What are the perceptions of stakeholders in the homecare industry in Finland regarding the adoption of Automated Medication Dispensers

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Abstract

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The growing number of elderly people and shortages of nurses in Finland causes a significant challenge for home care organizations to provide services, Medication is one of primary reasons that elderly people or their relatives seek for help of Home Care. This results in searching alternatives solutions, since there are not enough nursing resources available. This thesis investigates the perceptions of stakeholders in the Finnish home care regarding the adoption of Automated Medication Dispensers (AMDs). The study aims to identify the facilitating factors and obstacles of AMD adoption and assess their potential demand. A qualitative research approach was employed, involving interviews with key stakeholders from different home care organizations. The research highlights the increasing need for AMDs due to the shortage of nursing staff and the growing demand for personalized care.

The research findings show that AMDs significantly enhance medication safety, reduce physical visits and allow caregivers to free up time, and support elderly independence by enabling them to have a role in their medication intake. However, there are some factors that are seen as barriers for adoption of AMDs. Challenges such as staff resistance, adoption of AMDs by elderly, and bias towards reliability of AMDs were identified. Stakeholders noted that the adoption of AMDs is influenced by organizational leadership, customer suitability, and continuous training for caregivers to ensure their skills and expertise.

This research concludes that while AMDs offer clear advantages in efficiency and safety, addressing implementation barriers is important for broader adoption. Recommendations include investing in user training, and aligning AMD features with home care needs to maximize their benefits for healthcare organizations and elderly individuals alike.

Key words
Automated Medication Dispenser, Home Care, Elderly people, Public Sector, Adoption of New Technology, Welfare Service County

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Ikääntyneiden ihmisten määrän kasvu ja hoitajien pula Suomessa aiheuttavat merkittäviä haasteita kotihoito-organisaatioille palveluiden tarjoamisessa. Lääkitys on yksi keskeisistä syistä, miksi ikääntyneet tai heidän omaisensa hakevat apua kotihoidosta. Tämä johtaa uusien ratkaisujen etsimiseen, sillä hoitohenkilöstöä ei ole riittävästi saatavilla. Tämä opinnäytetyö tutkii suomalaisten kotihoidon sidosryhmien näkemyksiä automaattisten lääkeannostelijoiden / lääkeautomaattien käyttöönotosta. Tutkimuksen tavoitteena on tunnistaa lääkeautomaattien käyttöönottoa edistävät ja estävät tekijät sekä arvioida niiden potentiaalista kysyntää.

Tutkimuksessa käytetty laadullista tutkimusta, ja siihen sisältyi haastatteluja keskeisten sidosryhmien kanssa eri kotihoito-organisaatioista. Tutkimus korostaa lääkeautomaattien kasvavaa tarvetta hoitajapulan ja yksilöllisen hoidon kysynnän lisääntyessä.

Tutkimustulokset osoittavat, että lääkeautomaatit parantavat merkittävästi lääketurvallisuutta, vähentävät fyysisten käyntien tarvetta, vapauttavat hoitajien aikaa ja tukevat ikääntyneiden itsenäisyyttä osallistumalla heidät lääkkeenottoon. Kuitenkin lääkeautomaattien käyttöönotossa on havaittu myös haasteita. Haasteita ovat muun muassa henkilöstön vastustus, ikääntyneiden sopeutuminen lääkeautomaattien käyttöön sekä ennakkoluulot laitteiden luotettavuutta ja toimintavarmuutta kohtaan. Sidosryhmät huomauttivat, että lääkeautomaattien käyttöönottoon vaikuttavat organisaation johtaminen, asiakkaiden sopivuus sekä jatkuva koulutus hoitajille heidän taitojensa ja osaamisensa varmistamiseksi.

Tutkimuksen johtopäätöksenä todetaan, että vaikka lääkeautomaatit tarjoavat selkeitä etuja tehokkuuden ja turvallisuuden kannalta, käyttöönoton haasteiden ratkaiseminen on tärkeää laajamittaisemman omaksumisen saavuttamiseksi. Suosituksina esitetään panostamista, käyttäjäkoulutukseen sekä lääkeautomattien ominaisuuksien sovittamista kotihoidon tarpeisiin, jotta niiden hyödyt kotihoidolle ja ikääntyneille voitaisiin maksimoida.

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Avainsanat
Lääkeautomaatti, Kotihoito, Ikäihmiset, Julkinen sektori, Uuden teknologian hyväksyminen, Hyvinvointialue

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1 Introduction

This thesis aims to explore the potential of Automated Medication Dispensers within Home Care organizations, with a focus on identifying both the challenges and benefits these devices could offer. The thesis seeks to understand the factors that facilitate the adoption and demand of Automated Medication Dispensers and those that may act as obstacles.

People all over the world are living longer than before, with many now living into their sixties and beyond. This increase in life expectancy is happening globally, meaning the number of older people is growing in nearly every country. As the population ages, the proportion of elderly individuals is rising, which brings both opportunities and challenges. Societies must adjust to this demographic shift, considering changes in healthcare, pensions, and other services needed for older populations. The trend is expected to continue, as advancements in healthcare and living standards allow people to live longer lives (Ageing and Health 2024).

By 2030, one in every six people in the world will be aged 60 or older. The total number of older people will grow from 1 billion in 2020 to 1.4 billion by 2030. By 2050, the number of people aged 60 and above is expected to double to 2.1 billion. Additionally, the number of people aged 80 or older will triple between 2020 and 2050, reaching 426 million. This rapid increase in the aging population highlights the growing need for services and policies that support older individuals, especially in healthcare, housing, and pensions (Ageing and Health 2024).

The primary reason elderly people often need Home Care services is because they have trouble following their medication schedules. This is usually due to physical or mental challenges that make it hard for them to manage their medicines on their own. However, Home Care services are struggling to keep up with the increasing demand for help because they don’t have enough resources. As a result, many people are turning to private companies for support (Mattila, 2022).

A qualitative research methodology has been used to conduct this research, involving interviews with three professionals from different Home Care organizations. These interviews were conducted online via digital platforms, ensuing real time interaction and comprehensive data collection, all of which were recorded for accuracy. This thesis focuses to explore the factors affecting the adoption of Automated medical dispensers (AMD) in Finland and their potential demand

1.1 Background and purpose of study

This chapter aims to address several key fundamental elements to the study. It starts by providing **background information** on the research topic, offering necessary context to understand the significance and relevance of the study.

This chapter continues to outline the **research problem**, identifying the specific issue or gap that this study aims to address. This step is very important, because it provides the basic structure for the research to continue effectively.

The **objectives of the study** are then detailed, explaining the primary goals and what the research seeks to accomplish. This section clarifies the direction and focus of the research. Furthermore, the chapter discusses the **significance of the study**, elaborating on how the research contributes to the existing body of knowledge and its potential implications in the field.

This thesis aims to highlight the growing number of elderly people and the challenges that Home Care organizations are facing now and might face in the future. It will also explore how well-being technology, like Automated Medication Dispensers, can help elderly people manage their medications better and how these technologies can benefit Home Care organizations.

The world's population is living longer in comparison to previous centuries. People easily live beyond their sixties. The main reason for living longer is long life expectancy due to healthier lifestyles and reduction of mortality from diseases. This creates challenges for health care organizations when their personnel resources are not enough to meet the growing number of elderly people. Well-being technology plays a significant role to help health care organizations to meet the needs of growing number of elderly people with current number of personnel in health care organization (Mace, Mattos, & Vranceanu 2022).

The COVID-19 pandemic, which began in 2019, made it riskier for elderly people to have in-person visits from home care workers. This increased the need for technology like Automated Medication Dispensers (AMDs) to provide safe care. These devices help make sure medications are taken correctly and avoid mistakes. Since they are considered medical devices, they must follow strict safety rules. They can work on their own or with other technologies (European Health Management Association 2022).

