CHAPTER 10

Summary & general discussion
Summary

Clinical medication reviews have become a valuable tool for community pharmacists to contribute to the medication management of older patients. The studies in this thesis investigate different aspects how to improve medication reviews. This is done by developing new patient selection methods, exploring patients’ perspectives of medication-related issues and deprescribing, exploring healthcare professionals’ (HCP) barriers and facilitators towards deprescribing, and testing a novel tailored clinical medication review for type 2 diabetes (T2D) patients at high risk for hypoglycaemia.

Chapter 2 describes the development and piloting of a selection algorithm for medication reviews. The final algorithm included four criteria, recent falls, number of medications, number of prescribers and whether patients collect their own medication. This algorithm performed moderately well at selecting high complex patients, however, several patients categorised as simple were still considered complex by the participating community pharmacists. In a pilot study, we observed that medication reviews for the patients categorised as complex did not lead to more recommended and implemented actions than patient categorised as less complex. Medication reviews for the patients categorised as simple were not significantly shorter in duration. Further steps are needed to validate the four criteria and to facilitate data collection for the practical application of the algorithm.

Chapter 3 describes the development of an algorithm to screen for T2D patients at high risk for hypoglycaemia based on criteria commonly available in Dutch pharmacy information systems. The algorithm included age, sex, six criteria based on glucose lowering medication use and two co-medication-related criteria. The model had an acceptable performance, outperformed individual criteria and performed similar as a model which included additional clinical criteria. This algorithm can be used to screen for patients with T2D who may need additional support to prevent hypoglycaemic events.

Based on patients’ interviews and surveys chapter 4 provides insights into the behavioural causes of hypoglycaemia and the underlying self-management issues. The results from this chapter showed that physical activity and insufficient food intake were often attributed by patients to be the cause of their hypoglycaemia. Maintaining a daily routine was important to prevent hypoglycaemia. Patients sometimes lacked the procedural knowledge to anticipate deviations in their food intake, exercise and medication taking routine. Negative emotional and mental states like stress, grief and cognitive overload could interfere with proper self-management and self-care, which could lead to hypoglycaemia. The results from this study underline the importance of daily routines, having the knowledge on how to adjust medication in relation to changes in physical activity, food intake or illness, and the ability to deal with stress to prevent hypoglycaemic events.
In **Chapter 5** the results from focus groups among older patients with polypharmacy, including cardiometabolic medication are presented, showing that beliefs about medication and about stopping cardiometabolic medication strongly varied between patients. For some patients positive beliefs about medication and a good health status were reasons to not wanting to stop medication, while others with positive beliefs about their medication were still willing to discuss stopping with their physician. In general, patients with a relatively negative view about their medication were willing to stop, but they still considered some of their medication as essential. Trust in the HCP that proposed stopping, monitoring the effects of stopping and the option to restart were important conditions for stopping medication. For cardiometabolic medication, the concept of personalised treatment targets needs to be explained so that it is clear that benefits and risks of such medication change when people grow older. Our findings illustrate the complexity of decision making and the need for involving patients early in the process of deprescribing.

Results presented in **chapter 6** show that the vast majority of older patients with polypharmacy who use cardiometabolic medication are willing to stop medications if their doctor said it was possible, even though most patients were satisfied with their medication. Taking more than ten medications was associated with a higher perceived medication burden. When comparing cardiometabolic medication groups, insulins and antihypertensive medications were considered more appropriate than statins and insulins were considered more appropriate than sulfonylureas. HCPs should take into account that patients perceive some of their medication as more appropriate than other medication when discussing deprescribing.

In the focus group study presented in **chapter 7**, the uncertainty and lack of evidence regarding the benefits and risks of deprescribing cardiometabolic medication in older patients were identified as barriers for the HCPs to conduct such deprescribing. Also, resistance from patients or family members and previous negative experiences with stopping were barriers for deprescribing. On the other hand, deprescribing of cardiometabolic medication in older patients was considered relevant. Good multidisciplinary collaboration was seen as facilitator for deprescribing, both in primary care and in secondary care. The identified barriers and facilitators can be used to develop a HCP training program for implementing deprescribing.

