SAVONIA
University of Applied Sciences

THESIS – MASTER'S DEGREE PROGRAMME
SOCIAL SERVICES, HEALTH AND SPORTS

DIGITALLY LED COMPREHENSIVE MEDICATION MANAGEMENT

A Narrative Literature Review

AUTHOR Tanja Levala

SAVONIA UNIVERSITY OF APPLIED SCIENCES

THESIS
Abstract

Field of Study Social Services, Health and Sports	
Degree Programme Master's Degree Programme in Health Care, Digital Health	
Author(s) Tanja Levala	
Title of Thesis Digitally led comprehensive medication management. A Narrative literature review	
Date 22.09.2024	Pages/Number of appendices 55/3
Client Organisation /Partners Savonia University of Applied Sciences	

Abstract

Polypharmacy, particularly among the elderly, was identified as a growing concern in Finland due to the aging population and increased medication use. Digital CMM was found to be essential in preventing DRPs and improving healthcare outcomes, especially with the rise of electronic services and accelerated digital solutions during the COVID-19 pandemic.

This research aimed to review the current knowledge on digital comprehensive medication management (CMM), including its benefits, challenges, and overall impact on patients, healthcare providers, and society. Two databases were chosen as the primary sources for this literature review, which was conducted to collect and analyze existing information. An inductive approach was used, allowing for flexible analysis without a predefined classification structure.

The study revealed that digitally led CMM offers significant advantages, including improved access to healthcare, enhanced health outcomes, increased patient satisfaction, collaborative care, and economic benefits. However, challenges were identified, particularly for individuals who do not speak the local language of the services. Incompatibility between systems also limited database access and hindered collaboration among multidisciplinary teams. Future research was recommended to investigate the effects of digital CMM on interdisciplinary collaboration and the practical challenges faced by healthcare professionals.

This study provides valuable insights for implementing digital CMM services, benefiting professional communities and informing future professional practices.

Keywords

comprehensive medication management, medication management service, telehealth, remote, telephone, telemedicine, telepharmacy, digital technology, internet

CONTENTS

1 INTRODUCTION

The World Health Organization actively promotes equal access to medical services, striving to eliminate inequality caused by factors such as discrimination, social and economic status, ethnicity, and geographic location. These measures aim to ensure fair access to healthcare for all. (World Health Organization 2023, 5.) The Finnish Ministry of Health has embarked on a significant initiative to prioritize the healthcare of its citizens through the establishment of comprehensive medication treatment guidelines spanning from 2018 to 2022. The primary objective of this program is to ensure that every resident of Finland, regardless of their geographical location, has access to the latest and most accurate information regarding treatments (Ministry of Social Affairs and Health s.a.). This initiative empowers patients by allowing them to actively engage in decisions regarding their treatment. In turn, the role of rational medication management is crucial, particularly in cases of complex multi-drug therapies, where controlling and regularly reviewing medication lists is essential. It involves the precise and timely administration of medications to enhance individual well-being, ensuring that healthcare practices are not only effective but also efficient and patient-centered. (Ministry of Social Affairs and Health s.a.) However, notable challenges remain in medication management for older individuals in nursing homes. A report by Farmasia (2019) reveals that in 71% of cases, medication lists do not accurately reflect the medications patients are actually taking. Even when these lists are available, they often contain outdated or incomplete information, highlighting the lack of up-to-date medication records (Kuitunen & Schepel 2020, 2014). These discrepancies contribute to treatment issues such as underuse, incorrect administration, and irrational drug use, potentially leading to adverse events (Kuitunen & Schepel 2020; Hakoinen et al. 2017, 17; Ni, Yang, Bai, Hu, Zhang 2021). Pharmacists are crucial in managing drug-related problems (DRPs) and promoting rational, safe, and cost-effective treatment (Yalçın et al. 2023; Kuitunen & Schepel 2020).

A rational medication management program, based on a comprehensive medication management approach (Association of Finnish Pharmacies 2021), is essential for preventing medication errors, which can lead to increased healthcare costs and incorrect treatment decisions (Finnish Medicines Agencies 2018). According to the Finnish Medicines Agency and the Social Insurance Institution of Finland (2022) medication consumption continues to rise due to the rapid aging of the population (Finnish Institute for Health and Welfare 2023, 46). From 2020 to 2022, 20% of citizens over 75 experienced polypharmacy. Problems arise when overall treatment is not evaluated and medication lists are not regularly reviewed, potentially worsening the situation without providing additional health benefits (Finnish medicines agency s.a.) This highlights the need for digital comprehensive medication management, especially as electronic services are increasingly integrated into healthcare. The COVID-19 pandemic advanced the implementation of digital solutions, making comprehensive medication management essential for preventing errors and ensuring effective care amidst rising medication use and an aging population (Senbekov et al. 2020; Butcher & Hussain 2022, 115; Kyytsönen, Aalto & Vehko 2021, 15-16).

This thesis utilizes a literature review methodology combined with inductive content analysis to summarize the current knowledge on digital medication management, highlight its implementation advantages and challenges, and evaluate its impact on patients, healthcare providers, and society.

2 DIGITAL HEALTHCARE LANDSCAPE

2.1 Understanding healthcare digitalization

According to the OECD Health 2021 report, Digital Health, often referred to as eHealth, encompasses a diverse array of digital modalities. In particular, Electronic Medical Records (EMR) and Electronic Health Records (EHR) play a pivotal role in digitally storing medical data. This functionality facilitates patient engagement with healthcare institutions, providing individuals access to their comprehensive health history. Moreover, within the EHR framework, elements such as ePrescribing and eAppointments are integrated to provide patients with electronic prescriptions and potentially facilitate online appointment booking. Furthermore, Telehealth enables the remote provision of clinical services and facilitates the monitoring of care and treatment. Additionally, mHealth, another integral component of eHealth, encompasses mobile applications and health monitoring devices. (OECD 2021, 15.) These fundamental concepts represent pivotal components within the framework of digital health. They unveil a realm of possibilities for enhancing the accessibility, quality, and efficiency of healthcare services (Senbekov et al. 2020, 3). Utilizing various online platforms and mobile applications grants patients quicker and easier access to health services. This is particularly beneficial for patients living in remote areas, who are geographically distant from medical facilities, experience improved health accessibility. (Judijanto, Putra, Zani, Hasyim & Muntasir 2024, 134; Senbekov et al. 2020, 3.) Additionally, the introduction of digital technologies in the healthcare sector provides significant opportunities to elevate the quality of patient care (Butcher & Hussain 2022, 115). This idea is in line with the study by Senbekov et al. (2020).

The official concept of digitalization is still evolving and is often elucidated through practical examples. Digitalization occurs when a process, item, or object undergoes conversion into digital format. (Ilmarinen & Koskela 2015, 21–23.) Digital health care leverages digital technologies such as artificial intelligence, big data, blockchain, and the Internet of Things to enhance patient care and health outcomes (World Health Organization s.a.). The notion of digital health is based on the principle of eHealth, which refers to "the use of information and communications technology in support of health and health-related fields." (World Health Organization 2019, 1).

Digital transformation embodies a crucial aspect of the future of medicine (Stoumpos, Kitsios & Talias 2023, 1-2). The positive impacts of digital healthcare advancements, particularly in an aging society, include improved accessibility to healthcare services and potential cost savings, as demonstrated by Arief, Nguyen, & Saranto (2013, 52). Additionally, research by Nascimento et al. (2023) highlights the positive impact of digital technologies on the productivity, mental well-being, competence, and skills of healthcare professionals. Despite the outlined advantages, Arief, Nguyen, & Saranto (2013) emphasize barriers linked to data security and protection in the healthcare sector. Chen et al. (2022) highlight similar barriers, including concerns regarding privacy/security, user-unfriendly app interfaces, and a preference for in-person or phone care. Similarly, Mumtaz et al. (2023,6) address challenges encountered in digital progress during and beyond the COVID-19 pandemic, such as concerns regarding evidence-based standards, confidentiality, data management, and ethical considerations. It is essential to consider vulnerable groups such as the elderly, minorities, special needs individuals, low-income populations, less educated individuals, and those with

chronic illnesses, in order to develop digital services that improve availability and accessibility, as well as to promote digital equality. (Pennanen et al. 2023, 36.) While acknowledging the positive aspects of digital transformation in healthcare, it's imperative to address and surmount potential barriers that may emerge during the adoption of digital technologies. These hurdles could include concerns regarding data privacy, healthcare democratization, and digital inequality (Butcher & Hussain, 2022; Menachemi & Collum 2011, 51-52).

2.2 Digitalization's impact on patients and healthcare

A revolutionary change has taken place in the provision of EHR in Finland. MyKanta is an online citizen service regulated by law, first introduced in May 2010. Through MyKanta, users can view their prescriptions, request prescription updates, and access their health information. As it is gradually phased in, they will also be able to see their social welfare data. All information is consolidated within the MyKanta service, allowing patients to visit public or private facilities or access the service through occupational healthcare. (Kanta services 2024.) Accessibility to patient EHRs facilitates healthcare personnel in swiftly accessing patient information, thereby enabling the provision of prompt and high-quality service. Furthermore, due to digitalization, Finnish electronic prescriptions allow patients to acquire medications in Estonia, Croatia, Portugal, Poland, and Spain as part of the EU healthcare system. (EU-healthcare online service 2023.) Based on a population survey in 2021, MyKanta was found to be the most popular digital service, enjoying wide demand among 64% of respondents (Pennanen et al. 2023, 31).

Additionally, the influence of digitization goes beyond simply accessing data. Remote monitoring devices allow for continuous tracking of patients' health metrics, such as pulse, blood sugar levels, and blood pressure. This real-time data transmission allows physicians to monitor patients without the need for physical presence, enhancing both efficiency and patient care. (Judijanto et al. 2024, 137.) Portable medical diagnostic devices could prove invaluable in scenarios such as pandemics, wars, or natural calamities, where hospital infrastructure may be destroyed (Särestöniemi, Myllymäki, Reponen & Myllylä 2023, 7).

Besides, the integration of artificial intelligence into diagnostics has significantly impacted the field of medical diagnostics. It streamlines the analysis of medical images, laboratory test results, and clinical data with a high degree of accuracy, facilitating the swift identification of diseases. Moreover, artificial intelligence assists in predicting the risk of disease development using existing data (Judijanto et al. 2024, 137–140). According to Vahteristo & Kinnunen (2019, 207) it is feasible to utilize data from EMRs and analyze it using artificial intelligence, enabling the identification of health-related risks. Utilizing this information has the potential to enhance individuals' health outcomes at early stages.

Additionally, Virtual Hospital (Terveykylä) was created to assist patients and medical personnel. It is a research-based digital service developed and maintained by specialists in specialized medical care, offering health-related information and support for individuals, treatment for patients, and tools for professionals (Peltonen & Häyrinen 2020, 89). The platform also supports healthcare specialists through TerveykyläPRO, a service portal designed to enhance their skills and promote the adoption

of new working methods. (Terveyskylä s.a.) Another important digital service developed in partnership with the Welfare and Health Care Service of Finland is Omaolo. Omaolo represents a significant progress in healthcare digitalization. It is a certified medical device bearing CE marking (risk class IIa). It serves as a symptom checker, providing patients with up-to-date information about their health status and offering recommendations for necessary actions. (Omaolo s.a.) Digital health presents a wealth of opportunities to enhance healthcare services and patient care.

2.3 Healthcare landscape for digital solutions

Digitalization in the healthcare sector is a long-term trend that demands ongoing development and the implementation of standardized regulations (Piha & Seppälä 2023, 60). It is essential that digital health becomes an integral part of the healthcare sector, benefiting people in an ethical, secure, reliable, fair, and sustainable manner. Digital health should be designed according to the principles of transparency, accessibility, scalability, replicability, interoperability, privacy, and security. (World Health Organization 2021, 8.)

According to the World Health Organization's global strategy on digital health for the period 2020-2025, one of the key objectives is to fortify the health system by incorporating digital technologies and cultivating qualified digital specialists to deliver essential health services. Another pivotal goal is to enhance digital health literacy, promote gender equality, and empower women. Within this objective, there is a need to raise public awareness about digital health, thereby fostering improved digital health literacy among both the general populace and healthcare professionals. Additionally, it is crucial to acknowledge that achieving this goal necessitates transitioning the healthcare approach of a country from one focused solely on treating diseases to a comprehensive model centered around preventative medicine. (World Health Organization 2021, 22-26.)

