Together towards safer medication treatment for older persons

Malin Holmqvist
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Little by little, bit by bit, family by family, so much good can be done on so many levels

Elinor Ostrom
Abstract

**Background:** Medications contribute to and maintain health, but can unintentionally harm patients. Unsafe use of medications in healthcare is identified by the World Health Organisation as a global patient safety challenge. Older persons are more likely to be harmed by medications, and those harms tend to occur when prescribing or monitoring medications. Interventions to improve medication safety have not been sufficient and there is a need to rethink patient safety regarding medications. Patients co-producing their care may reduce the risk of adverse events and can be a resource to promote quality and safety in healthcare. Patients and healthcare professionals may help inform changes in healthcare and can be involved in the design of new services or products. Co-design is an approach that emphasises patient involvement in improvements of healthcare solutions. One co-design framework is the Double Diamond, which includes the four phases Discover, Define, Develop and Deliver.

**Aim:** To increase knowledge of how older persons and healthcare professionals can co-produce a solution for improved medication evaluation and thereby promote patient safety.

**Methods:** The Double Diamond framework guided this thesis, using both qualitative and quantitative methods to collect and analyse data. In the Discover phase, experiences of medication evaluations were collected. *Paper I* involved interviews with 20 older persons (age 75-91 years); data were analysed using qualitative inductive content analysis. *Paper II* used Critical Incident Technique, to gather and analyse data from interviews with 29 healthcare professionals in primary care. In the Define and Develop phases, *Papers III and IV*, a case study design was used to explore older persons', nurses' and physicians' design choices for a medication plan and their experiences of a remote co-design approach. The collected data were analysed with descriptive statistics along with directed content analysis (Paper III) and thematic analysis (Paper IV). The Deliver phase, *Paper V*, used a feasibility study approach to examine the feasibility of a medication plan intervention and used study methods. Data were analysed with descriptive statistics and inductive content analysis.
Findings: Paper I: Older persons experienced having a responsibility to engage in their medication evaluations even if some felt unable to do so or considered themselves unconcerned. Continuity of care and participation facilitated evaluations, but a comprehensive medication evaluation was missing. Paper II: Healthcare professionals experienced that medication evaluations for older persons were influenced by their working conditions and working in partnership. Actions taken to manage evaluations were carried out through working with a plan, and collaborative problem-solving. Paper III: A medication plan had to provide an added everyday value related to safety, effort and engagement. It needed to support communication, continuity and interaction, and important requirements were to provide instant access, automation and attention, with detailed information about the medication treatment. Having the plan linked to the medication list was addressed more over time. Paper IV: A remote co-design approach allowed an accessible environment for the participants, who had a positive experience of participating. Sharing of daily practice created learning and resulted in the participants gaining awareness of possible risks and strategies that could contribute to safer medication treatment. Paper V: The feasibility of applying a medication plan, assessed as usability, varied according to the System Usability Scale, and the participants’ experiences of usability concerned a de-prioritised medication plan, functionalities, individualisation for relevance and resources. Of all prescribed medications, 59% had a documented plan. The participants’ perceptions of patient safety concerned awareness and information, patient involvement and challenges beyond the medication plan.

Conclusion: Healthcare services may benefit from adopting resilience principles to promote patient safety by involving older persons in the medication evaluation. Proper working conditions and co-production with older persons and other healthcare professionals enable such evaluations. A co-designed medication plan can facilitate evaluations if it is provided with adequate and adapted information, and is easy to access and overview for all involved parties. Co-designing patient safety solutions remotely is inclusive and facilitates learning between older persons and healthcare professionals. Implementing a medication plan in clinical practice is complex and requires continuous co-produced improvements of the intervention.
Bakgrund: Läkemedel är en vanlig behandlingsstrategi i vården som kan förebygga, behandla och lindra sjukdomar, och som kan bidra till att vi lever längre. Samtidigt kan läkemedel orsaka negativa läkemedelshändelser och Världsanorganisationen (WHO) lyfter Medication without harm (Läkemedel utan att skada) som den tredje största globala patientsäkerhetsutmaningen. Skador av läkemedel kan leda till sjukhusinläggning, ökat behov av sjukvårdsresurser och lägre patientnöjdhet. Äldre personer (i denna avhandling definierat som personer 75 år eller äldre) löper en större risk att skadas av läkemedel, eftersom de oftare har en multi-sjuklighet och får behandling med många läkemedel (kallat polyfarmaci). Tidigare forskning visar att skador av läkemedel i primärvård främst inträffar när läkemedel ordineras och/eller inte följs upp och utvärderas. För att förbättra patientsäkerheten i äldre personers läkemedelsbehandling verkar insatser som syftar till förbättrad uppföljning och utvärdering av läkemedel lovande.

Patienter som är delaktiga i sin egen vård kan minska risken för negativa händelser, eftersom de kan observera och kommunicera problem som de upplever innan problemen leder till skada. Tillsammans med hälso- och sjukvården skulle patienter kunna stödja resiliens, dvs ett systems förmåga att anpassa sig till utmaningar och förändringar för att upprätthålla god kvalitet. En samskapad utvärdering av läkemedel, dvs att patient och sjukvårdspersonal arbetar tillsammans, skulle kunna bidra till en ökad patientsäkerhet. Patienter kan också hjälpa till att utforma nya tjänster eller produkter, som kan förbättra hälso- och sjukvården. Samskapade lösningar kan öka patientsäkerheten, men det saknas fortfarande utvärderade arbetssätt för hur detta kan göras på bästa sätt. Eftersom äldre personer har en ökad risk att drabbas av negativa läkemedelshändelser, finns det framförallt behov av att identifiera sätt att involvera äldre personer i framtagande av samskapade lösningar. Ett ramverk för att samskapa en lösning tillsammans (kallat co-design) är Double Diamond från Design Council i Storbritannien. Ramverket består av fyra olika faser; Discover (Utforska), Define (Definiera), Develope (Utveckla), Deliver (Leverera) och har använts som ett stöd i arbetet med denna avhandling.
Syfte: Att öka kunskapen kring hur äldre personer och sjukvårdspersonal tillsammans kan skapa en lösning för förbättrad utvärdering av läkemedelsbehandling, och därmed främja patientsäkerheten.

De specifika målen var att:

- Utforska hur äldre personer som använder läkemedel upplever utvärderingen av deras läkemedel, samt hur läkare och sjuksköterskor i primärvård upplever utvärderingen av äldre personers läkemedel och hur de agerar för att hantera problem relaterat till utvärderingen (Artikel I-II)
- Definiera och utveckla en co-designad läkemedelsplan och utforska deltagarnas designval och erfarenheter av ett digitalt co-design arbete (Artikel III-IV)
- Leverera en läkemedelsplan för äldre personer i primärvård och undersöka genomförbarheten av interventionen och använda metoder (Artikel V).

Slutsats: Avhandlingen ökar kunskapen kring hur äldre personer och sjukvårdspersonal kan samskapa utvärdering av läkemedelsbehandling. En gemensamt utformad läkemedelsplan kan bidra till en mer resilient vård och därmed främja patientsäkerheten.

- Många äldre personer kan och vill vara aktivt involverade i utvärderingen av sin läkemedelsbehandling och kan utgöra en underanvänd resurs för att öka resiliens i sjukvårdsystemet. Deras förtroende för att läkare och sjukvården utvärderar deras läkemedel regelbundet behöver beaktas, liksom att vissa äldre känner sig oförmöga att medverka i utvärderingen av sina läkemedel.

- Bra arbetsförhållanden samt samverkan med den äldre personen och annan sjukvårdspersonal möjliggör en fungerande utvärdering av äldre personers läkemedelsbehandling. Genom att anpassa sitt arbete till de variationer som uppstår i vardagen kan läkare och sjuksköterskor i primärvård bidra till ökad resiliens och förbättrad utvärdering av läkemedel.

- En co-designad läkemedelsplan, kopplad till läkemedelslistan i den elektroniska patientjournalen, som innehåller detaljerad information om fortsatt läkemedelsbehandling kan stödja kommunikation, kontinuitet och interaktion. Informationen måste vara adekvat och anpassad för alla inblandade, samt lätt att komma åt och överblicka.

- Ett digitalt utfört co-design arbete inkluderar deltagarnas olika perspektiv och underlättar lärande genom att deltagarna delar erfarenheter. Tillvägagångssättet ökar möjligheten att utveckla lösningar som kan främja patientsäkerhet, men uppmärksamhet kring samverkan mellan de inblandade och på eventuella svårigheter i en digital miljö behövs.

- Att implementera och testa användningen av en läkemedelsplan i klinisk vardag är komplext. Det kräver kontinuerliga samskapade förbättringar av interventionen av användarna, samt en flexibel interventionsstrategi.
Original papers

This thesis is based on the following papers:

**Paper I**

**Paper II**

**Paper III**

**Paper IV**

**Paper V**
Holmqvist M, Thor J, Ros A, Johansson L. Applying a Co-designed Medication Plan for Safer Medication Treatment in Older Persons: A Feasibility Study. *In manuscript*
# Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADE</td>
<td>Adverse Drug Event</td>
</tr>
<tr>
<td>CIT</td>
<td>Critical Incident Technique</td>
</tr>
<tr>
<td>DRP</td>
<td>Drug-Related Problems</td>
</tr>
<tr>
<td>EHR</td>
<td>Electronic Health Record</td>
</tr>
<tr>
<td>ETTO</td>
<td>Efficiency-Thoroughness Trade-Off</td>
</tr>
<tr>
<td>NPO</td>
<td>National Patient Overview</td>
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<tr>
<td>SUS</td>
<td>System Usability Scale</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Preface

This thesis centres on patient safety in medication treatment, but it is essential to remember that medications are an important treatment method in healthcare, contributing to maintaining and enhancing health. However, medications may unintentionally harm patients, emphasising the need for healthcare to make every possible effort to prevent such occurrences. In 1995, I graduated as a pharmacist from Uppsala University and have a Master of Science in Clinical pharmacy. Throughout my years as a clinical pharmacist, I have encountered numerous older persons using medications, an experience that has been both inspiring and frustrating. Inspiring, as medications play a vital role in medical treatments, enabling people to live long lives. Frustrating, as older persons may suffer harm if medications are used improperly.

In the early 21st century, I was encouraged by my then manager to conduct research in patient safety. At that time, patient safety was a novel concept both in Sweden and internationally. Although patient safety interested me, research studies did not. So I continued my work within Region Jönköping County, engaging in activities like the “Global Trigger Tool” for measuring of adverse events, the “Esther initiative” to bridge gaps between care providers and the regional patient safety initiative “Safe care – every time”. Much pointed in a patient safety direction and in 2012 I completed a course in patient safety, which significantly expanded my understanding of patient safety but also made me humble about the complexity of healthcare. Between 2014 and 2015, Region Jönköping County participated in a quality improvement project, aiming for a better medication use process in municipality-based home healthcare. During that project, I had the privilege of participating in the follow-up research, and at the end of the project, I was invited to join Region Jönköping County’s patient safety research. This time I embraced the opportunity and applied for admission to a Licentiate degree program.

My ambition was to contribute to clinical research in health and care science, particularly focusing on patient safety among older persons using multiple medications. Influenced by my previous clinical experiences, I wanted to propose a model to promote patient safety, and subsequently implement and
evaluate it. However, I had to step back and approach the problem as a researcher, acknowledging the significance of the older person’s role in patient safety. During the research period, new research questions emerged, so I continued my studies towards a doctoral degree. To align with the healthcare region's ongoing efforts for patient safety, the studies were carried out in cooperation with the Drug and Therapeutic Committee and the local Patient Contract initiative within Region Jönköping County.

Throughout my studies, I have continued part-time work as a clinical pharmacist and for me, this was the best match between two worlds. My newfound research knowledge has helped me to observe clinical practice from new viewpoints. From a scientific perspective, there has been a need to reflect constantly on my dual roles as a PhD student and a clinical pharmacist, assessing how my pre-understanding of healthcare and medications may have influenced my research. The complexity of healthcare can indeed appear overwhelming, whether viewed from a researcher’s or healthcare professional’s perspective. Nevertheless, every effort taken to promote patient safety holds the promise of advancing safer medication treatments.
1. Introduction

Modern healthcare contributes to better treatment strategies, for instance with new medications, and possibilities to prevent, treat and relieve diseases. This is a welcome accomplishment in terms of better health, but brings growing challenges due to the complexity of healthcare. Today’s healthcare system, with its variety of patients, healthcare professionals and working conditions, makes it a high-risk organisation. A systematic review of patient safety in primary care showed a median of two to three incidents of harm for every 100 consultations, where diagnosis and prescribing of medications were the most common causes of harm (1). Unsafe medication practice is globally a leading cause of harm in healthcare. The World Health Organization (WHO) has identified “Medication without harm” as the third global patient safety challenge since harm by medications can cause increased morbidity, additional resource utilisation such as unplanned hospital admissions and even mortality (2). According to regulations, healthcare organisations in Sweden, like many other countries, must plan, manage and control activities to maintain good care (3). Interventions to reduce harm in primary care, such as medication reviews or assessment of appropriate medications, seem to decrease unplanned hospital admissions and polypharmacy but not mortality (4-7). In ambulatory settings, harm by medications among older persons is common, yet often preventable, and tends to occur when prescribing or monitoring (or not) medications (8, 9). To promote patient safety further, interventions directed towards improved monitoring, and subsequent evaluation of medications, seem promising.

Older persons play a significant role in the medication use process. Patients being involved in their own care may reduce the risk of adverse events and promote patient safety, probably because actively involved persons can observe and communicate problems they experience before they result in harm (10). Accordingly, if healthcare services allow and encourage patients to be involved, the patients may be a resource in supporting the quality and safety of healthcare (11). Involving patients to work with healthcare professionals on different levels in the healthcare system, to improve health can be called co-production (12, 13). When striving to improve healthcare,
users of healthcare may help to shape and inform changes in care, and be involved in the design of new services or products (14). There seem to be potential opportunities for improving the involvement of patients in (re-)design and improvement initiatives for patient safety (15), and specific needs to explore ways to involve older persons, on their terms, as they tend to be at a higher risk for adverse events. Co-design is an approach that emphasises patient involvement in improvements of healthcare services (16). Today, it is an established way in healthcare to involve users to make improvements feasible for everyone involved (17). However, co-design initiatives involving older persons are still novel but have so far addressed for example the development of electronic healthcare tools and improvements in healthcare services (18-20). Consequently, involving older persons in co-design to promote patient safety appears promising.

This thesis seeks to explore jointly informed approaches towards safer medication treatment for persons 75 years or older, where the older persons are invited to co-produce the evaluation of medications. Given that co-design has been used with good results in improvement efforts in healthcare services, the approach seems suitable to apply when trying to promote safer medication treatment in older persons.
2. Background

The research in this thesis was conducted within Swedish primary care, focusing on older persons using medications. The background section begins by describing and problematising this context. Older persons who use medications have a vital role as co-producers in healthcare and represent the only constant factor throughout the medication use process. Therefore, the background proceeds by describing co-production and co-design in healthcare. Towards the end of the background, the research field of patient safety is considered, with a brief description of concepts and current knowledge of patient safety.

2.1. Medications in an aged population

2.1.1. Definition of older persons

With an ageing population, both in Sweden and internationally (21), more people will live with multi-morbidity, that is the co-existence of two or more chronic conditions in the same individual, in the future (22, 23). A systematic review addressing the occurrence of multi-morbidity in persons 65 years or older found a prevalence ranging from 55 to 98% (24), indicating that older persons, from a healthcare perspective, are a heterogeneous group of people. While no universally accepted definition characterises older persons, one approach is to consider chronological age. Based on the following reasoning, the chronological age of 75 years or older is used to define older persons in this thesis. Built on analysis of existing, relevant data regarding older persons' physical status Orimo et al. in 2006 defined older persons as those aged over 75 years (25). With advancing age, biological changes affect the pharmacokinetics and pharmacodynamics of medications, such as reduced renal clearance and increased sensitivity to psychotropic medication (26). No specific age is considered as a cut-off based on pharmacokinetics and pharmacodynamics, but 75 years has been used in various Swedish recommendations on medications in older persons, such as the National Board of Health and Welfare in Sweden report “Indicators of good medication therapy in older people” (27).
However, age is a relatively imprecise way of describing an older person, and an additional way is to divide the later phases of life into the third and the fourth ages. The third age is characterised as an era of independence and self-realisation, and begins around retirement, whereas the fourth age is characterised by dependency, frailty, and death (28). This division of life phases has been used as a complement to chronological age in the discussion of the findings.

2.1.2. Healthcare in primary care

Primary care as a complex system

Healthcare in Sweden is organised into 21 healthcare regions, with approximately 80 hospitals and 1100 primary care centres that provide healthcare services to all citizens, and 290 municipalities that provide healthcare services to older and disabled persons in their homes (29). Primary care in Sweden is provided by both healthcare regions and municipalities (30). How healthcare services should be organised and conducted in Sweden is outlined by the Health and Medical Services Act (31). Persons who are unable to manage their healthcare independently can receive support from healthcare providers (29). In Sweden, home healthcare services are usually provided by nurses, or assistant nurses, employed by the municipality. Compared to other countries within the European Union, Sweden has a higher number of physicians and nurses per member of the population, but a lower number of general practitioners in primary care than the European Union average (32). In this thesis, physicians and nurses are sometimes collectively referred to as healthcare professionals.