In Europe, health technology devices are regulated under EU laws to ensure their safety and effectiveness. Since 2022, regulations for health technologies have been standardized across all EU countries. To be approved for use in the European Economic Area, devices like AMDs must have a CE-mark, which shows they comply with EU safety and usage standards. These regulations aim to

maintain high levels of safety and reliability for healthcare technology used in patient care (European Health Management Association 2022).

1.2 Automated Medication Dispensers

Automated Medicine Dispensers are in a very early stage of their lifecycle in Health care sector. The oldest service provider has been in the market for almost 10 years and yet, there is a lack of academic resources to provide enough information regarding their functionality, effectiveness and benefits they provide to Home Care Organizations and other potential target markets.

1.2.1 Automated Medication dispensers in Home Care

Automated medication dispensers are part of the home care service package and help to manage the dispensing of medications, so the client does not have to worry about their medication intake according to the scheduled time. The dispenser provides the correct medications for the elderly at the right time. The medications are stored in a locked compartment within the device. If, for any reason, the client does not take their medicine at the scheduled time, the dispenser sends an alarm to the Home Care team, and a caregiver re-administers the medicine. Re-administration of the medicine remotely by caregivers is only possible by Axitare. Automate Medicine dispensers are easy to use and help to promote the client's independent living at home (Pharmaceutical Machines s.a.).

A medical device meets certain definitions and requirements. It is intended to be used on humans, and its purpose is the prevention, anticipation, diagnosis, treatment, alleviation, or monitoring of diseases. The manufacturer's stated purpose is used to compare to the definition of a medical device, and these devices are marked with a CE label (European Commission 2020).

Digital services used through smart devices have become popular year by year in supporting the independent living of the elderly and in providing home care services. Many useful and versatile applications based on video, audio, and text communication have been developed through these devices. Services that are used for maintaining social contact such as screen visits, remote rehabilitation services and Medication supporting services are some of successful examples being implemented recently (Niemela et al. 2023).

The growing elderly population brings challenges for social and healthcare systems, both in terms of service capacity and rising costs. According to the Ministry of Social Affairs and Health of Finland, in order to ensure quality ageing, It requires new services and solutions that enables elderly people to live at home independently for as long as possible. Technology can play a key role in supporting elderly people to remain at home while improving the quality and efficiency of care

services. Automated Medicine Dispensers bring advantages for Health Care organizations. Automated Medicine Dispensers enable caregivers to prioritize their visits for those who need it the most (Istekki 2024).

1.3 Commissioning Company

This chapter seeks to present an overview of Axitare Ltd. and the range of services it offers. The primary objective is to provide readers with a clearer understanding of what Axitare is, how it distinguishes its products and services from other Automated Medication Dispensers (AMDs) available in the market, and the advantages that Home Care organizations can gain by utilizing Axitare's solutions.

Axitare Ltd. is a Finnish company founded in 2017. By 2022, it had over 2,000 users across the country. Axitare focuses on making the simplest Automated Medication Dispenser (AMD) for elderly people who live independently but use Home Care services. The company started working with South Karelia (EKSOTE) in 2017 to improve medication care, which led to the creation of their easy-to-use dispenser (Finnish innovator in healthcare technology | Axitare).

Home care clients are diverse, for this reason Päijät-Häme Welfare service county has decided to use 2 types of medication dispensers, choosing the best option based on each client’s needs. "In future contracts, we will continue working with several dispensers. Axitare is a great choice for our services because its features stand out," says Mattila, encouraging other Welfare Service Counties to adopt this method. When a new client needs help with medication, an Axitare dispenser can be delivered right at the start of their care, and it can be used with their current medications. The client can start using it right away, which helps avoid extra nursing visits. "Axitare is the only dispenser that supports this approach," says Mattila. The best results happen when the dispenser is used right away and continues as long as the client can manage. "At the beginning of care, the client hasn’t yet adjusted to getting medication from a nurse, so their independence is best kept by using their own dispenser (Piritta Mattila. s.a.).

1.3.1 Current providers of Automated Medicine dispensers

This Chapter aims to introduce the main and mostly used Automated Medicine Dispensers in different Welfare Service Counties in Finland.

1.3.2 Axitare

Axitare is a simple, easy-to-use device that is remotely operable and has many functions. It can give out daily medications, course of medicine, or medicines needed only occasionally. Liquid

medicines can also be used if placed in a cup with a lid. Unlike other devices, Axitare uses medicine cups instead of pre-packaged doses, which many people find easier to use. The device can be controlled and monitored remotely using a smartphone or computer with a login. Caregivers or family members can check if the user has taken their medicine. If not, the device locks the untaken medicine in a safe compartment and allows it to be given again remotely, avoiding extra home visits. Axitare also has a 24-hour battery backup to keep working during power outages. (Easy-to-use medicine dispensing robot to support independent living at home s.a.).

Päijät-Häme Welfare Service County has pointed out several important features of Axitare's product and service in how they work. These include:

- I**mmediate service activation** for home care patients
- Use of a familiar medicine cup, simplifying the process of taking medication
- Integration with the Gillie system, enabling seamless functionality within existing health care system
- Remote operability, allowing adjustments and management from a distance
- A Finnish product
- As of January 2024, 363 Axitare devices are in use, with an average of 25,161 medication doses dispensed monthly (Etähoiva ja teknologiayksikkö. s. a.)

1.3.3 Evondos

The idea for the Evondos automatic medication dispenser came from a project by Mika Apell and his classmates during an adult education program at the University of Turku. They all knew how hard it could be to manage medications, so they wanted to make things easier for elderly people and caregivers. In 2009, they created the first version of the dispenser. It took several more years to improve the design and turn it into a complete product and service (Evondos 2024b).

The Evondos device uses a dose roll, or sachets prepared by a pharmacy, which are placed inside the device. It reads the medicine name and time written on the pouch and gives the medicine at the right time. If the user doesn't take the medicine, the device locks it inside. This is reported to the healthcare system, and only a caregiver can take the medicine out from the locked compartment (Evondos 2024b).

1.3.4 Smila

Tamro is a Public Limited Company which is specialized in selling medicine and health care technologies. They sell their products and services to multiple niche such as, medicine firms,

Pharmacies, Hospitals, private health care and retailers. Almost 60 % of medicines consumed in Finland are delivered by Tamro Plc (Tamro s.a.)

Smila is an automated medication dispenser made by Tamro Plc to improve how medications are managed. It works with dose rolls or sachets prepared by pharmacies, which are placed into the device. Smila reads the time and details, like the medicine name, from the text on the pouches and gives the medicine at the right time. Unlike other devices that mainly serve home care, Smila is designed for both home care and nursing homes (Tamro s.a.).

1.4 Demarcation

This study will primarily focus on Finnish home care organizations, examining their current challenges related to the shortage of nurses and their use of Automated Medication dispensers. It will explore the experiences these organizations have had with Automated Medication dispensers, assess emerging trends, and evaluate the potential of these devices in Finland.

According to the World Health Organization, the global population is aging, but the European population is aging at a faster rate. The Nordic countries are at the forefront of this demographic shift, with Finland being the fastest aging country. Consequently, this thesis will also provide an overview of the global situation of the elderly people, with a particular focus on Europe, the Nordic countries, and specifically Finland.

It is essential to understand how automated Medication dispensers are perceived by home care organizations, the challenges they have encountered in implementing them, and the benefits they have achieved. Additionally, it is important to assess the future potential of automated medication dispensers, particularly within the context of Finland.

1.5 Research problem and questions

The researcher has discovered that clearly identifying the research problem is a key step in conducting research. It serves as a guide for the entire research process and helps organize the work into smaller, manageable stages. Before starting any research, it's crucial to determine what the main problem or question is.