2.4 Regulation and digitalization in Finland's healthcare sector

In Finland, the healthcare sector is governed and regulated by laws that determine standards for the provision of medical services, patient rights, and obligations, as well as other aspects related to the organization and functioning of healthcare. Based on The Constitution of Finland (713/1999), all residents of the country have rights to social and health services. Act on Organising Healthcare and Social Welfare Services (612/2021) regulates the provision of these services, and Social Welfare Act (1301/2014) specifies the services that welfare districts must organize for patient The provision of healthcare services is governed by the Health Care Act (1326/2010). Additionally, the Act on the Status and Rights of Patients (785/1992, 3) states, "Every person who is permanently resident in Finland is entitled to health and medical care required by his state of health without discrimination, within the resources available to healthcare at the time in question."

As of January 1, 2023, the responsibility for organizing healthcare and social services transitioned from municipalities to the wellbeing services counties. The city of Helsinki and the Åland Islands are not part of the wellbeing services areas. The HUS Group is accountable for providing advanced medical services as mandated by specific legal provisions. Healthcare services are divided into primary and specialized healthcare. Primary healthcare encompasses services for schoolchildren and students, general outpatient care, dental care, and basic treatment for mental health and substance

abuse. Specialized medical care is mainly provided in hospitals and their associated outpatient clinics. They encompass investigations and treatment across various specialties. Access to specialized inpatient care is provided through a multi-level treatment system with specific criteria and usually requires a referral. (Ministry of Social Affairs and Health 2023.)

Key stakeholders in the development of digital health include the Ministry of Finance (VM), the Ministry of Social Affairs and Health (STM), the National Institute for Health and Welfare (THL), the National Pensions Institute (Kela), and DigiFinland. These organizations play a crucial role in shaping and advancing digitalization in the healthcare sector (Piha & Seppälä 2023, 60). The Ministry of Finance controls activities and finances in the health and social sectors, and it is also responsible for regulating finances. The Ministry of Social Affairs and Health plays a crucial role in digital health development by serving as a producer of strategies and enacting legislative changes. National Institute for Health and Welfare is responsible for national data collection and to follow population health and well-being. Kela is responsible for maintaining national Kanta-services as Omakanta, Prescription-services, The Finnish medical Society Duodecim. DigiFinland is company which offers digital services to social and health care for both patient and professionals. Its services include Omaolo, Omasuuntima, Päivystysapu 116117, Hoidonperusteet.fi, Basics of urgent care and Electric family center. (Piha & Seppälä 2023, 60-62.)

In the Finnish healthcare sector, digitalization is regulated by the law on personal data in social and health care (784/2021). While most of our population expresses a desire to use digital services, effective implementation requires consideration of people's ability to master digital technologies, the availability of necessary equipment, and their experience with using digital services. Currently, a fifth of the population expresses the need to learn how to use digital services in the healthcare sector. This need is typically seen among individuals with low income, older age, and weak health and memory. It was also noted that a low level of education affects the desire to use digital services (Finnish Institute for Health and Welfare 2024). Digitization and information management in the social and health care sector strive to create conditions for preserving the well-being of the population with the help of digital services, thereby encouraging the population to actively participate in supporting their health. In addition, conditions are created under which clients can use remote services at any time and in any place, regardless of the region or city in Finland, ensuring a single standard of quality. (Ministry of Social Affairs and Health 2023, 19-20.)

According to the results of a 2021 population survey by the Finnish Institute for Health and Welfare, 83% of respondents had used digital health services at least once in their lives. MyKanta emerged as the most popular digital service, with significant demand reported by 64% of respondents. (Pennanen et al. 2023, 31.) In 2023, there were 13 million transactions made online through MyKanta, whereas in 2022, the number was slightly higher at 14.2 million, likely influenced by the COVID-19 pandemic. Additionally, the number of renewal requests for electronic prescriptions sent to healthcare from MyKanta was 3.7 million in 2023, compared to 3.4 million in 2022. (Jormanainen & Vehko 2024, 6–14.)

The sphere of digital services in healthcare demands regular updating and development. The various digital solutions mentioned earlier necessitate constant modernization to ensure the timeliness

and availability of services for patient care. The efforts of Finnish key stakeholders create a patient-centered healthcare ecosystem.

2.5 Future of digital health

According to the World Health Organization's (WHO) vision for 2030, accelerating human progress necessitates bridging the digital gap and fostering global knowledge among all countries. This objective can be achieved through technologies like IoT, virtual care, remote monitoring, AI, big data, blockchain, smart wearables, and remote data collection tools. These advancements enable the provision of pertinent information within the healthcare ecosystem, consequently improving health outcomes with better diagnostics, data-driven treatments, digital therapeutics, and clinical trials. (World Health Organization 2021, 8.)

Going forward, there will be an increasing emphasis on ensuring the accessibility of digital services to the general public, as well as efforts to improve the digital literacy of the population. The focus will be on expanding digital inclusion, especially for marginalized groups who may face barriers to accessing digital services. The global goal is to intensify efforts to engage the majority of the population in digital health, which will ultimately improve overall well-being. Moreover, there will be an increased focus on ensuring user-friendly interfaces and the safety of available digital solutions, aiming to provide users with comfort and ease of use. (Finnish Institute for Health and Welfare 2023, 230; Judijanto, Putra, Zani, Hasyim & Muntasir 2024, 141-142.)

In subsequent times, as technological advancements continue to unfold, there will be significant opportunities to further enhance medical services, especially through the integration of artificial intelligence (AI), the Internet of Things (IoT), and more sophisticated data analytics. This digital transformation in healthcare not only revolutionizes how medical services are accessed but also promises to make healthcare more equitable and accessible for all. (Judijanto, Putra, Zani, Hasyim & Muntasir 2024, 133-134, 142.) AI emerges as a crucial tool in addressing pressing global issues like climate change, rapid population growth, and the growing demand for high-quality healthcare among aging populations. Nonetheless, besides AI, tangible resources and proactive measures are essential to drive progress into the future. (Rousku et al. 2019, 42.) According to Rousku et al. (2017, 51), robots in healthcare have the potential to significantly enhancethe quality of life for older individuals, offering a cost-effective solution. However, the main challenge lies in ensuring that robots are accessible to all older adults and others who require assistance while living independently at home.

To further enhance the development of digital health and new technology in all variations, continued investment in technology and digitalization, as well as promoting literacy in utilizing new technologies among both patients and staff, is imperative.

3 SIGNIFICANCE OF MEDICATION MANAGEMENT

3.1 Rational pharmacotherapy in Finland

In Finland, the Ministry of Social Affairs and Health is responsible for ensuring that drug therapy is effective, safe, high quality and equitable. This includes providing cost-effective pharmacotherapy for everyone who needs it. (Ministry of Social Affairs and Health s.a.) According to the action plan of Prime Minister Sipilä in 2016, the introduction of rational pharmacotherapy has been carried out in order to improve the comprehensive treatment of patients. This approach ensures the creation of conditions for the economically effective use of medication both for the patient and for society. The action plan outlines 5 main topics related to the management of pharmacotherapy and pharmaceutical services at national and regional level. (Hämeen-Anttila, Närhi & Tahvanainen 2018, 7.)

A rational pharmacotherapy action plan can significantly improve the functionality and performance of the population if the treatment plan is correctly selected. Otherwise, it can lead to drug-related problems (DRPs) and potentially cause more harm than benefits. In Finnish hospitals, between 700 and 1,700 patients die each year as a consequence of medical mistakes, primarily attributed to drug therapy (Pasternack 2006). DRPs cover a broad range of issues, including medication errors such as suboptimal drug selection, incorrect dosage, regimen, dosage form, or duration of use, unnecessary drug therapy, therapeutic duplication, as well as drug-drug, drug-disease, drug-food, or drug-nutrient interactions, and drug allergies. (Chisholm-Burns et al. 2016.) Moreover, it is acknowledged that approximately 50% of medication regimens are adhered to as prescribed by healthcare providers (World Health Organization 2003). The significant increase in drug use in recent decades is due to the increased incidence of diseases among elderly population, who often require multiple medications for treatment. On average, older adults use 4 to 10 medications. (Pitkälä, Hosia-Randell, Raivio, Savikko & Strandberg 2006.) Based on the forecast by Kestilä, Karvonen, Jauhiainen & Mikkola (2023, 46), the number of elderly people is on the rise. In 2022, the number of people over 75 years old in Finland have been reached 600 000, and by 2030, this number is predicted to increase to 780 000. Based on Kela's statistics, drug costs increased between 2020 and 2022. In particular, the use of prescription drugs in 2022 increased by 3.9% compared to 2021 (Finnish medicine agency & Social Insurance of Finland 2020; Finnish medicine agency & Social Insurance of Finland 2021; Finnish medicine agency & Social Insurance of Finland 2022). In addition, there has been an increase in mortality from diseases of the circulatory system, with the majority of deaths still attributed to this category of diseases, accounting for almost one in three deaths. More than 19,500 people have died as a result of circulatory system diseases, which is 700 more cases than in 2021. (Statistics Finland 2023.)

The increase in the elderly population and the prevalence of polypharmacy among them have necessitated the implementation a national drug safety program called Valo. Developed by the Finnish Pharmacists Association and the Center for Client and Patient Safety, the Valo program aims to enhance drug safety in outpatient care. By the end of 2023, it had already documented over 25,000 Haipro hazard events in pharmacies. (Valo 2024, 3-4.) Alongside this, continuous improvement in the culture surrounding safe treatment within organizations is crucial. Learning from past mistakes is a primary priority, providing valuable insights to perpetually enhance the safety and quality of

patient medication therapy (World Health Organization 2003). Additionally, a steadfast commitment to medication therapy significantly influences treatment effectiveness and prognosis (Pitkälä et al. 2006). Rational treatment has the potential to deliver effectiveness, safety, cost-efficiency, equity, and high quality. However, realizing this potential requires active patient engagement as collaborators with healthcare professionals and diligent adherence to the medication regimen. (Hämeen-Anttila, Närhi & Tahvanainen 2018, 10-11.)

The importance of systematic medication management in enhancing drug therapy is underscored. Through systematic monitoring of therapy plans for the elderly and careful selection of medications, safer and more effective treatment can be ensured, ultimately leading to improved treatment outcomes. (Mucalo et al. 2019, 33-35.)

3.2 CMM service

The principles of rational therapy take center stage in comprehensive medication management (CMM), offering an integrated approach to managing drug therapy. A rational drug therapy program focuses on enhancing effectiveness and proper drug utilization, thereby aiding in achieving a therapeutic effect. (Oliveira, Nascimento & Ramalho-de-Oliveira 2020.) CMM integrates these principles but with a more expansive and patient-centered approach. More than 30 years ago, Hepler and Strand introduced the concept of pharmaceutical care, which focuses on administering medication therapy to achieve targeted outcomes that enhance the patient's quality of life. It involves the active and responsible provision of pharmaceutical care in partnership with the patient and other healthcare professionals. (American Society of Hospital Pharmacists, 1993.)

Based on the principles of pharmaceutical care, the primary aim is indeed to enhance the patient's condition and quality of life. These concepts essentially form the basis of standard drug therapy, encompassing the assessment of the medical plan to ensure treatment effectiveness and safety, while considering the patient's diagnoses and other health factors. (Oliveira, Nascimento & Ramalho-de-Oliveira 2020.) This progression naturally leads to CMM, which involves the active involvement of a clinical pharmacist in assessing each of the patient's medications. CMM services are typically delivered in collaboration with the patient, general physician, and other healthcare professionals. Additionally, it is crucial to ensure that patients can use medications as prescribed and follow the recommended regimen. (McFarland et al. 2021.) Moreover, CMM service ensures that not only prescribed medications, but also over the counter (OTC) medicine, alternative supplements, or vitamins, are individually evaluated to ensure that each medication is suitable for the patient and effective for their medical condition. Identified issues with drug therapy require the pharmacist to provide concrete solutions and medication advice. (Rojas, Dupotey, & De Loof, 2023.)

