quick fall risk screening was conducted by the pharmacy technician with patients in order to decide whether they were eligible for fall consultations.

Training and toolkit material

Pharmacists and pharmacy technicians completed an e-learning about FRIDs and the different steps of the fall prevention service. The training was based on Dutch fall prevention guidelines and current evidence concerning identification and deprescribing of FRIDs.[16,19–22] Pharmacists completed an extended version of the e-learning for pharmacy technicians to ensure they were sufficiently trained regarding the decision-making of deprescribing of FRIDs.

Additional material was provided to pharmacists existing of: a quick screening instrument (Figure 2), a fall consultation guide (Supplementary Information S1: Table 1), and a patient information leaflet.



Response to question:	Yes (N, %)	No (N, %)	Don't know (N, %)
1	54 (56.8%)	37 (38.9%)	4 (4.2%)
2	40 (42.1%)	42 (44.2%)	13 (13.7%)
3	46 (48.4%)	32 (33.7%)	17 (17.9%)
4	87 (91.6%)	6 (6.3%)	2 (2.1%)

Figure 2. Quick screening conducted by the pharmacy technician. The table shows the number (and percentages) of given responses of the 95 participants to the questions of the quick screening.

The quick screening was developed based on:

- A validated fall risk screening instrument, which includes two screening questions[23];

- the minimal intervention strategy for smoking cessation, in order to only include patients who are motivated.[24]

For support with deprescribing, pharmacists were referred to evidence-based resources (e.g. the European consensus FRIDs list and deprescribing tool STOPPFall).[16]

Ethics and confidentiality

The study protocol was approved by the Institutional Review Board of the Division of Pharmacoepidemiology and Clinical Pharmacology, Utrecht University (reference number UPF2007). All participating patients gave written consent and all participating pharmacists gave oral consent.

DATA COLLECTION

Data collection focused on two aspects of the implementation: 1) quantitative assessment of the process of the implementation and 2) qualitative evaluation of pharmacy staff perspective on implementation.

Quantitative assessment of the implementation process

Medication verification was performed at start of the fall prevention service. All responses to quick screening questions were noted by the pharmacy technician, as well as all recommendations from fall consultations. Pharmacists registered their suggestions for drug changes and the actual changes after agreement by the GP and patient. The durations of the fall consultations were noted.

After the quick screening eligible patients completed the Short Fall Efficacy Scale-International (FES-I) and a short knowledge test about fall prevention.[25] The FES-I consists of seven questions assessing fear of falling on a scale of 1 to 4. The sum score ranges from 7 to 28; scores 7-8 suggest low fear of falling, scores 9-13 moderate fear of falling, and scores 14-28 high fear of falling. The knowledge test consisted of 12 multiple choice questions and the percentage of correct answers was calculated. The FES-I and knowledge test were also administered after one-month follow-up.

Qualitative evaluation of pharmacy staff perspective

Pharmacists were interviewed before and after approximately three-months, except for one pharmacist who was involved as a researcher in this project (MG). In principle, interviews were performed with pharmacists only but the researchers accepted double interviews when pharmacists asked team members to join the interviews. During these interviews, pharmacists' perception on the implementation of fall consultations in their practice was investigated. The semi-structured interview guide was based on the five domains of the CFIR (Figure 3).[26]

The Consolidated Framework for Implementation Research (CFIR) was applied to guide interview data collection for evaluation of the implementation process.[26] This is a widely used framework in implementation research used to investigate barriers and facilitators explaining implementation outcomes.[27,28]

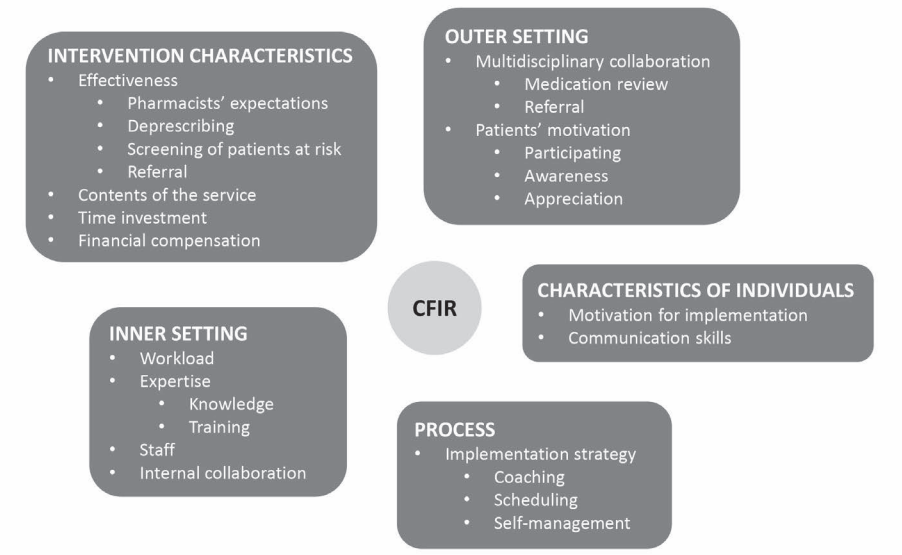


Figure 3. Overview of the addressed topics in the interviews in relation to the five domains of the consolidated framework for implementation research (CFIR).
Abbreviations: CFIR = Consolidated framework for implementation research

Data analysis

Descriptive statistics were used for pharmacists' and patients' background characteristics. The implementation of the fall prevention service was described by

calculating the number of all kinds of interventions and medication adaptations. Two-tailed paired t-tests were conducted to investigate the significance of intervention effects on patients' scores on knowledge and FES-I. A significance level of < 0.05 was considered statistically significant.

The audio-recordings of the interviews were transcribed verbatim and imported in NVivo version 12 software. Names of participants were removed from the transcript. The interviews were analysed by a postgraduate student researcher (MG) with experience in qualitative research. The coding process was checked and reviewed by an experienced postgraduate researcher (EK). Inconsistencies were resolved through discussion with a third researcher (MB).

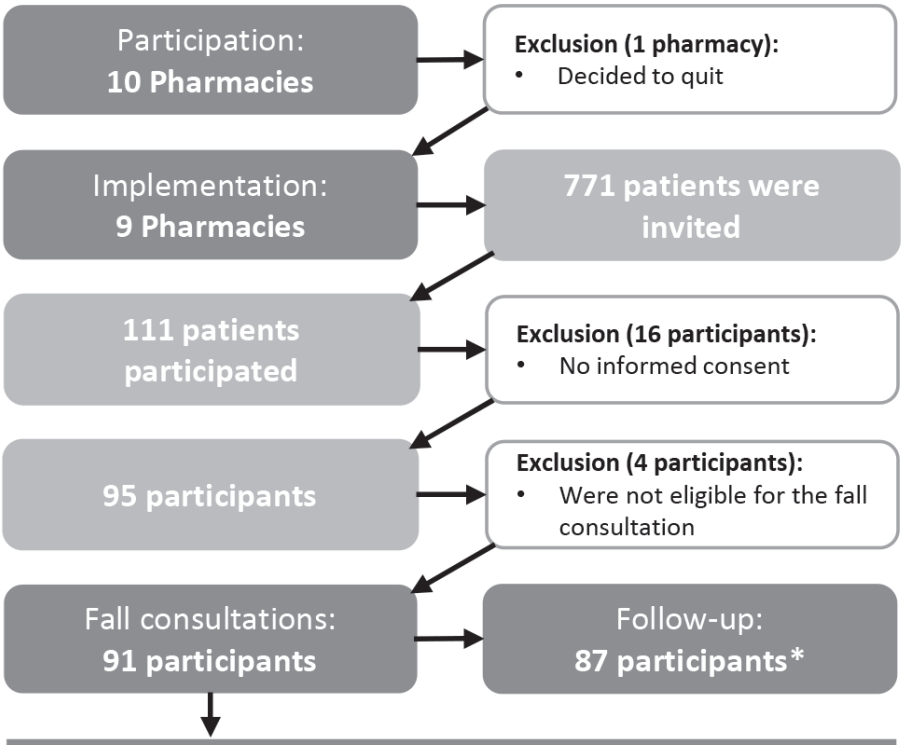
RESULTS

Quantitative assessment of the implementation process

From 10 pharmacies that agreed on participating nine pharmacies actually implemented the fall prevention service (Figure 4). The mean duration of the project was 3.9 months per pharmacy (sd = 1.4). The number of fall consultations per pharmacy ranged from 2 to 32 (median = 6 [Q1 – Q3 = 4 – 9]). The mean duration of the fall consultation was 42.1 minutes (sd = 18.8). thought their medication use could influence their risk of falling and the majority (91.6%) appreciated a medication review by the pharmacist.

A total of 91 patients received a fall consultation and 87 of them also underwent the follow-up. All patients received a quick medication check by the pharmacist, and for 41 patients a medication review with a physician was conducted. More men (52.7%) than women participated, and the median age of the participants was 78 years (Q1 – Q3 = 74 – 85.5 years).

In total, 157 lifestyle recommendations were given to the 91 patients. Of these, patients were most often recommended on home safety (N = 39; 42.9%), footwear (N= 38; 41.8%), and exercise (N = 39; 39.6%). Twenty-three patients (25.3%) were referred to another health care provider e.g. for a full multifactorial fall risk assessment in accordance with the Dutch fall prevention guideline.[22] Pharmacists proposed medication adaptations for 41 patients (74 medication adaptations). As a result, medication was adapted for 32 patients (44 medication adaptations). (Table 1)



Background characteristics (N = 91)	
Age in years (median [Q1-Q3])	78.0 (74.0 – 85.5)
Female gender (N, %)	43 (47.3%)
≥ 1 fall experience(s) in the past year (N, %)	54 (59.3%)
Short FES-I score (median [Q1-Q3])	9.3 (8.0 – 12.0)
Number of dispensed medications (median [Q1-Q3])	10.0 (7.0 – 12.0)
Number of dispensed FRIDs (median [Q1-Q3])	4.0 (3.0 – 5.0)

**Patients who did not participate in the follow-up were unreachable at that moment, with exception to one who explicitly mentioned that she did not want to participate in the follow-up*

Figure 4. Flowchart and background characteristics of patients included in the fall consultations. Abbreviations: Q1 = first quartile; Q3 = third quartile; N =number; FRID = fall risk-increasing drug

In total, 771 patients were invited and 95 of them agreed on the quick screening. Of these patients, 56.8% reported at least one fall in the past year and 42.1% reported a fear of falling (Figure 2). Nearly half of the participants (48.4%) Patients had a significant higher FES-I score at follow-up than baseline (p = 0.047).

Table 1. Quantitative implementation outcomes

Fall prevention intervention		
Recommendations	**Provided recommendations**	**Number (%)**
	Home safety	39 (42.9%)
	Footwear	38 (41.8%)
	Exercise	36 (39.6%)
	Vision/hearing	26 (28.6%)
	Incontinence	10 (11.0%)
	Nutrition	8 (8.8%)
Referrals	**Reason**	**Number (%)**
	Fall analysis[§]	18 (19.8%)
	Other reason	10 (11.0%)
Prescription adaptation	**Number of patients**	**Number (%)**
	Proposed for prescription adaptation to GP	41 (45.1%)
	Prescription adaptation accepted by GP	32 (35.2%)
	Sum of adaptations	**Number**
	Proposed prescription adaptations (Total)	74
	Accepted prescription adaptations (Total)	44
	Accepted prescription adaptations (CNS)	8
	Accepted prescription adaptations (CVS)	14
	Accepted prescription adaptations (Calcium/Vitamin D)	13
	Accepted prescription adaptations (Other)	9
Effectiveness		
Short FES-I (N = 85) [†]	***Time***	***Mean (sd)***
	Baseline	10.8 (4.4)
	Follow-up	11.6 (4.0)
	Paired t-test	***Value***
	P-value	0.047[*]
Knowledge test (N = 47) [†‡]	***Time***	
	Score at baseline (%)	66.3 (15.5)
	Score at follow-up (%)	66.8 (15.2)
	Paired t-test	
	P-value	0.86

Abbreviations: Short FES-I = Short Falls Efficacy Scale – International; sd = standard deviation
[*] Significant at level p < 0.05
[†] Results on the short FES-I and knowledge test at follow-up were missing of two patients, due to loss and because one follow-up was performed with the wife of the patient instead of the patient himself
[‡] Data of knowledge tests were missing for 39 patients, since one pharmacy was not instructed to perform the knowledge tests and other pharmacies lacked to perform or save patients' knowledge tests of 17 patients
[§] Referral for the official fall risk assessment of the Dutch fall prevention guideline [22]

The mean score on the knowledge test at baseline and follow-up did not differ significantly (p = 0.86).

Qualitative evaluation of pharmacy staff perspective

Nine pharmacists were interviewed at the start of implementation, and eight pharmacists were interviewed after the implementation. One participating pharmacist was not interviewed since she was also involved as a researcher in this project (MG). In one interview the pharmacy technician also joined the interviews with the pharmacist, and in another interview a pharmacist-in-training was present. Interviewed pharmacists were on average 44.4 years old (standard deviation [sd] = 12.0). Pharmacists' years of work experience ranged from 2.5 years to 38 years. Four pharmacists were male and five were female.

Perspectives of pharmacists are summarized along the CFIR domains below (Table 2).

Intervention characteristics

Before implementation, participating pharmacists were generally positive about fall prevention because they were aware of increased fall risk in older patients and the potential contribution of FRIDs to this increased risk. Many pharmacists were, however, uncertain about whether the intervention could have significant positive impact, due to the multicausality of falls. Furthermore, pharmacists expected that routinely performing fall consultations would influence the workload. They, however, mentioned that fall consultations could be combined with medication reviews as these were already standard of care.

At follow-up, pharmacists remained positive, however, they doubted effectiveness of their interventions in reduction of falls. Regardless of its effectiveness on falls, some pharmacists indicated that it was difficult to deprescribe FRIDs, because physicians did not agree with suggestions for deprescribing, or because patients were reluctant to discontinue medication. On the other hand, one pharmacist indicated that she had lots of experience with deprescribing in collaboration with physicians, and another pharmacist indicated that deprescribing is a relatively simple intervention to reduce fall risk.

To facilitate further implementation, most pharmacists would appreciate an abbreviated version of the fall consultation, preferably integrating the fall

consultation into regular medication reviews. One pharmacist did not implement the fall prevention service, because his opinion was that the content of the fall consultation was too broad. He thought pharmacists should only focus on reducing use of FRIDs. Correspondingly, another pharmacist reported that he felt his expertise of other risk factors than medication use was not sufficient to adequately advice patients.