In **chapter 8** a tailored pharmacist-led clinical medication review intervention aimed at deprescribing and appropriate use of cardiometabolic medication among T2D patients at high risk for hypoglycaemia was evaluated. The pharmacists received a training and a conversation aid based on the results from **chapters 4-7**. The conversation aid focused on asking questions related to deprescribing and hypoglycaemia. The pharmacists also received a summary of the newly developed deprescribing guideline with information on how and when to deprescribe glucose lowering medications, antihypertensive medications, and
Patients were selected for this intervention based on hypoglycaemia risk scores, calculated with the screening algorithm developed in chapter 3. This novel pharmacy-led intervention resulted in a clear focus on optimizing cardiometabolic medication and showed an increase in deprescribing of such drugs.

The process evaluation in chapter 9 showed that both patients and pharmacists evaluated the novel pharmacy-led intervention positively. The new deprescribing guideline and the consultation aid helped the pharmacists in communicating about deprescribing with both patients and other HCPs and the guideline helped the pharmacists' clinical reasoning. Not all selected patients had experienced a hypoglycaemic event recently, and for some pharmacists this was a barrier for deprescribing glucose lowering medication. More attention may be needed during the training of HCPs for proactive deprescribing. Furthermore, differentiation between frail older patients eligible for deprescribing and relatively younger patients in need of disease management education might be helpful.

Based on these findings, several recommendations can be made for clinical practice related to conducting medication reviews. In the following paragraphs, implications for practice will be discussed, focusing on (a) selecting patients for medication reviews, (b) preventing hypoglycaemia, (c) involving patients in medication management and deprescribing, and (d) conducting targeted and tailored medication reviews. Subsequently, some reflections on the research methods used in this thesis are presented, answering questions related to (a) machine learning using data from community pharmacies, (b) the use of self-report assessments, (c) measuring the impact of deprescribing interventions. Finally, a general conclusion to optimise medication reviews and support deprescribing and some future perspectives are presented.

Implications for practice

Selecting patients for medication reviews

When selecting patients for medication reviews, there are two important aspects. That is identifying patients who are in need of a medication review and improving the efficiency of medication reviews. These two aspects do not always coincide. For instance, by selecting patients with a high anticholinergic and sedative medication load a vulnerable group of patients with a high number of potentially inappropriate medications (PIMs) was identified, however, pharmacists were not able to decrease this medication load making these medication reviews inefficient. In chapter 2 patients who were categorised as simple by the algorithm used fewer medications, had lower morbidity scores and were considered to be less in need of a medication review. In the pilot, however, the medication reviews for these patients did not lead to fewer recommendations compared to the medication reviews for the patients that were categorised as complex. Also, the medication reviews for the
less complex patients were not significantly shorter. It appeared that all patients had received a full clinical medication review, as commonly conducted by Dutch community pharmacists. This implies that the implementation of an algorithm as we have developed should be combined with a clear differentiation in types of medication reviews. Offering simpler medication reviews like prescription reviews for less complex older patients could increase efficiency. On the other hand, for identifying patients in need of a medication review the selection algorithm may need further improvement.

Medication reviews become less efficient when selecting patients is time consuming. One of the issues of the selection criteria proposed in the original Dutch multidisciplinary polypharmacy in the elderly guideline from 2012 was that community pharmacies often did not have information about criteria such as low adherence, poor kidney function, risk of falls and diminished cognition. The selection and screening algorithms in chapter 2 and 3 take two different routes what type of information is used for the algorithms. Chapter 3 relies solely on information that is commonly available in community pharmacies, while for the selection in chapter 2 additional information is collected from patients, in particular information about recent falls. The participating pharmacists of chapter 2 had different opinions about the feasibility of collecting this information from patients. Collecting additional information from patients to select patients for medication reviews may be too burdensome and inefficient. Instead, pharmacists might collect additional information as part of routine care to be used for multiple purposes. This could include information about recent falls and diminished cognition to be used for medication reviews but also for reminder support. Such information could further be used for the development of new clinical rules and to improve existing ones. This could make clinical rules more specific, potentially reducing alert fatigue. At this point clinical rules are relatively simple, for instance, alerting pharmacists when lipid lowering medication may be indicated based on age and the use of glucose lowering medication.