One of the main objectives of a clinical pharmacist in providing CMM is to ensure that drug treatments serve their intended purpose effectively, thereby optimizing patient outcomes and promoting overall health. The role of clinical pharmacists in ensuring the safety and effectiveness of drug therapy remains crucial today. The role of the pharmacist continues to be a key factor in achieving optimal treatment results for patients.

3.3 CMM in Finland

In Finland, the concept of CMM corresponds to a service called "lääkehoidon kokonaisarviointi" (LHKA). CMM represents a relatively new form of healthcare service in Finland. The pharmacist training in Finland prioritizes geriatric medication management due to the increased complexities and risks linked to medication use in the elderly population. The University of Eastern Finland's continuing professional education service, Aducate, supervises the practical execution of the training. The special competence system is maintained by the Finnish Pharmacists' Association and the Finnish Pharmaceutical Society, which also grant a five-year valid special competence. Currently, there are about 200 individuals who have completed the CMM special competence and hold a valid CMM special competence. They work in community pharmacies, hospitals, health centers, and other healthcare facilities. (AATE 2017.)

CMM service in Finland includes the concrete provision of solutions for medication treatment for the patient, as well as interdisciplinary cooperation aimed at solving problems related to medications, rationalizing treatment, and offering measures for disease prevention. The aim of this service is to enhance the patient's well-being and reduce healthcare costs. (University of Eastern Finland i.a.) This approach aligns with the research by Mucalo et al. (2019) and the practices of other countries where this service is also provided.

The OLKA-pilot project in Finland (Oikea Lääkehoito Kokonaisarvioinnin avulla) utilizes the CMM program. In this pilot project, a clinical pharmacist conducted a trial version of the service. The objective was to evaluate medication costs, functional capacity, and quality of life before and approximately 3 months after implementing changes in medication therapy. Sitra (The Finnish Innovation Fund Sitra) obtained results suggesting a model for optimizing resource utilization in the national economy and improving client health outcomes. The pilot project included 50 patients, among whom 26 patients (55%) reported improved well-being or resolution of drug therapy-related issues following CMM service. Additionally, the condition of 30 patients (63%) did not worsen, despite a reduction in medication dosage. The economic impact of CMM was assessed in the project, with 43 patients (90%) experiencing economic benefits from the program. In monetary terms, the change in KELA compensation amounted to a reduction of 50,65 € over three months per reimbursed individual. Healthcare systems can derive significant benefits from the implementation of CMM services, particularly if improvements in patient well-being and optimization of drug therapy decisions lead to reduced interactions with healthcare teams, shorter hospital stays, and fewer specialist visits. These outcomes not only alleviate the burden on healthcare resources but also contribute to long-term cost savings. (Heikura, Pitkänen, Hakala & Puurunen 2009, 5-6.)

The 2018 Ilma study on elderly medication use found that the annual costs for class D medications totaled 100,000 €, with KELA reimbursing 70,000 € of this amount (Merikoski et al. 2017). The CMM program aims to resolve medication therapy issues, leading to significant healthcare cost savings.

In Finland, from 2020 to 2022, drug use increased among individuals aged 75 and older (Finnish Medicines Agency s.a.). This highlights challenges in medication management. Implementing CMM

services is crucial for ensuring treatment safety and effectiveness, improving patient health, and reducing costs (Pestka, Blanchard & Sorensen 2022). Given the high costs associated with medication use, CMM becomes a crucial service in today's healthcare landscape.

3.4 CMM worldwide and across Europe

CMM practice is widespread in many Anglo-Saxon countries and greatly enhances patient treatment outcomes, consequently improving their health. While this service is well-established especially in Australia, Latin America and a large number of healthcare facilities in the USA. Europe has not yet fully developed CMM service delivery. (Rojas, Dupotey, & De Loof 2023; Mucalo et al. 2019.) In England, the introduction of pharmacists into GP practices began in 2015 due to concerns about a shortage of GPs. Croatia was among the first countries in South-Eastern Europe to establish CMM services, and Spain has also made progress in this area (Mucalo et al. 2019).

However, a large body of research demonstrates the benefits of CMM. It shows that this practice provides better care, reduces costs, and improves patient interactions with providers. Additionally, numerous studies demonstrate positive effects on chronic disease indicators such as cardiovascular measures including blood pressure, glucose levels, hemoglobin A1c, and cholesterol. The introduction of such services also beneficially impacts the utilization of healthcare resources. (Brajkovic et al. 2022, 4-5.)

The case study from Texas demonstrates the implementation of CMM, resulting in an annual reduction in medication costs per patient by 123 $. This was achieved by transitioning to less expensive medications. Additionally, the program successfully resolved 301 medication therapy problems, preventing 270 potential medical services. Consequently, estimated cost savings were realized among patients with chronic conditions. Early identification of medication therapy problems can prevent costly specialist visits or emergency department (ED) visits. (Chung et al. 2020.) These findings align with the results of a pilot project conducted by Heikura and colleagues in Finland, which examined the secondary benefits of providing CMM services (Heikura, Pitkänen, Hakala & Puurunen 2009). Moreover, the pilot project conducted at the health center in Zagreb, Croatia, revealed numerous DRPs during the CMM project. The majority of patients were found to be using more than 4 medications, emphasizing the necessity of introducing pharmaceutical care services, especially for patients with type 2 diabetes who are taking 5 or more medications. (Brajkovic et al. 2019, 585.)

Furthermore, primary care providers have also acknowledged pharmacists as collaborative partners in patient care, appreciating their complementary knowledge and skills. They have described positive aspects of collaboration with pharmacists in delivering CMM services, including reduced mental exhaustion, reassurance, decreased workload, and the addition of valuable skill sets and resources. (Funk et al. 2019, 466.)

In conclusion, while the CMM service in Europe may not be as advanced as in regions like Australia, Latin America, and the USA, where it has yielded numerous positive outcomes, the healthcare system is still evolving. Given the aging population and the growing use of medications, the collaboration between pharmacists and primary care providers will be crucial for the future of healthcare and patient well-being.

3.5 Digitally led CMM

The topic of integrated medicines management is quite well studied (Badowski et al. 2020), which underlines its relevance. While this aspect is well established, the controversy surrounding digital delivery has gained prominence, particularly during the COVID-19 pandemic. The pandemic acted as a catalyst for digital transformation in healthcare (Leyens, Simkins & Kronidou Horst 2022; Olanrewaju, Faisal& Randell 2023). COVID-19 rapidly changed the trajectory of patient care, shifting primarily in-person meetings to virtual consultations (Wosik et al. 2020). The World Health Organization's 2023 summary on digital health in the European region highlights the positive outcomes of digital technology adaptation efforts. In a study involving Norwegian general practitioners, 51% of video consultations were deemed effective, with no significant difference compared to face-to-face consultations. (World Health Organization 2023, 58.)

Telemedicine is a modern form of providing medical services based on the use of information technology to transmit medical information and conduct consultations at a distance. This format is becoming increasingly popular, especially among those who live in remote areas or face limited access to medical care. Telehealth services allow patients to receive quality care through real-time phone calls or video conferencing, making them especially valuable in situations where visiting a doctor in person is not possible due to distance or time constraints. Telemedicine services are becoming a standard alternative for those seeking a convenient and efficient way to receive medical care without the need to be physically present at a clinic or hospital. This service delivery format becomes critical in settings where access to medical resources is limited and time is of the essence in providing medical care. (Badowski et al 2020.)

In the study carried out between December 2018 and December 2019 to evaluate the effectiveness of CMM using telephone conversations, the research describes that CMM telemedicine methods were effective even before the COVID-19 pandemic. Positive results were recorded, and 35% of changes proposed by pharmacists were approved. (Graybill et al. 2021.) This is a priority for remote patient care and pharmaceutical care support, especially when face-to-face contact is limited, as was the case during the COVID-19 pandemic.

According to a white paper by American College of Clinical Pharmacy, providing CMM services via Telehealth requires staff to acquire technological skills, as well as the ability to exercise clinical judgment and effective communication skills to identify patients in need of further medical intervention or face-to-face assessment. Conducting Telehealth services follows standard methods, where patient encounters can take place either in person or online and includes the same processes. The guidance emphasizes the importance of maintaining patient safety and confidentiality, nurturing trusting relationships, and improving communication. Consultations use video or telephone conferencing, with particular attention to patient privacy and safety, as well as good lighting and visibility of the patient's face. Also important to effectively deliver this service remotely is the ability to share information via EHR with members of the patient's healthcare team, even if the pharmacist and other team members are in different organizations. This is facilitated by the Health Information Exchange (HIE). It is noted that in providing a digital service, it is extremely important to document every visit and any communication, as well as record any changes in the patient’s treatment, in

addition to informing the patient about all the details in an accessible way. The possibility of establishing adequate telephone or internet access with sufficient signal strength to provide a clear communication channel should also be discussed with the patient. Moreover, the monitoring device, technical skills, and patient preferences must be carefully assessed and continuously monitored. (Badowski et al. 2018.)

The escalating aging of the population and the corresponding surge in elderly individuals experiencing functional impairments, as stated by Rappe and Rajaniemi (2021,14-15), underscore the critical necessity of utilizing CMM through digital solutions. A 2021 study proved that digital CMM enhances accessibility, especially for individuals who previously could not access such services due to geographic, logistical, or financial constraints (Badowski et al. 2018). Another study highlights the advantages of a CMM program for managing hypertension through telemedicine. The program has shown significant improvements in telemedicine-based medication management for hypertension, helping to stabilize blood pressure levels and enhanced medication compliance compared to usual care during the COVID-19 pandemic. As a result, there was a noticeable reduction in the overall occurrence of adverse cardiovascular events. (Li et al. 2022.) CMM services remotely provided by clinical pharmacists have the capacity to meet the health needs of elderly individuals and reduce the necessity for frequent appointments with physicians or healthcare team. Benson et al. (2021) highlight that the use of remote clinical pharmacists can facilitate effective management of medication management problems in primary care settings. In the study conducted by Amundsson et al. (2022), customer and service provider satisfaction were recorded, along with statistically significant clinical results for chronic illness compared to usual service provision.

Furthermore, projections indicating a potential requirement for up to 200,000 additional healthcare professionals over the next 15 years underscore the urgent necessity for advancing methodologies in medication management (Ministry of Economic Affairs and Employment 2020, 11).

4 RESEARCH OBJECTIVE

The study aims to describe the impact of providing digital comprehensive medication management on both patients and healthcare providers, as well as its overall effect on healthcare. The paper will examine the advantages offered by digital comprehensive medication management. Additionally, a secondary question for this research was chosen to explore potential disadvantages or pitfalls, if this can be answered using the selected research articles for the main research question.

The thesis addresses two questions:

1. What are the advantages of providing comprehensive medication management services through digital solutions?
2. What challenges arise in organizing medication management services through digital solutions?

5 METHODOLOGY OF THE THESIS

5.1 Narrative literature review

The literature review methodology aids in the formulation of new theories regarding the current topic, evaluating its significance, and tracing its historical evolution (Kangasniemi et al. 2013, 293). This method encompasses both qualitative and quantitative approaches. The primary objective is to derive conclusions from the available literature and address the research questions posited earlier in the study. (Vilkka 2023, 21-24) According to Salminen (2011, 6), there are three primary types of literature reviews: descriptive, systematic, and meta-analyses. For this thesis, a narrative literature review has been selected, as it is considered the most common method according to Salminen (2023, 7). A narrative literature review was chosen as the methodology for this thesis, as it was essential to explore the existing information on comprehensive medication management facilitated by digital means. A narrative review is characterized by its flexibility in exploring information and establishing criteria for various sources. This method may involve an intuitive component, whereby the researcher encounters insights that inform the process of sourcing new literature. Through analysis, significant issues pertinent to the original thesis question can be discerned. Moreover, the questions intended to be tackled in the study can be further honed during the information analysis process. (Vilkka, 2023, 21-24.) In international sources, terms such as descriptive literature review, narrative overview, unsystematic narrative review, traditional literature review, and literature review are used interchangeably to refer to the same method as narrative literature review, which was utilized for this paper (Kangasniemi et al., 2013, 293).

Kangasniemi et al. (2013, 294) outline four stages in writing a narrative literature review. The initial stage focuses on developing a research question, which serves as a foundation and guides all subsequent phases of the study. According to Niela-Vilén & Hamari (2016, 24) the question must be formulated clearly and precisely to allow for an in-depth analysis of the phenomenon. On the other hand, the question may be broad enough to allow consideration of different aspects of the topic.