Most other pharmacists believed the content of the fall consultation was in line with the expertise of pharmacy technicians and that it hence was a suitable task for them. One pharmacist indicated that since deprescribing results in less prescriptions, it is financially unattractive. Therefore, financial compensation for broad implementation of such services is needed.

Pharmacists thought that by participating in the fall prevention service, patients got more aware of their own fall risk and the risks of their medication use.

Outer setting

Multidisciplinary collaboration

Pharmacists recognized the importance of a multidisciplinary approach in fall prevention both before and after implementation. The GP was the most important collaboration partner for them. A few had, prior to the project, informed the GP about the project, and one had even informed the physiotherapist. Afterwards, some pharmacists mentioned they regretted that they had not collaborated more with other health care providers including home care nurses, practice nurses, or physiotherapists. One pharmacist mentioned that she was proud she managed to strengthen her relationships with physiotherapists.

All pharmacists indicated that they had good relationships with the GPs in their neighbourhood. However, they mentioned that GPs or other health care providers seldom spontaneously requested a medication review to reduce fall risk. Pharmacists reported to be very dependent on prescribers regarding deprescribing.

Patients' motivation

Before implementation, most pharmacists expected that patients would react positive on the invitation to participate in the study. At follow-up, pharmacists particularly experienced that patients appreciated the attention that was given

to them. They also thought that patients were generally open to receiving recommendations of pharmacy technicians regarding fall prevention. Pharmacists reported that patients especially appreciated that their medication was reviewed.

On the other hand, some pharmacists expressed that the response to the invitation letters was low, and therefore had doubts about reaching the target group. Some pharmacists expected that patients might underestimate their own fall risk and patients thus believe fall prevention services are unnecessary for them. Pharmacists thought most patients are unaware about the risk of medication use on falling.

Pharmacists thought that the provision of the fall prevention service contributes to the awareness of patients regarding risks of medication use on falling. However, it was mentioned by pharmacists that it was difficult to explain to patients that their medication use might increase their fall risk. Furthermore, pharmacists thought that patients believe medication safety is guaranteed by the fact that their physician 'knows what's best for them'.

Inner setting

Most pharmacists indicated that they previously only paid attention to fall prevention in an unstructured way during regular medication reviews. For example, they did not regularly ask patients about fall history nor informed them about fall risk-increasing drugs. One pharmacist who was involved in a fall prevention project organized in the health care centre, indicated that she already paid attention to increasing patients' awareness on risks of fall-related drug effects. She mentioned that in her pharmacy stickers are pasted on some drug boxes, including benzodiazepines and opioids, that specifically warn patients for the adverse effects related to falls.

Workload

Prior to the project, some pharmacists were very confident about being able to implement the project successfully, whilst others were less secure. Eventually, in most pharmacies less fall consultations were performed than initially planned.

Most pharmacists indicated that the implementation of the fall prevention service takes time which is often lacking. Pharmacists reported that occasionally it was not possible to spend time on the service, for example in times of staff absence. In these circumstances pharmacist gave priority to the primary processes.

Table 2. Pharmacists' perspectives on the implementation of the fall prevention service before and after the project.

CFIR domain	*Time*	*Pharmacists' perspectives*	*Topic*	*Barrier / Facilitator*
Intervention characteristics	Before the project	*"I think it happened one month ago when someone physically fell in the pharmacy. […] I warned the general practitioner because I saw he used medicines that may cause falls."* 36-year-old pharmacist, Pharmacy 10	Effectiveness: expectations	Facilitator
		"The drug is only part of the story. As pharmacists we overestimate the contribution of drug use to falls. […] However, every bit helps and, in any case, it supports awareness." 59-year-old pharmacist, Pharmacy 7	Effectiveness: expectations	Barrier
	After the project	*"At least I think that fall risks of a few patients are captured by the GP now. The question is if a follow-up action takes place that prevents a fall incident."* 47-year-old pharmacist, Pharmacy 1	Effectiveness: screening of patients	Facilitator
		"We modified some medications, especially beta-blockers. I called with many people who feel dizzy regularly, and I think that when it is easy to halve the dose, then they might be helped with that." Pharmacy technician, Pharmacy 3	Effectiveness: deprescribing	Facilitator
		"There are many drugs that could increase fall risk, but they are used for reasons. If someone is using a selective serotonin reuptake inhibitor, you could switch to another selective serotonin reuptake inhibitor, but this has a similar negative impact. And you don't want to switch just like that. Sleeping pills are hard to discuss in any case. […] And also, when patients are dizzy, it is often unclear where it comes from. For example, someone is using many antihypertensives indeed, but blood pressure is high, then they cannot be deprescribed." 31-year-old pharmacist, Pharmacy 9	Effectiveness: deprescribing	Barrier

CFIR domain	*Time*	*Pharmacists' perspectives*	*Topic*	*Barrier / Facilitator*
		"With regard to the fall consultation guide, sometimes you think, I don't have experience with this, for example in the field of psychotherapy or shoes. […] Thus, should this really be a task for pharmacists? And then, how is it financed?" 36-year-old pharmacist, Pharmacy 10	Contents of the service	Barrier
Outer setting	Before the project	*"We approached the physiotherapist that we wanted to start with this project. Meanwhile, we also informed the GP."* 36-year-old pharmacist, Pharmacy 10	Multidisciplinary collaboration	Facilitator
		"For me, it is very difficult to convince those physicians that medication withdrawal is better for those patients [older than 75 years, cognitively impaired and a recent fall]." 28-year-old pharmacist, Pharmacy 4	Multidisciplinary collaboration	Barrier
		"Yes, I expect patients are positive. It is free and it is attention. Vitamin A from Attention, that is awesome. I think the target groups likes every conversation, especially when it is about themselves." 64-year-old pharmacist, Pharmacy 3	Patient's motivation: participating	Facilitator
		"The patients who need it the most, you can often reach them, but they just do not want it. Sometimes they just do not get it." 41-year-old pharmacist, Pharmacy 5	Patient's motivation: participating	Barrier
		"They think it comes with age and it is normal, or they disagree with that they fall. Because they fell because of their dog, or because of a stone, or something else." 36-year-old pharmacist, Pharmacy 10	Patient's motivation: awareness	Barrier
	After the project	*"We were searching for a good geriatric physiotherapist in the district, because previously there was one, who is now retired. But this did not get off the ground well."* 41-year-old pharmacist, Pharmacy 5	Multidisciplinary collaboration	Barrier

CFIR domain	*Time*	*Pharmacists' perspectives*	*Topic*	*Barrier / Facilitator*
		"We started to align our actions more with other health care providers. By this, these other health care providers are increasingly realizing that medication use could negatively affect patients' fall risk. And we know that we can also refer patients to the physiotherapists here." 31-year-old pharmacist, Pharmacy 9	Multidisciplinary collaboration	Facilitator
		"There was one specialist who said, well, she is under my close medical supervision, and I cannot change her medications based on what you tell me, that it is in increasing her risk a little bit." 24-year-old pharmacist in training, Pharmacy 5	Multidisciplinary collaboration	Barrier
		"I expected that more people would participate. Apparently, patients are not appealed to this subject. It is never about them. I also notice this when I am conducting medication reviews and ask about falls." 46-year-old pharmacist, Pharmacy 8	Patient's motivation: participating	Barrier
		"People think: 'the doctor is prescribing this, so it must be good.' There is very little knowledge among patients about risks of medications and people often don't think that is important." 28-year-old pharmacist, Pharmacy 4	Patient's motivation: awareness	Barrier
		"Sometimes I thought: 'damn, we couldn't adjust anything for this sir or madam… […]. And then you told this to these people and they replied: 'that's totally fine, how nice to hear you've checked this'." Pharmacy technician, Pharmacy 3	Patient's motivation: appreciation	Facilitator
Inner setting	Before the project	*"The pharmacy I am working is a very small pharmacy. There are only two assistants in the workplace. […] This means we experience quiet moments, but also have high peak moments. We have little cushion."* 36-year-old pharmacist, Pharmacy 10	Workload	Barrier

CFIR domain	*Time*	*Pharmacists' perspectives*	*Topic*	*Barrier / Facilitator*
		"It is hard to implement this when you are understaffed. It needs to fit in the schedule. […] When you thus called me a month ago and I knew we were temporary weakly staffed, I thought: 'aaaah,' so I said: 'call me back in a month'. 48-year-old pharmacist, Pharmacy 6	Staff	Barrier
		"I already broadly had the knowledge explained in the e-learning. However, the unawareness or denial of patients at fall risk, that was an eye-opener. There were a few things of which I thought: I did not know that." 36-year-old pharmacist, Pharmacy 10	Expertise	Facilitator
		"The pharmacy technicians should be educated, and I think, once is not enough. I think it could be even more extensive. […] The technicians have lot of experience with conservations at the counter, but this is a different kind of conversation." 31-year-old pharmacist, Pharmacy 9	Expertise	Barrier
	After the project	*"It was a busy period anyway. When we signed it was a calmer period because of COVID-19, but at moment we wanted to start with the project it became extremely busy. Then it is difficult to implement the project in addition to the regular work activities."* 31-year-old pharmacist, Pharmacy 9	Workload	Barrier
		"I think it is a specific skill to perform such conversations well, to ask questions in respond to cues. […] I think someone needs to be very trained for this. I doubt whether the e-learning is sufficient to prepare them properly in order to perform fall consultations eventually." 28-year-old pharmacist, Pharmacy 4	Expertise	Barrier
		"We have a lot of experience with deprescribing and medication withdrawal. We have been doing this for years." 46-year-old pharmacist, Pharmacy 8	Expertise	Facilitator

CFIR domain	*Time*	*Pharmacists' perspectives*	*Topic*	*Barrier / Facilitator*
		"It is easier to implement this when you are already doing a lot of comparable things in your pharmacy on the field of patient care. Because you need to motivate your pharmacy technicians and when they have never done anything with regard to consultations, it is difficult." 46-year-old pharmacist, Pharmacy 8	Internal collaboration	Barrier
		"I often asked the pharmacy technician: 'how is it going?', 'did you have another conversation?' and the pharmacy technician always passed on the results. As a pharmacist you need to keep an eye on the project." 48-year-old pharmacist, Pharmacy 6	Internal collaboration	Facilitator
Characteristics of individuals	Before the project	*"You need to have the right feeling for older persons. We have some pharmacy technicians who think the elderly are amazing, and even talk to them in our dialect."* 64-year-old Pharmacist, Pharmacy 3	Communication skills	Facilitator
		"This pharmacy technician also participates in the fall prevention project of the health center. It was hence a logical decision to ask her again. When we asked her back then to participate in the project, we also chose her because of her competences, in particular regarding communication." 48-year-old pharmacist, Pharmacy 6	Communication skills	Facilitator
	After the project	*"I noticed that at a certain moment the pharmacy technicians thought: 'again a patient I cannot really mean something for...' Of course, they also hoped to find that patient who falls daily and there is a very strong relationship with medication."* 28-year-old pharmacist, Pharmacy 4	Motivation to implement the project	Barrier
		"Our pharmacy technician is very driven and she aimed to perform fifty fall consultations [...]. She all did this with a lot of energy. And she often chose me to have a seat: 'can we discuss four patients and could you also discuss them with the general practitioner?'" 64-year-old pharmacist, Pharmacy 3	Motivation to implement the project	Facilitator

CFIR domain	*Time*	*Pharmacists' perspectives*	*Topic*	*Barrier / Facilitator*
		"We definitely showed that a pharmacy technician is able to perform such consultations very well." 46-year-old pharmacist, Pharmacy 8	Communication skills	Facilitator
Process	Before the project	*"I am planning to monitor how the fall consultations will be performed, by doing the first conversation together, in order to startup well and they feel comfortable to perform the fall consultations."* 28-year-old pharmacist, Pharmacy 4	Implementation strategy: coaching	Facilitator
	After the project	*"In advance of implementing fall consultations, you should think about the time schedule carefully. It works quite well to schedule half a day per week for fall consultations, and in advance you are able to estimate which time periods are most convenient."* 28-year-old pharmacist, Pharmacy 4	Implementation strategy: scheduling	Facilitator
		"When we had a response I told the pharmacy technician, you should make time for this, so check the week schedule. And then she asked a colleague to take over some of her tasks for a moment, because she needed to perform a fall consultation. 46-year-old pharmacist, Pharmacy 8	Implementation strategy: self-management	Facilitator

Pharmacists had different opinions on whether the service could be implemented in routine pharmacy practice. For example, one pharmacist did not even start with the project. He reported that for pharmacy practice an easier implementable service was needed. Most pharmacists seemed to somehow agree with this, as they believed that fall prevention should be provided in practice by integrating it in medication reviews. One pharmacist indicated that for sustained implementation she needed extra staff.

Knowledge and training

Most pharmacists thought they have sufficient knowledge to perform medication reviews aimed at reducing fall risk. Yet, they valued the e-learning. In particular, pharmacist valued the e-learning for pharmacy technicians, since they indicated importance of training of pharmacy technicians on conducting fall consultations. Apart from knowledge about fall prevention or FRIDs, pharmacists specifically indicated the importance of training in interviewing techniques.

Characteristics of individuals

Pharmacists and pharmacy technicians were motivated to implement the fall prevention service. Pharmacists mentioned they are positioning themselves increasingly as health care provider. Providing a fall prevention service fits in this picture.

Pharmacists included all patients who responded to the invitation letters, but most did not put an extra effort to include more patients. Unfortunately, most pharmacies were hence not able to reach their goal of performing 10 fall consultations, with exception of two pharmacies. In one of these two pharmacies a pharmacy technician was very motivated to implement the fall prevention service and she even managed to perform 32 fall consultations.

In most pharmacies, pharmacy technicians performed the fall consultations. Pharmacists selected technicians who showed interest in this new service, were emphatic, had good communication skills, or had sufficient knowledge of fall prevention.

Pharmacists stated that technicians were motivated to perform fall consultations when they felt that these led to meaningful interventions. One pharmacist

therefore gave feedback on the results of the medication reviews to the pharmacy technicians. However, still some pharmacy employees questioned the effectiveness of fall consultations, which decreased their motivation. One pharmacist tried to keep pharmacy technicians motivated by explaining that increased awareness of patients regarding their fall risk and medication use is also an important result.