For this particular study, the researcher is focused on finding answers to the questions below:

> IQ 1. What are the perceptions of stakeholders in the homecare industry in Finland regarding facilitating factors towards the adoption of AMD in Finland

IQ 2. What are the perceptions of stakeholders in the homecare industry in Finland regarding barriers to the adoption of AMDs in Finland

IQ 3. What are the perceptions of stakeholders in the homecare industry in Finland regarding the potential demand for AMDs

1.6 Benefits

This thesis will help the author to facilitate the collection of data from various levels of Home Care organizations concerning the use of Automated Medication Dispensers (AMDs). Its primary objective is to explore the experiences and potential benefits of AMDs within Home Care organizations. Two main types of AMDs are available on the market: AMDs functioning only with medication bags or sachets, and Axitare, which operates using medication cups, but Sachets can also be used in parallel with the cups. The thesis aims to highlight the key differences between these types from the perspective of Home Care organizations and to analyze the specific advantages each provides for these organizations.

This thesis offers insights into the use of various Automated Medication Dispensers (AMDs) that can benefit Home Care organizations. The implementation of AMDs varies across different Home Care organizations in Finland, providing comparative data that can be valuable to organizations with less experience in using these devices.

1.7 Key Concepts

The purpose of this chapter is to offer a brief understanding of key terms used throughout the thesis. It aims to familiarize the reader with essential concepts, ensuring a thorough and accurate understanding of the subject. Each term is carefully defined to give clarity and enhance comprehension of the topic being explored.

Automated Medication Dispenser technological devices that are part of the home care service package and help to manage the dispensing of medications, so the client does not have to worry about their medication schedule. The dispenser provides the correct medications to the client at the right time. The medications are stored in a locked compartment within the device. If, for any reason, the client does not take their medication at the scheduled time, the dispenser sends an alert to the home care team, and a caregiver re-administers the medication. Medication dispensers are easy to use and help promote the client’s independent living at home (Pharmaceutical Machines s.a.).

Home care covers both home assistance services and home nursing care. Its main objective is to support clients in maintaining their ability to live independently in their own homes by promoting their functional capacity, health, well-being, self-sufficiency, and social inclusion. These services are delivered by the Welfare Service Counties, through service vouchers, or by private contracted providers (Keski-Suomen hyvinvointialue 2023).

Medication safety is a key component of comprehensive care. It can play a crucial role treatment, slow down the pace of the diseases and prevent illness. Drug safety and Medication Safety are two components of Safe Medication. The difference between two terminologies are as follows: Drug safety refers to the safety of the pharmaceutical product itself, while medication safety focuses on the safe administration and management of medication treatment (Ministry of Social Affairs and Health. s.a.).

Nursing shortage It is estimated that there are approximately 29 million nurses and 2.2 million midwives globally. However, the World Health Organization (WHO) projects a shortage of 4.5 million nurses and 310,000 midwives by 2030 (World Health Organization 2024).

Elderly people/ Home care client An individual at age of 65 year old and above. They are above retirement age and due to their physical or mental restrictions, rely on others to maintain their daily activities fully or partially (OECD 2024).

2 Literature Review

Finally, the chapter aims to shed light on what are the factors that facilitate the use of Innovation and what factors play a role as barrier.

2.1 Elderly patient care

Due to the increase of life expectancy, people globally are living longer. Majority of individuals can live into their sixties and beyond. Countries are experiencing growth not only in the number of adult individuals, but also in the share of elderly individuals in the population (Ageing and Health 2024).

There are two major factors causing the growth of aging population. The first factor is significant increase of life expectancy, only in the UK there are over 10 million of over 65-year-old people, in other words it means every sixth individual is over 65-year-old. The latest projections estimate that in 20 years the number of elderly people increase by 5,5 million more and by 2050 the number will be doubled to approximately 19 million. It would mean that every fourth individuals in the UK will be over 65-year-old (Cracknell, 2010).

The global increase of life expectancy is largely due to a reduction in death rate from infectious and parasitic diseases, such as smallpox, polio, and measles, alongside healthier lifestyle of people. The second factor is due to improvements and access to birth control methodologies and broader willingness towards education and career-orientation have contributed to a substantial decline in fertility rates. The worldwide total fertility rate has decreased from 5,0 children per woman in the period 1950-1955 to 2,5 children per woman between 2010 and 2015, with projections indicating it will decline below the current level by 2050 (Institute for Health Metrics and Evaluation 2024).

Europe is aging faster than other continents and the population is already older, ranked by median age, and it is estimated to maintain this status until 2050. Globally, the number of elderly people is projected to more than double, rising from 841 million in 2013 to over 2 billion by 2050 (United Nations, 2013). However, the percentage of elderly people compared to the rest of the population is more important than their increase in numbers. Globally the percentage of people aged 60 year old andabove has risen over time from 9.2 % in 1990 to 11.7 % in 2013 and according to statistics it wil reach 21.1 % by 2050 (Sander et al., 2015).

The chart below shows the increase in the number of people aged 65 and over between 2013 and 2023 in Europe.

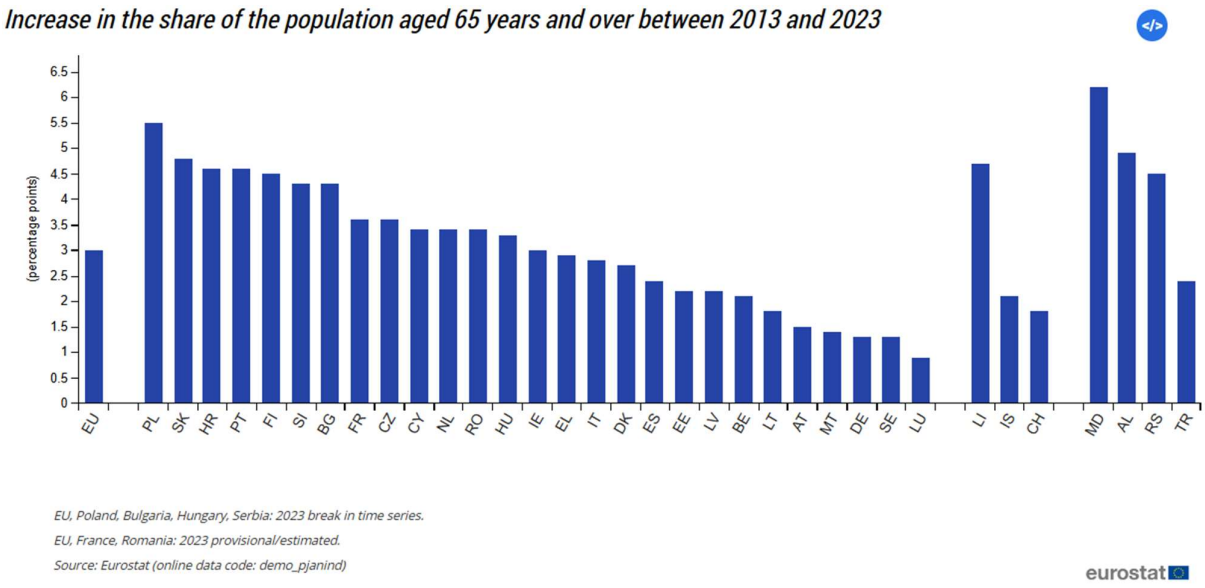

Figure 1. Increase in the share of the population aged 65 years and over between 2013 and 2023 (Population structure and ageing 2024)

Elderly people need more Health Care and since they are increasing in number, they are perceived as reliant on others, and as a burden to society. Health Care professionals need to challenge this societal bias, because it is harmful and lead to age discrimination (World Health Organization s.a.).

Modern developments such as globalization, advances in transportation and communication technology are influencing the lives of elderly people in significant ways. These factors can affect the access of elderly people to resources both positively and negatively. Its crucial for Health professionals to take these factors into consideration when creating strategies to ensure the access of elderly people for Health Care's services (World Health Organization s.a.).

The UN Decade of Healthy Ageing (2021-2030) program is designed to reduce inequalities towards elderly people concerning health and improve their quality of life. It also refers to their families and communities. This program focuses on four key areas; changing attitudes and addressing ageism that society adopt more positive views about elderly people, creating supportive communities that help elderly people to maintain their abilities and independence, Providing human-centered healthcare to provide services that meets the needs of elderly, Offering quality long-term care to ensure those elderly individuals who need continuous support receive effective care (Decade of Healthy Ageing s.a.).