At the second stage, materials are selected in accordance with the research question posed. The purpose of this process is to find the most appropriate materials to answer the research question. Materials for review are typically sourced from electronic scientific databases, and sometimes through manual searches of scientific publications. (Kangasniemi et al. 2013, 295.) During the material selection process, criteria such as keywords, year limitations, and language specifications are utilized. However, under specific circumstances, deviations from these criteria may occur to align with the research question's requirements. Exclusion and inclusion criteria are employed to limit the search database. (Lehtiö & Johansson 2016, 51.)

Once an adequate amount of literature has been gathered, it is read and organized. Following this, in the result paragraph, the amassed materials are synthesized into themes, categories, or chronological sequences, forming a coherent structure or progression. Throughout this process, the content of the literature is consolidated, critically evaluated, and then synthesized to produce a structured and comprehensive representation of the chosen material. (Kangasniemi et al. 2013, 293.)

Conclusions derived from the selected literature are typically presented in tabular format (Lemetti & Ylönen 2016, 70).

The fourth and final stage involves reviewing the obtained results, including reflection, assessing the reliability and ethics of the paper, and drawing conclusions (Kangasniemi et al. 2013, 297-298). Reporting results should be done with sufficient accuracy to ensure the research can be replicated and to allow the evaluation of the review's reliability based on the report (Niela-Vilén & Hamari, 2016, 32).

5.2 Identification and selection of relevant literature

The purpose of the literature review is to create a comprehensive understanding of digitally driven comprehensive medication management. The choice of this topic is due to its relevance in the context of growing challenges in healthcare related to the increasing elderly population and the rise in medication use, which leads to risks of side effects and impacts the overall condition of the aging population. This issue was addressed in paragraphs one and two. Before selecting the topic, a review of available literature on the subject was conducted. The relevance of the topic is also highlighted by the increasing digitization in medical services, as mentioned in the previous paragraphs.

To ensure successful research, it's crucial to conduct a systematic search for materials, beginning with broad concepts and progressively delving deeper into the topic. This approach enables the establishment of diverse and comprehensive search criteria essential for addressing the main research question. (Vilkka 2023, 54-55)

Selection of databases

For this research, two databases, PubMed and EBSCOhost, were selected. It is advisable to use multiple databases to ensure the comprehensiveness and variety of the information collected. The choice of databases should be guided by the research topic. (Vilkka 2023, 58; Lehtiö & Johansson 2016, 42.)

Keywords

A search phrase used for finding articles for this research was developed from a combination of keywords. To select keywords and form a search phrase, the informatics service of the University of Savonia for Applied Sciences library was utilized on April 26, 2024. This enabled the selection of the most relevant keywords for the literature search. (Lehtiö & Johansson 2016, 36.)

It is not recommended to use the research paper title or research questions as a search phrase. Instead, the topic should be organized into subtopics, which will serve as the basis for generating search keywords. (Lehtiö & Johansson 2016, 36.) In this research, comprehensive medication management and digitalization were selected as subtopics, and the literature search keywords were created accordingly. Boolean operators were utilized to facilitate the search process. (Vilkka 2023, 58.) The keywords used for the literature search were comprehensive medication management, medication management service, telehealth, remote, telephone, telemedicine, telepharmacy, digital technology, and internet. The search phrase can be found in Table 1.

Search limits in databases.

The search strategy should clearly establish inclusion and exclusion criteria, which will effectively control the size of the database. Typically, these criteria include the year of publication of the study and the language of publication. (Niela-Vilén & Hamari 2016, 25–26.) A selection criterion based on publication years was established from 2018 to 2024 for this research. This will enable the collection of the most recent and pertinent literature on the thesis topic, which is crucial due to the rapid development of digitalization during the COVID-19 period. Additionally, only English was chosen as the language for literature search, due to the widespread prevalence of research published in this language. The criteria are shown in Table 1.

TABLE 1. Exclusion and Inclusion criteria of databases search

Exclusion criteria	Inclusion criteria
Published before 2018	Published between 2018–2024
Non-English literature	English literature
The search phrase for PubMed: ("Comprehensive medication management" OR "medication management service*") AND (telehealth OR remote OR teleph* OR telemedicine OR telepharmacy OR "digital technology" OR internet OR "Telemedicine"[Mesh]) **The search phrase for EBSCOhost (CINAHL):** "Comprehensive medication management" OR "medication management service*" AND (MH "Telehealth+") OR telehealth OR remote OR teleph* OR telemedicine OR telepharmacy OR "digital technology" OR internet.	Search outside the search phrase.

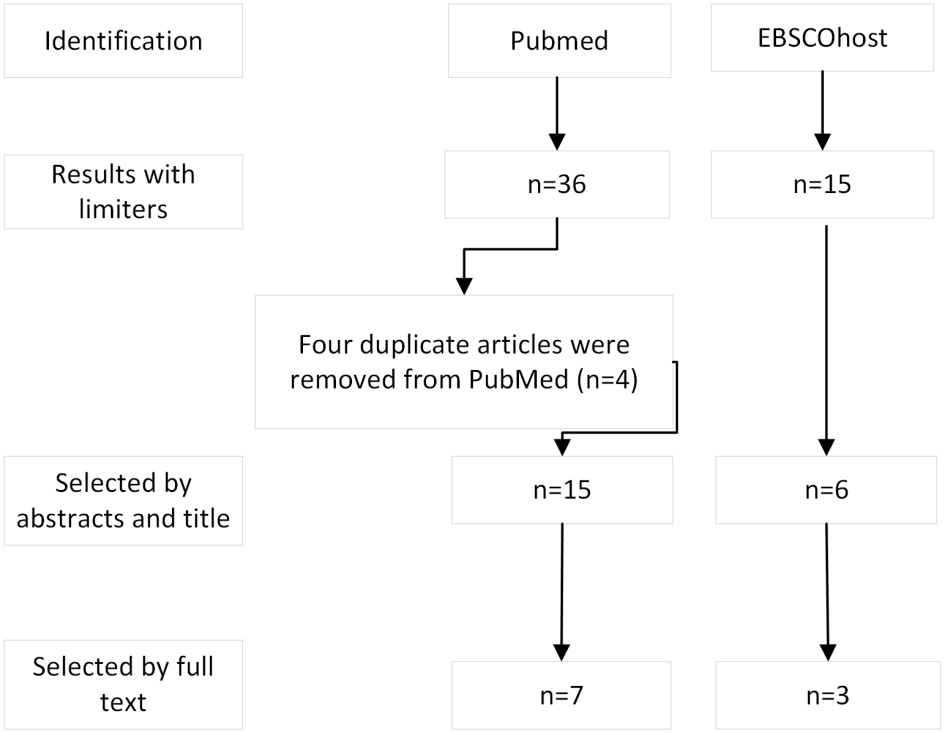
Evaluating search result

According to Lehtiö & Johansson (2016, 51-52), it is advisable to gather a range of 100 to 1000 articles for a comprehensive literature review. Should the search yield fewer than 100 articles, an expansion of the search criteria is recommended to ensure adequate coverage. However, there is no absolute numerical threshold prescribed for research, as the requisite volume of literature inherently varies depending on the specifics of each individual study.

On April 26, search phrases were compiled, and on April 27, articles were selected based on their abstracts and titles. The article selection process is detailed in Table 2. According to the constraints established in Table 1, thirty-six articles were selected from PubMed and fifteen from EBSCOhost for

this research. From these, fifteen articles from PubMed and six from EBSCOhost were chosen for detailed reading based on their abstracts and titles. Four articles appeared in both databases and were counted as EBSCOhost articles, as the initial search was conducted on this portal. All articles were thoroughly read. Subsequently, 5 articles from PubMed and 3 from EBSCOhost were selected for this study as they addressed the research questions posed by this paper. One of the articles required a purchase and was obtained through the Savonia University of Applied Sciences. After determining the necessary research, the initially excluded articles were reviewed. Initially, there were doubts about the relevance of these sources. However, further critical analysis allowed for a reassessment of their value and the inclusion of an additional 2 articles in the PubMed count. In total, 10 articles were selected for consideration of the research questions.

TABLE 2. Flow-chart of literature selection



For the literature review, ten (n=10) studies were selected. It is advised to assess these studies based on the application process. The assessment of selected studies can be integrated into the selection process or conducted separately during the analysis or evaluation of evidence. It is crucial that the methodology and evaluation rationale are clearly justified within the literature review report. (Niela-Vilén & Hamari 2016, 28, 30.) Annex 1 provides an overview of the studies utilized in the thesis results. Article selection for this research focused on both the relevance of content and ensuring that studies were peer-reviewed, using various methodological approaches to establish reliability. The research methods and sources applied in the studies were also taken into account. The selected studies for the results consist of qualitative (n=2), quantitative (n=4), and mixed-method research (n=3), as well as one project study (n=1).

5.3 Literature analysis

The primary aim of the literature review, and consequently the processing of the material, is to ensure that the findings are aligned with the research objectives and the established research

questions. The aim of processing the material is to establish a well-rounded and trustworthy comprehension of the phenomenon under investigation. This forms the foundation to ensure that the material processing is aligned with the review's objectives and supports the justification of the chosen method. It is important to ensure that progress in processing the material can be monitored and that the resulting findings are logically presented. (Kangasniemi & Pölkki 2016, 80–81.)

Qualitative content analysis is one of the most commonly used analysis methods (Elo, Kujala, Tohmola & Kääriäinen 2022, 216). This method of content analysis was chosen for this paper because it allows for the analysis of all research material that can be documented in written form (Elo & Kyngäs 2008). Content analysis seeks to represent the research material clearly, succinctly, and in an organized summary (Elo, Kujala, Tohmola & Kääriäinen 2022, 216).

Content analysis can be conducted using two methods: inductive and deductive. The first is a material-oriented approach, meaning the inductive approach, and the second is based on theory, meaning the deductive approach (Elo & Kyngäs 2008, 109; Vilkka 2023, 86). For this thesis, the inductive method was chosen, which does not require a pre-existing classification structure for data analysis. Instead, the researcher creates the classification based on the material being analyzed. (Elo, Kujala, Tohmola & Kääriäinen 2022, 218). Since the research topic is still underexplored, the inductive method of analysis is considered the most appropriate, as stated by Elo, Kujala, Tohmola, & Kääriäinen (2022, 218) and Elo & Kyngäs (2008, 109).

In the process of content analysis, three main stages are distinguished: preparation, organization, and reporting (Vilkka 2023, 86; Elo & Kyngäs 2008, 109; Janhonen & Nikkonen 2003, 24–25). Content analysis begins with defining the units of analysis, which can be a word, phrase, sentence, part of a sentence or mental construct (Janhonen & Nikkonen 2003, 25). In this paper, the sentence was utilized as the unit of analysis. Selecting a phrase or set of words was difficult because the advantages and disadvantages of CMM were described in full sentences or even multiple sentences. The preparation stage also includes thoroughly studying and reading the material before beginning the analysis. At this stage, it is recommended to review the research questions and ensure that the materials will provide answers to the questions posed. (Elo, Kujala, Tohmola & Kääriäinen 2022, 219.)

After conceptualization the data, analysis is conducted using either an inductive or deductive approach. (Elo & Kyngäs 2008, 108). Tuomi & Sarajärvi (2018, 110) describe the stages of inductive data analysis as reduction, clustering, and abstraction. In material-oriented content analysis, the first stage is reduction, which involves asking questions of the material according to the research objectives. The "answers from the material" are written using the language of the material. This process is called "open coding" and means that before the main classification, various notes are made while going through the material, such as highlighting with different colors or creating marginal notes that describe the essence of the content. (Elo & Kyngäs 2008, 109.) Sentences were written in a separate file and categorized according to the first question. If an answer to the secondary question was found, it was written in a different file. In some cases, when a sentence was short, it was necessary to go back and read the surrounding text to ensure the correct understanding of the sentence. After this, the original sentence was reduced. The next step of data analysis is

clustering and abstraction, where clustering is already part of the abstraction process (Tuomi & Sarajärvi 2018, 114). The coded initial expressions were carefully analyzed, and similarities and differences in the reduced expressions were identified. Concepts that signify the same thing were grouped and combined into subcategories. (Tuomi & Sarajärvi 2018, 112–113.) It is important that the names of the subclasses describe the content of the coded expressions very specifically and accurately. The name of the subcategory should be as detailed as possible to ensure that the content of the coded expressions is not lost. It is also necessary to verify that each subcategory definitively contains items that signify the same thing and not those that belong to another subcategory. (Elo, Kujala, Tohmola & Kääriäinen 2022, 220.) At this stage, subgroups with identical content are combined into higher categories (Janhonen & Nikkonen 2003, 29). Abstraction, or in other words, conceptualization, should be continued by merging classifications as far as possible based on the content of the data (Tuomi & Sarajärvi 2018, 114). The author carefully analyzed the selected category names to ensure that the meaning of the original sentences was not lost. Grouping examples according to research questions can be found in annexes 2 and 3.