Primary care is the cornerstone of effective healthcare delivery, determined by access, continuity of care, coordination of care and comprehensiveness of care (33). The Swedish primary care reform of 2018, “Good quality, local healthcare” (34), clarifies a person-centred way of working, that emphasises patient involvement and outlines primary care as the basis of healthcare. Being the basis of Swedish healthcare, intended to meet the needs of citizens of all ages, primary care needs to interact with specialised healthcare, social services and other stakeholders. Older persons with multi-morbidity may suffer from gaps in the service provision between different healthcare providers within the
healthcare system, and coordination, continuity and integration of care are central to making healthcare work out well for them (35). To strengthen collaboration between citizens and healthcare providers, some primary care centres in Sweden have appointed care coordinators, mainly trained nurses, to coordinate healthcare services for persons with substantial healthcare needs. Supporting older persons with multi-morbidity is complex and calls for interventions integrated into existing healthcare systems, as approaches that are not integrated may be difficult to sustain (36).

As the foundation of healthcare, primary care can be viewed as a well-connected component within a complex adaptive system, which means a dynamic system of components that constantly react to each other in nonlinear patterns, and where order emerges or self-organises rather than being predetermined (37, 38). When making improvement efforts or conducting research in primary healthcare the complexity has to be reckoned with, as it may be inappropriate to apply simplistic linear quality methods or measures to this context (39). To cope with complexity it is important to think beyond linear models to solve problems, and instead try to accept the unpredictable, respect autonomy and creativity, and respond flexibly to emerging opportunities (40).

Digitalisation of medical information
The majority of healthcare organisations in Sweden utilise electronic health records (EHRs) for documenting and communicating medical information. Access to medical information is regulated by the Patient Data Act (41). Each healthcare organisation has its own EHR but can, according to the Act on Coherent Health and Care Documentation (42), share data in the National Patient Overview (NPO) (43). This gives authorised healthcare professionals the possibility to access medical information, such as medical notes or a medication list, concerning a patient previously cared for elsewhere. Patients can access their medical information from EHRs digitally through a secure web interface, the Patient Portal 1177 (43). Giving patients access to their EHRs has the potential to contribute to person-centred care, (44), but having easily accessible and user-friendly EHRs is important, particularly for older persons.
In Sweden, electronic prescriptions are obligatory and visible to the patient and to authorised healthcare professionals through the Swedish National Medication List (45). For patients with multiple-dose drug dispensing support, prescriptions are managed in a web-based service available for authorised healthcare professionals (43). Patients can receive a printed copy of their list of prescriptions from the pharmacy.

2.1.3. The medication use process for older persons

Defining the medication use process

After a first decision on the need for medication treatment, the medication use process starts and includes several stages (46, 47), here outlined as prescribe, dispense, administer, monitor and evaluate, and illustrated in Figure 1.

![Figure 1. A description of the medication use process from a healthcare perspective based on descriptions by Kitson (47) and Stowasser (46).]
In Swedish healthcare, older persons mainly get medications prescribed by physicians, generally trained as general practitioners or under training to become licensed physicians or specialists, employed at a primary care centre (29). Regulations in Sweden direct prescribers to document the purpose of prescribed medication and the plan of continued treatment in the health record (48), but compliance with the regulations may vary. After a medication is prescribed, the prescription is dispensed at a pharmacy. Medications are then administered by the older persons, or by someone supporting them with their medications.

Monitoring and evaluating medications are central in the medication use process, as these stages influence the decision on continued (or stopped) treatment (46, 47, 49). Monitoring involves history-taking for symptoms and performing physical examinations and/or laboratory tests (46, 49) and informs the evaluation. Evaluation is here defined as an assessment of performance against an established set of goals or objectives at a point in time (46, 50), and is used to decide whether to continue or stop the medication. As medical conditions may change over time, the medication use process is cyclic, meaning there is a continuous evaluation of whether to stop or continue a medication.

When addressing the medication use process, medication reviews are often mentioned. A medication review is a structured evaluation of a patient's medications to optimise medication use and improve health outcomes (51), and entails detecting drug-related problems (DRP) and recommending interventions. A DRP is defined by the Pharmaceutical Care Network Europe as an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes (52).

Use of medications in older persons

Multi-morbidity may lead to the use of multiple medications, as one or more medications can be used to treat each condition. Using multiple medications is often called polypharmacy. There is no consensus definition for polypharmacy (53), but the most used numerical definition is five or more medications daily. In 2013 almost half of persons 75 years or older in Sweden were prescribed five or more medications (54). The prevalence of polypharmacy in other European countries is not well described in the
literature, but a study from primary care in Scotland reports that 51.8 % of persons aged ≥80 years received four to nine medications and 18.6 % ten or more (55). Studies have suggested a shift towards assessing the appropriateness of a medication instead of the actual number and accordingly, the term inappropriate polypharmacy is more relevant to use (53).

Self-management of medications at home, defined as the extent to which a patient takes medication as prescribed, including not only the correct dose, frequency and spacing but also its continued, safe use over time (56), requires a range of knowledge, skills and behaviours. There is a relationship between self-management of medications and health literacy (56). Health literacy can be defined as the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions (57). It covers knowledge of health, processing and using information, and the ability to maintain health by self-management and working in partnership with healthcare providers (58). Accordingly, health literacy can be important to consider in the context of safe medication treatment in older persons, as lower health literacy is associated with a reduced understanding of when to seek medical attention or how to properly follow medication instructions (59).

Medication use in older persons can be seen as a complex intervention where the older person manages medications by themselves or with support from next-of-kin, and interacts with different healthcare professionals (60). In this thesis, next-of-kin is used to refer to a family member, close relative or friend, and is defined as one or more living persons in the nearest degree of relationship to a particular individual (61, 62). Next-of-kin can be involved in activities like preparing “pill boxes” and assisting with medication administration at home (63), but they may also be involved in more complex activities, such as gathering medical information or making treatment decisions. If a person is considered unable to manage their medications by themselves or with support from next-of-kin, which is known as self-care, they should according to Swedish regulations receive assistance from home healthcare services (64).
2.1.4. *Harm caused by medications*

Prevalence and outcome of harm by medications

Measuring and monitoring safety in healthcare is difficult, as mistakes and injuries tend to occur often but in various ways (65, 66). Patient safety measurements in primary care are novel (67), but the medication use process tends to be the area where most measures take place. Unplanned admission or re-admission to hospitals due to DRP are on average between 15% and 21% (68-70), and higher age and polypharmacy are factors contributing to hospital admissions (70). Polypharmacy is associated with negative consequences such as adverse drug events (ADEs), morbidity and increased healthcare costs (71, 72), where ADE is understood as an injury resulting from medical intervention related to a medication (73). For primary care, a review of 43 studies including diverse populations of all ages residing in industrialised countries reported that the median percentage of patients experiencing ADEs in ambulatory-based care was approximately 16.5% (74). The prevalence varied between different age groups, with a higher prevalence in the older population. In a newer review of medication safety in primary care the rate of ADE varied between 7.4% and 9.4% for high-risk patients (patients ≥ age 60 with polypharmacy) (75). About one in 30 patients is exposed to preventable medication harm, with a higher rate in the older population (9), and most medication-related harms tend to occur in the prescribing and monitoring stages of the medication use process (8, 9). In addition to harm affecting the individual negatively, studies show a negative economic impact, especially in the older population (4, 76-78).

Preventing harm from medications

So far, various interventions such as medication reviews in multi-disciplinary teams, de-prescribing efforts, education for healthcare professionals, assessments of appropriate medications and support systems to healthcare professionals in EHRs, have been applied in efforts to reduce or prevent medication-related harm in primary care. Many of these interventions appear promising in terms of their ability to reduce unplanned hospital admissions or re-admissions, visits to the emergency department or inappropriate polypharmacy (4-7, 79), but no conclusion can be drawn regarding the end-point outcome of mortality.
As medication-related harms tend to occur in the prescribing and monitoring stages of the medication use process (8, 9), interventions specifically addressing these stages seem promising. A post-hoc analysis following an intervention involving medication reviews in a hospital setting identified insufficient follow-up of medications as one of three primary causes for preventable revisits (80). Furthermore, in international guidelines monitoring, follow-up and updated treatment plans have been addressed as important for safe clinical management of older persons with multi-morbidity (81). In a similar spirit, Sweden has a national initiative called the “Patient Contract” (82), which is an agreement regarding the patient’s planned healthcare, created collaboratively with the patient and documented in the health record. The intention is to strengthen the patient’s role in healthcare and support continuity of care. The Patient Contract includes an agreement on treatment goals, planned activities and coordination of care, but so far, medication treatment is not addressed specifically.

2.2. Creating healthcare together

2.2.1. Co-production of healthcare

National regulations and policies in Sweden, as in many other countries, strengthen and clarify the patients’ position and promote their participation in healthcare (83, 84). During the past decade, there has been a growing interest in involving patients in their care but also in the development of healthcare services more generally (85). Traditionally, patient involvement focused on engaging patients in healthcare decisions or efforts supporting the management of their care, but has continued to evolve to also incorporate patients’ experiences in improving or re-designing healthcare services or products (86). Different terms and concepts for this, including patient participation, patient involvement, patient engagement and person-centred care are used interchangeably (87).

Co-production is another term used to define and conceptualise the complex approach of having patients and healthcare professionals working together on different levels to improve health (12, 13). Co-production builds on service design, first described by Elinor Ostrom as a social phenomenon (88),
meaning that successful delivery of services builds on organisations' understanding of their users’ needs and of the importance of engaging them in the design and delivery of services. Co-production has profound implications for improving healthcare quality, safety and value, as it is self-evident that health outcomes are a consequence of both patients’ and healthcare professionals’ capacity and behaviours (12, 13, 89, 90). Over the years, the concept of co-production has been defined and applied in healthcare in different ways (17, 91). In this thesis the definition by Batalden is used, meaning that co-production in healthcare is the interdependent work of users and professionals to design, create, develop, deliver, assess, and improve the relationships and actions that contribute to the health of individuals and populations (13). This means that patients and healthcare services can co-produce health and healthcare on the micro level, in an encounter between the patient and a healthcare professional, but also on the meso level (for example between a healthcare provider and its patient council) or the macro level (for example between government and patient organisations) (92, 93). On the micro level, many older persons want to participate and be involved in their care, but the population is highly heterogeneous and not all have the desire or ability to do so, which calls for individual approaches (94, 95). Co-production seems to hold the most promise in healthcare where complexity occurs, such as the medication use process for older persons, as the approach aims to generate personalised solutions that minimise the burden of illness and treatment (85).

2.2.2. Co-design in healthcare

Defining co-design

Co-production can contribute to the health of individuals and populations, by interdependent work of users and professionals in different ways, where one is by design (12, 13). Co-design is an approach related to co-production (96) that emphasises patient involvement in improvement efforts in healthcare services (16). It combines design and user experience and enables participants to share experiences, where each participant’s experience is considered their expertise (97). Co-design originates from participatory design and is a powerful, yet challenging activity, as both patients and healthcare professionals need to negotiate their roles and balance power among
themselves (98). Complex services like healthcare can benefit from learning from design thinking when trying to optimise or improve services or products (99). Co-design has proved to be a useful approach to apply in healthcare when designing or re-designing services or products to improve their quality and perceived value (96), and to promote successful high-level patient engagement (100, 101). Applying a co-design approach seems to result in a culture change within organisations that leads to meaningful collaboration and mutual learning as well as shared or neutralised power (100). The approach may increase the acceptability and integration of interventions in daily practice, as users can identify problems already in the development phase of a new or changed solution (12).

As with co-production, there are different definitions for co-design (17), and one that is often referred to is Sanders and Stappers’ definition which refers to the creativity of designers and people not trained in design working together in the design development process (16). Even so, in this thesis when co-designing a solution collaboratively, the definition of Vargas is used instead, meaning that co-design is an active collaboration between stakeholders in designing solutions to a pre-specified problem (102). A range of methods or frameworks for co-design exist, all aiming to facilitate collaboration between people who are not trained in design thinking (17, 103), and one such framework is the Double Diamond (104).

**The Double Diamond framework**

The Double Diamond is a clear, comprehensive and visual description of a design and innovation process from the Design Council in England (104). The framework consists of four phases: Discover, Define, Develop and Deliver, Figure 2.
In the Discover phase, the users’ experiences of the problem are mapped to understand what the problem is. This often involves speaking to people who are affected by the upcoming innovation. Their insights are synthesised and used in the next phase, Define, where insights are used to clearly define the challenge and needs of the innovation in different ways. The result from the second phase is then used in the Develop phase, in which users are encouraged to explore potential solutions. Finally, in the Deliver phase solutions are tested and improved at a small scale before being incorporated into clinical practice (105). In 2021, the Design Council launched an updated version of the Double Diamond (106) where the different phases were re-named. Even so, the original framework was used in the included papers in this thesis and is therefore the one referred to here.

Co-design with older persons

So far, most co-design initiatives involving older persons have been applied for improvements of specific healthcare services (20, 107) or the development of different electronic healthcare tools (18, 19, 108). Evaluations regarding the effects on health and well-being of co-design with older persons are rarely studied and the co-design processes tend to vary in their intensity of involvement (109). Accordingly is it difficult to determine its impact, but building a relationship between users and expertise in the co-design
methodology is considered important to facilitate co-design with older persons (109). Co-design initiatives for patient safety solutions in primary care are scarce but have for instance been used for designing a patient safety guide (110), and designing supportive interventions for patients with multi-morbidity (107).

2.3. Patient safety

2.3.1. Patient safety as an area of knowledge

Defining patient safety

Safety is one of six dimensions, identified by the Institute of Medicine, US, as critical for healthcare services to consider to achieve high-quality care and to meet patient needs (111). There is no clear division between safety and quality in healthcare but safety can be seen as an attribute of quality, meaning that a positive healthcare outcome is dependent on the presence of safety (112). The knowledge area of patient safety is fairly novel. Concentrated efforts to reduce treatment-caused injuries in healthcare, known as the patient safety movement, began just before the 21st century, initiated in part by the paper “Error in medicine” (113) and the report “To err is human” (114). Today, patient safety is both an attribute of healthcare that strives to achieve a trustworthy healthcare system, and a research field that applies safety science methods to healthcare (115). Patient safety can be seen as organised activities that create processes, environments, cultures and behaviours in healthcare that lower risks, reduce avoidable harm, make errors less likely, and reduce the impact of harm when it does occur (116). Patient safety is understood in this thesis as the avoidance, prevention and amelioration of adverse outcomes or injuries stemming from the process of healthcare (117). A range of models and concepts, based on theories from different knowledge areas are potentially relevant when trying to understand, change and predict the effects of patient safety interventions intended to reduce the risk of harm (118, 119). Different strategies, linked to interventions, have been outlined and are applicable across all levels of the healthcare system. These strategies aim to optimise care, manage risks and avoid harm.
Resilient healthcare

Since the recognition that patient safety is a knowledge area of its own, the understanding of it has continued to develop. An important contributory factor in the development has been the perspective of healthcare as a complex adaptive system (120, 121), in the sense that multiple components interact so that the system is constantly changing, causing emergent unexpected situations. With this perspective, patient harm is seldom due to a single cause, and many things go right just because people within the system adapt to match the prevailing situation and thereby maintain reliability and safety (122).

A system's ability to adapt to unstable environments is called resilience, a concept that originates from resilience engineering, a paradigm for safety management in socio-technical systems (112, 123). Resilience engineering addresses a system’s capacity to cope with complexity and variability and the concept is applied in healthcare as Resilient Health Care (124, 125). Hollnagel defines a resilient system as one that can adjust its functioning prior to, during, or following events (changes, disturbances, and opportunities), and thereby sustain required operations under both expected and unexpected conditions (122). Various definitions exist, but in this thesis healthcare resilience is understood as the healthcare system’s capacity to adapt to challenges and changes at different system levels, to maintain high-quality care (126). Resilient performance relies on four abilities: to respond, to monitor, to anticipate, and to learn in order to maintain a desired level of performance (112, 127). The ability to respond is about knowing what to do and to adjust when something regular or irregular happens. The ability to monitor is to know what to look for and to be able to understand if something unexpected happens. The ability to anticipate is about knowing what to expect in a situation and being prepared for new challenges and opportunities. The last ability, to learn, is about knowing what has happened and being able to learn from experiences.