Process

Prior to the start of the project pharmacists informed their team. Pharmacists applied diverse strategies to facilitate the implementation of the fall prevention service. First, pharmacy technicians were scheduled to perform fall consultations on a weekly basis. Second, some pharmacists coached technicians, by performing the first fall consultation together. Third, some pharmacists made one pharmacy technician fully responsible for fall consultations. Fourth, some pharmacists combined fall consultations with regular medication reviews.

Many pharmacists thought that improved collaboration with other health care providers could aid them to contribute to fall prevention e.g., for the selection of patients and for referral. Therefore, some pharmacists contacted physiotherapists. Some pharmacists needed more decision support for the identification of patients at risk of medication-related falls. For example, a contra-indication "fall risk" in patient records could trigger alerts in case of the prescription of FRIDs.

DISCUSSION

Nine community pharmacies completed the implementation project for a fall prevention service. On average, 10 fall consultations were performed per participating pharmacy. The fall prevention service led to adaptation of medication in approximately one-third of the patients and a quarter was referred. Pharmacy technicians felt capable to assess fall risk, provide lifestyle recommendations, and refer patients, on basis of a fall consultation guide. Pharmacists were positive about the pharmacist-led fall prevention service, but they experienced several barriers during implementation, including lack of time, absence of staff, and limited multidisciplinary collaboration.

Previously, multiple component fall risk interventions including a medication review have shown to be effective to reduce falls.[14] The effectiveness

of deprescribing FRIDs as standalone intervention to reduce fall risk is questionable.[29] Of all intervention components, the most effective component of multiple fall prevention interventions is exercise and a basic fall risk assessment including medication review comes second.[14] The fall consultation guide was designed to address all common modifiable fall risk factors. However, a minority of the patients was recommended to exercise more or was referred. Pharmacists in our study reported that their focus was primarily on identifying and modifying the use of FRIDs. The fall prevention service might hence have fallen short of recommending patients sufficiently on other risk factors.

Previously, patient education has shown to be effective to reduce falls.[14,30] However, patients' fall prevention knowledge did not significantly increase in our study, even though they were educated extensively. Fall prevention education might not easily be accepted by older people.[31] Patients' uptake of fall prevention education might increase when pharmacy employees are trained to frame the information positively, as being part of healthy ageing.[31] Pharmacists in our study also indicated pharmacy technicians might need more training in interviewing techniques. On the other hand, it is well-known that consolidation of memory declines during aging[32], and fear of falling has also been associated with memory decline.[33] Therefore, the time of follow-up might have influenced older people's performance on recall, because the information might not have been consolidated and forgotten at the time of follow-up.

Patients' fear of falling was increased at one month after the fall prevention service. As fear of falling has often been associated with falls, the hypothesis was that patients' fear of falling would decrease by participating.[34,35] However, regardless of high levels of fear of falling being associated with falls, sufficient awareness of one's own fall risk seems beneficial for acting on fall prevention.[34,36–38] Furthermore, patients who are aware of their fall risk behaviours but who do not adopt recommendations, have a higher fear of falling than patients who are not aware of their fall risk behaviours.[38] In our study, patients most often had a low or moderate fear of falling at start and pharmacists indicated that the service seemed to increase patients' awareness their risk of falling. Therefore, the small increase in fear of falling presumably indicates participants became more aware of their fall risk and this could eventually motivate them to act on fall prevention. This assumption should be monitored in practice, because persisting fear of falling should be a reason for therapy e.g., exercise or cognitive behavioural therapy.[39,40]

In the literature, patients' underestimation of fall risk is an extensively described phenomena.[41–43] Pharmacists in our study also reported that they thought many patients underestimate their own fall risk and emphasized the low response to the invitation letters. On the contrary, pharmacists were generally positive about patients' motivation to participate in the service and to follow recommendations. Patients could, however, give socially desirable answers during fall consultations.[44]

Important motivators for the pharmacy team to implement the service were (1) pharmacy employees believed that the service could be effective and (2) pharmacy employees noticed that the service was appreciated by patients. Eventually, many pharmacists reported that they believed that fall prevention should be included in regular medication reviews instead of providing fall consultations. The design of the service may therefore not correspond to pharmacists' beliefs about providing fall prevention, limiting their motivation to implement the service.[45]

The major barrier for the implementation of the fall prevention service was a by pharmacists perceived high workload and subsequent lack of time. Similar barriers to provide pharmaceutical care services have been reported previously.[10,46,47] Pharmacists in our study reported that for successful implementation the project needs to be carefully planned and scheduled into daily routine. In a previous study it has been indicated that community pharmacists who have more time for the provision of pharmaceutical care services, generally spend less time on pharmacy management.[48] Pharmacists' prioritization to pharmacy management and logistics should be reduced, so that pharmacists have time for pharmaceutical care services, including fall prevention.[49]

Corresponding to findings of a previous study[4], pharmacists valued the provision of training material in order to implement the fall prevention service. Most pharmacists thought that the e-learning provided sufficient material to prepare pharmacists and pharmacy technicians to implement the fall prevention service. However, pharmacy technicians might need more training in communication to ensure that patients' needs and concerns are adequately discussed during fall consultations. This was indicated by pharmacists in our study and relates to previous findings suggesting that pharmacy technicians rarely discuss patients' needs and concerns at the counter even though they are instructed to do so.[50]

Prior to implementation most pharmacists indicated that they planned to expand their multidisciplinary collaboration in order to implement the service effectively.

In spite of few attempts of pharmacists, most eventually indicated that they only collaborated with the GP for the performance of the medication reviews. However, to ensure adequate treatment of all risk factors, interprofessional collaboration in fall prevention should be strongly recommended.[8,51–53]

Strengths and limitations

The application of CFIR supported the in-depth assessment of the variety of reasons explaining the success rate of intervention implementation. The CFIR is widely acknowledged as a suitable framework to explore barriers and facilitators for implementation. Another strength of this study was that pharmacists were interviewed both before and after the study. The consistency of their perceptions and the fulfillment of their expectations was hence evaluated. A limitation of the study was that the service was implemented in only nine pharmacies and evaluation was completed in only eight pharmacies. Pharmacists participated voluntarily in the implementation study and were hence motivated and interested to provide fall prevention services. Findings may therefore not completely be generalized to other settings e.g., when pharmacy teams are less interested in providing such services. Another limitation of the study was that evaluation primarily was performed with pharmacists. Pharmacy technicians were asked to complete a digital evaluation form. Because only three technicians filled out this form, it was decided that these data were not used.

Implications

Due to a current lack of time in pharmacies to implement complex fall prevention services, pharmacists pronounced their desire for less time-consuming fall prevention interventions to contribute to fall prevention. Related to this, pharmacy teams should be relieved on tasks that currently have their priority, such as logistics, in order to have time for the provision of fall prevention services. Because pharmacy employees struggle with referring patients adequately to health care providers after identification of patients at risk of falls, the multidisciplinary collaboration between pharmacists and other health care providers should be stimulated e.g., by enhancing two-way referral. Also, interprofessional education could facilitate the communication among primary care providers.[54,55] At last, training and resources should be provided to all pharmacists in order to implement fall prevention services in pharmacies.

Conclusion

Pharmacists believe that the provision of the fall prevention service in pharmacies is useful. The service led to adaptation of medication in approximately one-third of the patients and approximately a quarter was referred to another health care provider. Pharmacists feel that pharmacy technicians are able to perform the consultations adequately in case they are trained well. During the implementation process, pharmacists experienced the following barriers: lack of time, absence of staff, and limited multidisciplinary collaboration. Sustained implementation in pharmacy practice might require a less time-consuming intervention predominantly based on enhanced multidisciplinary collaboration. Furthermore, pharmacists indicated their need for financial compensation for the provision of pharmacist-led fall prevention services.

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AUTHOR'S CONTRIBUTION

MG wrote the protocol for the study, collected and analysed the data, performed the literature search, and wrote the original draft. NK and JB supported her with the data collection. She implemented the contribution of co-authors and she implemented input and feedback from her supervisors during the whole process.

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SUPPLEMENTARY INFORMATION S1: FALL CONSULTATION GUIDE

Table 1. Structure of fall consultations

Topic	Examples of questions	Examples of recommendations
Fall experiences	*How often do you fall?* *Where did you fall?* *Why do you think you fell?*	Referral for complete fall risk assessment
Balance and mobility	*Do you feel unsteady when walking or standing?* *What is your amount of daily exercise?*	Patient information Referral for complete fall risk assessment Referral to physiotherapist
Vision	*Do you experience problems with vision?* *Do you wear glasses or lenses?*	Patient information Referral to optician
Incontinence	*Do you experience accidental leaks of urine?*	Patient information Referral to general practitioner
Nutrition	*Did you have unintentional weight loss in the past 6 months?*	Patient information Referral to nutritionist
Medication	*Why do you think your drugs could increase your fall risk?* *Do you experience side effects?* *Do you think your medication is necessary?*	Patient information Medication review
Precautions	*What precautions do you take to prevent falls?*	Patient information Referral occupational therapist or home care
Referral	*Have you previously consulted another health care provider about fall prevention?*	Referral for complete fall risk assessment

Chapter 5.3

Patients' experience with a community pharmacy fall prevention service

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ABSTRACT

Background

Pharmacists can contribute to fall prevention, by offering services such as fall risk screenings, patient counselling, and medication reviews. Patient acceptance of the role of pharmacists in fall prevention is crucial.

Objective

The aim of this study was to explore patients' experience with a community pharmacy fall prevention service.

Methods

Interviews were conducted with patients one month after they participated in a community pharmacy fall prevention service. Patient inclusion criteria for the service were: age ≥ 70 years, use of ≥ 5 drugs simultaneously including ≥ 1 fall risk-increasing drug. The service included a fall risk screening followed by counselling and a medication review, if necessary. Topics of the interviews were: outcomes, patient's motivation, and contact with the pharmacy technician which were based the consolidated framework for implementation research (CFIR).

Results

Of the 91 participants of the fall prevention service, 87 patients were interviewed with a median age of 78.0 years (first quartile [Q1] – third quartile [Q3]: 74.0 – 84.75) and 46.3% were female. Patients were mainly positive about receiving a medication review. Most patients whose medication was deprescribed were positive about these adaptations. Others were reassured about the appropriateness of their medication use. Although patients reported that the service enhanced their awareness about fall prevention, only a limited number of patients was motivated to adapt their lifestyle. Patients appreciated the attention and contact.

Conclusions

Patients see a potential benefit from a medication review by their pharmacist and patient education appeared to enhance their fall risk awareness.

INTRODUCTION

Falling among community-dwelling older people is a growing health care problem, amongst others due to population ageing.[1] To date, many patients at risk of falling remain unidentified. Older patients are reluctant to inform their health professionals when they have experienced a fall.[2,3] Amongst other reasons, they perceive asking for such help as a loss of independence.[3] Because pharmacists are frequently in contact with older persons, their involvement in the identification of patients at risk of falls, e.g. casefinding, can be valuable.[4]

The causes of falls are multifactorial. Medication use is considered as an important modifiable risk factor among other risk factors such as impaired mobility and gait.[5–8] Therefore, pharmacists can play a valuable role in reducing fall risk by deprescribing fall risk-increasing drugs (FRIDs).[4,9–12] Moreover, pharmacists could take a role in the multifactorial approach, by for example motivating patients to follow lifestyle recommendations to reduce fall risk, such as exercise and home safety, and pharmacists could refer patients to other health care providers, such as the general practitioner (GP) or a physiotherapist.

Community pharmacy-led fall prevention services could be classified as cognitive pharmaceutical service (CPS). The benefits of pharmacists providing CPS have been described in literature and include amongst others optimisation of medication use. However, research findings of CPS are translated slowly into pharmacy practice.[13] To guide future implementation of CPS, including pharmacy-led fall prevention services, evaluation of the provision of such services is needed.

Patients' perceptions need to be taken into account when developing new interventions or services in health care to ensure a patient-centred approach.[14,15] Patient engagement is especially crucial in the field of fall prevention, since many effective fall prevention interventions require active participation and adaptation of lifestyle, such as exercising and home hazard modifications.[16] Furthermore, patient engagement naturally facilitates the shared decision-making process and increases guideline adherence by patients.[17] Previously, older patients indicated they value the provision of CPS.[18]

In a qualitative study, older patients' interest to enrol pharmacy-led fall prevention services depended on their perceived fall risk and their believes about the necessity and risks of medication use. Patients expected that pharmacists could especially contribute to the identification and modification of FRID use

and expected less benefits from lifestyle recommendations by pharmacy team members.[19]

We have recently developed and implemented a community pharmacy-led fall prevention service and aimed to explore how patients experience an actual fall prevention service from the community pharmacy.

METHODS

Study design

This qualitative observational study was performed alongside an implementation study of a fall prevention service in 10 Dutch community pharmacies (Chapter 5.2). The Consolidated Framework for Implementation Research (CFIR) was used to inform the interviews.[20]

Fall prevention service

The fall prevention service composed of a fall risk screening, multifactorial falls preventive assessment and intervention (fall consultation), and medication review. Patients meeting the following criteria underwent the fall risk screening by the pharmacy technician: aged ≥ 70 years, using ≥ 5 drugs simultaneously of which ≥ 1 classified as FRID.[21–23] Patients at increased risk of falling were offered a fall consultation conducted by the pharmacy technician. The fall consultation consisted of a fall risk assessment and accompanying interventions e.g., patient education on fall risk factors and referral to other health care workers when appropriate. The fall consultation was followed by a quick medication check on FRID use by the pharmacist, and a comprehensive medication review together with the general practitioner if needed. (Figure 1)

Interviews

One month after inclusion in the study, all patients who participated in fall consultations were approached to be interviewed. Interviews were performed by telephone, and tape recorded, by postgraduate researcher (MG) or a master student (NK; JB). Since the aim was to evaluate the patient experience of implementation, the CFIR was selected as appropriate framework to guide data collection and analysis. The CIFR consists of 5 domains. Patients were not

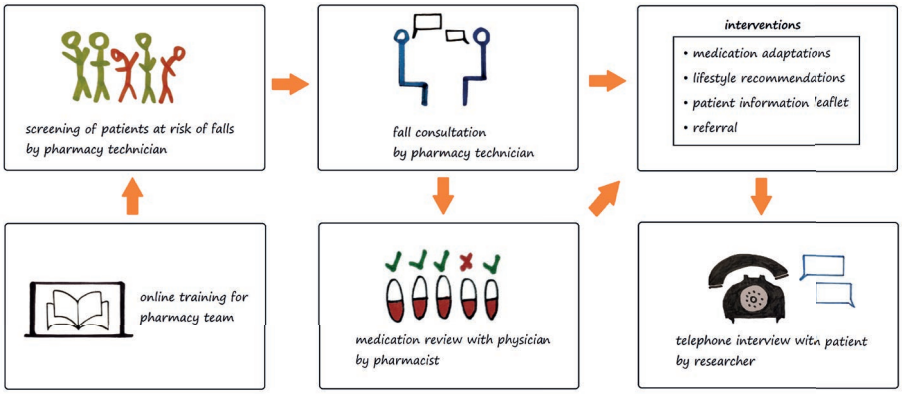

Figure 1. An overview of the study design, including the fall prevention service

expected to contribute information to the CFIR domains 'inner setting' and 'process', these domains were left out. Therefore, the main topics were based on the following three domains from the CFIR: intervention characteristics, outer setting, and characteristics of individuals.[20]

This led to the following three main topics for the interview guide: outcomes (intervention characteristics), patient's motivation (outer setting), and contact with the pharmacy technician (characteristics of individuals). The first main topic "outcomes" was divided in the following subtopics: experience with mediation check/review; behavioural change; awareness; referral. The second main topic "patient's motivation" was divided in the following subtopics: motivation to follow recommendations; motivation to participate. The third main topic "contact with the pharmacy technician" was divided in the following topics: experience regarding the contact; expertise of pharmacy technician.