A more data driven approach based on machine learning could help screen for patients who are at high risk for certain DRPs. Chapter 3 shows that in the case of hypoglycaemia screening is possible based on information already available in community pharmacies. This type of screening for patients at high risk of DRPs is well suited for community pharmacies. As a rule of thumb Dutch community pharmacies have about four times as many patients compared to general practices and pharmacists have far less one-on-one contact moments with their patients. This makes it more difficult for pharmacists to rely on first-hand knowledge about their patients when screening for patients at high risk of adverse events and other DRPs. Using an algorithm for the first screening can identify a high risk population with a limited time investment of pharmacists. Additional collected information may enhance the potential of such an approach.
New challenges do arise when collecting more information from patients. Collecting, recording, managing and interpreting this additional information as well as keeping it up-to-date would require an information technology (IT) investment to integrate this in the pharmacy information systems. Collecting more information could also lead to resistance from patients as they may not understand why community pharmacies require this additional information. Relying on automated IT solutions to manage and interpret large amounts of data also has ethical consequences. Patients whose characteristics do not align with the algorithms can fall through the cracks. People avoiding care are a population at risk for this, they are already a vulnerable group and they might be missed by screening algorithms because information about them is often incomplete.

Preventing hypoglycaemia
In patients with T2D, hypoglycaemia is a potential DRP one would like to prevent either by optimizing the medication treatment or educating the patients. One of the best predictors for hypoglycaemic events are previous hypoglycaemic events\textsuperscript{2-5}. When a patient experiences an event, it is helpful to identify the cause of the hypoglycaemic event in order to prevent future events. This can be difficult because patients are not always able to identify a cause, as shown in chapter 4 and other studies\textsuperscript{6,7}. There are several explanations why patients are unable to identify a cause. Some of the patients may lack the necessary diabetes related knowledge. They do not know what the impact of certain behaviour is on their glucose level and they will therefore not identify this behaviour as the cause of their hypoglycaemic event. This was the case for some interviewed participants presented in chapter 4. In hindsight, some patients recalled that they used to do something "wrong" that they did not know was wrong at that time. A second reason may be that some patients do not remember that they took their medication twice. In chapter 4 and other studies accidental medication overdoses are rarely identified as a cause\textsuperscript{8,9}. It is hard to reconstruct after the fact whether a patient took medication twice, so the frequency of this cause might be underestimated in studies relying on self-report. In the interviews in chapter 4 some patients acknowledged that injecting insulin twice might have been the cause of a hypoglycaemic events, although they could not be sure.

For younger patients maintaining a strict daily routine when it comes to medication use, food intake and exercise while working can be difficult. Especially physically demanding jobs with irregular hours can disrupt daily routine. In addition, work related stress can have a large impact on self-management and can be a cause of hypoglycaemic events\textsuperscript{10}. Another group at high risk of hypoglycaemia are patients with poorly controlled glucose\textsuperscript{11,12}. Chapter 4 shows that these patients find it difficult to keep their glucose stable, hypoglycaemic and hyperglycaemic episodes are often overtreated resulting in highly fluctuating glucose levels. For these groups of patients tailored education or training may
be needed. In type 1 diabetes (T1D) patients education has been shown to be effective at reducing hypoglycaemia\textsuperscript{13,14}. For T1D patients preventing severe hypoglycaemic is a major goal of self-management education programs from the start\textsuperscript{13}. From the moment that T1D patients are diagnosed and are treated with insulin they are at risk of hypoglycaemia. For T2D patients this is not the case. The first treatment option for T2D are lifestyle changes focused on diet and exercise. In about a quarter of T2D only lifestyle changes are used to control glucose levels\textsuperscript{15}. Self-management support and education for T2D is mostly focused on improving lifestyle and reducing cardiovascular risk factors by focusing on factors such as weight loss and maintaining a low HbA1c\textsuperscript{13}. As the disease progresses, glucose lowering medication is needed to control glucose levels, and eventually insulin is needed. The use of insulin results in new self-management challenges, such as having to plan physical exercise to avoid hypoglycaemia and adjusting insulin to reach desirable glucose levels\textsuperscript{10}. It is essential to address these new challenges in order to prevent hypoglycaemia.