2.3.2. Co-production of safety

Even if patient safety originated in hospital settings, most healthcare today occurs in ambulatory care. In the primary care context, medications, diagnosis and transitions are important safety issues, and strategies that address these tend to require patient involvement, coordination between teams, and a safety
culture of looking beyond the direct patient encounter (128). Already in 2002, Vincent and Coulter (129) argued that greater involvement of patients could promote patient safety, and in 2016 WHO summarised that patient engagement is one of the key strategies for improving patient safety in primary care (130). The Swedish national agenda “Act for safer care 2020-24” (131), highlights patients as co-creators as one of four basic conditions for safe care. A summary from 2010 about patient participation to promote patient safety observed promising results to decrease medical errors and to increase healthcare professionals’ adherence to optimal practice (10). Persons invited to participate in initiatives aiming at improved patient safety are generally willing to do so (132, 133), but one barrier to participation is health status, which is often age-related (133). So far, the main approach to involving patients in patient safety initiatives is to make them more aware of risks and to be comfortable with giving feedback about safety concerns, rather than having them participate in improvement initiatives (134). Still, there is insufficient knowledge about the implementation of co-production of safety, as well as evaluations of the effectiveness and added benefits of doing so (135, 136). Strategies to overcome barriers to patients' willingness to engage, as well as strategies to actively engage patients in patient safety efforts, need further research (135-137).

New ways to involve patients in safety improvements are called for, especially vulnerable patients who tend to be at the highest risk for adverse events (15). Patients may, due to their movement within the healthcare system and between different healthcare providers, support resilience by managing unpredictable circumstances and variability in care delivery in a positive direction (11, 138). Involved patients tend to develop strategies to reduce the risk of harm by medications and may thereby contribute to enhanced resilience interventions (139, 140). So far, interventions to promote safer self-management of medications for older persons have mainly focused on the ability to adhere to medication regimes or increase their knowledge of medications (141), but inviting them to monitor treatment and respond to problems might additionally contribute to increased resilience.
3. Rationale

Despite considerable efforts to promote patient safety in the context of older persons’ medication use, harm by medications remains a significant concern, both in Sweden and globally. Various interventions to make medication treatment for older persons safer have been studied, yet no single intervention has yielded entirely satisfactory results in terms of patient safety outcomes. Active prompting to monitor and evaluate medications in a more structured way appears promising, as harms tend to occur at these stages.

International guidelines addressing multi-morbidity and/or polypharmacy in older persons highlight the value of a joint plan to support medication treatment. Sweden’s primary care reform emphasises patient involvement through a shared agreement and a forward-looking coherent plan to promote safety. A co-produced plan for medications may allow older persons, their next-of-kin and healthcare professionals to better navigate and adapt during continued medication treatment, thereby facilitating resilient performance.

Research exploring the experiences of older persons and healthcare professionals regarding medication evaluation may generate additional knowledge that is helpful when designing and evaluating interventions intended to promote patient safety. Furthermore, research concerning the impact of active collaboration among older persons and healthcare professionals in co-designing solutions that promote patient safety is limited, but such research could contribute to increased knowledge about involving older persons in patient safety initiatives.

Consequently, there is a need for research that addresses medication evaluation for older persons and explores how an intervention to promote patient safety can be co-produced.
4. Aim

The overall aim of this thesis was to increase knowledge of how older persons and healthcare professionals can co-produce a solution for improved medication evaluation and thereby promote patient safety.

The specific objectives were to:

- **Discover** how older persons using medications experience the evaluation of their medications, and how physicians and nurses in primary care experience the evaluation of older persons’ medications and how they act to manage concerns related to the evaluations (Papers I and II)

- **Define** and **develop** a co-designed medication plan and explore the participants’ design choices for the plan and experiences of a remote co-design approach (Papers III and IV)

- **Deliver** a medication plan for older persons in a primary care context, and examine the feasibility of the intervention and used study methods (Paper V).
5. Methods

5.1. Study design

The choice of study design for each paper was based on the overall aim and the more specific objectives (142). The study designs are presented in Table 1.

Table 1. Summary of included papers, described with study design, participants, data collection and data analysis.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Design</th>
<th>Participants</th>
<th>Data collection</th>
<th>Data analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Explorative Qualitative Study</td>
<td>Older persons</td>
<td>Individual interviews</td>
<td>Inductive content analysis</td>
</tr>
<tr>
<td>II</td>
<td>Explorative Qualitative Study</td>
<td>Nurses, physicians</td>
<td>Individual interviews</td>
<td>Critical Incident Technique</td>
</tr>
<tr>
<td>III</td>
<td>Case Study</td>
<td>Older persons, nurses, physicians</td>
<td>Workshop-recording Questionnaires Individual interviews</td>
<td>Directed content analysis Descriptive statistics</td>
</tr>
<tr>
<td>IV</td>
<td>Case Study</td>
<td>Older persons, nurses, physicians</td>
<td>Workshop-recording Questionnaires Individual interviews</td>
<td>Thematic analysis Descriptive statistics</td>
</tr>
<tr>
<td>V</td>
<td>Feasibility Study</td>
<td>Older persons, next-of-kin, physicians</td>
<td>Questionnaires Interviews EHR data</td>
<td>Inductive content analysis Descriptive statistics</td>
</tr>
</tbody>
</table>
Moreover, the four phases of the Double Diamond framework (104) were used to support the study design structure, Figure 3.

![Figure 3. The Double Diamond illustrated with the five included papers.](image)

The research process started by Discovering the experiences of evaluations of medications for older persons from a user perspective, by gathering insights from older persons (Paper I) and healthcare professionals in primary care (Paper II). An explorative qualitative study design was used; this is valuable at the beginning of a research process to explore and understand a problem (142).

Thereafter a medication plan prototype was Defined and Developed, using a case study approach (143) to study older persons’ and healthcare professionals’ design choices for the medication plan (Paper III) and their experiences of a remote co-design approach (Paper IV). A case study design is useful when exploring efforts for improvement in complex systems, as the design has the potential to capture the dynamic interaction between context and implementation and explain why efforts succeed or not (144, 145).
Finally, a medication plan was delivered in a primary care context, and the feasibility of the intervention and used study methods was examined in a feasibility study (Paper V). Before evaluating a complex intervention, a feasibility study can give a diversity of perspectives on the process and support decisions about subsequent evaluation and implementation (146). The approach is useful to develop an intervention and potential outcomes, before evaluating the intervention on a larger scale (147).

5.2. Participants

5.2.1. Participants in the Discover phase

In Paper I, persons 75 years or older with at least one chronic disease and who were being treated with medication(s) regularly were recruited by healthcare staff at five primary care centres. Cognitive impairment, defined as a documented diagnosis of dementia, and not being able to understand or speak Swedish were exclusion criteria. Purposeful sampling based on different numbers of diagnoses and medications, sex and age was used. Participants were recruited until no new information emerged in the interviews, suggesting a sufficient amount of data.

In Paper II, physicians and care coordinator nurses were recruited through a general invitation by e-mail sent to all physicians and care coordinator nurses at 34 primary care centres. The area manager in one municipality recruited nurses working in home healthcare. Among 41 interested individuals, one of the researchers included participants to achieve variation in terms of profession, gender and geographic area. The recruiting process proceeded until a sufficient number of critical incidents were identified, aiming for more than 100 in total (148, 149).

5.2.2. Participants in the Define and Develop phases

In Papers III and IV, persons within the local Patient Contract initiative in one healthcare region recruited participants through existing contacts. A group with an equal number of persons 75 years or older with lived experience of taking long-term medications, next-of-kin, physicians in primary care, and
nurses in municipality-based home healthcare were sought to achieve a variety of perspectives and experiences. Access to and confidence in using the Internet, adequate communication capability in Swedish and the possibility to participate in the entire co-design initiative were inclusion criteria. No next-of-kin was identified during the inclusion process, but one of the older persons reported having experience of being a next-of-kin.

5.2.3. Participants in the Deliver phase

In Paper V, physicians were recruited through a general invitation sent to the managers of 42 primary care centres. The intention was to include 10 physicians, who would apply a medication plan for five patients each, resulting in 60 participants. After starting the inclusion, due to a high workload at the primary care centres and difficulty in recruiting physicians, the number of physicians was reduced. Subsequently, the total number of participants was reduced, but it was still in line with Lancaster’s recommendation for pilot studies, aiming for 30 participants (150). Persons 75 years or older, using five or more medications and with the ability to understand and communicate in Swedish, and who had a scheduled appointment with one of the participating physicians, were recruited by healthcare staff at each primary care centre. Cognitive impairment, defined as a documented diagnosis of dementia, and late palliative phase, defined as estimated life expectancy shorter than six months, were exclusion criteria. If they met the inclusion criteria, the older persons received brief information about the study from the healthcare staff and were asked if one of the researchers could provide them with further information. When the older persons agreed to participate, they were also asked if someone, next-of-kin or a nurse in primary care, supported them with their medications. If so, each older person was asked for permission to invite these persons to participate in the study, and if permission was granted these persons were invited by one of the researchers.

5.2.4. Demographic characteristics of participants

The number of participants and the demographic characteristics of the participants in each paper are presented in Table 2. Altogether, 91 individual persons participated: 46 persons 75 years and older, two next-of-kin, 22 nurses and 21 physicians. One physician participated twice (in Papers I and V).
Table 2. Participants in included studies, numbers and demographic characteristics.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Number</th>
<th>Demographic characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>N=20</td>
<td>Older persons; gender (female/male) = 9/11, age 75-91 years, number of medications 6-26 (incl. “as needed”), managed medications with support from next-of-kin n=3</td>
</tr>
</tbody>
</table>
| II    | N=29   | Nurses in the municipality: number (female/ male) = 7 (6/1), working as a registered nurse for 3-28 years  
Nurses at primary care centres: number (female/ male) = 9 (9/0), working as a registered nurse for 12-40 years  
Physicians: number (female/ male) = 13 (5/8), working as a registered physician for 9-48 years |
| III-IV| N=14   | Older persons: number (female/male) = 5 (3/2), age 72-82 years, number of medications 3-8 (incl. “as needed”)  
Nurses in the municipality: number (female/male) = 6 (6/0), working as a registered nurse for 4-35 years  
Physicians: number (female/male) = 3 (1/2), working as a registered physician for 5-39 years |
| V     | N=29   | Older persons: number (female/male) = 21 (11/10), age 76-97 years, number of mediations when included 5-24 (incl. “as needed”), managed medications with support from next-of-kin n=4  
Next-of-kin: number (female/male) =2 (2/0), age 74-88 years  
Physicians: number (female/male) = 6 (4/2), working as a registered physician for 10-32 years |
5.3. Settings

The studies were conducted in primary care in one healthcare system in southern Sweden, serving a population of 369,000 residents, where about 11% are 75 years or older (151). During the study period, there were approximately 40 primary care centres, both public and private, within the healthcare region (152) and 13 municipalities providing home healthcare.

5.3.1. Setting in the Discover phase

The interviews in Paper I were performed face-to-face, on one occasion and by the same interviewer (MH). The participants were invited to choose the time and day for the interview and whether they wanted to be interviewed at home or at a primary care centre. Sixteen out of 20 chose at home.

In Paper II, the interviews were also performed face-to-face, on one occasion and by the same interviewer (MH). The interviews took place at each of the participants’ workplaces and the participants were invited to choose the time and day for their interview.

5.3.2. Setting in the Define and Develop phases

The Define and Develop phases in the Double Diamond framework (104) informed the remote co-design initiative described in Papers III and IV. The initiative was part of the healthcare region’s local work for introducing Patient Contracts. The aim was to create a medication plan prototype, a model of a proposed solution, incorporated into the healthcare region’s EHR. The initiative, performed over two months, included three sessions; two digital workshops via Zoom, a web-supported videoconference system, and one digital survey, Figure 4.
Two facilitators (MH and a quality improvement leader) guided the participants through the workshops, supported by two additional persons providing technical support and encouraging collaboration. The workshops, lasting for two hours each, were guided by a minute-by-minute timetable. A digital notice board (Padlet Web platform) was used to capture the participants’ discussions during the workshops, and Zoom Polls, that is questions asked in Zoom, were used to narrow down the discussions and prioritise needs, requirements and final specifications for the medication plan.

In the **Define phase**, including the first workshop, participants were invited to analyse the findings from the Discover phase (Papers I and II), where insights about medication evaluations were gathered from older persons, nurses, and physicians, along with information from other research studies and regulations related to the initiative topic. The participants were asked to synthesise their analysis into needs for the medication plan, and then to identify functional and content requirements for a medication plan. Brainstorming was used to gather ideas and build a shared understanding of the orientation of the group. After the workshop, one facilitator (MH) formed a design brief and presented it to eHealth designers in the healthcare region, who used the design brief to inform two medication plan drafts.
The **Develop phase** included the second workshop and the survey. In the second workshop, the drafts were presented to the participants, who were then invited to develop the drafts further into one prototype, by designing components in detail and iteratively refining the drafts. Experience Prototyping (105), a way to test and refine a solution in interactive feedback loops, with made-up fictitious patient cases, was used to enable participants to gain a first-hand understanding of the drafts and provide feedback. After the second workshop, one facilitator (MH) gathered data and presented it to the eHealth designers, further informing their design of the medication plan prototype. The resulting prototype was sent out to the participants, along with the digital survey to collect final feedback on the prototype and the co-design initiative in a final feedback loop.

### 5.3.3. Setting in the Deliver phase

The Deliver phase in the Double Diamond framework informed an intervention described in Paper V, where the co-designed medication plan prototype was tested in clinical practice. The intervention consisted of a scheduled appointment at the primary care centre, where the physician and older person discussed prescribed medications, and jointly agreed on a plan for continued treatment. Before the appointments, each physician received a written guide for documentation of the medication plan in the existing EHR and was enabled to ask for additional verbal guidance about the approach. The physicians were asked to document the medication plan during the scheduled appointment and to update and re-distribute the medication plan to involved persons if medications were changed during the study period. The older persons were informed that a medication plan was to be agreed upon during the appointment. At the appointment, information about medications, treatment indications, treatment aims, the next step in treatment, what to monitor and when, and who was responsible for what regarding the medications would be documented in the medication plan prototype within the older person’s EHR. The older person would receive a printed copy of the plan and if next-of-kin and/ or municipality-based home healthcare supported the older person with their medications they would have the possibility to receive the medication plan as well. The estimated extra time to set up the medication plan during the appointment was ten minutes. Not all needs and requirements
specified in the co-design initiative (Paper III) were provided in the medication plan prototype. In the design field, this is referred to as low-fidelity prototyping, meaning that a prototype only includes basic elements to test an idea (153). One specific requirement not provided was the ability for older persons and persons supporting them with medications to access the medication plan digitally.

5.4. Data collection

For all studies, demographic characteristics for the participants were collected (Table 2) by asking the participants, but for Papers I and V, data were also collected from EHRs.

5.4.1. Data collection for the Discover phase

In Paper I, a semi-structured interview guide was developed based on knowledge of patient safety within the research group and guided by the medication use process (46, 47), to cover different aspects of medication evaluations, Appendix 1. The interview guide was pilot-tested, which yielded minor clarifying adjustments. The interviews were audio-recorded, transcribed verbatim and lasted between 28 and 65 (median 47) minutes.

In Paper II, the interview guide adhered to instructions for Critical Incident Technique (CIT) (148, 154), Appendix 2. During the interviews, critical incidents, understood as a retrospective situation with a beginning and an end, and with a clearly positive or negative consequence regarding a real and defined phenomenon were gathered (148). The phenomenon in these interviews was medication evaluation in older persons. The interview guide was pilot-tested, which yielded minor clarifying adjustments. The interviews were audio-recorded, transcribed verbatim and lasted between 16 and 36 (median 29) minutes.
5.4.2. Data collection for the Define and Develop phases

Following the case study approach (143), both qualitative and quantitative data were collected in Papers III and IV.

The two workshops were audio-recorded, and the recordings were transcribed verbatim and marked with time stamps. Notes on the digital notice board and the participants’ responses on 20 Zoom Polls, addressing their experiences of the workshops and their discussions about the medication plan, were downloaded after each workshop. In addition, the design brief, drafts and prototype produced during the co-design initiative were collected as case study data.

The survey, Appendix 3, created in a web-based survey tool (esMaker NX3), was sent out to all participants to collect feedback and reflections related to the medication plan prototype and the co-design initiative. It consisted of yes/no questions with space to add free-text comments, questions with response options on a 10-grade Likert scale and additional free-text questions. The participants had two weeks to respond and received two reminders, the first after one week and the second on the last day for completion.

At the end of the initiative, all participants were invited to participate in one individual remote interview in Zoom, performed by the same interviewer (MH). Seven participants; one physician, four older persons and two nurses, accepted the invitation. The semi-structured interview guide was developed by the research group based on the results of the survey and included questions about the medication plan prototype and the co-design initiative, Appendix 4. The interviews were audio-recorded and transcribed verbatim and lasted between 21 and 45 (median 29) minutes.
5.4.3. **Data collection for the Deliver phase**

The feasibility of the intervention and the used study methods was examined by several outcome measures, Table 3.