Population pyramids (see Figures 3 and 4) illustrate the distribution of the population across different age groups and genders. Each bar in the pyramid represents the percentage of the population within a specific age and gender category. As of January 1, 2023, the EU population pyramid

displays a narrow base and a rhomboid shape, reflecting the 'baby boom' generation born during the post-World War II period when fertility rates were high. These 'baby boomers' are now contributing to the expanding retiree demographic, as demonstrated by the comparison with the 2008 population pyramid. This bulge, moving upward through the pyramid, results in a narrower base and a reduced proportion of working-age individuals (Population structure and ageing 2024).

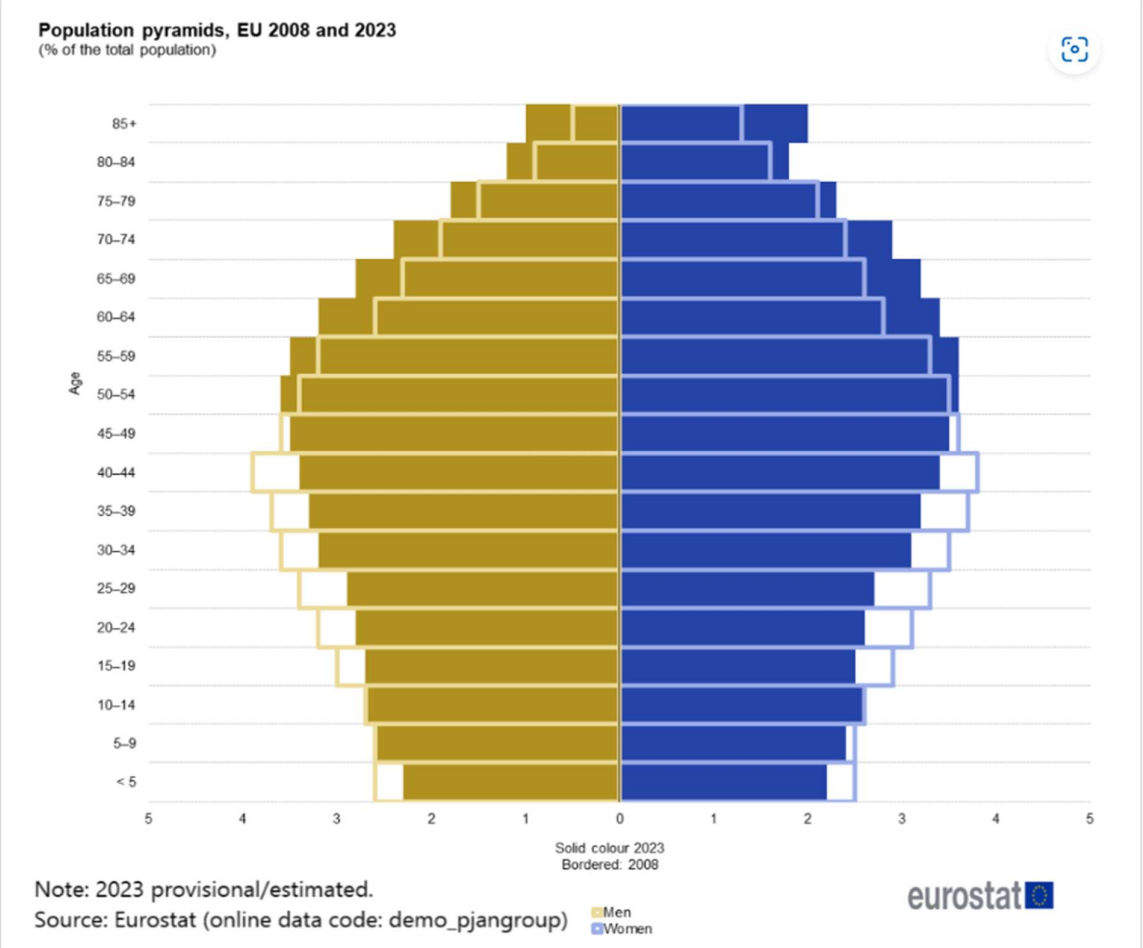

Figure 2. Population pyramids, EU 2008 and 2023. (Population structure and ageing 2024)

Another dimension of population aging is the increasing proportion of very old individuals within the older population. The relative significance of those aged 80 and over is growing more rapidly compared to other age groups within the EU. Projections indicate that the share of individuals aged 80 years and older in the EU population will rise approximately 2.5 times from 6.0% in 2023 to 15.3% by 2100 (Population structure and ageing 2024).

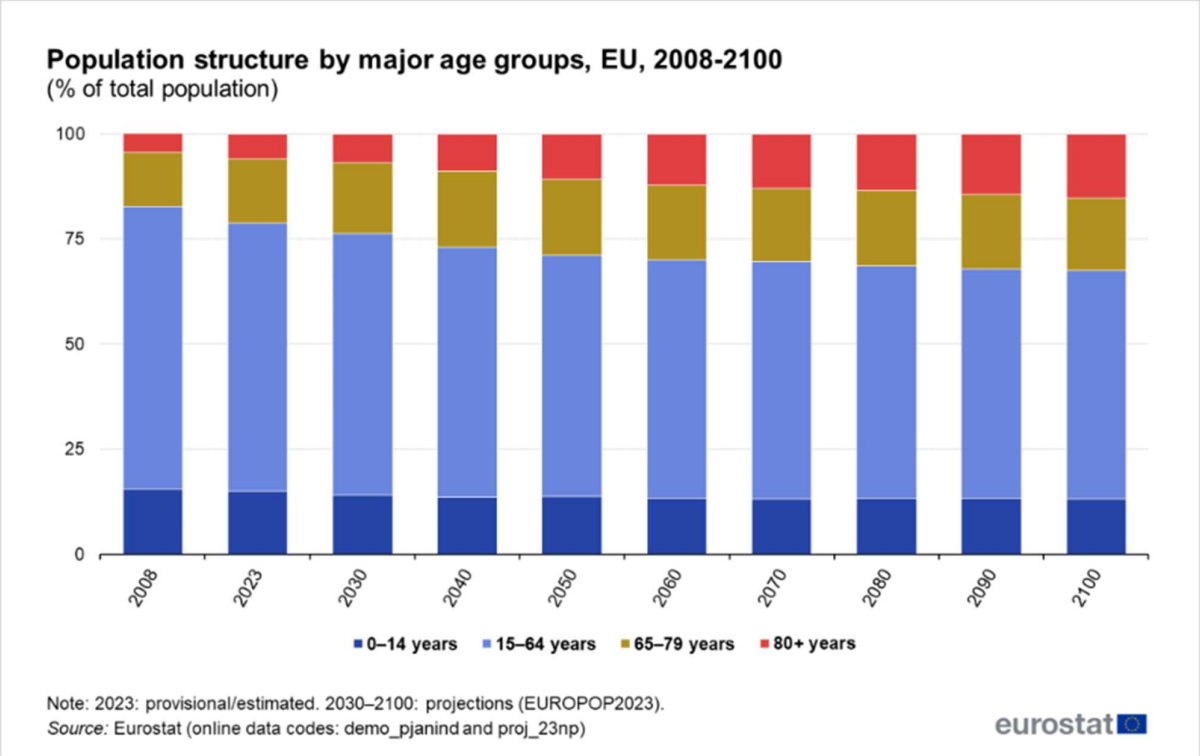

Figure 3. Population structure by major age groups, EU 2008-2100 (Population structure and ageing 2024)

According to Marco Marsella Head of the “eHealth, Well-being, and Ageing” in the European Commission; Digital technologies play a crucial role to transform health, care and wellbeing. Demographic change is a complex challenge and digital can help address provision of services across all European regions (European Commission 2021).