The reporting phase began by highlighting the principal or higher-level findings from the literature review. The data are presented from the author's subjective perspective. The success of the study depends on the ability to analyze the collected data in a manner that produces reliable descriptions of the study's subject. (Elo & Kyngäs 2008, 112-113). Chapter 6 presents the thesis results based on the research questions, while chapter 7.2 assesses its reliability.

6 RESULTS

6.1 Advantages of providing comprehensive medication management service through digital solution

An analysis of selected articles on the use of digitally led CMM services in healthcare reveals several key advantages for patients, providers, and the state overall. These benefits emerged from the articles chosen for this study through inductive content analysis, thereby identifying the main categories of advantages provided by digitally implemented CMM services. The primary categories of advantages include healthcare access, cost reduction, patient satisfaction, health outcomes, and collaborative care.

In this study, access to healthcare is defined by three key advantages: the impact on accessibility of healthcare services, enhanced healthcare efficiency, and online access to healthcare. These three advantages are further divided into subcategories. The general category of online access to healthcare is divided into improved access to CMM via telehealth (Passey et al. 2022, 840; Stoa, Frail, Farley, Pestka & Blanchard 2021, 3), the effectiveness of telehealth services in providing CMM (Passey et al. 2022, 840; Green et al. 2023, 630), the impact on patient reach to healthcare through telehealth (Green et al. 2023, 628; Thomas, Baker, Hoffman & Lamb 2021, 937-938), and enhanced access to care services (Thomas, Baker, Hoffman & Lamb 2021, 937; Stoa, Frail, Farley, Pestka & Blanchard 2021, 3; Litke et al. 2018, 985). The impact on the improved quality of service means improved patient volume, documentation and reduced no-shows (Thomas, Baker, Hoffman & Lamb 2021, 938) and increased patient volume, enrollment rates, and patient engagement (Thai et al. 2024, 983). The impact on accessibility of healthcare services includes flexibility in scheduling and reduced travel burden (Litke et al. 2018, 983-984), transportation issues (Green et al. 2023, 628) and digital CMM can improve care coordination and medical service quality in underserved areas (Thai et al. 2024, 985). These categories of advantages are illustrated in Figure 1.

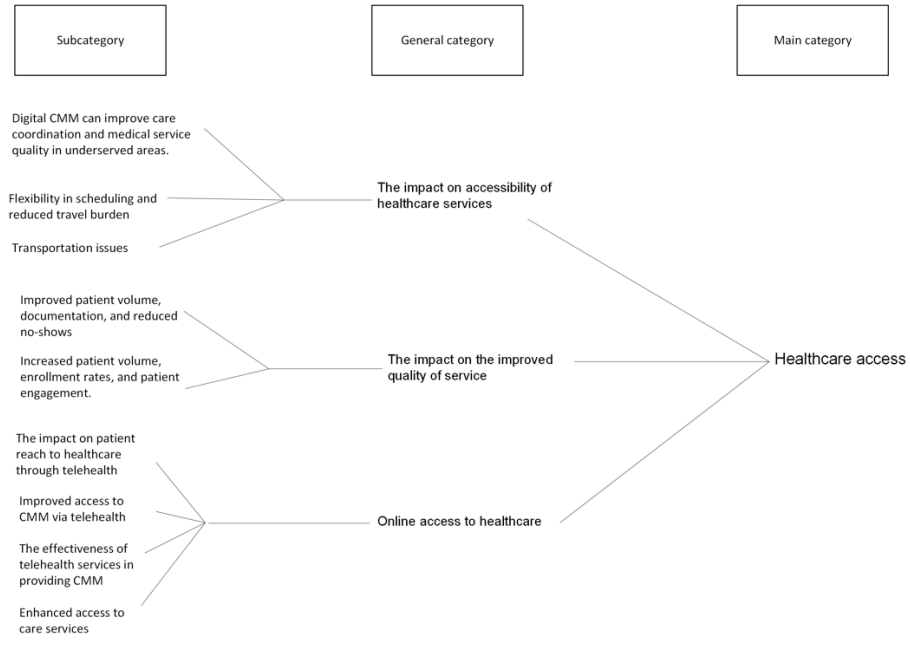


Figure 1. The main, general and subcategories of advantages of providing comprehensive medication management services through digital solutions

According to the results of the literature review, one of the most significant advantages of implementing CMM digitally is the potential for cost reduction, as illustrated in Figure 2. Cost reduction in the digitally led format of CMM is observed through two general categories: the impact on reduced medication-related expenses and the impact on reduced healthcare expenses. The impact on reduced medication-related expenses is seen as savings in medication-related costs (Passey et al. 2022, 840). The impact on reduced healthcare expenses includes reduced per-patient medical costs, cost-effective chronic disease management (Kessler et al. 2021, 1195), and cost savings through optimized medication administration (Kessler et al. 2021, 1187) and reduced ED and hospital visits (Urick et al. 2023, 363).

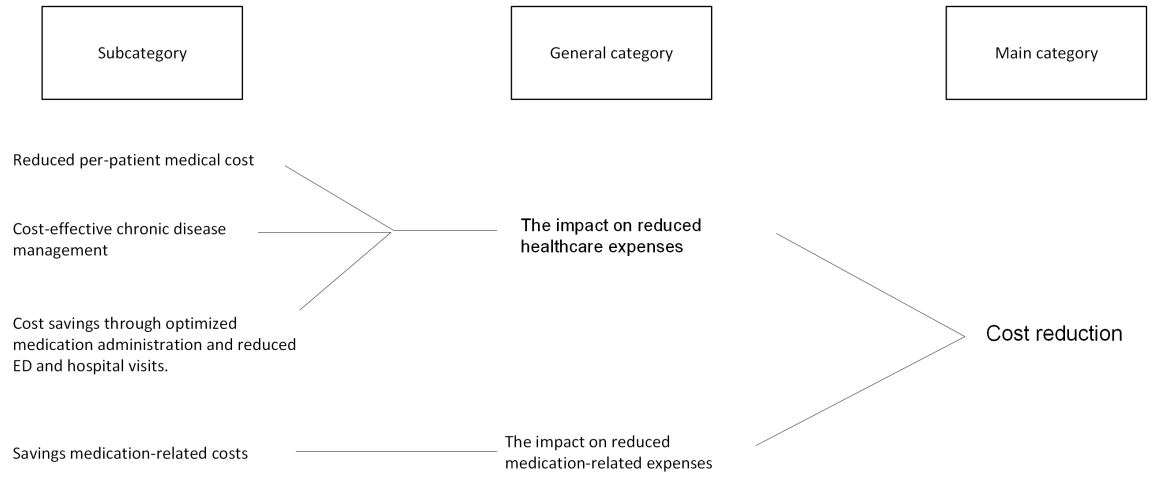


Figure 2. The main, general and subcategories of advantages of providing comprehensive medication management services through digital solutions

According to the review results, patient satisfaction has been identified as another advantage of digitally led CMM. Patient satisfaction encompasses several key aspects: satisfaction with digital healthcare services, the impact on collaborative healthcare relationships, the positive impact on patient care, and the influence on patients' social lives. The general category of satisfaction with digital healthcare services consists of patient satisfaction with CMM provided through telehealth (Passey et al. 2022, 840) and patient satisfaction with telepharmacy (Livet, Levitt, Lee & Easter 2021, 4). The impact on collaborative healthcare relationship includes patient-centered relationship between pharmacist and the patient (Livet, Levitt, Lee & Easter 2021, 4). Additionally, the positive impact on patient care encompasses patient satisfaction with comprehensive pharmacist support (Livet, Levitt, Lee & Easter 2021, 4). The influence on patients' social lives involves increased satisfaction with addressing their social needs (Livet, Levitt, Lee & Easter 2021, 4). These advantages are illustrated in Figure 3.

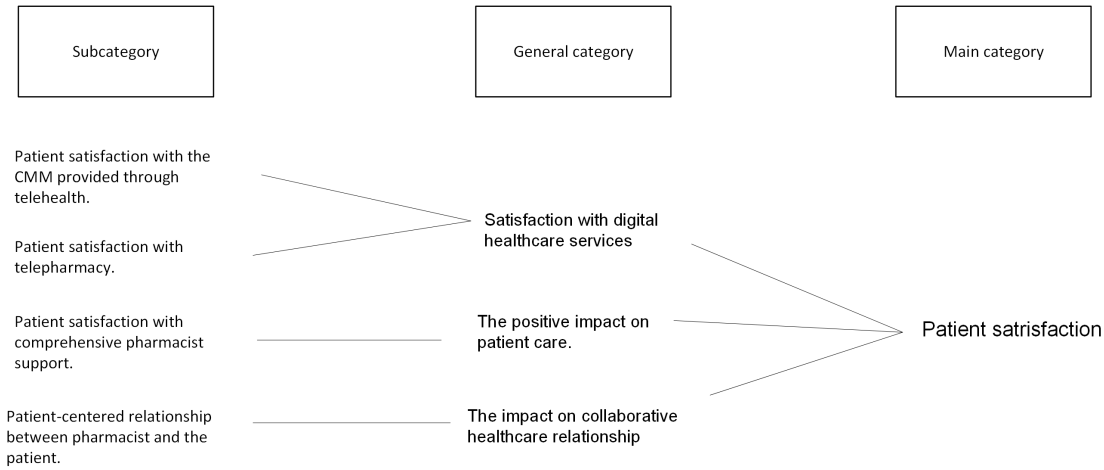


Figure 3. The main, general and subcategories of advantages of providing comprehensive medication management services through digital solutions

Main category, health outcomes, include the following general categories: the positive impact on patient health, the positive impact on patient health and medication adherence, the impact on medication adherence, the impact on health test results, comprehensive healthcare enhancements, and the impact on chronic disease management. Based on the selected studies, the positive impact on patient health is divided into four subcategory: achieving patient health goals (Green et al. 2023, 628), improved patient health (Livet, Levitt, Lee & Easter 2021, 4), digital CMM leads to better health outcomes through improved care coordination and medical service quality in underserved areas (Thai et al. 2024, 985), and reduction in hospital visits and stays (Thai et al.2024, 985). The general category of the positive impact on patient health and medication adherence encompasses enhancements in patients' adherence to treatment and their overall health, along with heightened confidence and adherence to the treatment regimen (Livet, Levitt, Lee & Easter 2021, 4). Additionally, the impact on medication adherence as a general category, this includes improving patients' adherence to treatment (Livet, Levitt, Lee & Easter 2021, 4). Moreover, the impact on health test results describes HbA1c and BP outcomes remaining unchanged as a benefit from digital CMM (Thomas, Baker, Hoffman & Lamb 2021, 937). Furthermore, highlighted benefits include comprehensive healthcare enhancements (Thai et al., 2024, p. 985). The impact on chronic disease management includes the advantage that telehealth CMM pharmacists have a significant impact on health goals and benchmarks in chronic disease management (Thai et al.2024, 985). These advantages are shown in Figure 4.