*Table 3. Outcome measures and data collection of feasibility.*

<table>
<thead>
<tr>
<th>Domain</th>
<th>Outcome</th>
<th>Data collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility of intervention</td>
<td>Acceptability</td>
<td>Usability (System Usability Scale)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Usability (interviews with semi-structured questions)</td>
</tr>
<tr>
<td></td>
<td>Fidelity</td>
<td>Number of medications with added information (EHR* review)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of older persons reporting having received a medication plan (question in the questionnaire)</td>
</tr>
<tr>
<td>Feasibility of methods</td>
<td>Recruitment</td>
<td>Percentage of eligible participants that enrolled in the study</td>
</tr>
<tr>
<td></td>
<td>Retention</td>
<td>Percentage of enrolled older persons who completed the intervention</td>
</tr>
<tr>
<td></td>
<td>Data collection procedure</td>
<td>Ease of data collection (in interviews and questionnaire)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The response rate to questions (questions in the questionnaire)</td>
</tr>
<tr>
<td></td>
<td>Outcome measures</td>
<td>Experiences of patient safety (12 questions from the National Patient Survey)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perceptions related to patient safety (interviews with semi-structured questions)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Polypharmacy (EHR* review)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Utilisation of healthcare as number of healthcare contacts (EHR* review)</td>
</tr>
</tbody>
</table>

* EHR= electronic health record
**Acceptability** was assessed by the System Usability Scale (SUS), which measures the perception of user experience (155-157). SUS consists of ten questions on a Likert scale (1-5), where each score by re-calculation contributes with an overall value of 0 to 100. SUS has been translated into Swedish (158). The Swedish version was used and modified by the researchers so that “product” was replaced with “medication plan”, and in question 4, “colleague/ technical persons” was replaced with “next-of-kin/ healthcare staff” for the older persons and for the next-of-kin. Usability was also explored by interviews, using a semi-structured interview guide developed by the research group and based on topics addressed in SUS, Appendix 5.

**Fidelity**, which supports the evaluation of the process and determines why the intervention works, fails or has unexpected consequences (146), was assessed by the number of medications with added information about the plan. Additionally, the number of older persons reported having received a medication plan, assessed by one question in the older persons’ questionnaire was collected.

**Recruitment** was assessed as the percentage of the eligible participants that enrolled in the study. Eligible participants were those who met the inclusion- and not the exclusion criteria, received information about the study and allowed one of the researchers to provide them with further information.

**Retention** was assessed as the percentage of enrolled older persons who had at least one documented medication plan in the EHR.

**Data collection procedure** was assessed based on the ease of data collection, using the number of participants answering one or more questions in the questionnaire and the number of participants in the interviews. The response rate to questions in the questionnaire was assessed as the proportion of response to questions in the questionnaire.

**Outcome measures:** Patients’ experiences are positively associated with patient safety (159). Accordingly, older persons' experience of patient safety was assessed in terms of involvement, information and continuity by 12 questions from the Swedish National Patient Survey Primary care 2022 (160), Appendix 6. The questions are answered on a Likert scale (1-5), where each score by re-calculation contributes with a percentage of positive respondents.
Patient safety was further explored through interviews, using a semi-structured interview guide developed by the research group and guided by the twelve used questions from the Swedish National Patient Survey in Primary Care (160) and with inspirations from indicators for safety monitoring in healthcare (65), Appendix 5. Polypharmacy was assessed using the number of medications at the appointment and at the end of the intervention. Utilisation of healthcare was assessed using the number and causes of unplanned visits or contacts to nurses or physicians within the healthcare region due to suspected ADEs during the follow-up period.

The number of medications, the medication plan and the number and causes of healthcare visits were collected from the older persons' EHRs. The older persons and next-of-kin were invited to share their experiences of the intervention three months after the appointment and the physicians one month after their last appointment. All participants received a questionnaire with two to three general questions about the medication plan and the questions addressing usability. The older persons received additional questions addressing patient safety. Physicians received an e-mail containing a link to a web-based survey tool (esMaker NX3), and the older persons and persons supporting them received a questionnaire by mail, with the option to respond via a link to the web-based survey tool. All participants received one reminder to complete the questionnaire. All participants were invited to participate in one remote interview (Skype or telephone), performed by the same interviewer (MH). Twenty participants; six physicians, 12 older persons and two next-of-kin, accepted the invitation. One older person and one next-of-kin were interviewed in pairs. The interviews were audio-recorded, transcribed verbatim and lasted between 8 and 34 (median 15) minutes.

5.5. Data analysis

5.5.1. Qualitative analysis

Content analysis
Content analysis is a qualitative method useful to obtain valid conclusions from data to provide knowledge and new insights about a phenomenon (161).
Both inductive and deductive approaches were used to make valid conclusions in the context where they were used.

In Papers I and V, data were analysed with inductive content analysis according to Elo and Kyngäs (162). The inductive approach was used to add knowledge about medication evaluations in older persons (162). In the analysis, open coding involved marking headings relevant to the area of analysis in the transcripts. In Paper I, all headings were put together into a manual coding sheet. In Paper V, data were organised using NVivo software (163). Headings with similar content were compared and grouped to generate subcategories. By abstraction, similar subcategories were formed into generic categories and finally main categories.

In Paper III, data were analysed using directed content analysis (164), which is a useful analysis method to validate a framework or theory. In the co-design initiative, the participants' needs, function requirements and content requirements for a medication plan were specifically asked for and were therefore chosen as three pre-determined and defined key concepts, forming one main category each. The analysis started by putting quotes representing the pre-formed main categories into the relevant main category. Similar quotes in each main category were put together in codes, and codes with similar content were compared and grouped together by abstraction to generate subcategories. Quotes not relevant to the pre-formed main categories but to the study aim were also identified and analysed by putting them together in codes, and by abstraction forming one additional main category. To support the analysis, data were organised using NVivo software (163). After the analysis, Matrix Coding Queries within NVivo were applied to data, which compared how quotes from older persons, nurses and physicians had underpinned the different design choices and how different design choices were expressed over time.

Critical Incident Technique (CIT)

CIT is used to understand the complexities of roles and interactions between involved parties (149, 154). The method focuses on uncovering real situations instead of general opinions.
In Paper II, data were analysed according to CIT (148, 149, 154). As one weakness of CIT is that no specific analysis method is recommended (165), the analysis approach was thoroughly described. Before the analysis started, the meaning of experiences and actions in the study was clarified: experiences consisted of what the participants experienced as meaningful related to medication evaluations, and actions represented the response they subsequently took. Real and defined situations related to the study's aim were included in the analysis. Experiences and actions were analysed separately. Each identified experience or action was condensed and coded based on content. All codes were put together into a manual coding sheet. Codes with similar content were grouped to form subcategories and then, by abstraction, categories and finally main areas.

**Thematic analysis**

Thematic analysis is useful to identify, analyse, organise, describe and report patterns (themes) within data (166, 167). Through its theoretical freedom, the method provides a rich and detailed description of data.

In Paper IV, data were analysed with thematic analysis, following the six-step guide described by Braun and Clark (166, 168). An inductive approach was applied to identify themes addressing the underlying meanings of data. Initial codes were generated by systematic work through all transcriptions to give equal attention to all data. When all data had been coded, all potentially relevant codes were gathered into potential themes. Finally, coded data for each theme were reviewed to consider if they formed a coherent pattern or required changes. To support the analysis, data were organised using NVivo software (163).

**5.5.2. Descriptive statistics**

Quantitative data used in Papers III, IV and V were analysed using Microsoft Excel. As the number of participants was small, no statistical tests were performed. Data were summarised using descriptive statistics, such as number and percentage, measures of central tendency (mean and median) and variability (range).
6. Ethical considerations

The three basic ethical principles in the Belmont Report by The Office for Human Research, namely respect for persons, beneficence and justice (169), are central for ethical considerations in research. To protect the participants and their rights the principles have guided the planning, studying and reporting of the studies included in this thesis. Ethical considerations of the Declaration of Helsinki (170) were taken into account. The Declaration states ethical principles for research involving human subjects and puts the health of patients as the first consideration. The studies include persons pinpointed in the Swedish regulation for ethical approval concerning research on humans (171) and have therefore been submitted for ethical review. The Regional Ethical Review Authority in Linköping, Sweden, approved the study for Papers I and II [Dnr 2017/292-31], with a supplement for Paper II [Dnr 2018/256-32]. The Swedish Ethical Review Authority approved the study for Papers III and IV [Dnr 2020-04781] and the study for Paper V [Dnr 2022-04430-01].

Respect

Respect for a person means that persons should be treated as autonomous beings and that persons with weakened autonomy need to be protected (169). One aim of this research was to make the older person’s voice on safer medication treatment heard. Even so, challenges may arise when ensuring informed consent from older persons with diminished autonomy or impaired cognitive capacity (172), and the consenting process needs to be implemented in a way that does not prevent research in a population. Receiving adequate information, comprehending it and being able to make a voluntary decision are essential. Consequently, all participants received verbal and written information about each specific study, including the study aim, handling of data, and confidentiality. They were informed that participation was voluntary, and that they could withdraw from the study at any time without having to state a reason or face consequences. Written consent was obtained before each intervention and data collection started.
All studies involved sensitive personal data, such as interviews and data from health records, addressed in the Swedish Act for Data Protection (173). The older persons who participated in Papers I and V were informed about and consented to data being accessed from their health records, and access was performed according to Swedish regulations.

To ensure confidentiality and protect the participants’ privacy and integrity, all data were de-identified and were presented in such a way as to avoid identification. During and after each study, data were kept secured by the entity responsible for the research. In the co-design initiative, the facilitators requested that the information shared between the participants in the digital workshops would not be discussed elsewhere, in the same way as in a focus group interview (174).

**Beneficence**

The first beneficent action is “do not harm” (169), but sometimes it can be hard to decide when it is justifiable to seek benefits despite risks. In the included studies, no physical risks were anticipated for individual participants. All participants were informed that they would decide by themselves what information they wanted to share with the researcher in the interviews and with the other participants during the workshops in the co-design initiative. However, addressing patient safety and risk of harm could cause concerns and worries among the participants, and therefore the researcher observed signs of concern during interviews and workshops. If any participant revealed having been exposed to harm in healthcare, both the researcher and the participant could discuss this with the chief medical officer in the healthcare region and ask for advice. On a small number of occasions, the researcher advised older persons to contact their primary care centre or to raise an issue regarding their medications at their next healthcare appointment.

The involved persons did not receive any direct individual favours from participation but could benefit by gaining new perspectives and knowledge on medication treatment for older persons, and were able to influence medication treatment and make it safer. At a societal beneficial level, this research can apply to the resolution of sustainable development adopted by the General Assembly (175), as one of the 17 sustainable development goals is “good health and well-being”. Harm caused by medication is a global safety problem
(2), and research to promote appropriate medication treatment for older persons is beneficial.

Justice

As a researcher, you need to reflect constantly on who receives the benefits of the research and who bears its burdens (169). Participation in these studies took up time for all participants that they could have used differently. Consequently, all studies were carefully planned and performed to optimise the efficient use of resources. For example, the interviews in Papers I and II were conducted at a location preferred by the participant, and in Papers III, IV and V, interviews were conducted remotely. The co-design initiative studied in Papers III and IV was built on the principle that those who are affected by a product or service are best placed to design them if given appropriate tools to express themselves (16). The facilitators had an important role during the workshops in maintaining an equal power balance between the older persons and healthcare professionals (176), ensuring that all voices were heard and that everyone involved were given the opportunity to influence the medication plan prototype.

One approach to ensure that healthcare professionals felt they could dedicate time to participate in a study during regular working hours was by obtaining authorisation from their employer. For Papers I and II, each manager of the primary care centres signed an approval for the primary care centre to participate in recruiting older persons and participate with healthcare staff. Likewise, the manager of the municipality-based home healthcare service signed an approval for healthcare staff to participate in the study for Paper II. For Paper V, the managers of the primary care centres signed an approval for participation in the intervention. For Papers III and IV, healthcare staff participated as part of the organisation’s quality improvement work (177).
7. Findings

7.1. The Discover phase

7.1.1. Paper I

The analysis of older persons’ experiences of medication evaluation formed two main categories and six generic categories, Figure 5.

![Figure 5. The main categories and generic categories describing the older persons’ experiences of medication evaluations.](image)

The older persons’ own role in the evaluation was about having the responsibility to engage in the medication evaluations, like adhering to instructions, making sure things worked out according to their understanding of the plan, contacting healthcare if not, and searching for information about their medications. The older persons described feeling unable to interpret their medication effectiveness and side effects by themselves, and they found it difficult to participate due to difficulties remembering received verbal information. They considered themselves being unconcerned, meaning not worried about medications as long as they felt fine, adopting the principle “no news is good news” and trusting the physicians to evaluate their medications properly.

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The older persons' views of evaluation received were about experiences of obtaining continuity of care, with structured evaluations regularly and the physicians' recurrent examinations and tests created a feeling of familiarity. When healthcare professionals discussed their medications, shared test results with them, encouraged them to monitor medications at home and provided them with written information about the plan, the older persons felt they were being invited to participate in the medication evaluations. The older persons were lacking a comprehensive medication evaluation and expressed concerns that no one took the overarching responsibility for all medications, that information about the plan was missing and that time to discuss medications at appointments was limited.

7.1.2. Paper II

The exploration of physicians’ and nurses’ experiences of evaluations of older persons’ medications, and their related actions, identified 653 critical incidents, divided into 445 experiences and 208 actions, Figure 6.

<table>
<thead>
<tr>
<th>Experiences (n=445)</th>
<th>Actions (n=208)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Working conditions</strong></td>
<td><strong>Work with a plan</strong></td>
</tr>
<tr>
<td>• Clinical knowledge and experience</td>
<td>• Perform day-to-day work</td>
</tr>
<tr>
<td>• Situational conditions</td>
<td>• Planning for continued treatment</td>
</tr>
<tr>
<td><strong>Working in partnership</strong></td>
<td><strong>Collaborative problem-solving</strong></td>
</tr>
<tr>
<td>• Co-operation around the older person</td>
<td>• Involve the older person</td>
</tr>
<tr>
<td>• The older person as a partner</td>
<td>• Communicate with colleagues</td>
</tr>
<tr>
<td></td>
<td>• Finding a solution</td>
</tr>
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Figure 6. Main areas and categories of physicians’ and nurses’ experiences of and actions taken regarding medication evaluation in older persons.
Healthcare professionals’ experiences formed two main areas. \textit{Working conditions} was about \textit{clinical knowledge and experience}, addressing the practical application of evaluations, knowledge about medications for older persons and the complexity that makes it difficult to distinguish between side effects and normal aspects of ageing. \textit{Situational conditions} concerned preconditions for medication evaluations, like having resources such as time and staff, and continued evaluations over time. The evaluation was facilitated when having a plan and written communication between healthcare professionals was experienced as important to ensure appropriate evaluations. \textit{Working in partnership} was about experiences of \textit{co-operation around the older person}, including other healthcare professionals, formal caregivers and next-of-kin. Sharing the same picture of what to do facilitated evaluations, but unclear division of responsibility, lack of involvement and multi-level communication of information was challenging. \textit{The older person as a partner} concerned expectations of the older person to take their own responsibility for medications, and that older persons expressed a wish to be involved. Communication problems, cognitive impairment or non-compliance with treatment could hinder collaboration, but written and verbal information facilitated understanding.

Physicians’ and nurses’ actions taken to manage evaluations also formed two main areas. \textit{Work with a plan} described \textit{performing day-to-day work} by closely monitoring medications, reporting findings to those responsible and documenting them so that colleagues could access the information. Physicians undertook actions to adjust medications accordingly. \textit{Planning for continued treatment} included actions such as planning evaluations, and providing colleagues with information about what to monitor. Renewal of prescriptions was sometimes done with no correlation to an evaluation. \textit{Collaborative problem-solving} described actions to \textit{involve the older person} by talking to them and their next-of-kin about continued treatment, facilitating medication compliance and assessing their ability to manage their medications by themselves. \textit{Communicate with colleagues} included actions such as asking for instructions, discussing continued treatment and informing about detected medication-related problems. \textit{Finding a solution} was proactive, often time-consuming activities like alerting about acute problems and making a brief plan for a short period to resolve a situation when no plan existed.
7.2. The Define and Develop phases

7.2.1. Paper III

Identifying older persons’, physicians’ and nurses’ needs and requirements that would make a medication plan work out in daily practice and promote patient safety resulted in a medication plan prototype linked to the medication list, Figure 7.

According to the qualitative findings, a medication plan with the same information for everyone involved (10/12) and a clear agreement about responsibilities (11/12) were important needs. In Workshop 1, there were diverse views on where to place the medication plan within the EHR; five of 12 participants preferred the medication list. However, in Workshop 2, 11 of 12 favoured the medication list. In the survey, all participants (13/13) agreed that the treatment goal, and when and how treatment should be evaluated, constituted the most important content in a medication plan and agreed on integrating the medication plan into the medication list.
The qualitative analysis, identifying and exploring the participants' design choices formed four main categories:

**Needs supporting communication, continuity and interaction**

- *Adequate and adapted information* addressed the need for a balance of sufficient information, available written information, and an understandable and clear plan adapted to all involved.
- *An updated and transparent source* reflected the need for a continuously updated medication plan that is easy to gain an overview of.
- *Clarified responsibility and interaction* addressed the need to make responsibilities visible and to have a plan that facilitates communication.