Pharmacists could play a role in preventing hypoglycaemia. So far, most of the pharmacist-led interventions aimed T2D patients have been focused on improving glucose control by optimizing the medication and have been effective at this\textsuperscript{16,17}. An Australian study showed the potential of a pharmacist-led education program\textsuperscript{18}. It was shown that the education program resulted in less hyperglycaemic and less hypoglycaemic events, although the effects on hyperglycaemia were more pronounced\textsuperscript{18}. Important aspects to address in educational interventions, as indicated in chapter 4 and other studies, is how to plan for physical activity, how to adjust medication based on glucose measurement or anticipating specific situations. Also, improving self-efficacy, how to cope with diabetes-related stress and stress in general, and improving diabetes related knowledge, especially in patients with low health literacy are important\textsuperscript{10,19,20}. The information and education provided in the intervention of chapter 8 was based on problems and needs identified during the patient consultations as part of the intervention. This opportunistic approach allowed the pharmacist to provide tailored advice and required a relatively small time investment compared to extensive self-management education programs\textsuperscript{13}. The intervention resulted in an increase in diabetes knowledge related to hypoglycaemia for the patients that scored low at baseline. The process evaluation of chapter 9 showed that the pharmacists did not always have the required knowledge to deal with identified problems related to insulin use, exercise and diet. Since hypoglycaemia is a multifactorial problem, it is not surprising that problems which were not directly related to medication were identified during the consultations. This can be addressed by collaborating with other HCPs when needed. Several patients in the intervention were indeed referred to a dietician or their nurse practitioner by the pharmacists to resolve identified problems.
Another solution to reduce the risk of hypoglycaemia, particularly relevant for older and frail patients, is deprescribing. Deintensifying glucose lowering medication and simplifications of insulin treatment can reduce the risk of hypoglycaemia\textsuperscript{21–25}. Deprescribing may lead to increases in HbA1c levels in accordance with higher HbA1c targets that are set for older and frail patients. Monitoring HbA1c levels may be helpful when deprescribing glucose lowering medication to establish that no unacceptable increases occur. As shown in chapter 5 monitoring is an important condition for some patients to consider deprescribing. It seems that healthcare professionals deprescribe glucose lowering medication more often in patients that experienced a hypoglycaemic events recently, so-called reactive deprescribing\textsuperscript{26,27}. Some pharmacists interviewed about the intervention for the process evaluation presented in chapter 9 stated that the patients that were selected did not always experience a recent hypoglycaemia. As a result, they felt that they did not have a clear reason for recommending deprescribing, preventing them to do so. Balancing potential harms and benefits of medication is essential for the decision to deprescribe. When medication is clearly causing harm the decision to deprescribe becomes easier. Patients without a recent hypoglycaemic event, however, can still be at risk for an event and patients are often not aware that they experienced a mild or moderate event\textsuperscript{28,29}. A more proactive approach to deprescribing apparently needs more support or training than provided in the intervention evaluated in chapters 8 and 9. Furthermore, more evidence is needed to show that patients who are not experiencing hypoglycaemia will benefit from deprescribing and which patients would benefit most.