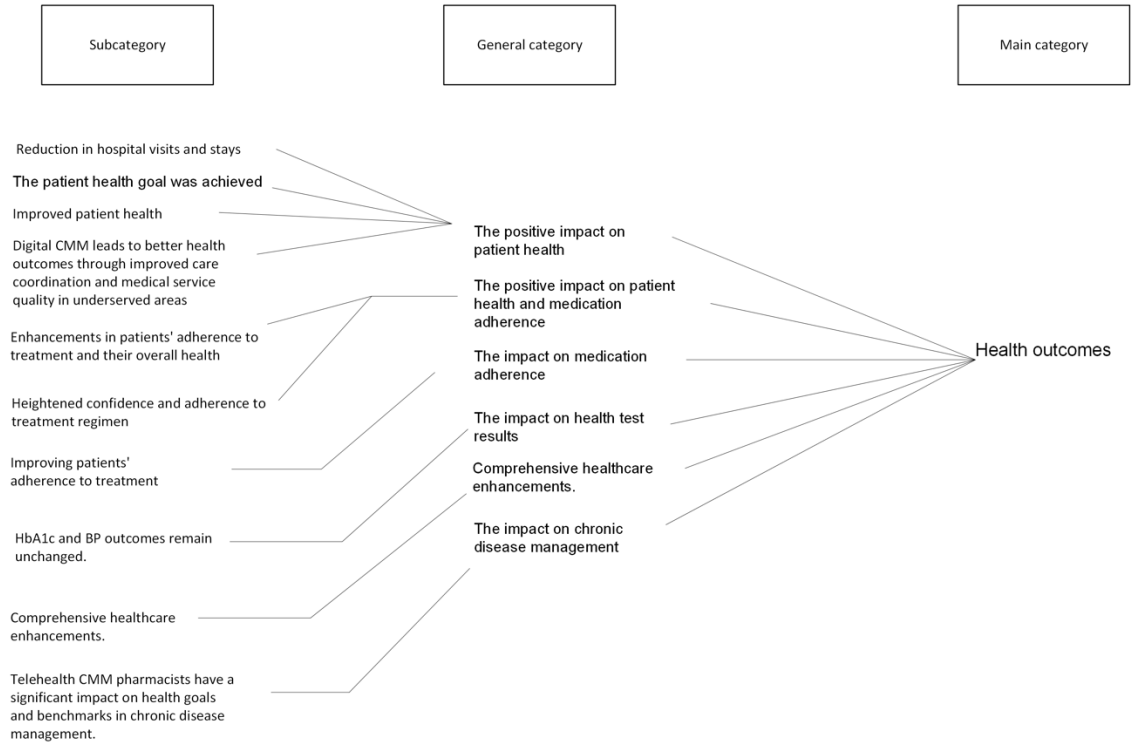


Figure 4. The main, general and subcategories of advantages of providing comprehensive medication management services through digital solutions

According to the articles selected for this thesis, another advantage of digital CMM is the enhancement of collaborative care. This includes provider support, with an emphasis on additional assistance and teamwork among healthcare professionals (Livet, Levitt, Lee & Easter 2021, 4).

6.2 Challenges in organizing medication management services through digital solutions

As part of this research study, a secondary question was developed to complement the primary question of the thesis. This secondary question aimed to identify the pitfalls and challenges associated with implementing digital CMM. Inductive content analysis methods were used to address this question, utilizing data from the same studies selected for the main research question. However, the analysis revealed that the chosen studies did not provide enough detailed information to fully answer the secondary question. Despite this limitation, additional insights were gathered that could be valuable for future research in this field.

According to the articles chosen for this study, three main categories were identified that address the research question, as illustrated in Figure 5. These categories are the challenges in patient retention, health information exchange, and communication barriers. The main category, challenges in patient retention, includes the impact of telecommunication issues in rural areas, which leads to higher rates of loss to follow-up (Litke et al. 2018, 986). The health information exchange category includes barriers such as the lack of interoperability between EMR systems (Passey et al. 2022, 840). Additionally, a category related to communication barriers was identified. In the context of digital CMM, a key challenge is the lack of language skills, particularly the limited English proficiency among clients and restricted access to virtual interpreter services (Green et al. 2023, 630).

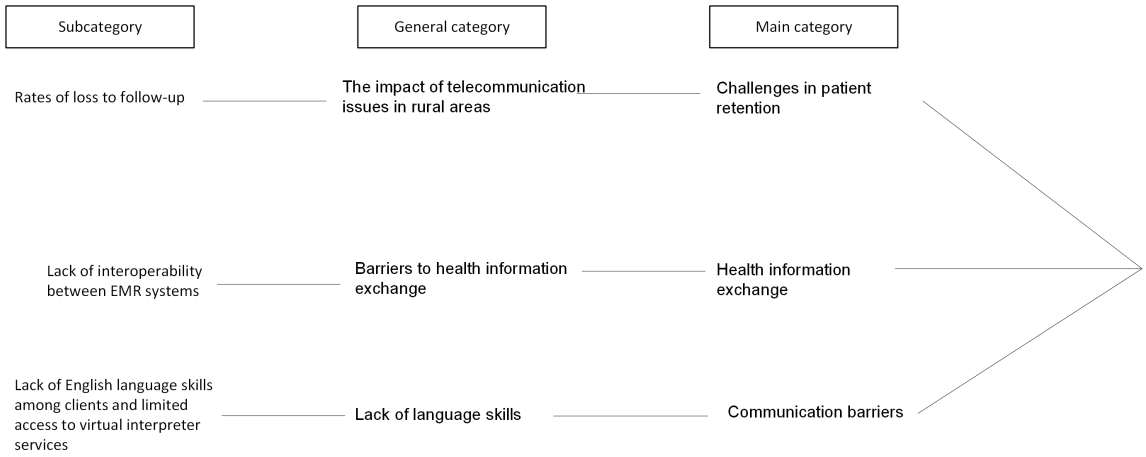


Figure 5. The main, general and subcategories of challenges in organizing medication management services through digital solutions

7 SUMMARY

7.1 Reflection

The objective of this research study was to identify the benefits of digitally led CMM for patients, healthcare providers, and society at large. The study was carried out through a literature review to gather and analyze existing information. There was a limited number of studies available on this topic that could comprehensively address the research questions. However, a sufficient number of studies were found to conduct the necessary analyses. Answers to the secondary question about the challenges of implementing digitally led CMM were sought in the same studies selected for the primary question. Although less information was found for the secondary question compared to the primary question, given the limited number of studies on this topic, it is assumed that more precise answers will require further research.

The studies selected for this review examined various aspects of digitally led CMM, including access to medical services, cost reduction, improved health outcomes, patient satisfaction, and collaborative care. In addressing the secondary question about the challenges in implementing digital CMM, issues such as patient retention, health information exchange, and communication barriers were mentioned in the selected articles. The results of this study, which describe digitally led CMM, revealed some similarities to studies conducted in a face-to-face CMM format. As mentioned earlier, CMM improves access to healthcare, provides economic benefits for patients and healthcare providers, facilitates collaboration among interdisciplinary teams, and improves health outcomes (Funk et al. 2019, 466; Chung et al. 2020; Heikura, Pitkänen, Hakala & Puurunen 2009).

This thesis also identified similar advantages of CMM, but now through digital solutions. It provides access to healthcare services in general, and specifically through telehealth, which simplifies CMM and expands access to healthcare. Passey et al. (2018, 940) noted that telehealth could enhance access to CMM for patients. Another study indicated that CMM services transitioned from face-to-face interactions to phone and remote consultations during the COVID-19 pandemic (Stoa, Frail, Farley, Pestka & Blanchard 2021, 3). This review also demonstrated the effectiveness of telehealth services in providing CMM. Passey et al. (2022, 840) asserted that delivering CMM via telehealth is both feasible and beneficial for veterans. Similarly, Green et al. (2023, 630) identified telehealth as a viable and acceptable approach for providing CMM during the pandemic. Green et al. (2023, 628) noted that CMM through telehealth allowed for increased patient engagement and visit frequency. Another study indicated that telemedicine enhanced veteran reach without compromising outcomes (Thomas, Baker, Hoffman & Lamb 2021, 937). An important advantage of digital CMM is that it has improved overall access to primary healthcare services through the integration of clinical pharmacists, who often provide CMM services (Thomas, Baker, Hoffman, & Lamb 2021, 937), which aligns with what Litke et al. (2018, 985) discussed in their article. According to Stoa, Frail, Farley, Pestka & Blanchard (2021, 3) during the pandemic, when access to traditional healthcare services was restricted, digital CMM provided consistent care. This, in turn, resulted in a total increase in patient numbers (Thomas, Baker, Hoffman, & Lamb 2021, 938; Thai et al. 2024, 983). It also improved access to healthcare settings by addressing transportation issues and adding scheduling flexibility (Litke et al. 2018, 983-984), reducing travel burden and transportation issues (Green et al. 2023,

628). Additionally, digital CMM can improve care coordination and medical service quality in underserved areas thereby improving population health outcomes (Thai et al. 2024, 985).

Cost reduction was identified as another advantage, with reductions in medication expenses noted by Passey et al. (2022, 840), as well as overall healthcare expenses. This was achieved through CMM, which reduces utilization and costs without the need for in-person care by optimizing medication management and decreasing ED and hospital visits. (Kessler et al. 2021, 1187, 1195; Urick et al. 2023, 363.)

Patient satisfaction was noted as an advantage in this review. Patients were generally satisfied with CMM provided through telehealth (Passey et al. 2022, 840; Livet, Levitt, Lee, & Easter 2021, 4). Additionally, clients also expressed satisfaction with the clinical pharmacist's work, the quality of the information they received, the support for self-care, and their involvement in medication-related decisions (Livet, Levitt, Lee, & Easter 2021, 4).

Regarding the benefits related to health outcomes, CMM contributed significantly to positive health outcomes for patients. It helped them achieve personal health goals (Green et al. 2023, 628), and by integrating CMM with Social Determinants of Health (SDOH), pharmacists were able to influence patient health more effectively (Livet, Levitt, Lee & Easter 2021, 4). Thai et al. (2024, 985) note that in communities where access to healthcare services is limited due to remoteness, lack of resources, or economic difficulties, CMM can significantly improve access to healthcare and enhance its quality. In addition, the same study demonstrated a significant reduction in repeat hospitalizations and ED use. Adherence to treatment and compliance with medication regimens were noted (Livet, Levitt, Lee, & Easter 2021, 4). It was observed that the analysis results remained consistent, and the digital implementation of CMM did not have a negative impact (Thomas, Baker, Hoffman, & Lamb 2021, 937). The pharmaceutical service within CMM can play a key role in achieving treatment targets for chronic diseases (Thai et al. 2024, 985).

According to this review, the analysis identified collaborative support as the final advantage. Physicians receive assistance and consultations with clinical pharmacists. (Livet, Levitt, Lee & Easter 2021, 4).

For the secondary question regarding the challenges in implementing CMM, it was noted that telecommunication issues in rural areas can complicate patient access to CMM services (Litke et al. 2018, 986). Passey et al. (2022, 840) observed that the incompatibility between EMR systems systems poses a challenge for the exchange of medical information among service providers. Additionally, the selected studies for this review indicated that CMM is often not suitable for patients lacking English language proficiency, due to limited access to language services or interpreters in a virtual format (Green et al. 2023, 630).

In conclusion, digital CMM offers numerous benefits, including improved access to health services, better health outcomes, and economic advantages. However, there are challenges, especially for individuals who do not speak the local language in which the services are provided. Additionally, incompatible systems can hinder access to databases and impede interaction with multidisciplinary

teams. Despite these challenges, digital service formats present many advantages. As mentioned, these complex aspects need further exploration to assess the value of these services.

CMM plays a crucial role not only in global population health but also in a more localized context at the country level. For instance, in Finland, the aging population leads to increased medication use, which can result in DRPs. From the conducted literature review, it appears that comprehensive medication management can act as a preventive measure for maintaining public health, thereby reducing costs related to medications and healthcare services. The implementation of a digital CMM benefits healthcare professionals, patients, and society as a whole. However, it is evident that such services are suitable for specific individuals and situations, contributing to the reduction of healthcare inequalities.

The study's results provided valuable insights into the advantages and challenges of CMM using digital solutions. It was found that CMM is widely developed in English-speaking countries, and digital CMM began to be implemented even before the COVID-19 pandemic, reaching its peak afterward. Exploring this narrow topic gave the author a clear understanding of the development direction in this field. This paper will be valuable in the process of implementing digital CMM services in Finland and other countries, benefiting professional communities. It has provided the author with significant new knowledge that will be useful in future professional activities.