The older persons raised the need for clear and understandable information, the nurses emphasised the need for a medication plan that is easy to gain an overview of, and the physicians highlighted the need for a plan with a balanced amount of information.

**Functions providing instant access, automation and attention**

- *Accessible for all involved* reflected functions of a connected EHR to support the transition of information, a printable option and readily access for eligible persons. A plan linked to the medication list was requested.
- *Automatically and instantly displayed* addressed functions that support an automatic display of updated and instantly obtainable information.
- *Embedded alerts and communication* addressed functions such as a digital communication platform and an embedded alert system that can draw attention to important issues in the plan.

A medication plan linked to the medication list was addressed mainly in Workshop 2. The physicians addressed more function requirements. The older persons addressed fewer functions related to automatically displayed information and embedded alerts, and instantly obtainable information was the major function requirement from the nurses.
Content providing detailed information about the medication treatment

- **Written content about a prescribed medication** described information about the medication, such as dosing, treatment length and prescriptions.
- **Written content about responsibility** described who is responsible and who to contact if deviations.
- **Written content for planning** described the treatment goal, how to monitor and evaluate, and what to alert about.

The older persons focused on content about prescribed medications, the nurses on what to alert about and the physicians on when to evaluate.

**The medication plan must provide added everyday value**

- **Challenges for clinical practice** called for a stepwise implementation and to prioritise time wisely when applying a medication plan.
- **Enable patient engagement** addressed the opportunity to empower patient involvement and to individualise the medication plan to suit the older person’s capabilities and wishes.
- **Make medication treatment safer** addressed creating security in collaboration and the possibility of reducing unnecessary care.

The older persons emphasised the medication plan’s possibility to enable patient engagement, whereas the physicians highlighted challenges in prioritising time wisely.

**7.2.2. Paper IV**

In the quantitative findings from the survey, 11 of 12 participants responded that the initiative corresponded to the aim; to develop a medication plan prototype together. On the 10-grade Likert scale they responded that they were able to speak to the extent they wanted (median response 9), and that their expressed views had been listened to when developing the medication plan prototype (median response 9). The overall experiences of participating in the co-design initiative, the balance between how much all involved expressed their wishes, and the information provided to facilitate participation were close to excellent (median response 9).
The qualitative analysis, exploring the participants’ experiences of the remote co-design initiative, generated three main themes, encompassing conditions of importance for establishing a permissive, dynamic, and appealing remote co-design process, Figure 8.

![Diagram](image)

**Figure 8. Themes and sub-themes exploring the participants’ experiences of a remote co-design initiative.**

**Everyone’s perspective matters** reflected the participants’ experiences of contributing from multiple viewpoints to the design of the medication plan, as the participants’ different perspectives complemented each other and added a broader input to the plan. **Inviting to dialogue** meant that all participants felt welcome to provide input and were allowed to speak and that their viewpoints were taken into consideration in the development of the medication plan. **The voice of medication users** reflected that healthcare services must be adapted to make sense for both patients and healthcare professionals, and there were concerns that the balance between participants might disadvantage older persons.
Learning by sharing highlighted the participants’ experiences in that they acknowledged each other’s daily lives, meaning that they might not normally be aware of the situations of others. The sharing of daily practice contributed to individual learning. Having a two-way dialogue helped in creating shared understanding. Creating something together was valuable and good, and the approach was considered worth applying in other improvement initiatives as well. The participants were reaching coherence for the final medication plan prototype, meaning that they seemed to emphasise each other’s needs and that the prototype corresponded well with their needs and expectations.

Mastering a digital space focused on the balance between the opportunities and challenges that the digital platform offers. The participants argued that meeting remotely is the future, as easy access from home or the workplace leads to efficient meetings. Even so, building relationships remotely seemed to be more difficult and social interaction could be hampered. Structuring the work was desirable according to the participants and related to the facilitators’ ability to give guidance and instructions. Technical problems contributed to digital hassles, as some participants needed more guidance than others, and contributed to participants missing out on parts of the workshop. Allocating time for co-creation was experienced as essential and more time would maybe have helped the older persons to provide more input.

7.3. The Deliver phase

7.3.1. Paper V

The feasibility of the intervention of applying a medication plan for older persons in primary care, and the feasibility of the used study methods was examined, Table 4.
Table 4. The outcomes of the feasibility of the intervention of applying a medication plan and used study methods.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Feasibility of the intervention</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Acceptability                                    | Usability assessed by the System Usability Scale  
  • Physicians (n=6): median 51.3 (range 22.5-67.5)  
  • Older persons: (n=4) median 75.0 (range 50.0-100.0)  
  • Next-of-kin (n=1): 80.0  
  * Participants’ experiences of the usability are addressed in the text below |
| Fidelity                                          | 59% of 267 prescribed medications had treatment goals and/or comments about the continued plan documented in the medication plan  
  8 of 15 older persons reported having received a medication plan |
| **Feasibility of the methods**                    |                                                                                                                                          |
| Recruitment                                       | 6 of 8 (75%) eligible physicians enrolled the study  
  23 of 33 (70%) eligible older persons enrolled the study |
| Retention                                         | 21 of 23 (91%) recruited older persons had a documented medication plan in their EHR |
| Data collection procedure                        | 24 of 29 participants answered one or more questions in the questionnaire  
  20 of 29 agreed to participate in an interview  
  11 of 16 participants answering the SUS had a valid score  
  10 of 21 older persons answered all questions about patient safety |
| Outcome measures                                  | Older persons experiences of patient safety (Questions from the National Patient Survey)  
  * No reliable data due to a low response rate to the questions |
|                                                   | * Participants’ perceptions of the medication plan’s ability to promote patient safety are addressed in the text below |
|                                                   | Polypharmacy: After the appointment: median of 11 (range 4-22) medications. At the end of the intervention: median of 11 (range 5-18) medications |
|                                                   | Unplanned visits due to a suspected adverse drug event: None |
Exploring the participants’ **experiences of the usability of the medication plan in clinical practice** formed four generic categories:

- **De-prioritised**: Other ways for having information about medications were used by the older person (**Older persons use medication lists diversely**) and medical notes were the physician’s first choice for medical information (**Physicians use medical notes for information**).

- **Functionalities**: The medication list supported a structure for information (**A visible and clear structure**) but the application of the plan was technically challenging (**Limited by technical constraints**), and the medication plan was not always recognised by the older persons (**The older person did not comprehend the medication plan**).

- **Individualisation for relevance**: The medication plan was not always relevant, related to both the older person him/herself (**Adapt for the individual**) or to a specific medication (**Adapt for medication**).

- **Resources**: Benefits needed to compensate for the negative impact on resources (**Balancing time and purpose**) and the medication plan was time-consuming to apply in the health record (**Time-intensive application**).

Exploring the participants’ **perceptions of the medication plan’s ability to promote patient safety** formed three generic categories:

- **Awareness and information**: The medication plan contributes and encourages engagement but may cause concerns (**Information as a source of comfort**), written information about medications offers clarity (**Provides information about ongoing treatment**) and the plan provides a way for communicating with next-of-kin and nurses (**Support Communication**).

- **Challenges beyond the medication plan**: Applying a medication plan is difficult due to the complexity of medication use for older persons (**Complexity in older persons' medication treatment**) and older persons can adopt a passive approach and trust healthcare to take proper actions (**Older persons feel secure and trust healthcare**).

- **Patient involvement**: Older persons and next-of-kin are, and have a responsibility to be, active in the evaluation of their medications (**Engaged older persons and next-of-kin**) and the medication plan enables them to take actions even if this is sometimes difficult (**Facilitates opportunities to respond**).
8. Discussion

8.1. Summary of the findings

Increased knowledge about ways in which older persons, and persons who support them with their medications, can be involved in enhancing resilience and patient safety in the healthcare system is called for (11). The findings in this thesis add knowledge about how older persons and healthcare professionals experience the evaluation of older persons’ medication as performed today. That knowledge enables proactively thinking about opportunities to invite older persons to a more co-produced medication evaluation that could enhance resilience in the healthcare systems. Based on their diverse views of co-producing medication evaluations, older persons are a heterogeneous group of people, meaning some want to be involved, some feel unable and some consider themselves unconcerned. Medication evaluations are facilitated by knowledge about medication treatment in older persons and by proper working conditions for healthcare professionals. Healthcare professionals acknowledge the importance of co-producing medication evaluations with colleagues and with older persons, and a medication plan may facilitate such collaboration.

A co-design approach is intended to increase the acceptability and integration of a product or service in daily practice (12). Research on remote co-design approaches with older persons is novel, and the findings in this thesis add knowledge regarding co-producing patient safety solutions with older persons and healthcare professionals. Based on the findings, remote co-design can be a complement to face-to-face approaches, providing an accessible and permissive environment for all involved. Sharing experiences from everyday life creates learning and awareness of potential risks and strategies that can inform a systematic approach to enhancing resilience. A medication plan has the potential to promote patient safety by supporting communication, continuity, and interaction, if being constantly updated, transparent, and containing accessible and adapted information. Evaluating a medication plan in primary care is challenging, but adds learning that can inform a medication plan further and increase knowledge about co-designed solutions in complex systems, as well as daily practice and capacity within the healthcare system.
8.2. Reflections on the findings

8.2.1. Older persons as co-producers of medication evaluations

Older persons actively involved in medication evaluations

According to the findings, some older persons want to be, and perceive themselves capable of being, involved in the evaluation of their medications (Papers I and V). These findings align with a study on older persons’ preferences for involvement in their care in general care (94). That specific study underscored that older persons’ definition of involvement did not primarily focus on active participation in treatment decisions but rather on receiving good information about their health and that their preferences were taken into consideration when physicians made decisions about their continued treatment (94). Similar experiences were expressed by the older persons in Paper I, meaning that involvement in the medication evaluation did not entail decision-making about their medications. Instead, involvement primarily focused on gaining information about their medications, adhering to instructions provided, monitoring symptoms and alerting healthcare professionals in the event of any issues. If older persons did not receive sufficient information about a medication, they felt responsible for either requesting more information from healthcare services or searching for it independently. These findings mirror an interview study with persons 65 years or older about their role in medication safety, addressing self-learning about medications and asking questions as crucial aspects of avoiding medication-related harm (178). The older persons experienced being invited to participate in the evaluation of their medications when healthcare professionals provided them with information about their medications and planned treatment, and asked them to monitor for positive or negative effects at home (Paper I). Furthermore, the older persons sometimes monitored and evaluated their medications at home independently. The older persons considered it their duty to provide feedback to healthcare professionals about observed symptoms (Paper I). Previous research shows that even if not actively employing health literacy skills during healthcare consultations, older persons seem to report good health literacy and practice such skills when self-managing and
monitoring medication regimes at home (179). Patients' ability to monitor and manage symptoms following hospital discharge has been associated with decreased re-admissions (180), and in transitions of care, patients have been able to enhance system resilience by anticipating medication-related problems and monitoring their health condition to prevent harm (140). Together with previous research, the findings in this thesis argue that older persons who want to be involved in the evaluation of their medications may enhance the resilient capacity, as they tend to use resilient skills such as anticipating and monitoring medications at home. Their engagement in the monitoring and evaluation of medications at home may accordingly promote patient safety.

Concerns with co-producing medication evaluations with older persons

Healthcare professionals acknowledge the importance of inviting older persons to co-produce the evaluation of their medications, and also sometimes expect them to take on the responsibility of self-managing their medication at home and alert healthcare when necessary (Papers II and V). Nevertheless, healthcare professionals also expressed concerns regarding the potential for misunderstandings arising from impaired cognitive capacity in some older persons or concerns about their self-reliance in adhering (or not) to medication treatment (Paper II). Some older persons said they felt unable to participate in the evaluation of their medications, due to lacking memory or having insufficient knowledge about medications (Paper I). Low health literacy can be a barrier to health services’ co-production (181), and personal capacity and practical knowledge have been described as two of five aspects important to address when considering engaging patients in patient safety in hospital settings (182). These aspects may be applicable to older persons in a primary care context as well, and are important to elaborate further from a resilience perspective, as resilient performance includes knowing what will happen and being able to understand if something happens (112, 127). Cognitive impairment or lack of knowledge may restrict the ability to anticipate and monitor, and thereby diminish the resilient capacity, which may be a reason why healthcare professionals addressed concerns. However, the older persons’ and healthcare professionals’ experiences of inability to co-produce medication evaluations are equally important to reflect on in the light of ageism, i.e. the complex and often negative construction of old age, which
takes place both at individual and group level (183). Even if being aware that not all older persons possess the capacity to co-produce health and healthcare, ageism may still occur among healthcare professionals and, conversely, self-ageism among older persons when it comes to medication evaluation. Identifying ageism attitudes and practices is one step towards eliminating ageism in healthcare (183). Excluding older persons or deeming them unable to co-produce medication evaluations may reflect ageism, and represents an outdated view of older persons as co-producers of healthcare, held by both older persons and healthcare professionals.

Moreover, the findings indicate that older persons sometimes seem unconcerned about their medications and trust their physicians to evaluate their medications regularly (Papers I and V), and they reflected on that evaluations might not be necessary at a later age (Paper I). Similar findings were made in other studies, indicating that older persons believe their medications are necessary, that they have a high level of trust in healthcare professionals’ clinical knowledge, and that trusting physicians to decide on continued treatment make them feel safe (184, 185). The expressed trust in the healthcare system aligns with a study about co-production of safety in healthcare, concluding that patients presume that the healthcare system protects their safety (186). Given that safety is invisible, patients tend to relate to a more accessible dimension of safety in terms of feelings, like trust or security (186). Consequently, the older persons’ expressed feeling of trust and security in the healthcare system’s capability to evaluate their medications could be a way of expressing safety. It is fundamentally good that older persons feel safe and trust the healthcare system to ensure proper medication treatment. Even so, trust combined with a lack of concern regarding risks associated with medications may undermine resilient performance, potentially making older persons less prone to monitor for and respond to safety hazards.

**Adopting co-production of medication evaluations**

The findings in the included papers contribute to increased knowledge about the diversity of older persons’ views of co-producing evaluation of their medications. While not explicitly explored, the older persons participating in the included papers could generally be categorised within the third age population (28), as a major proportion of them self-managed medications, and
this has to be taken into account when interpreting the findings. Nevertheless, the findings align with other studies regarding patients’ involvement in their medication management (187) and involvement to increase patient safety (182), both highlighting the importance of trying to see what is right for each patient. A thoughtful and systematic approach with a range of equally valued opportunities to co-produce, at different levels and in differing roles, has to be offered the older person (15). When interviewing Swedish physicians about patient participation for safer care they highlighted patients' capability to become involved but also addressed the physicians' capability, motivation and opportunities as potential barriers of relevance to achieve patient participation (188). It may appear straightforward, but the findings underscored healthcare professionals' limited capability to assess an older person’s ability to self-manage medications and adhere to instructions (Paper II), which if misjudged could potentially endanger patient safety. Inviting older persons to co-produce medication evaluation aligns with the Swedish primary care reform “Good quality, local healthcare” (34). Accordingly, healthcare professionals working with older persons need to find ways to invite older persons unconditionally to co-produce their medication evaluations, but must also acknowledge and be attentive to older persons’ variable ability and willingness to co-produce. Older persons who are unable or unwilling to co-produce medication evaluations have to be identified, so healthcare and healthcare professionals can step in and provide support.

8.2.2. Enhancing reliable medication evaluations

Continuity in medication evaluations

According to the findings, older persons emphasise continuity of care, with structured evaluations of their medications every year, preferably delivered by a designated physician with an overarching responsibility for their medications (Paper I). Continuity of care from a patient’s perspective tends to be described accordingly, as a continuous caring relationship with an identified healthcare professional, but from a provider’s perspective it is often described as a “seamless service” through integration, coordination and sharing of information between stakeholders (189). These different views of continuity of care are essential to reflect on when striving to promote safer medication treatment. For long-term conditions manageable in primary care,
continuity of care has been associated with fewer hospital admissions, emphasising that a good relationship between the patient and physician can lead to a better understanding of health problems and adherence to treatment plans (190). Having a designated physician at the primary care centre who creates security and continuity for persons with multi-morbidity is central both to the Swedish primary care reform “Good quality, local healthcare” (34) and to policy recommendations (35). Even so, healthcare is becoming increasingly complex and Sweden faces a shortage of general practitioners (32). Exclusively depending on a designated physician for the continuity of medication evaluations can therefore be challenging in today’s healthcare, and must not exclude efforts to adopt a system thinking approach that may contribute to the ability of the entire healthcare system to adapt to variations.