Involving patients in medication management and deprescribing

Shared decision making has become part of patient centred care\textsuperscript{30}. Involving patients in decisions about their medication can have many different forms, ranging from a HCP making a strong recommendation based on input from a patient to providing information about possible choices and leaving the final decision to the patient\textsuperscript{31}. Which type of approach is most suitable depends on the patient and on the decision that needs to be taken. Patients often do not have the necessary expertise to make informed decisions. In the case of deprescribing, most patients want to be involved in decisions about stopping their medication as seen in chapter 6 and previous studies\textsuperscript{32–34}. Results from chapter 5 and a previous study did, however, identify a group of older patient that prefer to leave decisions about their treatment to others, like family members and their HCP\textsuperscript{35}. Informing these patients about the options is still essential even when the HCP makes the final decision from the perspective of informed-consent with either continuing or deprescribing medication.

Making a decision about stopping medication can be difficult. For HCPs the uncertainties about the risks and benefits of stopping medication for an
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individual patient are barriers for deprescribing, as shown in chapter 7 and other studies36–39. For patients, as shown in chapter 5, decision making about stopping medication strongly revolves around balancing the perceived risks of stopping and the perceived risks of continuing medication. Patients’ beliefs about their medication can be based on incorrect interpretation of information and can be prone to confirmation bias40. Patients’ assessments which medication is risky or no longer needed do not always align with the assessment of their HCP41,42. One study illustrated that patients think that more aggressive treatment with glucose lowering medication is needed when there is a longer diabetes duration, more diabetes complications and comorbidities, in contrast with the recommendations in clinical guidelines41.

Facilitating an informed decision is an important task for HCPs during a deprescribing consultation. Identifying and addressing patients’ beliefs about their medication is a key step. Risk communication tools can be helpful in this regard. Various pharmaceutical risk communication tools and methods have been developed over the years ranging from tools to share information with patients about medication risks and tools to change behaviour43. These types of communication tools could also be developed for deprescribing decisions in general or for deprescribing of specific medication groups. How risks are assessed and ways to influence this assessment have extensively been studied44. Making use of insights gained from social sciences could help improve communication. The use of the mental model has shown potential for improving knowledge about risks and changing behaviour in non-pharmaceutical settings as discussed in chapter 543. Important steps that need to be taken are identifying beliefs about the risk of stopping medication and assessing which rationale patients find important for decisions to stop medication. A recent survey study explored which information patients prefer to explain stopping of statins or a sedative-hypnotic. The results from this study showed that patients are more swayed by arguments that focus on the risk of continuing medication, such as the risk of adverse effects, harmfulness of the number of medication and the harm of medication outweighing benefits45.

Conducting targeted and tailored medication reviews

In the Netherlands and internationally the most common approach adopted for medication reviews is a generalistic approach focused on older patients with polypharmacy46,47. In this approach all medication is evaluated with the main goal of identifying and resolving DRPs to reduce the risk of adverse events17. Reducing the number of preventable adverse drug events that may result in hospitalization is often mentioned as a goal of these reviews, however, meta-analyses have not been able to show a relevant reduction in hospitalizations due to medication reviews16,17,48. It seems that medication reviews focused on specific goals, such as improving glucose or blood pressure control, have more potential to reach the set goals16,17. This supports the idea to provide tailored medication reviews for
subpopulations with a high risk of specific DRPs. Focusing time and attention on predefined DRPs, that can cause the most harm in a population at high risk for these problems, might improve the efficiency of medication reviews. The intervention described in chapters 8 and 9 is an example of such an approach with a strong focus on decreasing the risk of hypoglycaemia. This type of tailored and targeted medication reviews could be developed for other treatment areas, particularly related to chronic disease management. Such tailored medication reviews can strengthen the pharmacists’ position as a partner for the management of chronic diseases. An example of a model fitting this approach is the yet to be published Combi Consult study conducted in The Netherlands. The Combi Consult strengthens the collaboration of community pharmacists with general practices by combining a patient consultation about medication with a pharmacist with a sequential consultation with a nurse practitioner or GP for patients with chronic diseases like diabetes, asthma/COPD and cardiovascular disease. In the intervention of chapters 8 and 9 close collaboration with a general practice was essential for the intervention. The pharmacists worked closely together with the nurse practitioners of the patients and several patients were referred to their nurse practitioner for problems detected by the pharmacist. For addressing multifactorial problems, like hypoglycaemia or falls, a multidisciplinary approach is essential. Formalised collaborations could be extended beyond the pharmacy and general practice with dieticians, physiotherapists, home care organizations, endocrinologists, life-style coaches and psychologists.