7.2 Ethics and validity

The research must strictly adhere to the principles of good scientific practice as described (Tuomi & Sarajärvi 2003, 129). This involves conducting all aspects of the study - research conduction, data storage, and result presentation - with honesty, diligence, and precision (The Academy of Finland 2003, 5). Additionally, it is necessary to present information objectively, without distortion (Tuomi & Sarajärvi 2003, 130). By following these principles, the research findings remain credible and reliable, building trust in the scientific community. The adherence to these principles ensures the credibility and reliability of the research findings, strengthening trust within the scientific community. Additionally, plagiarism, the act of presenting another's information as one`s own is strictly forbidden, as outlined by the guidelines set forth by The Academy of Finland (2003, 5-7.)

This thesis includes a narrative literature review and does not involve the processing of personal data. Consequently, the application of human subject's research principles and an ethical review is not necessary. The focus on assessing existing literature allowed the research to uphold high ethical standards without the need to involve humans as research subjects.

In the literature review process, maintaining an honest and sincere approach to the works of other researchers is crucial, as the methodology is fundamentally based on analyzing existing publications. Throughout the analysis, an honest approach was strictly adhered to, conducted with a critical, respectful, and constructive attitude. The selection of scientific papers for this review followed ethical standards, and information was systematically organized in tables to minimize interpretation errors, aligning with the principles of quality content analysis. (Vilkka 2023, 99-100). The quality of information, analysis of articles, and presentation of results are crucial for ensuring reliability. (Janhonen & Nikkonen 2003, 36). The reliability was enhanced by the selection of peer-reviewed articles, and

attention was paid to the publication year and source, prioritizing the most recent information when possible (Vilkka 2023, 84). It should also be noted that the reliability of this study was enhanced by the assistance of the informatics service at the Savonia University of Applied Sciences library. In this thesis, the ethical guidelines for writing were strictly followed, and the preparation of references fully complied with the rules of Savonia University of Applied Sciences.

The study's validity checks whether the measurements accurately reflect what they are designed to evaluate. Validity is divided into two types. External validity means that the research is capable of producing results specifically about what it was originally intended to study. Internal validity ensures that the study is free from errors and biases. It means that the results are due to the variables being tested, and there are no errors or biases in data collection or analysis. (Vilkka 2023, 104.) Balancing both types is crucial for achieving overall validity, as it ensures the research findings are credible. According to Vilkka (2023, 103), a clear and narrow research question is essential for evaluating a literature review, as it ensures the review's validity. Therefore, a very specific question was established for this research. It is also important to use adequate sources of information that correspond to the research question and provide answers, thereby enhancing the study's validity (Tuomi & Sarajärvi 2003, 133). Thus, the research successfully found answers to the research question, adding to its validity.

Several factors may impact the reliability of this study. First, the study was conducted by a single author, which may introduce interpretation errors due to the absence of collaborative verification. Moreover, the reliance on articles selected exclusively in English presents a risk of misinterpretation, especially since English is not the author`s native language. Additionally, this study represents the first scholarly work of this magnitude undertaken by the researcher in over a decade since completing their bachelor`s degree, potentially impacting the depth of analysis and interpretation.

Adherence to ethical standards was the foundation throughout the entire research process, contributing to its reliability. This commitment to ethical norms confirms the study's validity and enhances trust in its findings within the academic community. Despite the factors mentioned above that could have affected the accuracy of the results, this research still offers a reliable and valuable contribution to digital healthcare.

8 DISCUSSION

The theoretical section of this paper required significant effort in organizing and structuring the analysis due to the lack of an established framework for the research topic. This initial phase presented challenges in identifying the appropriate starting point for the analysis and linking different facets of the subject to emphasize its significance. Although the author's familiarity with the topic aided in gathering relevant materials, organizing the information into a cohesive and logically structured text demanded considerable time and attention to detail. Through this process, the author identified that the research topic, while relevant, is narrowly focused and underexplored, particularly within the European context, which may have limited the availability of studies and publications.

The timeline for completing the thesis spanned over six months, which allowed the author ample time to review and revise the theoretical component, improving its reliability and thoroughness. With this extended period, the theoretical part was structured into two key subtopics: the first addressed the broader theme of digitalization, while the second focused on CMM, justifying their relevance and applicability. Though the research primarily emphasized Finland, references to global perspectives provided a broader understanding of the significance of the topic worldwide.

In choosing the methodological approach, both systematic and narrative literature reviews were considered. Ultimately, the narrative approach was selected due to the narrow scope of the research, providing more flexibility in addressing the research question and allowing for a broader range of literature to be included. While systematic reviews offer the advantage of minimizing bias through strict inclusion criteria, the narrative review was more suited to this research, particularly given time constraints and the limited availability of data.

The literature analysis yielded critical insights into the benefits and challenges of digitally led CMM. A significant benefit identified is the increased accessibility to healthcare, particularly for patients in rural areas who may struggle to access services. By enabling remote care, digitally led CMM enhances access and reduces the need for patient travel, benefiting those with limited transportation options or physical limitations. Moreover, digital CMM demonstrates cost savings by reducing both medication costs and patient expenses, especially in the management of chronic diseases. This approach has also contributed to a reduction in ED and hospital visits, thereby alleviating pressure on healthcare systems.

Improved communication among healthcare professionals is another notable benefit. Physicians report feeling less isolated in decision-making and experience a stronger sense of teamwork, which positively impacts patient care. Patients express satisfaction with the quality of telemedicine services and value the improved interaction with pharmacists. Enhanced pharmacist-patient communication leads to better treatment adherence, ultimately improving health outcomes as patients become more consistent in following their prescribed treatment plans.

In conclusion, while the advantages of digitally led CMM are well-documented, there is a need to explore its potential drawbacks further. The lack of EMR interoperability and telecommunications infrastructure in rural areas are significant challenges that require attention. Additionally, language barriers for non-English speakers hinder the equitable delivery of telehealth services. Future

research should delve deeper into how digital CMM affects interdisciplinary collaboration and the practical challenges healthcare professionals face in daily practice. Addressing these issues will contribute to the development of more effective practices, improving both patient outcomes and the integration of digital systems in medical care. The following areas are recommended for further research:

1. The role of interdisciplinary team collaboration in managing comprehensive medication quality.
2. Practical challenges faced in delivering digitally led comprehensive medication management.

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ANNEX 1. RESEARCH SUMMARY TABLE

Writer(s) and year	Research article and place of publication	Research method	Objective of the study	Results
Litke, Jessica, Spoutz, Laura, Ahlstrom, Danielle, Perdew, Cassie, Llamas, William, Erickson, Katie 2018	Impact of the clinical pharmacy specialist in telehealth primary care AM J Health-Syst Pharm 75 (13), 982-986	A quality-improvement project	The study aimed to assess the impact of telehealth-based chronic disease management programs involving CPSs on primary care outcomes for veterans. It focused on evaluating the effectiveness of CPSs in improving healthcare access and quality for rural veterans with conditions like diabetes, hyperlipidemia, hypertension, and tobacco cessation.	Telehealth-based CPSs improved disease management and healthcare access for rural veterans, showing statistically significant improvements in diabetes and hypertension, and clinically significant improvements in lipid management and tobacco cessation.
Green, Gabrielle, Barragan, Noel, Abraham, Jessica, Chen, Steven, Kuo, Tony 2023	Delivery of Comprehensive Medication Management and Other Clinical Services via Telehealth by Pharmacy Type Journal of Pharmacy Practice 37 (3), 625–631	A quantitative and qualitative online survey	To describe experiences with providing comprehensive medication management (CMM) and other clinical services via telehealth by pharmacy type, before and during the COVID-19 pandemic.	Telehealth-based CPSs improved disease management and healthcare access for rural veterans, with significant improvements in diabetes, hypertension, lipid management, and tobacco cessation. During the pandemic, telehealth usage increased among independently owned and clinically integrated pharmacies, despite limited connectivity investments. Pharmacists from these pharmacies reported reaching more patients via telehealth, and most found it a feasible and acceptable method for delivering CMM.
Passey, Deborah, Healy, Regan, Qualls, Joshua, Hamilton, Clayton,	Development and implementation of a pharmacist-led telehealth medication management	A descriptive quantitative study	To outline the strategies used to implement comprehensive medication management (CMM) through telephone within a team-based at-home care	Delivering comprehensive medication management through telehealth is feasible from a healthcare system perspective and beneficial for patients. A board-certified oncology clinical pharmacist provided remote pharmacy

Tilley, Elizabeth, Burningham, Zach, Sauer, Brian, Halwani, Ahmad 2022	program for veterans receiving oral antineoplastic therapies through the MISSION Act Am J Health-Syst Pharm. 79 (11), 835-843		program and to assess the implementation process.	services to veterans across three locations in a large and rural VA service area. The program yielded several advantages, including positive clinical outcomes, high patient satisfaction, and reductions in medication costs.
Livet, Melanie, Levitt, Jordana M., Lee, Alyssa, Easter, Jon 2021	The pharmacist as a public health resource: Expanding telepharmacy services to address social determinants of health during the COVID-19 pandemic Exploratory Research in Clinical and Social Pharmacy 2	An Exploratory study: mixed method approach	This exploratory study aimed to assess the feasibility of extending a CMM telepharmacy service to support social determinants of health (SDOH) in four primary care clinics in rural and underserved North Carolina communities. It sought to describe the expanded service, evaluate stakeholders' experiences, and assess the short-term impact on diabetes patients.	Through SDOH screening, the pharmacist identified and addressed 26 COVID-related concerns among 66 patients with brief interventions: information/education (71%), resource access (21%), and care coordination (7%). Clinic team members and patients reported high satisfaction, with patients showing increased SDOH self-efficacy and improved diabetes quality of life. These findings suggest that pharmacists can effectively address health gaps and enhance patient engagement and overall health.
Kessler, Shawn, Desai, Manisha, McConnell, Will, Jai, Edward M, Mebine, Patrick, Nguyen, Jenny, Kiroyan, Celesti, Ho, Dennis,	Economic and utilization outcomes of medication management at a large Medicaid plan with disease management pharmacists	A Retrospective observational study	To evaluate the impact on medical claims of a novel artificial intelligence (AI) platform that identifies high-risk Medicaid members and supports clinicians in conducting telephonic interventions similar to MTM and CMM.	Significant correlations were observed between receiving interventions and reduced costs and utilization. The economic analysis demonstrated a substantial decrease in total care and medication expenses, resulting in significant savings per member per month. Furthermore, there was a marked reduction in emergency department visits, hospital admissions, and bed days. The return on

Von Schweber, Erick, Von Schweber, Linda. 2021	using a novel artificial intelligence platform from 2018 to 2019: a retrospective observational study using regression methods J Manag Care Spec Pharm. 27 (9), 1186-1196			investment, considering the savings from total care costs and program expenses, was highly favorable.
Thomas, Ashley M., Baker, Jennifer W., Hoffman, Terry J., Lamb, Kristen 2021	Clinical pharmacy specialists providing consistent comprehensive medication management with increased efficiency through telemedicine during the COVID19 pandemic Journal of the American College of Clinical Pharmacy 4, 934-938	A quantitative retrospective review	The purpose of this quality improvement analysis is to compare CPS efficiency as well as some objective patient metrics to assess for a change in the quality of care. This is the first study to compare the efficiency and quality of care by CPS in the VA pre-COVID19 and during the COVID19 pandemic.	When PACT CPS services transitioned from primarily face-to-face visits to all virtual care, the consistency of care improved, and the quality of care was not compromised.
Urick, Benjamin Y, Peters, Amanda, Pathak, Shweta, Vest, Mary-Haston, Colmenares, Evan, Blanchard, Carrie, Easter, Jon, Leigh,	Telehealth medication management and health care spending in a Medicare Accountable Care Organization	A pretest-posttest nonequivalent group design	To evaluate the impact of a scalable pharmacist-driven telehealth intervention to improve medication management on health care spending for clinically complex patients who were enrolled in a	A group of patients received the telehealth intervention, while another group served as controls. The telehealth intervention significantly reduced overall medical expenses per patient during the initial six months of the service. Depending on the cost estimates for service delivery, the return on investment ranged from approximately 3.6 to 5.2 times the cost.