Between 2017 and 2020, Tech4Care developed and tested a virtual reality (VR) system for stroke rehabilitation as part of a pre-commercial procurement initiative led by healthcare organizations in Northern Ireland and Italy. This project significantly accelerated the company’s internal research and development efforts, contributing to its growth and the advancement of additional digital health products that are now commercially available. The VR-based solution allows stroke patients to undergo rehabilitation in the comfort of their homes through adaptive, immersive VR games, with clinical staff remotely monitoring their progress (European Commission 2021b).

European Commission organized a workshop in 2021, the workshop was organized as part of the European Week of Regions and Cities (EWRC) Health Day, in collaboration with the European Commission’s Directorate-General for Communications Networks, Content and Technology (DG

Connect) and the Committee of the Regions' Commission for Natural Resources (NAT) (European Commission 2021b).

2.2 Home Care

The origins of home care are closely tied to the practice of nursing, which emerged in the United States in the late 1800s. The concept of delivering nursing care at home was pioneered in 1859 by William Rathbone, a wealthy businessman and philanthropist from Liverpool, England. After experiencing the care provided to his wife at home before her passing, Rathbone created a system of visiting nurses. He also collaborated with Florence Nightingale to establish a training school for visiting nurses at Liverpool Infirmary. The nurses who graduated from this program focused on assisting the poor in their homes. During the late 1800s, rapid urbanization and the arrival of large numbers of immigrants in the U.S. caused living conditions to decline, leading to health issues that required attention. Similar to England, home care in the U.S. was initially aimed at helping the poor, and visiting nurse associations (VNAs) were formed by groups seeking to improve the health of impoverished communities. These associations provided nursing care in people's homes as a response to the unhygienic conditions and the rise in illnesses during this period. (Carolyn & Paula 1996, Chapter 2).

The modified draft below shows the lifecycle of Home Care client:

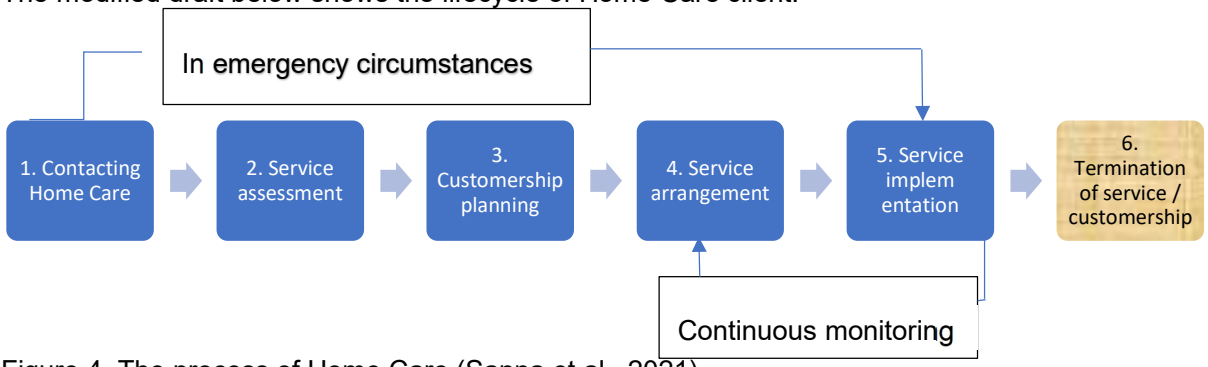

Figure 4. The process of Home Care (Sanna et al., 2021)

World War II further contributed to the growth of home care, as physicians reduced the frequency of home visits, leaving nurses to manage most health and illness care in the home. In 1946, New York City's Montefiore Hospital created a program for post-hospital acute care, extending convalescent care to patients in their homes. From this period through the mid-1960s, VNAs expanded throughout the U.S., with their services primarily aimed at providing health and illness care for the poor. Acute care was mostly administered in hospitals during this time. The introduction of Medicare in 1965 marked a significant turning point in home care. Under this legislation, home care became a benefit available to elderly individuals enrolled in the Medicare program. This change led to a greater demand for home care services and resulted in the transformation of home health

agencies, with an increase in the number of for-profit providers offering home health care services (Carolyn & Paula 1996, Chapter 2).

The concept of ‘home care’ is understood differently across the world. The services included in Home Care differ a lot depending on the country and the culture. Studies on home Care do not precisely define what services are included in Home Care. (Thomé, Dykes & Hallberg, 2003; Breedveld, 2004). Home care can be understood of as any care provided in someone’s house aiming to enable them to live in their house independently by using services provided by Home Care. Home care services might be provided only by professionals or shared with family members, like a spouse or relative. These services can include personal help, such as bathing or dressing, or practical tasks like cleaning and cooking (Genet et al., 2013, Chapter 4).

In the last 20 years, elderly care has shifted from institutions to home-based services. This change is mainly due to cost issues and preference of elderly people to live in their homes for as long as possible. To meet the need of elderly people more efficiently, new policies prioritize greater collaboration, integration and coordination between healthcare services and social welfare services (Jamieson 1997).

All 15 European countries have home nursing and help services, but home care is still new in Greece and Italy. Many areas in these countries lack these services. Home care is part of healthcare everywhere, but home help is mostly under social services. In Sweden, since 1992, home nursing has been moved from healthcare to social services. In some parts of Italy, home nursing is also handled by social services. This leads to different ways of funding nursing and help services (Jamieson 1997).

Home care is a service that helps elderly people manage their daily life at home. It aims to support and ensure elderly people manage their daily lives at home (Ageing 2024).

When elderly people require care and support, the goal is for them to stay in their homes as long as possible, even until the end of life. Care is given at home or in a home-like living environment (Home Care s.a.).

2.2.1 Specific needs of Home Care

The primary and common tasks that nurses perform in home care are described as follows:

- Provide medical and nursing care at the elderly person’s own home
- Provide assistance with daily activities of elderly people
- Coordinating the care of the elderly person to promote well-being and facilitate their ability to remain in their own homes for as long as possible (Jamieson 1997).

2.2.2 Lack of nurses and resources to address specific needs for elderly care (Europe)

The European Commission's Health and Food Safety department warns about a growing lack of nurses and caregivers in the EU. This shortage is likely to get worse as the population ages and many current workers retire (European Commission 2024).

The COVID-19 pandemic has made healthcare worker shortages in Europe worse. A recent Lancet report says the world needs 43 million more healthcare workers, like doctors and nurses, to overcome current shortage. (GBD 2019 Human Resources for Health Collaborators, 2022). In Europe, 40% of doctors in one-third of countries are close to retire, and 9 out of 10 nurses are thinking about leaving their job (WHO, 2022). This is critical because there is a severe shortage of nurses and midwives, with 30.6 million more needed globally (GBD 2019 Human Resources for Health Collaborators, 2022). (Global Burden of Disease Collaborative Network 2022).