Data analysis

All interviews were audio-recorded and transcribed verbatim and imported in NVivo version 12 software. A topic list, prepared in advance and based on CFIR, was used to guide the coding of the interviews. Three quarters of the interviews were coded by both a master student (NK/JB) and a female researcher and community pharmacist (MG), and a quarter was only coded by MG. This last quarter was reviewed by an experienced female researcher with a background

in pharmacy health services research (EK). Possible discrepancies were resolved through discussion or submitted to a third male researcher (MB).

Ethics and confidentiality

The study protocol was approved by the Institutional Review Board of the Division of Pharmacoepidemiology and Clinical Pharmacology, Utrecht University (reference number UPF2007). Data were collected between September 2020 and September 2021.

All patients gave written consent at time of participation in the fall prevention service. Before start of the interview, the patient's oral consent for audio-recording was obtained. Participants' names were replaced by participant numbers in the transcripts to ensure anonymity.

RESULTS

Background characteristics

Of the 91 patients who received a fall consultation, 87 patients were interviewed (Table 1). The median age of the participants was 78.0 years old (first quartile [Q1] – third quartile [Q3]: 74.0 – 84.75) and 46.3% were female. Interviews lasted an estimated 20 minutes.

Table 1. Background characteristics of the study population

Patient characteristics (N = 87)	
Age in years (median [Q1 – Q3]	78.0 (74.0 – 84.75)
Female gender (N, %)	42 (48.3%)
≥ 1 fall experience(s) in the past year?	
Yes (N, %)	54 (62.1%)
No (N, %)	32 (36.8%)
Not sure (N, %)	4 (4.6%)
Afraid of falling?	
Yes (N, %)	39 (44.8%)
No (N, %)	38 (43.7%)
Not sure (N, %)	13 (14.9%)
Number of dispensed medications (median [Q1 -Q3])	10.0 (7.0 – 12.0)
Number of dispensed FRIDs (median [Q1 -Q3])	4.0 (3.0 – 5.0)

Patients' experiences with the delivery of the pharmacy-led fall prevention service

Patients' experiences with the fall prevention service are illustrated in Table 2. In the following paragraphs their experiences are summarized according to three main topics: outcomes, patient's motivation, and contact with the pharmacy technician.

Outcomes

Medication review

Many patients mentioned they appreciated that their medication was evaluated, particularly that the pharmacist reassured that their medications were necessary, safe, and tailored to their needs and conditions. A few patients, whose medication was adjusted, reported experiences of relapse of their condition e.g., hypertension. One patient experienced severe relapse symptoms after an opioid rotation. Some patients were glad that their medication had not been changed. They believed medication discontinuation was unfavourable, because of absence of adverse effects, necessity of medication, and confusion caused by modifications.

Behavioural change

Most participants indicated they had not changed their behaviour after participating in the fall prevention service e.g., regarding exercise, footwear or home safety. Reported reasons to continue same behaviours were: a perceived a low fall risk, adaptations to prevent falls that had already been made previously, and perceiving fall risk as an established phenomena that cannot be modified.

There were some patients who reported they changed behaviour after participating in the fall prevention service. They mentioned for example use of vitamin D, exercising more, a visit to the shoemaker for a check-up of shoes, and checking their homes carefully for home environmental hazards.

Awareness: fall risk

A part of the patients indicated that by participating in the fall prevention service they became aware of their increased fall risk. Despite that most patients did not significantly change their behaviour, patients reported that they got more cautious. Not all patients became more aware of their fall risk e.g., because they indicated that fall prevention was not applicable to them.

Table 2. Patients' experiences with the provided fall prevention service

CFIR Domain / Topic	*Subtopic*	*Patient's experience*
Intervention characteristics / Outcomes	Medication review	*"I am using less now. […] I think that if I would not have participated in the fall prevention service, I would still have been using the same medications."* Pharmacy 3, Patient 10, 85-year-old man
		"I had a tablet for blood pressure and a diuretic and the diuretic has been withdrawn. This week my blood pressure was measured, but it was too high. And then I think: 'give me back the old one.' But they give me a new drug." Pharmacy 3, Patient 9, 74-year-old woman
	Behavioural change	*"I just never think about such things as falls. I am happy and physically healthy."* Pharmacy 2, Patient 1, 88-year-old man
		"The recommendations about calcium and vitamin D intake, and going outside, exercising, I took these advices. Because of this I go to a sort of bicycle-gym now." Pharmacy 4, Patient 4, 74-year-old woman
	Awareness: fall risk	*"I started thinking about it and I came to the conclusion that I need to pay attention to fall prevention for myself."* Pharmacy 9, Patient 1, 74-year-old woman
		"I started thinking more about falling, but it is not really applicable to me, because I have been doing sports all my life." Pharmacy 5, Patient 3, 79-year-old man
	Awareness: risk of medication use	*"Well, I have been thinking different about my medication for a long time. I think: six years of the same medication? Has my body not been changed during that time?"* Pharmacy 3, Patient 12, 78-year-old woman
		"The general practitioner and pharmacist told me: 'you really need those'. Thus, I did not start thinking differently about my medications. Because I feel that I am only using what I need and nothing unnecessary. I have accepted that and I am satisfied with it." Pharmacy 3, Patient 17, 65-year-old man
	Referral	*"After participating in the fall prevention service I went to the general practitioner for my annual examination. He screened me and he told me the same, that I could go in therapy for fall prevention. In the same building of the pharmacy and general practice, there is a physiotherapist. […] Then I went there for a conversation about fall prevention."* Pharmacy 8, Patient 1, 73-year-old man

CFIR Domain / Topic	*Subtopic*	*Patient's experience*
		"I visit a physiotherapist, but this is because I had COVID-19. For the longs, I need to have physiotherapy, but not for fall prevention." Pharmacy 3, Patient 20, 73-year-old woman
Outer setting / Patients' Motivation	Following recommendations	*"It depends on what kind of recommendations they give, because I'm old but also critical, so they should not tell me: 'Mind the steps, because you may fall'. […] They don't need to tell me that. I know that. When there is a doorstep, then I see that, I also got eyes in my head."* Pharmacy 3, Patient 21, 65-year-old woman
		"Recommendations were not given to me, but I mean, I don't have problems with experiencing falls. So, there is nothing for them to recommend to me." Pharmacy 8, Patient 4, 78-year-old man
	Motivation to participate	*"Well, I am also 82 years, and I thought: 'when would that happen to me?' That's why I was 100% motivated to participate."* Pharmacy 3, Patient 25, 81-year-old man
		"Of course, I also belong to the category of persons who are afraid of falling, are dizzy sometimes, and that I need to grab walls for stability. That's why I participated, maybe that it could bring me relief or progression in some aspects." Pharmacy 6, Patient 3, 86-year-old man
Characteristics of individuals / Contact with pharmacy technician	Experience	*"She listened well; the questions were clear. I did not think: 'what do you mean?' It was all very well"* Pharmacy 3, Patient 3, 75-year-old woman
		"Some questions were quite simple for me and it made me think: 'well, are you really asking that?' But well, I understand that one needs to ask the questions in a manner that everyone is able to answer them." Pharmacy 9, Patient 3, 74-year-old woman

Awareness: risk of medication use

A part of the participants indicated that they became more aware of the risks of their medication use by participating in the fall prevention service. A few reported they had been questioning the appropriateness of their medication already for a long time. Others reported that their believes about their medications did not change e.g., because of absence of adverse effects or having trust in health care providers prescribing the correct medications, and necessity of medications for the treatment of their conditions. Even after participation, most patients continued believing that their medications could not increase their risk of falls.

Referral

Only a few patients indicated they had been in contact with another health care provider in response to the service. These patients were referred by their general practitioner, as a result of a discussion between the GP and pharmacist during the medication review. One patient was referred to a geriatrician and the geriatrician referred her to a physiotherapist. Two more patients indicated they were referred to a physiotherapist.

Some patients, to whom physiotherapy or home care was already provided, mentioned to discuss fall prevention with them, whilst others to whom such care was provided, reported that they have never discussed fall prevention with them.

Knowledge on fall prevention

The majority of the patients indicated that their knowledge on fall prevention did not increase by participating in the fall prevention service. One patient mentioned that the only thing he learned was that he could approach the pharmacy if he had questions about fall prevention and medication.

Patient's motivation

Following recommendations

Most patients indicated they did not receive nor could remember any given recommendations by the pharmacy technician. They reported that recommendations were not discussed, that they did not need them, or that the recommendations were already known. A minority of the patients reported to be motivated to follow the recommendations given by the pharmacy technician.

Motivation to participate

Patients had different reasons for participating in the fall prevention service. A minority was specifically interested in fall prevention. Some patients participated under the guise of "better safe than sorry", as it might turn out that they were at risk of medication-related falls. A part of the patients was specifically interested in their medication being reviewed or they hoped medication to be deprescribed. At last, some patients wanted to support the research project, some were just curious, and some participated just because they were invited.

Contact with the pharmacy technician

All participants reported a good experience with regard to the conversation held with the pharmacy technician. They appreciated the attention and were satisfied that questions were clearly explained. A minority of the patients had some comments on the conversation. For example, a few patients mentioned that they expected that the pharmacy would be faster in contacting them about outcomes of their medication review. Also, a few patients reported that they had the experience that instead of having a conversation, the pharmacy technician was ticking off answers from a questionnaire.

DISCUSSION

Patients were primarily positive about the community pharmacy based falls prevention service, predominantly about the medication review that reassured them they have the correct medications prescribed. They appreciated the attention that was given to them and reported that they became more aware of their fall risk. Regardless of the efforts of pharmacy technicians to motivate patients to adapt their lifestyle during the fall consultations, most patients reported that they had not followed these recommendations.

Patients have previously reported that, with regard to fall prevention, they expect from pharmacists to focus on medication-related interventions.[19] It could be assumed that, in order to motivate patients to accept health care interventions, there is a need for sufficient clinical expertise.[24] Due to the multicausality of falls, clinical expertise covering all fall risk factors may only be guaranteed by working interprofessional.[25–28] This might also explain the engagement of patients in our

study towards receiving a medication review, as patients consider pharmacists have sufficient clinical expertise of medication use.

An important finding of our study was that patients indicated that their fall risk awareness had increased. In order to decide to act on fall prevention, patients need to be aware of their own fall risk.[29–32] This could motivate them to adapt their behaviour to prevent falls. Nevertheless, the motivation among participants to change behaviour was limited. A previous study reported that educating patients on fall prevention had only limited effect on engaging patients to fall prevention and that patients were often unable to recall recommendations.[33] It thus may be a challenge to engage patients in fall prevention education, as it often appears that it is hardly accepted by older people.[33,34] This is in line with that the finding that patients in our study were unable to recall recommendations that were given to them. Multiple patient-provider interactions may be needed to change patients' behaviours.[35]

Evidence suggests that multifactorial fall prevention programs including medication reviews, are effective in reducing falls.[36] However, a lack of effectiveness has been described previously in a few settings of multifactorial fall prevention programmes.[37,38] In these studies, the lack of effectiveness had been attributed to several factors including study populations e.g., relatively younger or less vulnerable populations. Also, in Dutch healthcare settings fall prevention services have already been implemented to some extent in primary care settings, such as at GPs. Therefore, the fall prevention programs possibly had limited benefit to these and our settings.[37–39] Also, a lack of patient compliance to the fall prevention program could have resulted in a lack of effectiveness in these studies.[37,38]

To promote uptake of patient-centred interventions, patient engagement in healthcare interventions should be evaluated regularly as should novel approaches.[40,41] In previous studies, patients seemed more engaged in fall prevention interventions that demand minor adjustments than interventions that request major adjustments.[42] This might explain why patients seemed more engaged in the medication review, that most often demanded minor adjustments, compared to other fall prevention interventions, such as exercising and modification of home environment, which generally requires major adjustments. On the other hand, a recent nurse-led pragmatic falls prevention trial in the US, showed that a medication review and accompanied deprescribing was

only seldom prioritized by the participants.[43] Possibly, the explanations of this differing outcomes between the studies can be explained by the setting and the professionals providing the services. Patients may have different expectations, trust and beliefs depending on which professional leads the service, as in our case, the patients expected a medication review from their pharmacists and trusted their judgement.