Reflection on research methods
Machine learning: using data from community pharmacies
In chapter 2 a conventional logistic regression analysis was used to develop a selection algorithm, while in chapter 3 several machine learning analyses were tested to develop a screening algorithm for patients at high risk of hypoglycaemia. Logistic regression is a suitable method for low dimensional data. Machine learning methods, like least absolute shrinkage and selection operator (LASSO) logistic regression and random forest (RF), are better suited when data are high dimensional and there is multicollinearity between variables. In the Dutch healthcare system, pharmacy information systems contain rich and relatively reliable data about medication use of patients. At first glance these data may seem to be one-dimensional, that is, whether or not a certain medication is dispensed but a lot more information about the use of a medication is captured. Medication dispensings can be tracked over time. Duration of treatment, frequency of intensifications, other medication changes, and prescriptions not regularly collected can provide important information about disease progression and certain DRPs. As shown in chapter 3, five of the ten criteria used to predict hypoglycaemia were related to insulin use. Without the use of LASSO this type of multicollinearity would lead to an unstable model and overfitting in logistic regression models. A common practice
to prevent multicolinearity in a model is dropping some of the related variables. Insulin use is such an important risk factor for hypoglycaemia that having to drop variables that convey different aspects of insulin use would result in a model with poor performance. The type of machine learning models, like the one developed in chapter 3, appear more complex than traditional models but can just as easily be translated to a simple formula in order to calculate patients' risk in practice. LASSO is still based on regression and the coefficients retrieved from the model can be transformed to a screening algorithm.

Self-report
In many of the studies presented in this thesis self-report was used. This is the most suitable and conventional method when investigating peoples' personal beliefs, attitudes, perspectives and experiences. Examples of this are the attitudes towards deprescribing explored in chapter 6, the treatment satisfaction in chapter 8 and the satisfaction with the intervention in chapter 9. There are several limitations when using self-report. There is a risk of getting socially desirable answers. In the studies presented, this risk was reduced by using open and non-judgemental wordings in the topic lists and questionnaires. Socially desirable answers are not a concern when using a test to evaluate knowledge about a certain topic such as the Diabetes Knowledge Test used in chapter 8. Other aspects than the level of diabetes knowledge, however, can affect a patient's test results, such as language skills and experience in taking multiple choice tests. Self-report may also be limited when it is used to investigate phenomena for which objective criteria are relevant. One example is the measurement of hypoglycaemic events, as presented in chapters 4 and 8. As discussed in these chapters, patients with T2D may not always realize that they experienced a hypoglycaemic event, leading to an underestimation of such events. They may not know which symptoms are associated with hypoglycaemia, they may not be able to recognize the symptoms, events during sleep can stay unrecognised, only severe events can be considered as "real" events by patients and patients might not know when low glucose levels can be considered a hypoglycaemic event. To paraphrase a participant from chapter 4: "I never experienced a hypo, I did however measure a glucose level of 2.2 once". Methods like daily dairies or continuous glucose measurements can improve the accuracy but these can only be used prospectively and come with other limitations.

Measuring the impact of deprescribing interventions
When investigating the impact of deprescribing two different research approaches should be distinguished. The first research approach investigates the clinical effects of stopping a specific medication or group of medications in a specific population, preferably in an RCT. In such RCTs medication is stopped for all
intervention patients. A second research approach uses methods from health services research to investigate the impact of interventions aimed at supporting deprescribing in daily practice. For the intervention described in Chapters 8 and 9, the primary outcome was the proportion of patients for whom medication was deprescribed. This study was not designed and not suitable to evaluate the clinical effects of deprescribing. Given the aim of the intervention, it is expected that not all participating patients will need to stop medication.