Graduates – nursing professionals and midwives, 2010 and 2020

	Head count (number)				Ratio (per 100 000 inhabitants)			
	Nursing professionals		Midwives		Nursing professionals		Midwives	
	2010	2020	2010	2020	2010	2020	2010	2020
Belgium	:	:	648	648	:	:	5.9	5.6
Bulgaria	300	481	99	199	4.1	6.9	1.3	2.9
Czechia	1 283	1 318	229	195	12.3	12.3	2.2	1.8
Denmark (*)	2 228	2 563	162	165	40.2	44.1	2.9	2.8
Germany (*)	30 623	35 850	596	750	37.8	43.1	0.7	0.9
Estonia	379	367	31	30	28.5	27.6	2.3	2.3
Ireland	1 641	1 534	186	128	36.0	30.8	4.1	2.6
Greece (*)	1 585	1 368	236	235	14.3	12.8	2.1	2.2
Spain (*)	10 098	10 587	353	360	21.7	22.4	0.8	0.8
France	22 311	25 558	877	898	34.4	37.9	1.4	1.3
Croatia (*)	351	1 399	190	82	8.2	34.2	4.4	2.0
Italy	9 776	*9 992*	804	*456*	16.5	*16.8*	1.4	*0.8*
Cyprus (*)	277	122	0	0	33.4	13.8	–	–
Latvia	:	:	13	42	:	:	0.6	2.2
Lithuania	581	761	23	33	18.8	27.2	0.7	1.2
Luxembourg	101	68	4	5	19.9	10.8	0.8	0.8
Hungary	1 184	3 071	52	229	11.8	31.5	0.5	2.4
Malta	48	165	19	11	11.6	32.0	4.6	2.1
Netherlands (*)	2 530	4 460	141	150	15.2	25.6	0.9	0.9
Austria	2 914	*2 847*	91	74	34.8	*31.9*	1.1	0.8
Poland (*)	9 653	9 070	1 757	1 471	25.4	23.9	4.6	3.9
Portugal	3 706	2 667	:	:	35.1	25.9	:	:
Romania (*)	2 091	1 239	155	:	10.3	6.4	0.8	:
Slovenia (*)	414	611	26	37	20.2	29.5	1.3	1.8
Slovakia	:	:	82	59	:	:	1.5	1.1
Finland	:	:	177	196	:	:	3.3	3.5
Sweden	4 081	4 502	279	345	43.5	43.5	3.0	3.3
Iceland (*)	127	117	10	10	39.9	32.5	3.1	2.8
Liechtenstein	0	0	0	0	–	–	–	–
Norway	3 260	4 069	89	145	66.7	75.6	1.8	2.7
Switzerland	2 783	3 711	68	203	35.6	43.0	0.9	2.4
Montenegro	:	42	:	:	:	6.8	:	:
North Macedonia (*)	203	154	14	24	9.9	7.4	0.7	1.2
Serbia	638	1 091	382	364	8.8	15.8	5.3	5.3
Turkey (*)	11 597	15 237	1 262	3 479	15.9	18.3	1.7	4.2

(*) 2019 instead of 2020.
(*) Nursing professionals: break in series.
(*) Nursing professionals: break in series due to change in the nursing diploma; please refer to the article's section on data sources for information on the deviations from the standard definition.
(*) 2018 instead of 2020.
(*) 2018 instead of 2020. Please refer to the article's section on data sources for information on the deviations from the standard definition.
(*) Midwives: break in series.
Source: Eurostat (online data code: hlth_rs_grd)

eurostat

Figure 5. Graduates- nursing professionals and midwives, 2010 and 2020

2.2.3 Nursing shortage in Finland

Finland has been warned about the nursing shortage for years, but it has gotten worse in the past few years. Some hospitals and elderly care departments have closed, surgeries are delayed, and services have been reduced (Punkari 2023).

At the start of 2023, Keva, the municipal pension insurer, released its analysis of the nurse shortage in Finland. Keva reported that Finland needs over 16,000 registered nurses and nearly 9,000 practical nurses. These numbers gained a lot of attention and became common topics in election debates (Mäntymaa 2023).

Finland is facing a shortage of nurses and other healthcare workers. To solve this problem, the country plans to bring in more workers from Asian countries. A survey by Yle, which is a Finnish media company, found that health services in Finland want to hire at least 1,000 healthcare workers from abroad in the next few years. This move is part of Finland’s plan to fill the gap caused by the shortage of local workers in healthcare jobs. By attracting skilled workers from countries in Asia, Finland hopes to improve the quality of care and ensure that there are enough workers to meet the demand for healthcare services. (Mäntymaa 2023).

Jussi Salo, who is the Development Director of the nurses' union Super, says that if Finland doesn't manage the process of integrating foreign nurses into the country and their workplaces well, it could create more problems instead of solving the nursing shortage. It could add extra challenges, making it harder to improve the healthcare system instead of helping it (Pennanen & Suikkanen 2023).

According to a survey by Yle, wellbeing service counties in Finland spend a lot of money to hire nurses from Philippines. For each nurse, they pay staffing companies between 5,000 and 10,000 euros. If they hire 1,000 nurses in a year, the total cost adds up to several million euros (Mäntymaa 2023).

Last spring, Finland's Ministry of Social Affairs and Health (STM) created a plan with steps to make sure there are enough workers in social and healthcare services (Mäntymaa 2023).

To provide good quality and enough social and healthcare services, skilled workers are essential. Finland has created a roadmap for 2022–2027, along with a detailed plan for 2022–2023, to ensure there are enough healthcare professionals. This plan focuses on several key areas: offering sufficient training for staff, improving what is taught in training programs, changing how tasks are assigned and work is organized, making better use of technology, and creating better and more

sustainable working conditions. These measures aim to strengthen social and healthcare services in Finland (Ministry of Social Affairs and Health 2024b).

Finnish Prime Minister Petteri Orpo's government has a plan to tackle the shortage of social and healthcare workers, which is affecting the availability of important services in the country. The plan includes both immediate actions and long-term solutions to fix the problem (Ministry of Social Affairs and Health 2024b).

2.2.4 Whom does AMDs serve?

Medication dispensers can be given to people who qualify for home care services. These services are for those who need help living at home and handling daily tasks because of issues like limited ability to function, long-term illness, disability, intellectual disability, or memory problems. A person's age does not affect whether they can receive home care services (Pharmaceutical Machines s.a.).

A medication dispenser is suitable for someone who needs help remembering to take their medicine, can follow instructions, and does not have severe memory problems. The person should be able to move around their home on their own, hear and see the dispenser's alerts, and have enough hand strength and coordination to pick up the medicine and take it (Pharmaceutical Machines s.a.).

In Pirkanmaa's Welfare Service County, 659 home care clients use medicine dispensers. This is 11.5% of all the regular home care clients in the area (Hurme & Räisänen 2023).

Automated medication dispensers also help nurses by making their work easier. Maarit Nurminen, a nurse in Lohja's home care, says these dispensers have made a big difference for both elderly clients and caregivers. Mornings are usually very busy because many people take their medicine then. But when clients can take their medication on their own using the dispenser, nurses can visit later in the day. This gives them more time to focus on other important tasks for the client, instead of spending time on giving out medicine (Pharmaceutical automation freedom and security for people living at home 2024).

Medication dispensers are designed for people who have mild memory problems, those receiving mental health rehabilitation, and individuals who need to take medications at specific times, like people with Parkinson's disease. These machines help ensure that patients take their medicine correctly and on time, improving their health management (Strengthening/social services/services for older older people 2024).

2.2.5 Feeling of independence

Safe medication management is an important part of home care to keep clients and patients safe. Most home care clients take regular medications, and some need help to make sure they take them correctly. Traditionally, caregivers visit clients at home to help with medication, especially in the mornings and evenings, which uses up a lot of resources. Lapland's wellbeing services county plans to increase remote home care by 10% in 2024 and by 30% by 2026. Over the past ten years, the use of medication dispensing machines has grown. Studies show that these machines are a good alternative to home visits. They improve medication management and help elderly people stay more independent (Strengthening/social services/services for older older people 2024).

Digitalization and new technologies like, artificial intelligence, and robots offer new ways to improve health and well-being. These technologies can make life better for elderly people and make the service system work more efficiently. They help people live healthier lives, manage illnesses, and stay independent and safe in their own homes. These innovations can make healthcare services more accessible and effective (Quality recommendation to ensure aging of good ageing 2020-2023 : Towards age-friendly Finland 2020).

Home care is an important part of services provided at home, but it needs to grow and improve in both the number of services offered and the types of services available. This includes using new technologies and digital tools, as well as considering the growing importance of volunteer work. Good home care builds trust and meets the needs of both elderly clients and staff. To help people live at home, there also needs to be more variety in the types of housing options available (Quality recommendation to ensure aging of good ageing 2020-2023 : Towards age-friendly Finland 2020).