The accurate fall risk of patients in our study has not been determined. The interventions of our implemented pharmacy-led fall prevention service are less applicable to patients with a low fall risk. Many patients in our study however reported that they perceived a low fall risk. It has been shown that patients with a perceived low fall risk may also participate in fall prevention programs.[3] In our study, 62.1% of the patients reported a history of falls and all were polypharmacy patients. Based on these characteristics, most of them could possibly be classified as being at moderate or high risk of falls. Also, underestimation of one's own fall risk is common among older patients.[3,44,45]

Strengths and limitation

The most important strength of this study was that the qualitative evaluation with patients was an indispensable augmentation of the in-depth evaluation of the implementation process of the pharmacy-led fall prevention service (Chapter 5.2). By interviewing patients, we could investigate their behavioural changes and engagement in fall prevention, and those are essential for ensuring effectiveness of fall prevention services. Altogether, the evaluations aid the formulation of implications for implementation on a larger scale. Another strength was the high participation rate. Data saturation was not determined, since all participants of the fall prevention service were invited to participate in the follow-up. A limitation of this study was that the purpose of CFIR is to underpin implementation research studies and it fits less well to exploring patient perceptions, as two domains needed to be left out. As this study was an augmentation to the aforementioned implementation research (Chapter 5.2), the authors determined that application of CFIR was justified in order to guarantee consistency in applied evaluation frameworks in both studies. Furthermore, the CFIR is a widely used framework in implementation research and ideal to investigate barriers and facilitators explaining the implementation outcomes.[46,47] At last, the fall prevention service was implemented in nine Dutch pharmacies,

including both urban and rural settings. However, the findings might be less applicable to settings where pharmacy practice is organized differently.[48]

Implications

Pharmacists could contribute to fall prevention, particularly by deprescribing of FRIDs. To ensure the multifactorial approach that is essential in fall prevention, pharmacists should be recommended to work interprofessional. After a quick fall risk screening, pharmacists could consider to focus on the monitoring of medication safety, and refer patients to other health care providers for sufficient treatment of other fall risk factors. If community pharmacists would like to extend their role in fall prevention services beyond the identification and monitoring of FRIDs, education of pharmacy staff is needed. Patient engagement in pharmacy-led fall prevention activities might enhance when pharmacy technicians' skills are advanced. For instance, pharmacy team members could be offered trainings in motivational interviewing as communication method as such skills have been shown to be effective to encourage patients to change behaviours to prevent falls in physiotherapy and hospital settings.[49,50]

Conclusion

Patients appreciated the pharmacy-led fall prevention service, especially the medication review, providing assurance about appropriate and safe use of their medication. Although they reported an increased awareness of fall prevention, only a few were motivated to adapt their lifestyle.

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AUTHOR'S CONTRIBUTION

MG wrote the protocol for the study, collected and analysed the data, performed the literature search, and wrote the original draft. NK and JB supported her with the data collection. She implemented the contribution of co-authors and she implemented input and feedback from her supervisors during the whole process.

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Chapter 6

General Discussion

This thesis aimed to answer the question how pharmacists can contribute to fall prevention, and how fall prevention services can be implemented, including their barriers and facilitators. Also, this thesis aimed to assess the perspectives of patients, pharmacists, and other health care providers, for the provision of pharmacy-led fall prevention services.

MAIN FINDINGS

Chapter 2 described the complexity of identifying patients at risk of medication-related falls. The aim of the study was to develop a fall risk screening method for pharmacists based on medication information from the pharmacy information system. Unfortunately, the predictive performance of our medication-based models was low and thus of limited value for use in clinical practice. Inclusion of other risk factors in prediction models is needed to identify patients at risk of falls more accurately.

In *Chapter 3* patients' perspectives on pharmacy-led fall prevention services were assessed during focus groups. Most patients were currently unaware of that their medications could have fall risk-increasing effects. Therefore, they have never thought about reaching out to their pharmacy for fall prevention. Furthermore, they expect that community pharmacists inform them proactively about potential risks of medication use and fall prevention. With regard to pharmacy-led fall prevention services, most patients are particularly interested in deprescribing interventions. However, some may be sceptical about deprescribing of medication.

Chapter 4 describes primary care providers' perceptions to provide fall prevention services, focusing on the role of community pharmacists in such services.

Chapter 4.1 assessed pharmacists' perspectives on their contribution to fall prevention, including deprescribing of fall risk-increasing drugs (FRIDs). Community pharmacists indicate they are capable and motivated to provide fall prevention, but perceive barriers related to their opportunity to contribute to fall prevention. In addition to the findings of *Chapter 3*, the importance of patient engagement as facilitator for deprescribing interventions was underlined by community pharmacists in *Chapter 4.1*. Having good communication skills was reported to be crucial in order to convince patients and GPs of the importance of deprescribing. Flaws in multidisciplinary collaboration were perceived as a

major barrier to provide fall prevention. Other barriers were lack of time and lack of financial compensation.

In *Chapter 4.2* barriers and facilitators for multidisciplinary collaboration in fall prevention from the perspective of practice nurses, home care nurses, and physiotherapists, were assessed during focus groups. Practice nurses, home care nurses, and physiotherapists mentioned to have little attention for medication as risk factor for falls. They also seemed to have limited collaboration with community pharmacists on medication-related fall prevention. The most important barriers for multidisciplinary collaboration were: role unclarity, lack of coordination, and limited communication among healthcare providers in different settings. Primary care providers believed that enhanced communication and collaboration with community pharmacists could lead to improved patient outcomes regarding fall prevention.

Chapter 5 describes and evaluates the implementation process of a fall prevention service in community pharmacies.

In *Chapter 5.1* we elaborated on pharmacists' decision-making processes during deprescribing of FRIDs. The three presented cases illustrate pharmacists' capabilities to propose interventions to deprescribe FRIDs. Decision-making on deprescribing was facilitated by patient engagement, pharmacist communication skills, knowledge about FRIDs, and good multidisciplinary collaboration.

Chapter 5.2 describes the implementation of a fall prevention service in community pharmacies and provides an in-depth reflection of pharmacists' perceptions on the implementation. The fall prevention service consisted of 1) a fall risk screening and 2) a fall consultation to assess modifiable fall risk factors with accompanying interventions conducted by the pharmacy technician and 3) a quick medication check and 4) a comprehensive medication review if needed by the pharmacist. Pharmacists adapted medication for approximately a third of the patients and a quarter was referred to another health care provider. A small increase in patients' fear of falling was documented at follow-up, probably indicating patients' awareness on fall risk was enhanced. Pharmacists believed that pharmacy technicians could have an important role in patient counselling on fall prevention, but indicated that additional communication training was needed for technicians. Most importantly, the pharmacy teams struggled with having insufficient time to spend on fall prevention. Pharmacists reported that they planned to continue their provision of fall prevention during regular medication reviews.

Chapter 5.3 describes the patient experience of the fall prevention service described in *Chapter 5.2*. Patients were in general positive about the service and particularly valued pharmacists' efforts to judge their medication on safety with regard to their fall risk. Patient awareness on fall prevention seemed increased, but they reported limited behavioural change.

HOW CAN PATIENTS MOST IN NEED OF A FALL PREVENTION SERVICE BE REACHED?

Nowadays, the desire for the development of information-based screening tools is high in order to make quick selections of patients at risk of falls.[1] Drug histories are readily available for screening in pharmacies. Another significant advantage of medication-based screenings is the potential to detect patients eligible for deprescribing interventions.[2] Current tools to assess fall risk often focus on measuring impaired mobility and are therefore difficult to implement in pharmacy practice.[3] Therefore, attempts to develop prediction models to identify patients at risk of falls on basis of their medication use are described in *Chapter 2*, and were based on 1) the calculation of the Drug Burden Index (DBI) and 2) inclusion of FRIDs as factors. Both models were of limited value for implementation into pharmacy practice.

It is known that sedative and anticholinergic drug effects influence fall risk, but other drug properties causing adverse effects, such as (orthostatic) hypotension, may increase fall risk as well.[4] Since currently consensus on an international FRIDs list is lacking, the included FRIDs in the models of *Chapter 2* could be a point of discussion.[5] However, since all possible FRIDs, identified in literature, were included it is unlikely that potential FRIDs were missed. Inclusion of too many FRIDs could admittedly influence the internal validation of the model, but would not negatively affect the predictive performance of a model. Nevertheless, medication-based models seem insufficient for use in practice to screen for patients at risk of falls *(Chapter 2)*.

Other available tools to assess fall risk by focusing on impaired mobility or balance have low predictive performances as well.[3,6] To guarantee sufficient discrimination between low and high fall risk, it has been recommended to assess fall risk by focusing on at least two fall risk factors.[3] As a patient's fall history

appears to be a pretty good predictor for future falls, pharmacists may more effectively identify patients at risk of falls by combining a quick screening based on fall history with a screening based on the use of FRIDs.[6,7] For instance, it has been shown that a combined screening on DBI and questioning on fall history is more likely to result in medication-related recommendations than when the DBI is not included in the screening for fall risk.[2] Therefore, in the developed fall prevention service of *Chapter 5* patients were selected on the basis of their medication use (polypharmacy and use of ≥ 1 FRID) and questioning on fall history and fear of falling.

As another example, in 2021, Dormosh et al described the development and internal validation of a risk prediction model for falls among older people by using primary care electronic health records. The developed model had sufficient ability to discriminate fallers from non-fallers and included the following parameters: age, sex, history of falls, 2 medications (use of opiods; use of proton pump inhibitors), and 5 medical conditions (previous injury; depression; osteoarthritis; urinary incontinence; memory and concentration problems).[8] Remarkably, proton pump inhibitors were included as one of the two medications as predictors for falls. The association between proton pump inhibitors and falls is less strong as of some other medications which were not include in the model e.g., psychotropic agents. However, the association between proton pump inhibitors and falls has been observed previously.[9,10] Presumably due to the high prevalence of proton pump inhibitors, it appeared a good predictor for falls in this study.

Since this model requires data that has not been stored in pharmacy information systems, its use seems, unfortunately, restricted to general practices. However, collaboration with general practices and combining data sources could enable both GPs and pharmacists to more efficiently identify patients at risk of falls. Since at GPs patients' fall histories and fear of falling are recorded[11], electronic links between pharmacy information systems and GP information systems could be helpful for pharmacists to identify patients at risk of medication-related falls. However, GPs reported to seldomly collaborate with pharmacists to prevent medication-related falls.[11] Introducing a new contra-indication "fall history" in GP and pharmacy information systems could support the identification of patients at risk of medication-related falls as well. Pharmacists and GPs should therefore make agreements about the identification of patients at risk of falls and two-way

referral in their area, e.g. during regular multidisciplinary meetings. Specifically, such agreements could be made within pharmacotherapeutic consultation groups of pharmacists and general practitioners.

Collaboration with other health care providers such as physiotherapists or home care nurses and interprofessional sharing of information about patients at risk of falls could support pharmacists in their screening of patients at risk of medication-related falls as well. However, primary care providers have little collaboration with pharmacists on fall prevention *(Chapter 4.2)*. Currently, patients at risk of falls may therefore be identified by a certain health professional, but not referred to the pharmacist for a medication review aimed at deprescribing of FRIDs.

WHAT DO PHARMACISTS NEED FOR BETTER IMPLEMENTATION?

Fall prevention service

Prior to implementation, fall prevention services need to be developed, including a fall risk screening, a fall risk assessment, training, and a manual to guide interventions and refer patients *(Chapter 5)*. Ideally, community pharmacists should be involved in multidisciplinary fall prevention services, aimed at modification of multiple risk factors e.g., impaired mobility, medication use, and home environmental hazards.[12,13]

Multidisciplinary fall prevention services are complex interventions. The Medical Research Council developed a framework for developing and evaluating such complex interventions in 2000 and updated it in 2006 and 2021.[14] According to this framework, complex intervention research can be divided into four phases: development or identification of the intervention, feasibility, evaluation, and implementation. During the development and evaluation of multidisciplinary fall prevention programs it should be recommended to apply this framework.

The four phases of the framework of the Medical Research Council have also been addressed in this thesis. The service was developed based on previously developed effective multiple component fall prevention interventions *(Chapter 5.2)*. The feasibility of the service was assessed by studying patients' and pharmacists' and other health care providers' expectations with regard to the service *(Chapter 3; Chapter 4)*. The implementation and evaluation led to formulation of several

implications to foster effective and sustained implementation in clinical practice *(Chapter 5)*. These implications are also discussed under the headings below.

Knowledge dissemination

Our studies have shown that other health care providers and patients expect that in multidisciplinary fall prevention collaborations, pharmacists focus on reducing fall risk by adapting medication use. Pharmacists therefore need sufficient knowledge of FRIDs.

Many kind of drugs have been associated with an increased risk of falls in observational studies.[10,15,16] Due to methodological issues of observational studies the findings of such studies should be interpreted with caution.[17] For 14 classes of drugs an expert panel recently agreed on their classification as FRIDs, but for some other drug classes no consensus was found.[5] Moreover, there is still little known about possible differences between individual associations of FRIDs with falls among drugs of the same drug categories.[18] An international list of drugs classified as FRIDs is currently lacking. Furthermore, prioritization, monitoring and proper withdrawal schemes are lacking.[19–21]

Future research should therefore focus on the creation of an international FRIDs list. Registration of falls and fall-related injuries as potential adverse effects of drugs should be encouraged. For instance, these registrations should take place in randomized controlled trials of new drugs.[22] Ideally, FRIDs should also be classified as being associated with either low, medium, or high fall risk-increasing properties. This would support pharmacists with their identification of FRID use in older people.

Moreover, future research should focus on the creation of FRID deprescribing guidelines including prioritization, monitoring, and withdrawal schemes. These may be developed in the near future.[5,22] Deprescribing of FRIDs in pharmacy practice will benefit from knowledge dissemination on this topic.[22] In the past years, several guidelines on deprescribing have been developed e.g. the Dutch multidisciplinary guideline *Minderen en stoppen van medicatie*.[23] For successful implementation it is essential that the content of these guidelines are communicated to pharmacists (and physicians) e.g. by provision of online trainings and videos. Furthermore, pharmacy students should be educated on the deprescribing of FRIDs.

Pharmacists' knowledge

Due to the aforementioned evidence gaps in the literature on FRIDs, community pharmacists may experience difficulties with making decision to promote deprescribing of FRIDs *(Chapter 5.1)*. Within this context, it is unclear whether pharmacists currently have sufficient knowledge to identify and relate fall risk-increasing side effects correctly. As an example, a recent systematic review and meta-analysis reported that drug-induced orthostatic hypotension depends on the type of drug use, and the association seems strongest in drugs causing sympathetic inhibition.[24] This kind of information is necessary for pharmacists to identify drugs correctly that cause symptoms of orthostatic hypotension in their patients. And this may be different in patients with postprandial hypotension or postmicturition syncope.