The Swedish primary care reform describes how a Patient Contract can promote continuity of care through a shared agreement addressing treatment goals, planned activities and coordination of care (82). As indicated by the findings, the need for a medication plan to support interaction and provide updated information (Paper III) aligns well with the aim of the Patient Contract, and may accordingly promote continuity of medication evaluations.

In the light of continuity and regular medication evaluation, older persons sometimes lacked a comprehensive evaluation, a medication review, of all their medications (Paper I). The experience from both the older persons and healthcare professionals was that when a medication seemed to work well, closer evaluations tended to decrease, potentially leading to medication continuing without questioning its appropriateness (Papers I and II). Clinical inertia, such as lack of re-evaluation of long-term medications and changing medications initiated by others, was addressed in a systematic review of factors associated with potentially inappropriate medications for older persons (191). Medication reviews are an important way of evaluating a patient's medications in a structured manner and optimising their use. Medication reviews are often performed annually, but as medical conditions in older persons can change rapidly, the capacity to continuously adapt to unexpected changes in the older person's health condition is vital for patient safety. International guidelines highlight that a plan that facilitates continued medication treatment can support safer clinical management of medications in older persons with multi-morbidity (81). Healthcare professionals seemed to enhance medication evaluations by adapting their performance according
to a predefined plan or by making a plan if it was missing (Paper II). Moreover, in the co-design initiative and when applying the medication plan in daily practice, the participants perceived that a medication plan may support all involved persons to know what to expect and what to look for (Papers III and V), which may increase the resilient capacity. Accordingly, a medication plan may be a supportive complement to annual medication reviews in a more dynamic process over time. The potential to support continuity and reduce unnecessary care could not be evaluated within the short follow-up period of the feasibility study (Paper V). Further studies are therefore needed to evaluate the contribution of the medication plan to promoting patient safety.

Co-production of medication evaluations

Based on the findings, central to facilitating medication evaluations is collaboration between the older person, their next-of-kin and healthcare professionals involved in the older persons’ medication (Papers I and II). Furthermore, healthcare professionals enhance medication evaluations through collaborative problem-solving with colleagues and older persons to resolve complex situations. Nurses specifically informed colleagues about medication-related problems and asked for instructions (Paper II). Nurses, both at the primary care centre and in municipality-based home healthcare, were perceived as a link between the older person and the physician, and played a central role in medication monitoring (Papers I and II). Prior research has addressed how nurses in home healthcare have a central role in coordinating care between the older persons, homecare staff and physicians, and often depend on home care staff or next-of-kin to be able to monitor medication treatment and ensure medication safety (192, 193). Collaboration regarding medication evaluations with next-of-kin and homecare staff was perceived by the healthcare professionals both as an asset and as an obstacle, depending on the next-of-kin’s and homecare staffs’ presence, involvement, knowledge and commitment (Paper II). Next-of-kin’s and homecare staff’s perspectives on their role in medication evaluations and collaboration with healthcare professionals have not been explored within this thesis. However, their views need further attention, as they often play a central role in older persons’ medication management (60).
Co-production principles seem promising in the context of older persons, where complexity sometimes occurs due to interaction between the older person and different healthcare professionals (85). As indicated by the findings in Paper II, unclear allocation of responsibility among all involved persons, including the older persons, their next-of-kin and healthcare professionals could undermine co-production and accordingly hinder medication evaluations. During the co-design initiative, the participants highlighted the need for a medication plan to facilitate interaction, emphasising the particular importance of providing clarity about responsibilities (Paper III). Clarifying who has responsibility to identify, communicate and respond to changes in the condition of an older person exemplifies the promotion of resilience in the system by strengthening the ability to anticipate and be prepared for changes (112, 127).

A balanced amount of understandable and accessible information

According to the participants in the co-design initiative, having information about medications, knowing their intended purpose and the planned treatment length, and having information about how to monitor and evaluate medications were important content in a medication plan (Paper III). The participants specifically highlighted information about the medication and planning. The older persons, in particular, emphasised the need for clear and understandable information. Receiving information about medications is important to make older persons feel comfortable and secure (178, 194), and individualised information has been proposed as an important intervention to give older persons a sense of control over their medications (60). Having information aligns with the ability to anticipate, as it enables persons to know what to expect from their treatment, ultimately supporting resilient performance (112, 127). Even so, simply receiving information is not enough, the ability to comprehend the information is equally crucial and older persons with low health literacy may have a limited capacity to understand health information (57). The older persons highlighted that they wanted to be able to read their medical notes in the EHR (Paper III), but also experienced that medical terminology can be difficult to understand (Paper I). The problem of understanding information in medical notes, has been equally found in other research about the usability of Patient Portals (195). From a co-produced approach to medication evaluations, it is essential to balance both the amount
and the content of information in medical notes to make it useful for both older persons and healthcare professionals.

Having access to updated medical information was a prioritised function requirement for a medication plan, as access could support interaction and clarify responsibilities (Paper III). Patients’ access to correct and comprehensive information about treatment plans, particularly through medical notes in EHRs, appears to enhance their confidence in self-managing their care, and is also a key issue in terms of perceptions of safety in primary care (196, 197). As digital health is increasingly embraced by older persons (198), digital access to medical information seems increasingly important, regardless of age. If older persons want to co-produce their medication evaluation, and also are expected to self-manage their medications, requirements of accessible information about continued treatment is essential to ensure patient safety. Additionally, the nurses in municipality-based home healthcare particularly highlighted functions that would make the information in the medication plan readily accessible in a connected EHR. Having access to medical information corresponds with findings from other Swedish studies performed with nurses in home healthcare (199, 200). These studies found that the nurses’ limited access to health record systems prevents the transfer of information and forces them to spend time searching for it. Interoperability between EHRs appears to have a positive influence on medication safety by reducing patient safety events and costs (201). Access to EHRs provides authorised healthcare professionals with updated information necessary to properly monitor and evaluate medications, and thereby maintain the ability to promote resilient capacity. To co-produce medication evaluations, the findings highlight the importance of nurses in municipality-based home healthcare, who support older persons with their medications, having readily access to information in a medication plan.
Remote co-design as an inclusive and informative approach

Achieving shared understanding and managing different participants' perspectives in a co-design session can be challenging (202). Even so, the remote approach aiming to finalise a medication plan seemed to create a dynamic two-way dialogue with possibilities for the participants to provide immediate responses to one another (Paper IV). Valuing all users’ input when improving healthcare services is a key aspect of importance for knowledge mobilisation in co-design approaches (203). Sharing of daily practice during the co-design initiative improved awareness of possible risks in the medication evaluations, provided insights into why special requirements were called for and highlighted strategies that could contribute to safer medication treatment (Paper IV). Allowing patients, along with healthcare professionals, to address safety concerns, increases the participants’ awareness of risks in their daily life (11). Learning occurs continuously in healthcare systems through interaction between patients and healthcare professionals (126). Accordingly, a remote co-design approach could be used as a systematic tool for collaborative learning in the patient safety field, where older persons and healthcare professionals learn from each other’s daily lives and jointly find solutions to manage unpredictable circumstances and variability within the healthcare system.

Moreover, the remote approach, supported by the structure in the Double Diamond framework (104), created a permissive environment where everyone’s perspectives mattered and viewpoints from both older persons and healthcare professionals were taken into account (Papers III and IV). As indicated by the findings, various ways to interact, such as chats, notice boards and breakout rooms, seemed to provide diverse opportunities for self-expression and served as an effective way for the participants to articulate their perspectives (Paper III). Previous research about remote co-design suggests that the web-based meeting space establishes equal participation and breaks down power imbalances (204). Even so, co-production requires that healthcare professionals share power with patients (176), and the importance of continually addressing and reflecting on power relations is central to maintaining balance between involved persons. Bearing that in mind, the
findings of the co-design initiative provide further perspectives on the remote environment as an inclusive space for older persons, suggesting the feasibility of applying remote co-design in other initiatives focused on patient safety solutions for older persons.

However, co-design has received criticism for lacking evaluation of clinical outcomes and cost-effectiveness (205). End users' input into tomorrow's healthcare is vital, but having time for co-design was addressed in the findings (Paper IV). Co-design in general requires more time compared to approaches such as individual or group interviews (103, 206). Accordingly, the issue of time is important to consider, as using the time of older persons' and healthcare professionals' efficiently is vital from both a resource and ethical perspective. The participants highlighted the possibility of joining a co-design initiative digitally from home or work, without spending time on travel, as a way to save time and allow participation (Paper IV). With previous research (204, 207), the findings suggest that a remote approach can even expand the participant group by inviting older persons and healthcare professionals who want to participate, rather than being limited to those with the time and capacity to attend a “face-to-face initiative”. Even so, the remote environment may be limiting and the findings showed that digital hassles took time and affected allocated time adversely. Managing new technology seems not to be limited only to aspects of age (208), suggesting that the digital environment is not automatically exclusive of older persons. Still, adequate preparations for both participants and facilitators before a remote co-design initiative starts are important for an effective approach.

Challenges in an integrated medication plan

When applying a medication plan within the medication list, approximately half of the older persons reported they had received a take-home medication plan at their appointment (Paper V). Based on the participants' feedback, the discrepancy may be due to a mix-up with the printed list of prescriptions provided by the pharmacy or with other paperwork from healthcare providers, which could make it difficult to keep track of the medication plan. Both the findings in Paper V and other research (209) show that patients prioritise the printed list of prescriptions provided by the pharmacy before the medication list they receive from their physician. As the list from the pharmacy only
presents valid prescriptions (45) there may be discrepancies between that list and the medication list from a healthcare provider. As many as two-thirds of patients have at least one discrepancy between the medications on the printed list of prescriptions and medications they actually use (209). Using the printed list of prescriptions from the pharmacy may, besides the potential negative consequences of continuing to use the wrong medications, risk overlooking information about planned treatment if that is only presented in the medication list. Establishing a medication plan within a medication list requires seamless interconnectivity between digital lists of medications, ensuring consistent information accessibility for older persons and healthcare professionals across the entire healthcare system. Expanding upon this thesis’ context where the focus was on a medication plan, older persons with multi-morbidity may also need the inclusion of non-pharmacological treatments in a treatment plan. To ensure a co-produced approach and prevent older persons from managing numerous disparate treatment plans for different treatments, highlighting the coordination of plans is paramount. The coordination must be emphasised both within the Patient Contract initiative (82) and in clinical practice. To facilitate a co-produced medication evaluation and allow older persons to navigate and adapt to the variability and challenges in their medication management (11), these findings underscore the need to enhance the coordination of medical information provided to older persons.

As healthcare professionals and older persons experienced challenges in finding information about planned medication in medical notes (Papers II and III), the medication list was emphasised as a central hub for coordinating medication-related information (Paper III). Nevertheless, feedback from physicians concerning the usability of the medication plan yielded mixed results, indicating that physicians primarily rely on medical notes for their own information about medication treatment. Other ways to provide older persons with information about medication treatment were also used (Paper V). Consequently, including a medication plan within the medication list resulted in double documentation of medical information, something that the participants in the co-design initiative emphasised as critical to avoid (Paper III). These findings highlight variability in clinical practice as described in terms of “Work as Done” as something different from “Work as Imagined” (210). Applying a medication plan for older persons may seem feasible when planned (Work as Imagined), but can be complex to perform in clinical
practice (Work as Done). Functions that could optimise documentation, and thereby avoid double documentation of medical information, were particularly requested by the physicians (Paper III). Physicians’ increased workload related to excessive data entry and long medical notes has been addressed continuously since the implementation of EHRs in healthcare (211). Consequently, it is essential to address the issue of EHRs supporting documentation, as high workload can increase stressful situations and may have a negative impact on safety (212). It is important to note that the medication plan used in the intervention was a low-fidelity prototype with basic elements (153). Even so, the findings underscore the importance of enabling collaboration between patients, healthcare professionals, EHR providers, and relevant authorities supporting the medical information infrastructure in ensuring effective functioning of these systems in daily practice. Further feedback loops are called for to better adapt the medication plan to clinical practice (104). Additionally, as indicated by the findings, physicians tend to record medical information in an individualised manner (Paper V), which could be a contributing factor to that information on continued medication treatment was sometimes difficult to find (Paper II). Previous research shows that physicians agree on the importance of recording structured information in the medical record, but the structure and content of information are not recorded likewise in clinical practice (213). In order for EHRs to better align with clinical practice, healthcare professionals can play a complementary role by adopting similar approaches to the documentation of medication information. Regulations that seek to delimit actions through pre-planned models might be seen as demonstrating the opposite of resilience, but their interface when it comes to improving safety is complex (214). Based on the findings, careful standardisation by a joint approach of documentation of medication treatment may be a reasonable approach to increase adaptive capacity within the system.

Knowledge support for medications in older persons

For proper medication evaluation, healthcare professionals emphasised the importance of having good clinical knowledge about medication treatment for older persons (Paper II). Nevertheless, the complexity associated with polypharmacy in an aged population could make it difficult to distinguish potential side effects from effects of normal ageing, and could subsequently
cause unnecessary continuation of medications (Papers II and V). The importance of physicians having knowledge of appropriate medications for older persons, and having the ability to identify potential harm from medications has been previously emphasised (215, 216). Healthcare professionals’ clinical knowledge about medication treatment in older persons is central, as it increases their vigilance and their capacity to anticipate and monitor for potential risks, and thereby promotes resilience. Having sufficient knowledge to be able to identify potential harm in older persons with multimorbidity places high demands on healthcare professionals who meet the older persons. Working with a plan and thereby knowing what to look for were actions taken by healthcare professionals to facilitate evaluations (Paper II). Nevertheless, formulating goals and plans for continued medication treatment in the medication plan proved to be challenging in clinical practice, especially for medications that had been prescribed over an extended period (Paper V). This challenge may lead to insufficient of information regarding continued medication treatment. In Sweden, the National clinical knowledge support is an infrastructure to produce and display knowledge support on various healthcare conditions (217). The National clinical knowledge support has recently started to add recommended treatment goals and monitoring recommendations for different healthcare conditions in the support system. If these recommendations can be adapted to medication treatment in older persons, they may possibly facilitate the formulation of goals and planning in a medication plan, and thus provide better knowledge support for continuing medication for all involved.

Resources for medication evaluations
Having resources to evaluate medications properly, or to apply and document a medication plan in clinical practice were addressed as working constraints in the included papers (Papers I, II, III and V). From a patient safety perspective, these findings are important to address as they align with the efficiency-thoroughness trade-off principle (ETTO principle) (218), meaning that healthcare professionals in their daily practice need to balance between what is efficient and what is thorough. Lacking resources, and the resulting high workload, limited time and/or shortage of staff are organisational factors imposing trade-offs in daily practice (219). Balancing resources and demands to maintain healthcare quality and patient safety is a large part of healthcare
professionals’ daily practice, but organisational factors may limit their flexibility in weighing different opportunities (219). Given that harm from medications is a global patient safety challenge (2), and such harm among older persons is common (8, 9), resources to avoid increased morbidity or mortality, and additional resource utilisation seem reasonable. Organisational factors are important to consider, as the number of older persons with complex healthcare needs increases. The perception of insufficient time to evaluate medications or apply a medication plan in the older population during daily practice, as indicated by the findings, introduces trade-offs in clinical practice that are noteworthy at a higher level than in the individual patient encounter.

Designing complex interventions

The diverse preferences and abilities of older persons to co-produce medication evaluation were addressed throughout the papers in this thesis. The diversity supports a more individualised approach with the possibility to adapt to the individual’s needs, both in daily practice and when implementing and evaluating the medication plan. The ability to differentiate interventions during an ongoing study has been described previously for studies aiming to promote patient safety by patient involvement in complex contexts (11). Interventions performed in concordance with resilience thinking, where some aspects are left for adaptation to contexts rather than using controlled interventions are called for in complex systems (220). In the specific context described in this thesis and more specifically in Paper V, where the older persons expressed diverse preferences for co-production and had different support with their medications, the possibility to adapt the intervention to the target group's preferences seems reasonable. If further evaluating the impact on patient safety with a medication plan in a larger study, an example of such adaptation could be to invite all older persons at the primary care centre using five or more medications to apply a medication plan rather than having healthcare professionals perform the selection. The decision to actively participate in the monitoring and evaluation of medications would then be co-produced by the older person, the physicians and any person (next-of-kin or healthcare professional) that might support them with their medications. Subsequently, the medication plan could be adapted to the situation in a co-produced manner.
8.3. Methodological reflections

In line with Lincoln and Guba's (221) proposal for qualitative research, trustworthiness is reflected on in terms of credibility, dependability, confirmability and transferability in relation to the design and methods used in the papers. The quantitative methods used are reflected on in terms of validity and reliability (222).

In patient safety research there is no single method that applies in all circumstances, which calls for careful consideration when planning and performing studies (223). Studies performed in complex systems, such as healthcare, require rich theorising, generative learning and a pragmatic adaptation to differences in context (224). In pragmatism, the choice of method is driven by the purpose of research and allows the contribution of both quantitative and qualitative methodological approaches (225). Multiple study designs and methods were therefore used to address the overall aim and the specific research questions in this thesis. Due to the complexity of healthcare, there are methodological challenges for studies addressing resilient healthcare (124, 226). To ensure transparency and quality, the research design and sampling strategies were thoroughly described and reported on. Even so, the included papers have strengths and limitations, and the methodology used is addressed in the following discussion.