Technology can help elderly clients stay independent, maintain privacy, and live more comfortably. Robots designed for social interaction, companionship, and therapy are already being used to improve social engagement. Video calls can make it easier for elderly people to communicate with doctors and healthcare workers without needing to visit them in person. Remote connections can also be used for group activities like meals, where 4–5 elderly people can eat together and socialize, with staff helping to manage the meal. Family members can also join in care meetings and support their elderly relatives through these remote connections. This makes it easier for families to stay involved in their loved ones' care (Quality recommendation to ensure aging of good ageing 2020-2023 : Towards age-friendly Finland 2020).

2.2.6 Cost efficiency

Since the 1970s, home care has changed a lot because of shifts in the healthcare system and what people need. In the late 1970s, a review of the Social Security system showed that the old

healthcare model, which focused on hospitals, was too expensive and not very effective. This led to changes in the healthcare, pharmaceutical, and insurance industries. The pharmaceutical and medical equipment industries were the first to start offering specialized home care services. As managed care grew, home care agencies needed to provide more advanced services to work with insurance companies. Home healthcare became a competitive business, where agencies had to offer high-tech care to meet the demands of the market. Today, home care continues to adapt to new needs and technologies (Carolyn & Paula 1997, Chapter 11).

The growth of high-tech home care happened because of the need to lower hospital costs and improve patient care. This led to the development of more advanced services, making treatments like home antibiotic therapy more common and accepted. As a result, home care nursing has become more specialized, requiring nurses to be skilled in handling complex medical equipment and providing serious care at home. Nurses play a key role in making sure care is safe and effective, whether they are directly providing care or coordinating with other specialists. Their work involves thorough assessment, monitoring, and following proper guidelines. This has made home care nursing an essential part of healthcare (Carolyn & Paula 1997, Chapter 2).

2.2.7 Medication safety

New digital tools, like robotics, e-prescriptions, automated medication preparation, safety cabinets, barcode systems, and smart pumps, have great potential to improve how medication is managed in hospitals across Europe. By using these tools, hospitals can improve patient safety and make healthcare systems more resilient. Widespread use of these digital tools would help healthcare workers and administrators meet important goals, such as making sure medicines are available, sharing patient data, fighting drug resistance, and supporting the EU’s goals for a greener and more digital future. However, many hospitals in Europe still have low levels of digital technology in their medication management, which creates challenges that could slow progress. This shows that more effort is needed to fully integrate these digital solutions (EHMA 2022).

Medication errors happen when a drug is wrongly prescribed, prepared, given to a patient, or monitored. In Germany, preventable medical errors cause about 18,800 deaths every year. In England, medication mistakes in hospitals lead to 1,700 deaths annually, and in Sweden, it's estimated that 3% of the population, or nearly 345,000 people, die because of medication errors. In Spain, medication errors are the most common cause of harm to hospitalized patients, making up 37.4% of all harmful incidents. Across Europe, it is estimated that one person dies every day from a medication error, which is more than the number of deaths caused by road traffic accidents, breast cancer, or HIV. Research shows that common medication mistakes include errors in writing prescriptions,

giving the wrong dosage, or forgetting to give medication, all of which can seriously affect patient safety (Mulac et al. 2021).

Figure 6. Proportion of mortality due to medication errors (EHMA, 2022).

2.3 Adoption of New Technology

Diffusion of innovation's theory

The healthcare system is shaped by many different factors, not just the people involved and their roles. These factors include things that can create obstacles or have an impact on the system, such as different theories and methods, the way policies are made, the specific features of the healthcare environment, and the attitudes of those who use the services. Market competition, the people pushing for new ideas, how clinics are organized, the right timing for changes, how new ideas are introduced, and the way society is structured also play a big role in shaping how healthcare is delivered (Daim et al. 2016,15).

There are studies about how healthcare professionals see and respond to telemedicine technologies, which allow healthcare to be delivered remotely (Al-Qirim, 2007a). In one study about community-based learning, nearly half of older participants said they were interested in using the Internet to find trustworthy health information (Cortner, 2006). There are broader social trends that are affecting older adults, making them more likely to adopt a connected, always-online lifestyle. This includes being monitored and encouraged to take care of their health around the clock. Another study on older adults' opinions about Smart Home Technologies showed that while many welcomed these innovations, they also had concerns about things like ease of use, reliability, trust, privacy, stigma, accessibility, and cost (Coughlin, D'Ambrosio, Reimer, & Pratt, 2007). Additionally, research has looked at what factors influence how people aged 65 and older use more advanced technology like personal computers and the Internet (Daim et al. 2016,15).

The adoption of healthcare technology is affected by how much market share care organizations have and how much competition exists between them. Research shows that hospitals are less likely to adopt new technologies when Healthcare Maintenance Organizations (HMOs) have a

bigger share of the market. However, hospitals are more likely to adopt new technologies when there is more competition among different HMOs (Bokhari, 2009). Additionally, the increasing pressure to cut costs in managed-care settings is encouraging hospitals to use clinical and administrative IT systems. These systems help improve efficiency and reduce costs (Daim et al. 2016,15).

Several factors help ensure the successful adoption of Electronic Health Records (EHRs). Larger hospitals, hospitals with academic connections, and those with bigger IT budgets and more dedicated staff are more likely to use advanced clinical information systems (Amarasingham et al., 2008; Kazley & Ozcan, 2007). Physicians working in larger groups, hospitals, or medical centers, especially in the western U.S., are more likely to adopt EHRs (DesRoches et al., 2008). Additionally, organizations with more IT resources are more likely to embrace new technologies (Angst, 2007). Environmental factors, such as being located in urban areas or dealing with more uncertainty, also make it more likely that EHRs will be adopted (Kazley & Ozcan, 2007). Important factors related to physicians, like having a larger practice, more years of experience, and being more ready for technology, also help with the adoption of EHRs (Abdolrasulnia et al., 2008). Finally, strong decision-making and planning processes within an organization greatly support the successful implementation and use of computerized patient records (Daim et al. 2016,15).

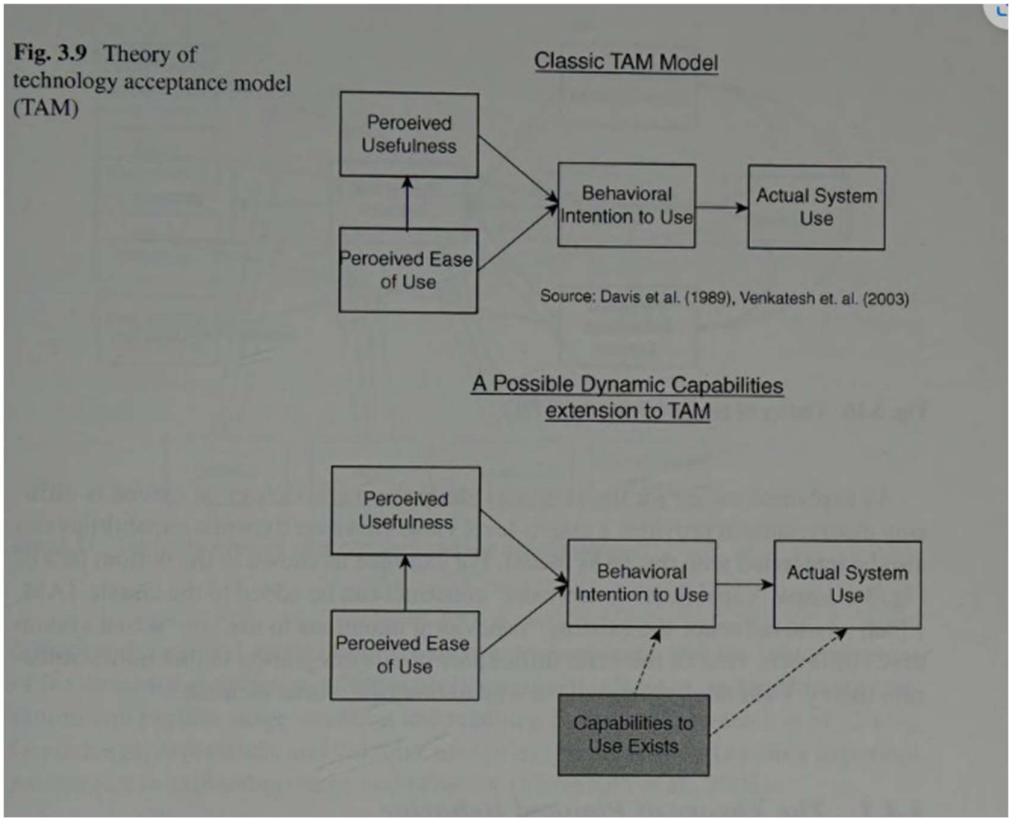

Figure 7. Theory of technology acceptance model (Daim et al. 2016).