Dissemination of new evidence on FRIDs to clinical practice takes time. Lifelong learning is crucial for pharmacists to guarantee that they keep up with emerging insights in the effects of FRIDs and can effectively improve patient care.[25] Pharmacists were provided an online training prior to their participation in the fall prevention service implementation project *(Chapter 5.2)*. Pharmacists indicated that they valued the training particularly because the design of the project was explained. Some pharmacists indicated it was a good refresher of their knowledge on FRIDs, but most believed their own knowledge was already sufficient to deprescribe FRIDs. This is in accordance with *Chapter 4.1*, wherein is described that pharmacists are confident about their own capabilities to identify and promote deprescribing of FRIDs. Correspondingly, literature findings suggest that pharmacists have capabilities to promote deprescribing, and to reduce numbers of prescribed medications and side effects.[26] In a survey study conducted among pharmacists and physicians of Kentucky performed in 2020, only twenty percent of the pharmacists and physicians reported that they were insufficiently educated or trained on deprescribing activities.[27]

The decision-making on deprescribing can however be complicated due to the simultaneous use of different FRIDs and other factors influencing the decision-making, including patients' preferences and multidisciplinary collaboration *(Chapter 5.1)*. In ambiguous cases, the knowledge of community pharmacists might therefore be insufficient to make wholly justified decisions.

Clinical reasoning

Pharmacists' responsibility to make clinical decisions, such as for the deprescribing of FRIDs, has grown. Pharmacists' decision-making processes are however largely unknown.[28,29] In general, pharmacists may feel uncomfortable with making decisions, due to lack of confidence and being reluctant with taking responsibility.[29] Previously, pharmacists and physicians have reported that the decision-making of FRID deprescribing is complicated, because the pros and cons of deprescribing should be weighed carefully.[30] In this thesis, pharmacists underlined these difficulties for FRID deprescribing *(Chapter 4.1; Chapter 5.1; Chapter 5.2)*.

Yet, in approximately one-third of the patients who participated in the pharmacy-led fall prevention service the medication was adapted because of pharmacists' interventions *(Chapter 5.2)*. Pharmacists appeared to have capabilities to propose a wide variety of suitable interventions to deprescribe FRIDs *(Chapter 5.1)*. By taking the lead in deprescribing interventions, pharmacists have potential to enable withdrawal of inappropriate medication use among elderly, including the use of FRIDs in patients at risk of falls.[26]

The decision-making in deprescribing of FRIDs might be hindered by the fact that guidance/evidence on how to deprescribe FRIDs is currently lacking.[19–21] Furthermore, deprescribing requires monitoring and patient engagement and since these both can be time-consuming, pharmacists might be reluctant to decide on deprescribing. Multidisciplinary collaboration could facilitate the decision-making on deprescribing. *(Chapter 4.1; Chapter 5.1)*

Communication skills

The provision of fall prevention services by pharmacists fits the transition of pharmacy practice evolving towards a focus on patient-centred care. Good communication skills are essential to improve health outcomes.[31] Pharmacists reported to find it difficult to convince patients and physicians on the relevance of deprescribing *(Chapter 4.1)*. Globally, pharmacists may need to improve their counselling skills for the provision of patient-centred care, including fall prevention services.[31] Insufficient communication may also hinder the

identification of medication-related problems, such as fall-related adverse effects, at the counter or during medication reviews.

In order to advance pharmacists' communication skills more education and training is presumably needed.[31–33] Pharmacists need to focus on identifying patients' preferences during their interactions with patients. Pharmacists should therefore be learned to adapt their communication and interventions to these preferences, in order to enable shared decision-making.[34,35] Pharmacists could also be trained in motivational interviewing techniques to engage their patients in their interventions.[36] Pharmacists should also communicate their roles clearly to patients to realize the desired patient-pharmacist interaction, and the same applies to the pharmacist-physician interaction.[37] Pharmacy students should receive more extensive communication training.

Qualified pharmacy technicians

As pharmacy practice is increasingly focused on provision of patient-centred care, the role of pharmacy technicians is evolving simultaneously. Pharmacy technicians are often the first contact for patients visiting the pharmacy and interact most with them. Pharmacy technicians are educated to perform a variety of tasks, including dispensing and informing patients on prescription and over-the-counter medication. It is more and more expected of them to identify, discuss and possibly solve or prevent medication-related problems.[38–41]

Pharmacy technicians are experienced in counselling, e.g. selfcare, at first drug dispensation, and at first refill.[38,42–44] Therefore, in fall prevention, pharmacy technicians could play a promising role in the counselling of patients on fall risk-increasing drug properties and fall preventive measures, such as removing home environmental hazards, exercise, and wearing sturdy shoes *(Chapter 5)*. Furthermore, pharmacy technicians could contribute to the screening of patients at risk of falls and the identification of FRID use in patients at risk of falls.[45,46] To make implementation of fall prevention services possible in community pharmacies, pharmacy technicians should start performing the aforementioned tasks. To identify patients at risk of fall, they could actively ask patients about fall history at the counter.[45]

The provision of fall prevention is however a new topic for pharmacy technicians. Pharmacists reported that they believed pharmacy technicians could perform

such tasks, but they stressed that training was necessary. Communication skills were, in particular, deemed important for identification of medication-related problems and counselling in fall prevention. Community pharmacists mentioned that pharmacy technicians are currently not very experienced in these kind of counselling tasks. *(Chapter 5.2)* Previously, it has been reported that pharmacy technicians' communication skills fall short of the professional guidelines.[43] Literature findings suggest that, in order to deliver pharmaceutical care services of high quality, training and education of pharmacy technicians is essential.[41,42,47]

Pharmacy technicians should thus be educated and trained on the screening of patients at risk of falls, identification of fall-related adverse effects, and advising on fall prevention. More attention should specifically be paid to improving the counselling skills of pharmacy technicians, e.g. during education.

Multidisciplinary collaboration

Due to the multiple underlying causes of falls, fall prevention needs a multidisciplinary approach. In *Chapter 5.2*, pharmacists were stimulated to implement a fall prevention service, and encouraged to refer and educate patients on multiple fall risk factors. The pharmacy teams seemed to predominantly focus on adapting medication use and might have insufficiently referred patients for the management of other fall risk factors. Physiotherapists, home care nurses and practice nurses recognize that collaboration with pharmacists could be improved *(Chapter 4.2)*.

Pharmacists reported that their current limited involvement in multidisciplinary collaborative fall prevention can be improved *(Chapter 4.1)*. Important barriers for the multidisciplinary collaboration in medication-related fall prevention are lack of clear coordination, role unclarity, and lack of structural communication *(Chapter 4.2)*. These overlap with barriers for interprofessional collaboration in general in primary care, such as lack of awareness of advantages of collaboration, unfamiliarity with the skills and knowledge of other health care providers, difficulties to change existing behavioural routines, and protection of one's own professional role and qualities.[48–50]

It is important that pharmacists become more involved in multidisciplinary fall prevention collaborations, because of their essential role in the identification

and deprescribing of FRIDs.[45,51,52] Therefore, it is necessary that health care providers, including pharmacists, make clear agreements about the provision of fall prevention and referral. Such agreements could be formulated on a national level e.g., in national clinical fall prevention guidelines. Such national guidelines could support the role clarity of community pharmacists in fall prevention. Furthermore, national clinical guidelines could support health care providers with how to organize fall prevention in their areas.

Since major differences seem to exist in how fall prevention is regionally organized, primary care providers should specifically be encouraged to make such agreements on a local level. Agreements are needed on at least the following topics: coordination of care, multidisciplinary meetings, referral, role clarification, and communication.

Pharmacists should see fall prevention in a broader perspective than focusing solely on patient's medication use. They should have basic knowledge about fall risk factors and tasks of health care providers to whom patients can be referred. Pharmacists might therefore need additional training. Interprofessional education could support role clarity and therefore foster multidisciplinary collaboration in primary care.[48,49] Pharmacists should show more initiatives to contact other health care providers personally to enhance two-way referral.[53]

In particular, deprescribing of FRIDs could benefit from a multidisciplinary approach *(Chapter 5.1)*. Good collaboration between physicians and pharmacists is of major importance to facilitate deprescribing.[27,54] Furthermore, other health care providers, including physical therapists and nurses, could refer patients to pharmacists when they suspect that use of FRIDs may play a role in older people at risk of falls.[55–57] A multidisciplinary approach may also support the patient engagement in deprescribing and the monitoring of withdrawal effects.[57,58]

With regard to deprescribing of FRIDs, roles of involved health care providers should be clarified. During medication reviews, physicians and community pharmacists should be encouraged to discuss with each other who will monitor the deprescribing process. For instance, nurses could support with monitoring ensuring safe deprescribing, and they could also have an important role in identification of undesirable medication use in patients at risk of falls.[56–58]

WHERE ARE WE NOW IN TERMS OF MULTIDISCIPLINARY FALL PREVENTION CARE INVOLVING COMMUNITY PHARMACIES?

The studies in this thesis are conducted in the Dutch health care setting. Although most findings are applicable to settings of other high-income countries, some details may be less applicable to such settings, such as the role and education of pharmacy technicians. In low- and middle-income countries, pharmacy practice may have other priorities, such as maintaining the supply of medicines and the provision of basic care to patients with low health literacy. Populations in these countries are generally younger, therefore ageing and the increase risk of falling in frail elderly is currently not their most important health care issue. Therefore, in these countries multidisciplinary fall prevention services are not a high priority.[59]

In the Netherlands, awareness on the relevance of providing fall prevention is growing among health care providers. In 2004, health care providers developed a Dutch multidisciplinary fall prevention guideline and this last was updated in 2017.[60] Unfortunately, pharmacists were not actively involved in the creation of this guideline. In addition to this guideline the Dutch organization VeiligheidNL developed a comprehensive fall risk assessment tool, last updated in 2020.[61]

In the past few years a few local and national initiatives have been started to improve the provision of fall prevention in community pharmacies.[62,63] Despite these efforts, more awareness on the need to provide fall prevention among pharmacists is necessary.

Implementation of new multidisciplinary fall prevention interventions should be stimulated locally. An overview of regional multidisciplinary fall prevention programs is currently being made and will help to identify and disseminate best practices.[64]

HOW CAN PATIENTS BE BETTER INVOLVED?

In this thesis, patients' perspectives on fall prevention services were studied during development of the service, prior to implementation and during implementation.[65] To develop and implement a sustainable fall prevention service, insight in patient needs is of utmost importance. Patients indicated that they

expected to be proactively informed by their pharmacy on fall risk-increasing drug properties, but that they were not expecting from pharmacists to be educated on other fall risk factors *(Chapter 3)*. Therefore, in the developed fall prevention service instructions for referral and collaboration were incorporated to ensure patients would be sufficiently educated and treated with regard to other fall risk factors than medication use *(Chapter 5)*. Eventually, an evaluation was performed to explore how the developed service befell to patients *(Chapter 5.3)*.

In fall prevention, patient engagement is essential during the implementation process, in order to ensure that interventions lead to desired outcomes.[66,67] Patients are often not motivated to participate in fall prevention activities, due to reasons as believing not to be at risk of falls or believing falling is a natural part of ageing.[67–70] To increase patients' awareness on fall risk, health care providers should increase their efforts to inform patients on the relevance of fall prevention. As patients often believe fall prevention activities are "better for others than for me", health care providers should focus on explaining them the personal benefits of participating in fall prevention activities.[71] Furthermore, public health initiatives, such as public health messages or mass media campaigns, could be used to enhance older people's awareness on fall risk. For example, older people could be informed on importance of fall prevention by displaying posters at institutions that are often visited by them, such as pharmacies, general practices, and at activities targeted for elderly. To ensure patients feel addressed, such fall prevention education could be framed as being part of healthy aging.[72]

Researchers should also investigate how patient engagement in fall prevention interventions could be enhanced. As the use of appropriate communication techniques could be essential to enhance patient engagement, researchers could focus on the implementation of such techniques e.g., motivational interviewing. The advantages of applying motivational interviewing techniques to improve medication adherence have been acknowledged, therefore the use this technique might also support patient engagement in fall prevention.[36]

Besides that patients are often unaware of their fall risk, patients are also unaware about the fall risk-increasing properties of their medication *(Chapter 3)*. Efforts should thus be made to educate patients on fall-related risks of medication as well. Therefore, pharmacy employees should inform patients more often about

the fall-related effects of medication use. Patients reported that they expected that they would be informed about these effects during the first dispensing of a drug and by patient information leaflets *(Chapter 3)*. Therefore, patient information leaflets should include a section on fall-related adverse effects. Pharmacy teams should be trained to ask and inform patients more often about such side effects.

Patients might be more engaged in fall prevention interventions that include minor adjustments in order to reduce fall risk, compared to interventions that ask for major adaptations, such as exercise.[70] In accordance to this, findings of *Chapter 3* and *Chapter 5.3* suggest patients are often engaged in deprescribing interventions that do not require much of their own efforts to reduce fall risk, but they seem less engaged in by pharmacy technician provided lifestyle recommendations. This lack of engagement may thus (partly) be explained by the fact that lifestyle adaptations need more behavioural change. It possibly requires more time and attention from health care providers to engage their patients in interventions that require behavioural change, such as exercise. Health care providers may need more training in how to engage their patients in such interventions e.g., by framing the message as being focused on healthy ageing and by explaining how patients will benefit from fall prevention activities.[71,72]

It also seems plausible that, in order to engage patients so that they increase their uptake of fall prevention interventions, there is need for sufficient clinical expertise.[73] Therefore, pharmacy technician might be better in convincing patients about necessity of medication-related adjustment compared to other kinds of adjustments to prevent falls. To ensure sufficient clinical expertise when recommending patients on other fall prevention activities, patients could be referred to other health care providers.

With regard to deprescribing, patient engagement often seems to depend on the type of drug that is deprescribed. In *Chapter 4.1* is described that pharmacists experience that patients are often unwilling to deprescribe psychotropic medications. Depending on the type of drugs and patients' own beliefs, patient engagement in deprescribing could be a challenge.[74,75] *Chapter 5.1* highlights case reports in which a lack of patient engagement was a barrier for deprescribing. Paradoxically, *Chapter 5.3* illustrates patients' high satisfaction with the medication review as part of the implemented fall prevention service. This high interest

might be explained by that deprescribing of preventive drugs was most common *(Chapter 5.2)*. Even when patients' medication was not adapted, they appreciated that they were reassured about the correctness and safety of their medication use.

To engage patients in deprescribing, pharmacists and physicians should aim to implement patient-centred shared decision-making. This means that pharmacists and physicians should educate patients about the personal benefits of deprescribing and the potential risks. Pharmacists and physicians should discuss patients' fears of discontinuation, including withdrawal symptoms and relapse of symptoms. Shared decision-making will enable patients to make their own decisions. Furthermore, patient support during the deprescribing process and monitoring process should be guaranteed.[35,76]

WHAT CAN WE LEARN FROM THE METHODOLOGY AND THEORETICAL MODELS APPLIED IN THIS THESIS FOR PHARMACY PRACTICE RESEARCH?