To structure and improve the reporting of findings, reporting guidelines were used in all papers except for Paper II. The Consolidated criteria for reporting qualitative research (COREQ) (227) was used in Paper I. The Standards for Quality Improvement Reporting Excellence (SQUIRE) checklist (228) was used in Papers III and IV. In Paper V the Consolidated Standards of Reporting Trials (CONSORT) extension to pilot and feasibility trials (229, 230) was used.

8.3.1. Management of pre-understanding

A researcher’s objectivity is essential to promote confirmability, meaning that findings are derived from information provided by the participants and not the researcher (221). Therefore, so that my pre-understanding as a pharmacist would not negatively influence the data analysis and to ensure objectivity, peer
debriefing was used in all qualitative analyses. In Papers I and II, I and one of the other researchers reviewed and analysed the data, and then discussed the findings with the other researchers within the research group until a consensus was reached. In the other papers, I performed the first analysis, then refined the data with one of the other researchers, and finally presented and discussed the data with the whole research group. The multi-disciplinary research group, with different professions, i.e. one pharmacist, one nurse, and two physicians, and for Papers III and IV, a person with a Master’s degree in Cognitive Science, added different practical and theoretical experiences in pharmacology, gerontology, patient safety, quality improvement science, and co-design (for Papers III and IV) into the research process, which supported the confirmability of the findings.

Even if it is challenging to control pre-understanding, and not to jump to fast conclusions during the qualitative analysis, pre-understanding can also be seen as an interpretation-enhancer and horizon-expander in all parts of the research process (231). My pre-understanding of being a pharmacist with several years of clinical practice with older persons and healthcare professionals may have supported the dialogue between data and theory in both research design, fieldwork and data analysis (231). Additionally, my pre-understanding was considered helpful both in CIT (154) and case studies (143), when determining whether the findings were real and accurate.

In Papers III and IV, I facilitated the co-design initiative with a quality improvement leader, meaning that I was a part of the initiative I conducted research on and evaluated. When performing interactive research, it is important to maintain a distance between practice and research and reflect on your role as a researcher (232). One way to do so was that I presented myself to the participants in the co-design initiative both as a PhD student doing research and as a pharmacist involved in the healthcare region’s ongoing efforts towards patient safety. During the workshops, I facilitated the discussions along with the other facilitator but avoided active participation and giving opinions. Furthermore, all data analysis was performed after the co-design initiative was completed.
8.3.2. Strengths and limitations

Study designs

In Paper I, a descriptive qualitative study approach was selected, using content analysis (162). The method is suitable for answering the question regarding the concerns of people about medication evaluation by employing a rather low level of interpretation of data (233). The approach was also a proper method to use for a beginner in qualitative research methodology, as data can be manifestly interpreted.

Paper II had an approach of learning from both situations that worked well and poorly, and therefore the CIT (154) was applied to gain insight into the complexity of medication evaluation. The approach has been used in studies of human error and safety (154), and was proved to be a suitable approach to address the study's aim, especially to learn about actions taken to manage concerns related to medication evaluations.

The study of the co-design initiative (Papers III and IV) used a case study approach (143). Case studies draw on different research traditions, with different epistemological and methodological preferences, and there is still limited guidance on different case study approaches (145). The case study approach has been criticised for not producing findings that could be transferable to other contexts, but theoretical sampling, respondent validation and transparency are ways to address these concerns (234). Using the Double Diamond framework for the co-design approach provided scientific rigour, and describing the case, the methods used and the researchers’ level of involvement supported transparency. The feedback loops where the findings were shared with the participants allowed them to clarify intentions, correct errors, and provide additional information that contributed to the participants’ validation of data. To ensure that the voices of all the participants were heard, the facilitators moderated the discussions in the workshops. The facilitators were me and a quality improvement leader within the local Patient Contract initiative in the healthcare region, and as in many other co-design activities (235), we had no formal training in co-design. Even so, the findings in Paper IV showed that the participants were satisfied with the facilitation. Furthermore, the set-up for the co-design initiative was pilot-tested and evaluated to determine whether the sessions allowed the participants to share
their views and to ensure that data could be properly collected. The pilot test resulted in some minor adjustments.

A feasibility study approach was applied for Paper V. Feasibility studies play an important role in the planning of a full-size evaluation (236), and are useful to help develop trial interventions or outcome measures. In retrospect, this was considered a good approach, as the feasibility of the intervention and outcome measures addressed difficulties in applying the medication plan in the clinical practice but also in evaluating the intervention. Identifying improvements by this approach, before conducting a larger intervention study in a complex system, is both an ethical right way and resource-saving.

**Settings and participants**

The included studies were performed in one healthcare system in Sweden. As healthcare systems are different within countries and internationally, the settings were described thoroughly, both in the included papers and in this thesis to support transferability and the possibility of applying the findings to other settings (221). To reflect views from different settings, healthcare professionals were recruited from different locations within the healthcare system, with different sizes of primary care centres and at different locations within the participating municipalities. In Paper II, for resources and convenience reasons, nurses were recruited from one of the 13 municipalities within the healthcare system. For Papers III and IV, the nurses were employed in five additional municipalities. Based on the aims of the papers, the effect on credibility, i.e. correct and accurate findings (221), of not having nurses from all 13 municipalities participating was considered low.

In Paper V, the older persons and persons supporting them with their medications could not access the medication plan digitally. This was because the EHR supplier and the e-service for the Swedish Patient Accessible Electronic Health Record (43) were not involved in the co-design initiative. Consequently, a prototype including only basic elements were used. This approach can be a limitation as studies show that giving patients access to their medical notes in the EHR can empower patients and improve their confidence in managing their care (197, 237). Not being able to assess the experiences of older persons and next-of-kin regarding the usability of a digital medication plan may accordingly have affected the credibility of the findings (221).
All included papers had a small number of participants, yet these numbers were considered appropriate related to the chosen study designs. In Paper I, no new information emerged after the analysis of 20 interviews, thus the collected number of informants was accepted (238). With CIT, used in Paper II, the number of identified critical incidents is important, not the number of informants (148). The number of critical incidents identified during the analysis was considered sufficient to support credibility (221). Considering the recruitment strategies, purposeful sampling was used to access a range of experiences among the participants in Papers I and II. The clearly described criteria for sampling, like gender, age, number of medications and profession, enhanced the credibility by providing transparency about the selection of participants (239). In Papers III and IV, the participants were recruited within the local Patient Contract initiative in the healthcare region, which may be considered a form of convenience sampling, in terms of selection based on the participants’ accessibility and/or proximity to the research (240). This strategy may have resulted in a selection of participants who were more interested or knowledgeable regarding the research field than the population in general. Even so, the strategy may also have contributed to an explorative context with a desire among the participants to discuss medication evaluation for older persons and promote safer medication treatment. In all papers, participants were recruited in cooperation with healthcare staff, managers or individuals within the local Patient Contract initiative. This recruitment approach reduced the control over the selection process, and could potentially have introduced bias such as recruiting persons with a positive attitude towards the study aim or persons deemed suitable by the recruiting individual. Even so, adhering to the specific recruitment process with specific inclusion and exclusion criteria partially avoided this.

To strengthen the credibility of the findings, the participants’ characteristics were described accurately in the papers to mirror reality of older persons, next-of-kin and healthcare professionals (221). The healthcare professionals included a mix of nurses from different primary care centres and municipality-based home healthcare settings, and physicians from different primary care centres, all with various work experiences. The older persons were a varied group, aged between 75 and 97 and with different numbers of prescribed medications. Of the older persons included in Papers I and V, 17% managed medications with support from next-of-kin or municipality-based home
healthcare, suggesting that the older persons included were mainly in the third age population (28). The inclusion and exclusion criteria for older persons therefore need consideration, as these may affect the transferability of findings. One inclusion criterion was having the ability to communicate in Swedish, i.e. the native language in the context of all papers, which limits the transferability to older persons who do not have Swedish as their first language or who have communication difficulties. A documented diagnosis of dementia was an exclusion criterion in Papers I and V. When presenting the findings, the exclusion of persons with cognitive impairment is important to address, as they tend to be at higher risk for adverse events (74, 241). Cognitive impairment may lead to a reduced ability to understand when to seek medical attention (59), and including persons with dementia could have provided additional perspectives on co-producing medication evaluations. Moreover, by including older persons with dementia in Paper V, they, together with next-of-kin or nurses who support them with their medications, might have been able to contribute jointly with input on the medication plan. Even if the intention was to include next-of-kin in the studies, they have not been included to the extent that would allow conclusions about their role in the evaluation of medications for older persons. The low number of next-of-kin may be due to the inclusion and exclusion criteria of the older persons, including mainly older persons who were independent and self-managing their medications. Thus, when interpreting the findings, the limited voice of the next-of-kin affects the transferability to this important group of persons who in many situations are closely involved in older persons’ medication management (242). In Papers III and IV, persons unable to use a computer were excluded, as the remote approach required digital skills like being able to use the Internet. The criterion excluded older persons who do not use computers, but research shows that managing technology, such as a computer, is not limited by age (208). The digital context may even broaden participant groups, by giving individuals with difficulties attending face-to-face sessions a possibility to participate (204).

Data collection and analysis

Semi-structured interview guides, developed by the researchers to address research aims, were used to collect qualitative data in all five papers. More specifically, the interview guide in Paper II used the CIT structure, focusing
on medication evaluations. A clear definition of what is to be explored is essential when using the CIT approach (154). For Papers I and II, the interview guides were pilot-tested to ensure dependability (221), i.e. that the findings were consistent and could be repeated. This yielded minor clarifications. Even so, during the CIT analysis (Paper II), it emerged that “medication evaluation” was interpreted differently among the healthcare professionals, and therefore the definition of “medication evaluation” in Paper II covers both practical management of medications and patients’ clinical response to treatment. The interview guides used in Papers III, IV and V were not pilot-tested, which may influence dependability negatively. To promote dependability and consistency throughout the research process, I conducted the interviews in all papers.

When using CIT a potential challenge is the participants’ difficulty in remembering incidents correctly, because the memory tends to fade and lose power over time (243). To promote credibility and confidence in data, meaning that findings mirror reality (221), the participants in Paper II, were asked to prepare themselves before the interview by recalling situations they had experienced that worked well and poorly related to medication evaluations. Reflecting and learning from situations where “things go right” is addressed in patient safety research as a field that needs more attention, to understand and develop patient safety (244). Even so, during the interviews, the participants found it more difficult to remember specific situations that had worked out well. The problem of recalling situations in daily practice has been noted in previous CIT interviews (149). Using CIT as a method in future patient safety research has advantages, but needs to address the importance of preparation for the interviews and allowing sufficient time for the participants to recall specific situations (149).

The interviews were conducted face-to-face in Papers I and II, remotely via Zoom in Papers III and IV, and remotely by telephone or Skype in Paper V. In remote interviews, like telephone interviews, the absence of visual signs may result in loss of nonverbal data and may thereby compromise understanding, but there is no evidence that producing data this way gives lower quality (245) and therefore this approach seemed to be a valid way of conducting interviews for everyone involved. The interviews used in the analysis for Paper V were short (median 15 minutes), which could have limited the richness of the material. In content analysis, sample size depends
on collecting a sufficient amount of data to describe the phenomenon (238). Even if the interviews were short no new information emerged at the end of the analysis, suggesting that the data gathered was sufficient to support credibility.

To support the confirmability of the findings in the qualitative analyses, illustrative quotes were translated into English and included alongside the findings. This addition served to better illustrate used headings and codes.

Quantitative data were collected and analysed with descriptive statistics, as the small sample sizes prevented any statistical calculations. The external validity, i.e. how the findings can be generalised to other contexts, and the internal validity, i.e. how the effect can be credited to an intervention, and reliability, i.e. how well a questionnaire produces similar results over time and in different settings (222), need reflection. In Papers III and IV, a non-validated questionnaire was used in the survey. Furthermore, the Zoom Polls used during the workshops to narrow down the participants’ views were not validated. Consequently, the validity and reliability of these questions have not been assessed. The Swedish National Patient Survey in primary care, applied in Paper V, is a validated care survey to collect patient-reported outcomes (160, 246). The survey is not explicitly used to gather experiences of patient safety, but the chosen questions are similar to questions in international questionnaires that try to capture patient safety in primary care by addressing access to healthcare, communication and care coordination (247, 248). Since the international questionnaires have not been translated into Swedish or validated in a Swedish context, they were not considered applicable to the feasibility study. The SUS questionnaire used in Paper V is translated into Swedish (158), but there is no available data regarding validation in a Swedish context. In addition, due to the small sample size and low response rate, the validity and reliability of data from the SUS and the Swedish National Patient Survey cannot be assessed. The validity and reliability of the methods need further consideration before a larger evaluation of the medication plan can be conducted.

In Papers III, IV and V both qualitative and quantitative data were collected, as data triangulation has been suggested as a strategic way to increase the internal and external validity of resilient research (226).
9. Conclusions

This thesis increases knowledge about how older persons and healthcare professionals can co-produce evaluations of medications. A co-designed medication plan may support resilient performance and thereby promote patient safety.

- Many older persons can and want to be actively involved in their medication evaluation, and they may represent an under-utilised source of healthcare resilience. Even so, their trust in physicians and healthcare to evaluate medications regularly and feeling unable to participate need consideration.

- Proper working conditions and co-production with the older persons, and other healthcare professionals enable the evaluation of older persons’ medications. By adapting their performance to the variations in clinical practice, physicians and nurses in primary care may contribute to resilience and improved medication evaluations.

- A co-designed medication plan linked to the medication list within the electronic health record, including detailed information about continued medication treatment, can support communication, continuity and interaction. The information has to be adequate and adapted for all involved, and easy to access and overview.

- A remote co-design approach is inclusive of participants’ perspectives and facilitates learning by sharing experiences. With attentiveness to interrelations between all involved and the digital context, the approach increases co-production between older persons and healthcare professionals to develop solutions that may promote patient safety.

- Implementing a medication plan in clinical practice is complex and requires continuous co-produced improvements of the intervention by the end users, along with a flexible intervention strategy.
10. Implications

10.1. Applications for clinical practice

Based on the findings the following applications for clinical practice are proposed to promote patient safety and “Good quality, local healthcare”:

- **Standardise to individualise.** Unconditionally invite older persons (and their next-of-kin) to co-produce the evaluation of their medications, and subsequently individualise the approach based on the older persons’ preferences and abilities.

- **Promote self-management.** Encourage older persons that want to co-produce medication evaluations to, in alliance with healthcare, take or continue to take, responsibility for monitoring medications at home and also respond to changes in their health condition.

- **Support resilience.** Assess the older persons' health literacy capacity and identify older persons not having the desire or ability to co-produce the evaluation of their medication, and confirm that healthcare professionals and/or next-of-kin have the ability to ensure continued evaluation of medications.

- **Co-design healthcare solutions.** Apply co-design approaches, preferably remote, with older persons and healthcare professionals to inform new products and services aiming to promote patient safety in healthcare. Especially relevant is the co-design of products related to EHRs, as older persons, nurses and physicians may have diverse needs and requirements for useable solutions.
10.2. Suggestions for future research

The findings in the included papers have revealed aspects of how to co-produce safer medication evaluations with and for older persons, and have also highlighted areas for further research attention:

- Feedback from the Deliver phase regarding the usability of the medication plan prototype can be further explored in iterative feedback loops, with specific attention given to how to develop and deliver usable solutions in existing EHRs.

- To fully understand how and if a medication plan can promote patient safety, an updated medication plan can be explored in a larger study. The outcome measures may additionally assess resilient performance, such as increased ability for older persons, next-of-kin and healthcare professionals to monitor and respond to variability in daily practice.

- The older persons’ abilities and preferences regarding being involved in the evaluation of their medications varied. To sustain resilient performance, ways to support healthcare professionals in identifying these abilities and preferences can be further explored.

- Experiences of usability of a medication plan from the perspective of next-of-kin and nurses in municipality-based home healthcare can be further addressed, as their experiences were not fully explored in this thesis.

- The use of remote co-design approaches with older persons to inform other solutions aiming to promote patient safety can be further explored to add knowledge about co-design in a digital environment.
Acknowledgements

I would like to express my sincere appreciation to all the older persons and healthcare professionals who participated in these studies. Thank you for generously sharing your time and personal insights. Your views have not only contributed to the content of this thesis, but have also enhanced my personal understanding of the complexity of medication evaluations.