The success of this type of deprescribing interventions can be difficult to measure. The success of the intervention is dependent on many factors like the targeted population, the health care setting, the time investment needed and the medication targeted. This is further complicated by the fact that deprescribing is not always the correct action for every individual patient. Patients’ preferences should be taken into account and deprescribing might not always be desirable from a clinical standpoint even when very strict selection criteria are used. In the intervention described in Chapter 8 and 9 patients were not selected for being overtreated but rather for their risk of hypoglycaemia. Deprescribing is not suitable for all patients at risk of hypoglycaemia. For young patients or patients with poorly controlled glucose levels deprescribing is often not an option. In fact, for several patients from the intervention described in Chapter 8 and 9 medication needed to be intensified. To refine the outcome measure it could be helpful to assess which patients appear to be overtreated, comparing this before and after the intervention. For assessing the impact of medication reviews, overtreatment is part of the recommended core outcome set. A challenge is how best to define and assess overtreatment, using experts’ evaluation or explicit predefined criteria.

It has been proposed that patient-reported outcomes should be included when evaluating the effects of interventions like medication reviews. Important outcomes for patients include quality of life and pain relief. Changes in quality of life can be difficult to determine, partly because quality of life questionnaire are not very responsive for changes in some specific conditions. More specific patient-reported outcomes may be needed, and a focus on personal goals and health-related complaints seems useful. Measuring reduction in pain, fatigue, gastro-intestinal problems, dry mouth or dizziness may be relevant when focusing on deprescribing, since these are commonly experienced side effects from medication. Also, outcomes like changes in mobility, reduction in the number of drugs or practical problems with intake of medication can be relevant for patients.

When investigating the implementation of complex interventions a process evaluation is important, such as the one performed in Chapter 9. This can be essential for assessing the extent and quality of its implementation, help explain and provide context to the results of the intervention, establish which elements of the intervention worked well and which did not work, identify what can be improved and determine which barriers still remain.
Conclusion and future perspectives

This thesis focuses on three aspects of managing medication treatment through medication reviews in community pharmacies, that is 1) patient selection, 2) perspectives on DRPs and deprescribing, and 3) implementation of deprescribing cardiometabolic medication. Two different patient selection methods for medication reviews were developed and tested, one making use of information collected from patients and one using currently available data from community pharmacies. The first approach appears to have limitations, both regarding the predictive value and regarding the feasibility. Routinely receiving data from other HCPs and collecting more data from patients can improve this approach. Community pharmacies already have rich and high quality data about the medication use of patients. It was shown that these data can be used to detect patients with a risk of specific DRPs, such as hypoglycaemia. With the rapid rise of machine learning methods, a data driven approach using community pharmacy data seems promising to detect DRPs and to select patients in need of interventions. Screening for patients at potentially high risk is the first step but cannot replace clinical judgment. For one, patients are more complex than any data can capture, and secondly, patients have their own preferences, medication beliefs, perspective and goals in life. Patients can have strong beliefs about the appropriateness of their medication and these beliefs do not always align with the judgment of their HCP. Therefore, any intervention should include a patient consultation. Before a decision about changing or stopping medication can be made the patient’s perspective needs to be explored and clinical judgment of the HCP needs to be aligned with the beliefs and preferences of the patient. In general, HCPs regard deprescribing as an important part of medication management and patients are in general willing to stop medication when their HCP proposes to do so. In spite of this, proactive deprescribing is still uncommon in the primary care practice. Medication reviews specifically focused on deprescribing have the potential to change this. However, HCPs may need more training and support to stimulate proactive deprescribing. Other improvements can be made to the tailored and targeted pharmacy-led intervention based on the results from chapter 9. Distinguishing between older or frail patients eligible for deprescribing and younger patients whom may benefit from disease management education could improve efficiency. For stable well controlled patients, the HCPs did not always agree on the need for deprescribing. Multidisciplinary collaboration and agreements about when to deprescribe are needed to advance the implementation of deprescribing in primary care.
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References