The studies presented in this thesis mainly used qualitative research methods. These qualitative methods were essential to gain insight into the perspectives of patients, health care providers, and the evaluation of the implementation of the pharmacy-led fall prevention service. Several frameworks were applied to underpin the design and analyses of the results. This section will provide a short description of these frameworks along with considerations of using them in future studies.

There is no gold standard for selecting a framework during the design or analysis of a study. Ideally, frameworks are selected at the research planning stage. Most importantly, the framework choice should be based on and match the study aim.[77,78] The main advantage of applying theories and models in qualitative research is enhanced focus and understanding of the research data.[77] Furthermore, application of frameworks supports the comparison of findings between individuals, groups, and studies.

The precaution adoption process model (PAPM), a framework that attempts to explain how a person comes to decisions to take action, has been applied in this thesis to study patient perspectives on pharmacy-led fall prevention services *(Chapter 3)*.[79] It is well known that patients are often unaware of their fall risk or

underestimate their fall risk.[67–70] The application of the PAPM was justified, as the model includes the stages at which patients are unaware of a threat or risk, and it was considered as the most appropriate model to investigate patients' transitions through stages of engagement. Researchers could consider to apply the PAPM in qualitative studies that aim to describe how persons perceive health threats and why they do or don't decide to act on reducing such health threats.

In particular, a wide diversity of frameworks, theories and models has been developed for studying implementation.[80–82] Application of these frameworks is essential to prevent that factors are missed that explain why health care interventions were or were not implemented. The selection of a framework could seem confusing, since theories, models and frameworks for implementation are abundant in literature.[80,81] The research aim should guide the decision-making, as the selected implementation framework should closely fit the research aim. In this thesis, the aim was to unravel the barriers and facilitators for implementation. Therefore, determinant frameworks were considered as most appropriate. It could been considered as a strength that the selected frameworks in this thesis closely match the study aim, and that these frameworks were considered as the most appropriate for the particular data collection and/or analysis.

In this thesis, there is a focus on identifying barriers and facilitators of implementation *(Chapter 4.1; Chapter 4.2; Chapter 5)*. The theoretical domains framework (TDF), the capability opportunity motivation - behaviour (COM-B) model, and the consolidated framework for implementation research (CFIR) are all appropriate to detect such determinants. The main difference between these models is that the TDF and COM-B are focused on detecting determinants for behavioural change, whilst the focus of CFIR is set on evaluation of implementation factors.[82–84] By combining these models the identification of determinants at multiple conceptual levels of implementation is possible.[85]

Since it is a challenge to translate findings of research studies concerning interventions into clinical practice, more research should be conducted focusing on the implementation of pharmaceutical care services, e.g. fall prevention. By conducting implementation research insight can be gained into the processes of implementation, explaining (1) why fall prevention interventions (do not) work in clinical practice, (2) how they can be implemented effectively, and (3) what is needed to foster the implementation process.

ARE FALL PREVENTION SERVICES COST-EFFECTIVE?

The prevalence of fall incidences has increased and consequently this increase leads to a major burden of costs for national health systems.[86,87] In this thesis, considerations on the cost-effectiveness of fall prevention interventions are lacking. Due to the complexity of fall prevention, involving modification of multiple risk factors, effective multifactorial fall prevention interventions are often accompanied with high costs.[88] During the design of multidisciplinary fall prevention interventions, special attention should be paid to avoidance of high costs. Close multidisciplinary collaboration in fall prevention could be cost-effective and will ensure the essential multifactorial approach.[89]

Medication reviews appear cost-saving. Therefore, paying attention to fall prevention during medication reviews is potentially cost-effective.[90,91] Nevertheless, deprescribing is a time-consuming process and therefore sufficient financial compensation is needed. In literature, it has been described more than once that there is a need for reimbursement for deprescribing for both physicians and pharmacists.[54,92,93] As community pharmacists are particularly dependent on their sales of medications per unit, deprescribing would currently be unprofitable for them.

CONCLUSIONS

Falling in older people is indisputably a major public health issue. Pharmacists are in the position to contribute to fall prevention. They should, however, take up the gauntlet and increase their visibility in fall prevention. Medication review and deprescribing are the most obvious fields where pharmacists can contribute. Additionally, with their complete team they can contribute in many other fields of fall prevention. Policy makers, professional organizations and payers should recognize and facilitate pharmacists in this role.

AUTHOR'S CONTRIBUTION

MG wrote the original draft of the general introduction. She discussed the main findings of her thesis and set-up of the general discussion with her supervisors and asked for feedback on basis of drafts. She conducted the literature search and

related the findings of her thesis to the literature and she elaborated on these findings. She implemented the feedback and contributions of her supervisors during the whole process.

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Chapter 7

Appendices

Chapter 7.1

English summary

INTRODUCTION

This thesis aimed to answer the question how pharmacists can contribute to fall prevention, and how fall prevention services can be implemented, including the identification of barriers and facilitators. To foster the implementation of pharmacy-led fall prevention services, this thesis aimed to assess the needs of patients, pharmacists, and other primary care providers.

SCREENING OF PATIENTS AT RISK OF MEDICATION-RELATED FALLS

The study of Chapter 2 aimed to investigate whether older people fall more often when they are using certain drugs. The study was conducted among 3545 Dutch patients who were older than 65 years and using at least 5 drugs simultaneously. Of these patients, 2448 patients (70%) reported no fall in the past year, 521 patients (15%) were single fallers, and 465 (14%) patients were recurrent fallers. The aim was to investigate, by use of two different methods, whether it is possible to predict falls based on the medication use of patients. Per patient a so-called drug burden index (DBI) was calculated. The DBI has often been used as an indicator of patients' total use of sedative medication. Examples of sedative medications are sleeping pills and morphine. A higher DBI means a higher use of sedative medication by a patient. Besides, for every patient was investigated which and how many fall risk-increasing drugs (FRIDs) were used. Both sedative medication and blood-pressure lowering drugs were included by use of this latter method. Statistical methods were applied and it appeared that both a higher DBI and the use of individual FRIDs were more common among patients who fell previously. There were also patients who were not using any risk medication and fell, and vice versa. Using either the DBI or use of FRIDs to recognize patients at risk of falls appeared insufficient for use in clinical practice. Based on these results, the recommendation for pharmacy practice is to screen patients at risk of medication-related falls on basis of the use of FRIDs in combination with asking patients about their fall history.

OLDER PATIENTS' NEEDS AND EXPECTATIONS OF PHARMACY-LED FALL PREVENTION SERVICES

The aim of Chapter 3 was to gain insight into the expectations of community-dwelling older patients regarding fall prevention services provided by community pharmacies. The perceptions of 17 patients, who were older than 75 years and were using at least 5 drugs simultaneously of which least one FRID, were investigated. These patients were invited to participate in a group interview, a so-called focus group. In total, three focus groups were held. The study indicated that most patients are unaware that their medication use may increase their fall risk. Patients expected and wished to be informed about fall-related adverse effects e.g., by patient information leaflets and during first dispensation. They believed this belonged to the primary tasks of the pharmacy team. Many patients were also interested in medication withdrawal, but a few were doubtful about possibilities of medication withdrawal. Patients who previously fell seemed more engaged in fall prevention, because they more often took precautions to prevent falls. From pharmacists patients expected to contribute to fall prevention by ensuring medication safety. They had no expectations of pharmacists concerning treatment of other fall risk factors.

PRIMARY CARE PROVIDERS' PERCEPTIONS TO PROVIDE FALL PREVENTION SERVICES

In Chapter 4.1, community pharmacists' perceptions on provision of fall prevention services were explored. These perceptions were investigated by use of three methods. First, 313 Dutch pharmacists responded to statements during a lecture about fall prevention for community pharmacists. Second, 205 pharmacists completed a survey. Third, 16 pharmacists were interviewed. Most importantly, pharmacists reported that despite they were motivated to contribute to fall prevention, they were currently only limited involved. Most pharmacists believed that they were capable to provide fall prevention. Pharmacists perceived they had limited opportunities to provide fall prevention. Major barriers were insufficient multidisciplinary collaboration, patient unwillingness to deprescribe FRIDs, and lack of time. Facilitators were goal-setting behaviour, financial compensation, and sufficient communication skills.

In Chapter 4.2, the perspectives of physiotherapists, home care nurses, and practice nurses on multidisciplinary collaboration in fall prevention, were addressed, focusing on collaboration with pharmacists. This was explored by conductance of six focus groups with in total 46 participants, including 17 physiotherapists, 14 home care nurses, and 16 practice nurses. The primary care providers reported that they collaborate interprofessional to prevent falls, but seldomly with community pharmacists. They had limited attention for medication as risk factor for falls and the potential role of pharmacists in fall prevention. They were open to more collaboration with pharmacists and believed this potentially improves patient outcomes. To improve collaboration primary care providers indicated to need enhanced communication and coordination, clarification of roles, and multidisciplinary agreements. In such collaborations, primary care providers expect pharmacists to focus on deprescribing of FRIDs and informing patients about medication-related fall risk.

IMPLEMENTATION OF A PHARMACY-LED FALL PREVENTION SERVICE

In Chapter 5, the implementation and evaluation of a pharmacy-led fall prevention service is described. The fall prevention service consisted of a fall risk screening and fall consultation (fall risk assessment with accompanying interventions) by the pharmacy technician, and a medication check and comprehensive medication review if needed by the pharmacist. Included patients were 70 years or older and using at least 5 drugs of which at least 1 FRID. Patients were contacted at one month follow-up for an interview to share their experiences, and to document changes in fear of falling and patient scores on a fall prevention knowledge test.

Chapter 5.1 aimed to give an impression of community pharmacists' decision-making when deciding on deprescribing FRIDs on the basis of three clinical case reports. The cases were of older patients who participated in the pharmacy-led fall prevention service. The community pharmacist performed a medication review in all three cases with the goal to reduce fall risk by deprescribing of FRIDs. For two patients FRIDs were successfully deprescribed, but in the other patient deprescribing led to severe withdrawal symptoms. The three cases indicate potential crucial facilitators for decision-making of deprescribing FRIDs. These were: patient engagement, sufficient pharmacist's knowledge and skills, and good collaboration with other involved health care providers. Making

agreements on the deprescribing process with other health care providers e.g., on follow-up monitoring, appeared essential. Close monitoring seems particularly of major importance in cases when relapse of condition or withdrawal symptoms could be expected. In such cases, patient engagement should be secured as well, by focusing on so-called shared decision-making. Therefore, to accomplish safe and effective deprescribing, pharmacists need communication skills for engaging patients and ensuring effective collaboration.

Chapter 5.2 aimed to assess the implementation process and evaluation of a fall prevention service in community pharmacies. From 10 pharmacies that agreed on participating nine pharmacies actually implemented the fall prevention service. In total, 95 patients agreed on the quick fall risk screening; 56.8% of them reported ≥ one fall in the past year and 42.1% reported a fear of falling. Of them, 91 enrolled a fall consultation. A comprehensive medication review was provided to 41 patients. Medication was adapted of 32 patients and 23 were referred to another health care provider. Of all lifestyle recommendations from pharmacy technicians (N = 157), patients were most often recommended on home safety (N = 39; 42.9%), footwear (N= 38; 41.8%), and exercise (N = 39; 39.6%). Patients' fear of falling was higher at one month follow-up and patients' scores on a fall prevention knowledge test did not differ. Pharmacy technicians felt capable to assess fall risk, provide lifestyle recommendations, and refer patients, on basis of a fall consultation guide. Pharmacists experienced the following barriers: lack of time, absence of staff, and limited multidisciplinary collaboration. Facilitators were: training, motivated staff, patient engagement, and project scheduling. Pharmacists thought the pharmacy-led fall prevention service was useful, but desired a less time-consuming intervention. Therefore, most pharmacists preferred to spend time on fall prevention only during medication reviews. In order to ensure sufficient treatment for other fall risk factors, pharmacists could be recommended to strengthen their collaboration with other primary care providers.

The patients' perspective on their participation in the fall prevention service was evaluated by use of interviews, as described in Chapter 5.3. In total, 87 patients were interviewed. Patients were positive about the fall prevention service, especially about the medication review. It was important for them to be assured on the safety and appropriateness of their medication. Patients showed limited motivation to adapt their lifestyle, even though they reported that by participating in the service their awareness concerning their fall risk was enhanced.

CONCLUSION AND RECOMMENDATIONS

Falling in older people is a major public health issue. Pharmacists are in the position to contribute to all prevention. The most obvious way for community pharmacists to contribute is by providing medication reviews and advising on deprescribing of FRIDs.

To identify patients at medication-related fall risk more quickly, a contra-indication 'fall risk' could be added for saving in pharmacy information systems. This may support the screening of patients at risk, so targeted advice can be provided to them. Pharmacy technicians could be trained to identify patients at risk of falls and advise them on fall prevention accordingly.

Community pharmacists should also pay attention to patient engagement and multidisciplinary collaboration. Pharmacists might need additional training in communication techniques. Improved communication skills would be helpful for the implementation of shared decision-making and to foster the collaboration. Health care providers in primary care should be stimulated to make agreements with one another. Such agreements should be about coordination of care, multidisciplinary meetings, referral, role clarification, and manners of communication.

Chapter 7.2

Nederlandse samenvatting

INLEIDING

Dit proefschrift beoogde in kaart te brengen hoe apothekers kunnen bijdragen aan valpreventie en hoe valpreventieservices geïmplementeerd kunnen worden. De identificatie van belemmerende en bevorderende factoren voor die implementatie stond daarbij centraal. Tevens zijn de behoeften van patiënten, apothekers en andere zorgverleners in kaart gebracht. Deze informatie kan gebruikt worden om de implementatie van valpreventieservices vanuit de apotheek te bevorderen.