Foushee, DeFalco, Penny 2023	Journal Manag Care Spec Pharm. 29 (4), 357-364		Medicare Next Generation Accountable Care Organization.	
Thai, Tram, Plotke, Thai, Downing, Greg, Olmsted, Eric, Cook, Brennan, Jafri, Farrukh N. 2024	Telehealth pharmacist approach to comprehensive medication management in post-discharge high-risk patients: a quality improvement initiative Telemedicine and e-Health 30 (4), 976-985	Quality improvement study	The goal of this study was to assess the impact of enhanced Comprehensive Medication Management (CMM) services delivered through a telehealth pharmacist clinic on hospital readmission rates and Emergency Department (ED) visit rates.	The study examined the impact of comprehensive medication management (CMM) on readmission and emergency department visit rates, as well as patient engagement and enrollment. The results indicated modest reductions in short-term readmission and emergency department visit rates for those who completed enrollment compared to those who did not. Process improvements led to increased patient volume, higher enrollment rates, and greater patient engagement.
Prudencio, Jarred, Cutler, Timothy, Roberts, Stephanie, Marin, Stephanie, Wilson, Machelle 2018	The Effect of Clinical Pharmacist-Led Comprehensive Medication Management on Chronic Disease State Goal Attainment in a Patient-Centered Medical Home Journal of Managed Care & Specialty Pharmacy 24 (5), 423-429	A quantitative retrospective study	To assess the effect of pharmacist-led comprehensive medication management (CMM) on therapeutic goal attainment rates for glycemic, blood pressure, and dyslipidemia outcomes in PCN patients, which was represented by a BRS based on how many therapeutic goals were met.	This study showed that adding CMM services by clinical pharmacists in the PCN improved therapeutic goal attainment for diabetic patients. This suggests that integrating clinical pharmacists into primary care can positively impact glycemic control, blood pressure, and statin treatment outcomes.

Stoa, Morgan K., Frail, Caitlin K., Farley, Joel F., Pestka, Deborah L., Blanchard, Carrie M. 2021	Adaptations made to delivery of comprehensive medication management in the community pharmacy setting during COVID-19 Exploratory Research in Clinical and Social Pharmacy 4	A survey: mixed method	Identify and describe the adaptations that have been made to the delivery of CMM among community pharmacies due to COVID-19.	Several reactive adaptations were made to CMM delivery as a result of COVID-19, including increased virtual or remote delivery of CMM, delaying CMM visits to allow pharmacies to provide care directly related to the pandemic including COVID-19 testing and vaccines, wearing personal protective equipment (PPE) in visits, new ways of obtaining clinical patient information and shifting CMM staffing models.

ANNEX 2. INDUCTIVE CONTENT ANALYSIS, RESEARCH QUESTION ONE

Original expression	**Reduction**	**Subcategory**	**General category**	**Main category**
"Telehealth pharmacy services could improve access to comprehensive medication management for patients taking OATs."	Telehealth could improve access to CMM for patients.	Improved access to CMM via telehealth	Online access to healthcare	Healthcare access
"The setting of CMM visits changed as face-to-face visits were not an option in the early phases of the pandemic, so all visits needed to occur virtually or telephonically. This adaptation is illustrated in Fig. 1, where the percent of CMM encounters and follow-up visits that occurred remote or telephonically increased dramatically after the emergence of COVID-19."	CMM visits and follow-up were conducted virtually or by phone.			
"Our results suggest that comprehensive medication management, delivered exclusively by telehealth, is feasible and beneficial to veterans."	Delivering CMM via telehealth is both feasible and beneficial for veterans.	The effectiveness of telehealth services in providing CMM		
" Pharmacists across pharmacy types generally found telehealth to be a feasible and acceptable method for delivering CMM"	Telehealth is a feasible and acceptable method for delivering CMM.			
"CMM via telehealth helped increase patient reach and visit frequency"	Increased patient reach and visit frequency via telehealth.	The impact on patient reach to healthcare through telehealth		
"This study showed that through optimal utilization of telemedicine, more veterans were able to be reached without compromising outcomes including A1c and BP during a national pandemic"	Optimal use of telemedicine increased veteran			

	reach without compromising outcomes.			
” The integration of PACT CPS's into primary care in the VA has allowed for increased access for veterans to primary care services and has served to enhance the PCMH.”	Veterans' access to services has increased.	Enhanced access to care services		
“Reactive adaptations due to COVID occurred during CMM implementation in community pharmacies. Despite these modifications, community pharmacies continued to provide access and care to patients when access to other health settings and services were limited.”	Through CMM services, access to medical personnel and patient care continued.			
“An increase in healthcare access through provision of phone call appointments was also demonstrated.”	Telephone consultations improve access to healthcare.			
“When pharmacist-led outpatient CMM clinics transitioned from primarily face-to-face patient care to all virtual care, the consistency and quality of care was not compromised, and actually improved in regard to number of patients seen and number of encounters documented, with a decrease in no show rates.”	Transitioning pharmacist-led CMM clinics to virtual care improved patient volume and documentation, reduced no-show rates.	Improved patient volume, documentation, and reduced no-shows	The impact on the improved quality of service	
“There was an overall average increase in patient volume, enrollment rates, and patient engagement.”	The CMM program increased patient volume, enrollment rates, and patient engagement.	Increased patient volume, enrollment rates, and patient engagement.		
“It helped patients with transportation issues.”	Transportation issues	Transportation issues		

"Telephone appointments allow the patient and provider greater flexibility for scheduling and minimize travel burden."	Telephone consultations provide patients and healthcare providers with flexibility in scheduling appointments and minimize travel burden	Flexibility in scheduling and reduced travel burden	The impact on accessibility of healthcare services	
"These additional benefits may be best realized by improving health outcomes in the therapeutic management of patients with complex care issues in rural, underserved, and disadvantaged populations."	Digital CMM helps improve care coordination and the quality of medical services for patients in rural, underserved, and disadvantaged populations, leading to better health outcomes.	Digital CMM improves care coordination and medical service quality in underserved areas.		
"We estimated that the VA CARES Program saved an estimated $200,724 in medication-related costs"	Savings medication-related costs.	Savings medication-related costs	The impact on reduced medication-related expenses	Cost reduction
"Scalable pharmacist-driven telehealth intervention significantly reduced per-patient total medical spending"	Pharmacist-led telehealth intervention significantly reduced per-patient medical costs.	Reduced per-patient medical cost	The impact on reduced healthcare expenses	
"CMM interventions delivered telephonically reduced utilization and costs without face-to-face care and provide a cost-effective means to manage chronic disease and associated medications at scale."	CMM reduced utilization and costs without face-to-face care, providing a cost-	Cost-effective chronic disease management		

	effective way to manage chronic diseases.			
"AI-powered telephonic CMM interventions, potentially leading to substantial savings as members' medications are optimized and these members avoid ED and hospital utilization."	AI-powered telephonic CMM interventions save costs by optimizing medications and reducing ED and hospital visits.	Cost savings through optimized medication administration and reduced ED and hospital visits.		
"Regardless of the survey version (long or short), all the veterans reported being satisfied or highly satisfied with the OCP and the-pharmacy services provided by the VA CARES Program."	Veterans were satisfied with the CMM provided through telehealth.	Patient satisfaction with the CMM provided through telehealth.	Satisfaction with digital healthcare services	Patient satisfaction
"They also reported a positive experience with the telepharmacy visits"	Patients reported positive telepharmacy experience.	Patient satisfaction with telepharmacy.		
"Based on the patient satisfaction survey, patients (N=10) reported the highest level of satisfaction possible with their pharmacist"	Patients reported the highest satisfaction level with their pharmacist.	Patient-centered relationship between pharmacist and the patient.	The impact on collaborative healthcare relationship	
"They also reported a positive experience with the telepharmacy visits, including their interaction with the pharmacist, the quality of information they were provided, the level of support for selfcare,and their level of involvement with decisions made about their medications"	Patient reported valuing pharmacist interaction, information quality, support for self-care, and	Patient satisfaction with comprehensive pharmacist support.	The positive impact on patient care.	

	involvement in medication decisions.			
"Helped achieve individual patient care goals"	Patient health goal was achieved	The patient health goal was achieved.	The positive impact on patient health	Health outcomes
"Telephonic CMM medication management services, reduces the cost of care and decreases ED and hospital utilization, which may be considered to be indicators of improved health"	Cost of care is reduced, with decreased ED and hospital utilization, indicating improved health.	Improved patient health		
"In other words, by combining a CMM service with simple yet practical interventions designed to assist the patients with immediate COVID prompted SDOH concerns that may interfere with their medication therapy, the pharmacist was able to improve patient outcomes."	The pharmacist was able to improve patient outcomes.			
"These additional benefits may be best really realized by improving health outcomes in the therapeutic management of patients with complex care issues in rural underserved and disadvantaged populations"	Digital CMM helps improve care coordination and the quality of medical services for patients in rural, underserved, and disadvantaged populations, leading to better health outcomes.	Digital CMM leads to better health outcomes through improved care coordination and medical service quality in underserved areas.		
Our study demonstrated statistically significant reductions in readmission and Ed utilization for treated patients"	significant reductions in readmission and ED utilization for treated patients	Reduction in hospital visits and stays		

"Pharmacists can play to address current population health gaps that can directly impact patients' engagement with their medication regimen and overall health status"	Pharmacists can address health gaps, improving patients' medication engagement and overall health.	Enhancements in patients' adherence to treatment and their overall health	The positive impact on patient health and medication adherence	
"Benefits to patients included extra attention from a healthcare professional, dedicated time to optimize medications, and consideration of the SDOH that might impact their health ("that's great that it [the SDOH component] was added on because it builds that relationship and their [patients'] sense of confidence, which ultimately will affect how they are doing on their medication regimen")."	Benefits included extra attention, optimized medications, and consideration of SDOH, might improve patient confidence and health.	Heightened confidence and adherence to treatment regimen		
Similarly, scores on the adherence to self-care regimen subscale significantly increased after two visits with the pharmacist (pre-Mean = 3.47(SD= 0.59), post-Mean = 4.07(SD = 0.60), $p < .01$)."	Adherence to the self-care regimen increased after two visits with the pharmacist.	Improving patients' adherence to treatment	The impact on medication adherence	
"The similarities in change in A1c and BP values in 2019 and 2020 show that these specific outcomes were not affected negatively."	There was no negative impact on A1c and BP outcomes.	HbA1c and BP outcomes remain unchanged.	The impact on health test results	
We noted enhancements in patient engagement, the provision of personalized interventions, streamlined communication processes, heightened program enrollment rates and ultimately improve program effectiveness through the course of the initiative"	The initiative will benefit health outcomes by increasing patient engagement, providing personalized interventions, improving communication, boosting enrollment rates, and	Comprehensive healthcare enhancements.	Comprehensive healthcare enhancements.	

	enhancing program effectiveness.			
"CMM pharmacist service may play a key role in achieving benchmarks of chronic disease management in designing future value-based care reimbursement models."	Pharmacists play an important role in achieving specific goals and benchmarks in chronic disease management.	Telehealth CMM pharmacists have a significant impact on health goals and benchmarks in chronic disease management.	The impact on chronic disease management	
"Identified benefits for the providers included more efficient provider visits, and extra support ("the fact that we can provide an additional support layer where they [physicians] don't have to have all of the answers and they've got that sense of team and help")."	Benefits for providers included more efficient visits and additional support, creating a sense of teamwork.	Additional support and teamwork	Provider support	Collaborative care

ANNEX 3. INDUCTIVE CONTENT ANALYSIS; RESEARCH QUESTION TWO

Original expression	**Reduction**	**Subcategory**	**General category**	**Main category**
"Rates of loss to follow-up were relatively high in our review; reasons might include the voluntary nature of participation in the CPS management clinic, the high number of patients consulted or enrolled through outreach by providers rather than by patient request, and telecommunication difficulties in rural areas."	Rates of loss to follow-up were relatively high, one of the reasons was telecommunication difficulties in rural areas.	Rates of loss to follow-up	The impact of telecommunication issues in rural areas	Challenges in patient retention
"The lack of interoperability between EMR systems was a major barrier to health information exchange between the VA and community providers."	The lack of interoperability between EMR systems was a major barrier to health information exchange	Lack of interoperability between EMR systems	Barriers to health information exchange	Health information exchange
"Many from both pharmacy types thought that CMM via telehealth was generally detrimental for patients who are not proficient in English, likely a result of having limited access to linguistic accommodations/interpreter services virtually."	CMM via telehealth was detrimental for patients not proficient in English due to limited access to virtual interpreter services.	Lack of English language skills among clients and limited access to virtual interpreter services	Lack of language skills	Communication barriers