I would also like to express my warmest gratitude to everyone who, in different ways has encouraged, inspired and supported me during these years as a PhD student. In particular, I would like to thank:

My three supervisors for creating a fantastic multi-disciplinary team for me, offering not only knowledge but also a spirit of generosity and humour. A run and a coffee solves a lot! My main supervisor associate professor Linda Johansson, for straightforward comments and many cups of refreshing coffee. After a scary start at my Research Study Plan seminar, you decided to join the supervisory team, and I am so grateful that you did. Your guidance in qualitative research and academia has been vital, and your commitment to research aimed at improving care and healthcare for older persons is truly inspiring. My co-supervisor associate professor Axel Ros, for superfast responses and engagement. Your concise and sincere feedback on the thesis papers has been central to my development as a researcher. I appreciate your willingness to share your knowledge on patient safety (and in particular to discuss resilience) and for allocating a few minutes during supervision to the additional topic of “snor-sportande”. My co-supervisor professor Johan Thor, for challenging questions and excellent English language skills. Your commitment to continuous learning and personal growth has been a source of inspiration, and the opportunity to exchange ideas and benefit from your wide expertise in improvement science has been invaluable to me over these years. The world has lost a talented researcher and generous supervisor.

Futurum – the Academy for Health and Care in Region Jönköping County, for financing my studies, and professor Staffan Hägg and associate professor Margaretha Stenmarker with staff for helping me out with practical research-related questions. An extra gratitude to the staff of the Medical Library for your competence and kind support with EndNote.
My former manager and associate professor Jörgen Dolby for sowing the first seed of interest in patient safety and research studies. Now, more than 20 years later the thesis is completed. Professor Mirjam Ekstedt for introducing me to the knowledge field of patient safety and research studies at the very beginning. Professor Boel Andersson Gäre for opening the door to research studies, believing in the significance of this topic and for offering enthusiastic cheer during these years. And my former manager and doctor of technology Ann-Sofie Fyhr, for being a role model as a researcher and pharmacist, and for encouraging me to embark on the path of research.

Professor Jan Mårtensson and research assistant Cecilia Helgesson (and the assistants before you) at the Research School within the School of Health and Welfare, for your practical support throughout my studies. Additional thanks to all fellow PhD students at the Research School, both current and former, no one mentioned no one forgotten. The warm and welcoming atmosphere has truly added an extra dimension to my studies and enriched me with many happy laughs. I will honestly miss being part of this inspiring context.

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Work and research are not everything, and I am so thankful for my friends who have reenergized me throughout my research studies. The Gymnasium-squad, the Uppsala-gang, the IKHP-ladies and the Non-IKHP-orienteers: thank you for diverting my attention and refilling my energy with cosy dinners, cultural events and celebrations, shopping and spa weekends, skiing and trekking in the mountains, fika and chats, cheering text-messengers, and for maintaining my health by keeping me company in all weathers during various training sessions. I hope to have even more time for this now!

Finally, yet importantly, I am forever grateful to my close family, for putting up with my sometimes absent-minded and stressful behaviour during the last couple of years. Especially, my brother Tobias, for being a forerunner as a PhD student and for stimulating discussions about healthcare versus the bus industry. Mom Anita and dad Kjell, for your unlimited love for my family and me. You have always encouraged me and believed in me. Tack mamma och pappa för allt ni har gett och ger mig och min familj. – Den här avhandlingen är tillägnad er. My husband Håkan, for your understanding of what these studies have meant to me, despite the countless hours of work they have required. Your down-to-earth approach reminds me of what truly matters in life ♥. My daughters Alma and Hilda, for kind, cheerful support and patience. As two young women, you inspire me through engaging discussions and provide me with a broader perspective on everything ♥♥. Love you.
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Appendices
Appendix

Appendix 1 - Interview guide in Paper I

Translated from Swedish

**Introduction:**
I do research on safer and better medication treatment for persons 75 years or older. I am interested in patients' perceptions regarding how their medication treatment is evaluated and monitored. Therefore, I would like to ask questions about this.

**Questions:**
You have been prescribed medications. Can you tell me about the most recent appointment with your doctor, when you discussed your medication treatment?
- Could you tell me how your medication treatment is monitored (i.e., evaluated to ensure it is still suitable for you)?
- Why are you receiving a specific treatment? Could you elaborate and provide more details?
- What effects can you expect?
- What side effects should you expect or be watchful for?
- What tests are conducted and why? Would you react if something was missed?
- Does anyone ask you about your experience with your medication treatment?
- What is the plan for your ongoing medication treatment?
- How often should you have appointments, tests, and check-ups?
- Do you know which examinations need to be done and when?

Who do you perceive as responsible for monitoring your medication treatment?
- What is your view of the doctor's role?
- How do you perceive your own responsibility regarding treatment follow-up?

How do you view your own ability to be involved (have influence) in your medication treatment?
- Your own ability to understand what needs to be done?

Medication treatment among older persons has increased, and the pros and cons are discussed. Do you feel safe in your medication treatment?
- What makes you feel this way?
- What is working well? What happened then?
- What is not working as well? What happened then?

Is there anything you wish was done differently in your medication treatment? If so, what?

**Conclusion**
- Now, summarizing what I have understood
- I have no further questions. Is there anything you would like to add about what we have discussed or bring up and ask about before we conclude the interview?

Additional prompt phrases:
What do you mean by that? Can you provide examples? Can you explain further?
Appendix

Appendix 2 - Interview guide (CIT) in Paper II

Translated from Swedish, additionally presented in the published Paper II

Introduction:
Since you are involved in medication treatment in older persons, I would like to share your experiences and views on how medications are monitored and evaluated. This study aims to explore physicians and care coordinator nurses at primary healthcare centres, and municipality-based home healthcare nurses' experiences from evaluations of older persons' medications, and their related actions to manage concerns related to the evaluations. We will try to find factors that enable us to improve patient safety and increase patient and relatives' participation in the medication evaluation.
I will ask you to describe a situation regarding the evaluation of an older person's medications that worked out well or not so well and I will ask additional questions to get the situation as complete and whole as possible.

Demographic characteristics of the participant
The participants’ age, sex, number of years in the profession and number of years at the workplace were asked for before the interview started.

Questions:
You have been prescribed medications. Can you tell me about the most recent appointment with your doctor, when you discussed your medication treatment?

Additional questions:
- Can you describe the situation?
- Why do you think the situation occurred?
- What was the consequence of the situation?
- How was the situation handled?
- How did you experience the situation?
- Has the situation changed your way of working?

Rounding up:
Do you want to add anything of relevance regarding the evaluation of older persons’ medications that had not been addressed during the interview?
Appendix

Appendix 3 – Questions from the Survey in Papers III and IV

Translated from Swedish, additionally presented in the published Papers III and IV

*Overarching question*
What was your "role" in this work? [Multiple choices]

*Questions related to the prototype*
1. As a group, you have identified that the treatment goal as well as when and how the medications will be evaluated are the most important content in a medication plan.
   1a. Do you agree that these contents are most important? [Single choice]
   1b. Do you find these contents in the medication plan prototype? [Single choice]
   1c. Is there anything in the medication plan prototype you still think is missing? If yes, what? [Open question]

2. As a group, you have wished for having the medication plan integrated into the medication list.
   2a. Based on the medication plan prototype, do you agree on that a medication plan should be integrated into the medication list? [Single choice]
   2b. What are the pros and cons of the medication plan prototype? [Open question]

3. To what extent do you feel that the prototype meets your objectives for a medication plan? [Graded]
   3b. What needs to be adjusted for your goals to be met 100%? [Open question]

4. Do you think that the time it would take to create/maintain the medication plan at a healthcare appointment corresponds to the medication plan’s potential contribution to patient safety? [Graded]
   4b. What needs to be adjusted for you to feel that it contributes to patient safety to 100%? [Open question]

5. Would you consider using the prototype as a medication plan? [Graded]
   5b. What needs to be adjusted for you to feel that it is usable to 100%? [Open question]

6. Imagine a perfect medication plan; how well does the medication plan prototype match your imagination? [Graded]

7. To what extent do you assess that the medication plan prototype may contribute to increased patient safety in medication treatment? [Graded]
   7b. Describe, in your own words, your thoughts about how the medication plan prototype could affect patient safety. We appreciate both positive and negative feedback. [Open question]

8. To what extent do you assess that the medication plan prototype is useful for you? [Graded]
   8b. Describe, in your own words, your thoughts about the usability of the medication plan prototype. We appreciate both positive and negative feedback. [Open question]
Appendix

Questions related to the co-design work

1a. What is your overall experience of participating in the work of creating a medication plan prototype? [Graded]
1b. Motivate, in your own words, your experience of participating in this initiative. We appreciate both positive and negative feedback. [Open question]

2. Has the initiative fulfilled its aim, which is to jointly develop a medication plan prototype that is usable and supports patient safety? [Single choice]

3a. How do you appreciate having persons with medications, physicians and nurses working together to create a joint, patient-safe and usable medication plan prototype? [Open question]
3b. What do you experience as difficulties in having persons with medications, physicians and nurses working together to create a joint, patient-safe and usable medication plan prototype? [Open question]

4a. In the workshops, I was allowed to speak to the extent that I wanted. [Graded]
4b. Describe, with your own words, your possibility to speak to the extent that you wanted. We appreciate both positive and negative feedback. [Open question]

5a. The views I expressed in the workshops were taken into account in developing the medication plan prototype [Grade 1-10; 1 = do not agree, 10 = totally agree // Do not know]
5b. Describe, in your own words, how you felt your expressed views were managed. We appreciate both positive and negative feedback. [Open question]

6a. How did you experience the balance between how much older persons with medications, general practitioners and nurses expressed their wishes? [Grade 1-10; 1 = very bad, 10 = excellent // Do not know + Open comment box]
6b. Describe, in your own words, how you experienced the balance between everybody’s wishes. We appreciate both positive and negative feedback. [Open question]

7. How did you experience the balance between how much the views of older persons with medications, general practitioners and nurses were listened to? [Grade 1-10; 1 = very bad, 10 = excellent // Do not know + Open comment box]
7b. Describe, with your own words, how you experienced the balance between how views were listened to. We appreciate both positive and negative feedback. [Open question]

8a. How did you perceive that the information provided before, during and after the workshops facilitated your participation? [Grade 1-10; 1 = very bad, 10 = excellent // Do not know + Open comment box]

9. How did you experience that the practical parts of the workshops (i.e. the use of the digital platform, and the facilitators’ actions) facilitated your participation? [Grade 1-10; 1 = very bad, 10 = excellent // Do not know + Open comment box]

**Final question:**
Do you have any additional comments on the prototype itself or on the co-design work that you would like to share with us? [Open question]
Appendix

Appendix 4 - Interview guide in Papers III and IV

*Translated from Swedish, additionally presented in the published Papers III and IV*

**Aim with the interviews:**
To collect participants' experiences on co-creating a medication plan by asking them to reflect on the co-design work and on the outcome, i.e. the medication plan.

**Introduction**
I do research on how to increase patient safety in the medication use process. As you have been involved in the co-creation of a medication plan prototype, I would like to hear your experiences of participating in this kind of work and on the outcome itself, i.e. the medication plan prototype. The interview is intended to clarify what emerged during the co-design initiative.

**Question-guide**
The interview concerns three topics: a background, questions about the outcome, i.e. the medication plan prototype and questions about participation in co-design work.

**Background:**
- What was your role in the team?

**Questions about the medication plan prototype:**
- What do you think was the most important outcome during this work?
- In what way do you think a medication plan prototype could contribute to increased patient safety?
  - In the survey, lack of time for physicians was highlighted as a possible risk. What are your thoughts about that?
- Do you find the result, i.e. the medication plan prototype, useful for yourself? If or if not – elaborate.
  - In the survey, the availability of the medication plan has been discussed. What are your thoughts about that?
  - In the survey, the overview of a plan in the medication list has been discussed. What are your thoughts about that?

**Questions about participation in a co-design work:**
- What does it mean for you to co-create a medication plan that should be usable and support patient safety?
- Why did you choose to participate?
- What is your opinion about participating in this type of co-creative work?
- What expectations did you have on the initiative? Were they fulfilled? If or if not – elaborate.

*Rounding up* - Do you want to add anything that has not been addressed?
Appendix

Appendix 5 – Interview guide in Paper V

Translated from Swedish

Introduction:
I am researching in how to enhance patient safety in medication treatment. Given your involvement in the implementation and assessment of a medication plan, I am interested in your experiences and views regarding the usability of medication plans for you. Furthermore, I would like to hear your thoughts on the extent to which you believe the medication plan may promote patient safety.

Question-guide
The interview is divided into three question areas; background, usability, and patient safety

Background
- Describe how you have been involved when applying the medication plan.
- Describe how you have used the medication plan in your daily life.

Usability of the medication
Usability is the effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments (ISO 9241-11).

To gather experiences and insights into the usability of the medication plan, we will start with your description and then proceed with follow-up questions.
- How has it been to use the medication plan?
  o Why? Please elaborate!
- Do you perceive the medication plan as useful for your use?
- Why? Please elaborate! What has worked well? In what ways could it be improved?
- How do you perceive the practical functionality of the medication plan in your everyday life, in terms of providing a basis for effective monitoring of medication treatment?
  o Why? Please elaborate! What has worked well? In what ways could it be improved?
- How do you find working with the medication plan in practical terms (e.g., on the computer, with the printed version)?
  o Why? Please elaborate! What has worked well? In what ways could it be improved?
- When you think about your expectations regarding using a medication plan, how well do they align with what you experienced?
  o Why? Please elaborate!
Appendix

The contribution of the medication plan to increased patient safety

Patient safety is protection from harm in healthcare (Patient Safety Act 2010:659). This means that patients should not be harmed in healthcare interventions or due to healthcare not carrying out actions that are justified based on the patient's condition.

To elicit experiences and perspectives regarding the potential contribution of the medication plan to enhance patient safety, we will base our inquiry on the following questions:

- In what way do you perceive that the medication plan could prevent errors or mistakes from occurring in medication treatment?
  - Why? Please elaborate!
- Have you observed that the medication plan has led to a different approach in terms of monitoring and evaluating medication treatment?
  - Why? Please elaborate!
- Do you believe that the medication plan has contributed to increased patient participation and engagement?
  - Why? Please elaborate!
- Do you think the medication plan has contributed to a greater sense of security?
  - Why? Please elaborate!
- Do you believe the medication plan has improved the information available regarding ongoing medication treatment?
  - Why? Please elaborate!
- What does it mean to you to have a medication plan for continued medication treatment?
- Do you think a medication plan, i.e., receiving a comprehensive plan for medications, should be included in the routine daily practices of medication treatment for older persons?

Rounding up

- Is there anything that has not been mentioned that you would like to add now?
- Thank you for your participation.
Appendix

Appendix 6 – Questions from the National Patient Survey in Paper V

Translated from Swedish

<table>
<thead>
<tr>
<th>Question</th>
<th>No, not at all</th>
<th>Yes, completely</th>
<th>Not applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Were you involved in decisions about your care/treatment to the extent you wanted?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Did the doctor involve you in decisions about your care/treatment?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Did the doctor take into account your own experience of your illness/health condition?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>At your visit, was a decision made about the next step in your care/treatment?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>If you spoke with several staff members during your visit, were they consistent in their communication?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Were you given enough information about medications and possible side effects?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Did you receive enough information about warning signals to be aware of regarding your illness/health condition or medications/treatment?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Did you receive enough information about your care/treatment?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Did the doctor explain the medications/treatment in a way that you understood?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>If you asked the staff questions, did you get answers that you understood?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Were you given the opportunity to ask the questions you wanted?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>If your family/next-of-kin wanted to talk to a doctor, were they able to do so?</td>
<td>1 2 3 4 5</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>
Together towards safer medication treatment for older persons

Medications play an important role in maintaining health, but they can also unintentionally harm patients. Safe use of medications is a global patient safety challenge, with older persons being at particular risk of harm. This thesis aimed to increase knowledge of how older persons and healthcare professionals can co-produce a solution for improved medication evaluations and thereby promote patient safety. The research process was guided by a co-design framework, and used both qualitative and quantitative methods to collect and analyse data.

The findings showed that older persons want to be involved in medication evaluations. Even so, some felt unable to do so or considered themselves unconcerned, trusting healthcare to evaluate their medications properly. To improve medication evaluations, both older persons and healthcare professionals emphasised the importance of continuity of care and adopting a co-produced approach. A co-designed medication plan integrated into the electronic health record’s medication list can facilitate evaluations, provided it includes adequate and adapted information, and is easy to access and overview for involved parties. Remote co-design of patient safety solutions, such as a medication plan, allows an accessible environment, and sharing everyday life experiences creates learning and awareness of possible risks and strategies. A remote approach can complement or substitute face-to-face co-design. Implementation and evaluation of a medication plan for older persons in a primary care setting presents challenges, related to different contextual factors and used study methods.

To promote safe medication treatment for older persons, the findings in this thesis highlight a co-produced approach to design patient safety solutions and to increase the ability to manage both expected and unexpected conditions in older persons’ medication treatment.

MALIN HOLMQVIST is a registered pharmacist with a Master of Science in Clinical Pharmacy. She works as a pharmacist at Region Jönköping County and has many years of experience working with older persons and healthcare professionals in hospital and primary care settings. Malin’s research area is health and care science, with a particular interest in promoting patient safety for older persons using medications.