HET HERKENNEN VAN PATIËNTEN MET EEN VERHOOGD RISICO OP MEDICATIE-GERELATEERD VALLEN IN DE APOTHEEK

In Hoofdstuk 2 is bij 3454 patiënten die ouder waren dan 65 jaar en minstens 5 geneesmiddelen gebruikten onderzocht of patiënten die vielen vaker bepaalde geneesmiddelen gebruikten. Van deze groep gaven 2448 patiënten (70%) aan het afgelopen jaar niet gevallen te zijn, 521 patiënten (15%) gaven aan één keer gevallen te zijn en 465 patiënten (14%) gaven aan meerdere keren gevallen te zijn. Er werd op twee manieren onderzocht of aan de hand van medicatiegebruik is te voorspellen wie van de oudere patiënten valt. Er werd per patiënt een zogenaamde drug burden index (DBI) berekend, een maat om het totale gebruik van versuffende medicatie, zoals slaapmedicatie en morfine, door een patiënt in kaart te brengen. Hoe hoger de DBI, hoe hoger het totale gebruik aan versuffende medicatie, die de kans op vallen verhoogd. Daarnaast werd voor iedere patiënt gekeken naar het gebruik van individuele valrisicoverhogende medicatie (FRIDs). Die laatste kunnen zowel versuffende middelen zijn als middelen die de bloeddruk verlagen. Uit de statistische analyses bleek dat zowel een hogere DBI als het gebruik van individuele FRIDs vaker voorkwamen bij patiënten die gevallen waren. Er waren echter ook patiënten die geen risicomiddelen gebruikten en toch vielen en omgekeerd. Het gebruik van de DBI en het kijken naar het gebruik van FRIDs om valrisico te herkennen was daarom onvoldoende bruikbaar om alle patiënten met risico op vallen in de apotheek op te sporen. Op basis van deze resultaten is het advies om hoog-risico patiënten op te sporen in de apotheek aan de hand van het gebruik van valrisicoverhogende medicatie in combinatie met het uitvragen van de valgeschiedenis.

DE BEHOEFTEN EN VERWACHTINGEN VAN OUDERE PATIËNTEN VOOR VALPREVENTIESERVICES VANUIT DE APOTHEEK

Het doel van Hoofdstuk 3 was om inzicht te verkrijgen in de verwachtingen van thuiswonende oudere patiënten ten aanzien van valpreventieservices vanuit openbaar apotheken. De perspectieven van 17 patiënten die ouder waren dan 75 jaar en minstens één valrisicoverhogend geneesmiddel gebruikten zijn onderzocht. Deze patiënten werden uitgenodigd om deel te nemen aan een groepsgesprek, een focusgroep. In totaal zijn er drie focusgroepen gehouden. Het onderzoek liet zien dat de meeste patiënten niet weten dat hun medicatiegebruik het valrisico kan verhogen. Patiënten verwachtten en wensten om geïnformeerd te worden over val-gerelateerde bijwerkingen, bijvoorbeeld middels bijsluiters, folders en tijdens het eerste uitgiftegesprek. Ze waren van mening dat dit behoorde tot één van de hoofdtaken van het apotheekteam. De meeste patiënten waren ook geïnteresseerd in medicatie-afbouw, maar een enkeling twijfelde of medicatie-afbouw mogelijk was. Patiënten die eerder gevallen waren leken meer geïnteresseerd in valpreventie en troffen zelf ook al vaker voorzorgsmaatregelen om vallen te voorkomen. Van apothekers verwachtten patiënten om veilig medicatiegebruik te garanderen en dusdanig bij te dragen aan valpreventie. Ze hadden geen verwachtingen van apothekers om aan andere valrisicofactoren dan medicatiegebruik te aandacht te besteden.

VERLENING VAN VALPREVENTIESERVICES VANUIT HET PERSPECTIEF VAN ZORGVERLENERS

In Hoofdstuk 4.1 werden de perspectieven van openbaar apothekers ten aanzien van het verlenen van valpreventieservices onderzocht. Deze perspectieven werden op drie manieren onderzocht. Ten eerste reageerden 313 apothekers op stellingen tijdens een lezing over valpreventie voor openbaar apothekers. Ten tweede vulden 205 apothekers en vragenlijst in en tenslotte werden 16 apothekers geïnterviewd. Apothekers gaven aan dat ondanks dat zij gemotiveerd waren om bij te dragen aan valpreventie, ze momenteel nog weinig betrokken waren op dit gebied. De meerderheid achtte zich wel in staat om valpreventie te verlenen. Apothekers ervaarden echter dat zij weinig kansen hadden om actief aan valpreventie bij te dragen. De belangrijkste belemmerende factoren

waren onvoldoende multidisciplinaire samenwerking, weigering van patiënten om FRIDs af te bouwen, en tijdstekort. De belangrijkste bevorderende factoren waren het stellen van behandeldoelen door apothekers, financiële compensatie en voldoende communicatieve vaardigheden.

In Hoofdstuk 4.2 zijn de perspectieven van fysiotherapeuten, wijkverpleegkundigen en praktijkondersteuners op de multidisciplinaire samenwerking binnen valpreventie belicht, waarbij de samenwerking met apothekers centraal stond. Hiervoor zijn zes online focusgroepen met in totaal 46 deelnemers, waaronder 17 fysiotherapeuten, 14 wijkverpleegkundigen en 16 praktijkondersteuners, gehouden. De zorgverleners gaven aan dat ondanks dat zij vaak samenwerken met andere (eerstelijns) zorgverleners om vallen te voorkomen, zij dit beperkt doen met apothekers. Ze hadden beperkt aandacht voor medicatie als risicofactor voor vallen en de mogelijke rol van de apotheker. Ze stonden er wel voor open om meer samen te werken met apothekers en ze geloofden dat dit kon bijdragen aan verbeterde patiëntuitkomsten. Om de samenwerking te verbeteren schetsten de deelnemende zorgverleners de volgende randvoorwaarden: meer communicatie en onderlinge afstemming, een duidelijke regiehouder, verduidelijking van rollen en verantwoordelijkheden en multidisciplinaire afspraken. In dergelijke samenwerkingen verwachten zorgverleners van apothekers om zich te focussen op het afbouwen van FRIDs en het informeren van patiënten over potentieel medicatie-gerelateerd valrisico.

IMPLEMENTATIE VAN EEN VALPREVENTIESERVICE VANUIT DE APOTHEEK

In Hoofdstuk 5 wordt de implementatie en evaluatie van een valpreventieservice in apotheken beschreven. De valpreventieservice bestond allereerst uit een valrisicoscreening en valconsult (valrisicobeoordeling met begeleidende interventies) door de apothekersassistente. Gevolgd door een medicatiecheck en indien nodig een uitgebreide medicatiereview door de apotheker. De geïncludeerde patiënten waren 70 jaar of ouder en gebruikten minimaal vijf geneesmiddelen, waarvan één FRID. Patiënten werden één maand na deelname benaderd voor een interview om hun ervaringen te delen. Tijdens deze follow-up werden ook vastgesteld of veranderingen waren opgetreden in valangst en kennis over valpreventie was toegenomen.

Hoofdstuk 5.1 beschrijft drie patiëntcasussen om inzicht te geven in de besluitvorming van openbaar apothekers rondom het afbouwen van FRIDs. Dit waren patiënten die deelnamen aan de valpreventieservice vanuit de apotheek. De openbaar apotheker voerde een medicatiereview om valrisico te verlagen door FRIDs af te bouwen. Voor twee patiënten werden FRIDs succesvol afgebouwd, in de andere patiënt leidde de medicatie afbouw tot ernstige onthoudingsverschijnselen. De drie casussen tonen dat verschillende factoren van belang zijn om te kunnen beslissen over medicatie-afbouw: het betrekken van de patiënt in de besluitvorming, voldoende kennis en vaardigheden van de apotheker, en goede samenwerking tussen verschillende betrokken zorgverleners. Het bleek essentieel om afspraken te maken met andere zorgverleners over medicatie-afbouw, bijvoorbeeld over de monitoring na medicatie-afbouw. Het goed volgen van de patiënt lijkt met name van groot belang in casuïstiek waarbij verwacht kan worden dat de aandoening terugkeert of onthoudingsverschijnselen kunnen optreden. In zulke gevallen is het belangrijk dat de patiënt betrokken is en er voldoende rekening gehouden wordt met de wensen en behoeftes van de patiënt. Apothekers hebben voldoende communicatievaardigheden nodig om patiënten te kunnen betrekken bij de besluitvorming en om goede samenwerking te realiseren.

Hoofdstuk 5.2 had als doel om het implementatieproces van de valpreventieservice in apotheken te beschrijven en te evalueren. Van de 10 apotheken die besloten om deel te nemen aan het onderzoek, hebben negen apotheken de valpreventieservice uiteindelijk geïmplementeerd. In totaal namen 95 patiënten deel aan een korte valrisicoscreening, waarvan 56,8% aangaf ≥ één keer gevallen te zijn in het afgelopen jaar en 42,1% gaf aan valangst te hebben. Van dit aantal hebben 91 patiënten een valconsult gekregen. Een uitgebreide medicatiereview werd uitgevoerd bij 41 patiënten. De medicatie werd aangepast voor 32 patiënten en 23 patiënten werden doorverwezen naar een andere zorgverlener. Van alle leefstijladviezen (N = 157) die gegeven waren door de apothekersassistente, betroffen deze het vaakst adviezen gerelateerd aan de woonomgeving (N = 39; 42,9%), schoeisel (N= 38; 41,8%) en beweging (N = 39; 39,6%). De valangst van patiënten was hoger na één maand follow-up en de score van patiënten op een valpreventie kennistoets was onveranderd. Apothekersassistenten vonden van zichzelf dat zij in staat waren geweest om het valrisico adequaat in kaart te brengen en patiënten te voorzien van leefstijladviezen en door te

verwijzen, op basis van een gesprekshandleiding. Apothekers rapporteerden de volgende belemmerende factoren voor implementatie: tijdstekort, verlof of verzuim van personeel, weinig multidisciplinaire samenwerking. Bevorderende factoren waren: training, gemotiveerd personeel, de medewerking van patiënten, inroostering van het project. Apothekers dachten dat de valpreventieservice nuttig was, maar ze verlangden naar een interventie die minder tijdrovend was. Vandaar dat de meeste apothekers de voorkeur hadden om alleen wat betreft medicatiereviews tijd te besteden aan valpreventie. Apothekers dient te worden aanbevolen om de samenwerking met andere zorgverleners te versterken, zodat zij bovendien kunnen garanderen dat andere valrisicofactoren ook goed behandeld worden.

Het perspectief van patiënten op hun deelname aan de valpreventieservice is geëvalueerd middels interviews en beschreven in Hoofdstuk 5.3. In totaal zijn er 87 patiënten geïnterviewd. Patiënten waren positief over de valpreventieservice, met name over de medicatiebeoordeling. Het was voor hen belangrijk dat zij verzekerd werden dat hun medicatie veilig was en juist op hen was afgestemd. Patiënten toonden weinig motivatie om hun leefstijl aan te passen. Ze gaven echter aan dat deelname aan de service had geleid tot een verhoogd bewustzijn van hun eigen valrisico.

CONCLUSIE EN AANBEVELINGEN

Vallen onder ouderen komt vaak voor. Openbaar apothekers hebben mogelijkheden om bij te dragen aan het voorkomen van vallen onder ouderen. De meest voor de hand liggende activiteit is het beoordelen van de medicatie en het adviseren over het afbouwen van valrisicoverhogende medicatie.

Het noteren van een contra-indicatie 'valrisico' in apotheekinformatiesystemen zou kunnen helpen bij het identificeren en gericht adviseren van patiënten die risico lopen op medicatie-gerelateerd vallen. Apothekersassistenten kunnen, mits voldoende getraind, een rol hebben bij het identificeren van patiënten met een verhoogd valrisico en het passend adviseren over valpreventie.

Apothekers zullen ook aandacht moeten hebben voor het betrekken en motiveren van patiënten en de multidisciplinaire samenwerking. Communicatietraining voor apothekers en implementatie van gezamenlijke besluitvorming over

afbouwen van medicatie kan hierbij bevorderend werken. Binnen de eerstelijn zouden zorgverleners samenwerkingsafspraken moeten maken over de regie van de valpreventie, rolverdeling, multidisciplinair overleg, doorverwijzing, en wijze van communicatie.

Chapter 8

Appendices

Chapter 8.1

Dankwoord

DANKWOORD

Dankjewel! Aan ieder die mij geholpen heeft: dankjewel! Aan ieder die er voor mij is geweest: dankjewel! Voor wie ik liefheb en aan wie dit leest: dankjewel! Duidelijk mag zijn dat ik een heleboel mensen heel dankbaar ben. Mensen die hebben bijgedragen aan het proefschrift, in mij geloven, mij hebben gesteund of gewoon lief voor mij zijn geweest. Desondanks heb ik het woord 'dankjewel' veel te weinig keren uitgesproken in de afgelopen vier jaar. Gelukkig dat er in een proefschrift ruimte is voor een dankwoord. Met dit dankwoord wil ik iedereen vanuit mijn hart bedanken, die er de afgelopen vier jaar voor mij is geweest.

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Chapter 8.2

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Chapter 8.3

List of publications

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Chapter 8.4

About the author

ABOUT THE AUTHOR

Marle Gemmeke was born in 1991 in Malden, the Netherlands. She graduated (cum laude) from the Nijmeegse Scholengemeenschap Groenewoud in 2009. After moving to Utrecht, she obtained her bachelor's degree in Pharmacy from Utrecht University in 2012 (cum laude). During her bachelor she obtained a minor degree in cognition (psychology) from Utrecht University, which motivated her to perform her research internship at the Donders Centre for Cognitive Neuroimaging, Nijmegen. She obtained her master's degree in Pharmacy from Utrecht University in 2015.

After her graduation, she moved to Amsterdam to work as a pharmacist in the Plesman Apotheek and Apotheek Delflandplein. In 2018, she completed the education programme of the Royal Dutch Pharmacists Association for the profession of community pharmacist as an advanced specialization.

Thereafter, she returned to the Utrecht University to start her PhD at the Division of Pharmacoepidemiology and Clinical Pharmacology, in collaboration with the Groningen Research Institute of Pharmacy, University of Groningen, under the supervision of dr. Ellen Koster, prof. dr. Marcel Bouvy and prof. dr. Katja Taxis. During her PhD project she assessed and fostered the role of community pharmacists in fall prevention. Whilst pursuing her PhD, she continued her job as community pharmacist in Amsterdam for two days a week.

During her PhD project, Marle was a member of the institutional review board of the Division of Pharmacoepidemiology and Clinical Pharmacology, Utrecht University, and she was a teacher in the bachelor's course Neurology. She supervised several master student research projects and bachelor theses. As part of her PhD project, Marle developed an online training for community pharmacists who were involved in her research. She presented her research findings at several (inter)national conferences.