2.3.1 Factors that facilitate the adoption

According to Everett M. Rogers in Diffusion of Innovations, there are 4 factors that facilitate the adoption of new innovation. These factors are explained below:

Relative advantage:

Relative advantage helps people adopt new ideas or technologies because it reduces uncertainty about whether the new innovation is better than the current way of doing things. When people are considering adopting something new, they look for information on how it can improve their financial situation, make their lives easier, save them time, or provide immediate benefits. The stronger the perceived advantage of the new idea, the more likely people are to adopt it. That's why relative advantage is one of the best ways to predict how likely people are to adopt new technologies. However, innovations that offer benefits later, such as preventive measures like insurance or vaccinations, often face challenges. These types of innovations are harder to promote because their rewards are not immediately obvious, which can make adoption slower (Everett 1983).

Relative advantage means how much better an innovation is seen as compared to the existing way of doing things, and it plays a big role in how quickly the innovation is adopted. This advantage can be seen in different ways, such as financially, socially, or in other ways, depending on what the innovation is and what the person adopting it cares about. For example, when pocket calculators became much cheaper in the 1970s, they became more appealing to consumers, showing how the perceived advantage of a product can grow over time and speed up its adoption. While making money is often the main reason for adopting new things, other factors like how well the innovation fits with what people already do and how easy it is to see its benefits also matter. Economic benefits alone don't fully explain why people adopt new innovations, because social and situational factors also play an important role (Everett 1983).

Compatibilty:

Compatibility helps people adopt new ideas because it makes the new innovation fit well with their existing values, past experiences, and needs, reducing uncertainty. People are more likely to accept something new when it matches their cultural beliefs, previous knowledge, or what they feel they need. For example, innovations that align with cultural norms are adopted more quickly, while those that conflict with traditions, like boiling water in Peru, may face resistance. Compatibility also makes it easier for people to relate the new idea to what they already do, which reduces the disruption and helps them understand it better. Additionally, when an innovation addresses the specific needs of the adopters, they are more likely to adopt it. However, if people have had bad experiences with past innovations, it can make them hesitant to adopt new ones, a phenomenon called

"innovation negativism." While compatibility is not as strong a reason for adoption as relative advantage, it still plays an important role when the innovation fits well within the adopter's situation (Everett 1983).

Triability

Triability helps to adopt new ideas by allowing to try out an innovation on a small scale first, which reduces uncertainty. Innovations that can be tested in smaller, low-risk steps are usually adopted faster than those that cannot be tested. This ability to experiment with something new lets people assess its benefits before fully committing, making it feel less scary. Early adopters, who don't have many examples to follow, often find trialability more important, while later adopters tend to rely on the experiences of others. Because trialability gives people a sense of control and lowers the perceived risk, it is generally linked to higher adoption rates (Everett 1983).

Observability

Observability helps to adopt new ideas by making the results of an innovation easy for others to see. When people can clearly see and understand how a new idea benefits others, they are more likely to adopt it themselves. Innovations with visible and obvious results tend to spread faster because they help reduce uncertainty for potential adopters. This is especially true for technological innovations, which usually include both hardware (physical tools) and software (digital systems). The hardware is easier to see and understand, so it leads to faster adoption, while innovations that rely more on software, which is less visible, tend to spread more slowly. In general, the more visible the results of innovation are, the higher the adoption rate (Everett 1983).

2.3.2 Barriers to adoption

Several factors can significantly hinder the adoption of innovation. This chapter seeks to highlight the key factors that act as barriers to the adoption of innovations.

Complexity

Complexity acts as a barrier to adopting new ideas because innovations that are seen as hard to understand or use tend to discourage people from trying them. If an innovation is more complex, it takes more effort to learn how to use it and put it into practice, which increases uncertainty and slows down the adoption process. Studies show that the more complex an innovation is, the less likely people are to adopt it, with complexity having a significant impact on adoption rates, only second to how beneficial the innovation seems. For example, complex innovations, like the card game Canasta, spread slowly because they were harder to understand, while simpler technologies, like

television, were adopted more quickly because they were easy to use. In general, when an innovation is too complex, it creates both mental and practical challenges, making it less appealing and reducing its adoption rate (Everett 1983).

Cultural belief

Cultural values and beliefs can be a significant barrier to adopting new ideas when they are very different with deeply held social norms. People are often reluctant to accept innovations that go against their existing cultural practices or values. For example, in Los Molinos, Peru, people resisted boiling water because it went against their traditional beliefs about hot and cold. Similarly, American farmers were slow to adopt soil conservation methods because these practices conflicted with their belief in maximizing farm production. In India, many people still avoid eating with their left hand, even though sanitation has improved. These examples show that when an innovation challenges long-standing cultural beliefs, it can face strong resistance, which slows down or stops its adoption (Everett 1983).

Homophily

Homophily is the tendency for people to connect with others who are similar to themselves. While this helps communication, it can also slow down the spread of new ideas. This happens because new, innovative ideas often come from people in higher-status positions, who mainly interact with others in similar social circles. This limits the spread of the idea to those in lower-status groups. To encourage the adoption of new ideas, change agents need to engage with leaders from different parts of the social structure. Research shows that while networks of similar people can slow the spread of new ideas, networks that connect different social groups can help share innovations more widely. This shows the importance of having strategies to connect different groups and improve the spread of new ideas (Everett 1983).

Pro-Innovation Bias:

The pro-innovation bias in diffusion research is the idea that new innovations are always good and should be quickly adopted by everyone. This bias comes from a few factors, like early studies focusing mainly on successful, profitable agricultural innovations and the fact that research is often funded by organizations that want to promote new ideas. Because of this, most research looks at innovations that have been successfully adopted and ignores cases where innovations are rejected, discontinued, or changed in some way. This creates an incomplete understanding of how innovations spread. To improve this, researchers should study not just the successful adoptions but also the failures and challenges in adopting innovations, to get a fuller picture of how innovations spread (Everett 1983).

3 Research Methods

This chapter outlines the research framework, discussing the approaches and techniques employed for data gathering and analysis. The purpose is to provide transparency on the choice and application of specific methodologies to address the research questions effectively.

3.1 Research Design

The research is structured as a qualitative study, focusing on interviews and observations within Finnish home care organizations. This qualitative approach was selected to capture in-depth insights from participants on their experiences and perspectives with Automated Medication Dispensers (AMDs).

Qualitative research often starts by observing and collecting data to develop new ideas or theories (inductive approach), focusing on understanding things naturally as they happen. Sometimes, it begins with an existing theory and uses data to test if that theory holds true (deductive approach). In many cases, researchers combine both methods (abductive approach), creating new ideas from the data and then testing those ideas against existing knowledge, repeating this process throughout the study (Saunders, Lewis, & Thornhill 2007)

Thematic Analysis is a way of analyzing qualitative data by looking for patterns or themes in the information you've collected, like interviews, observations, or diaries. This process involves organizing the data by coding, which means labeling pieces of information that relate to your research question. The goal is to find common themes that appear across the data to help you better understand and analyze it (Saunders, Lewis, & Thornhill 2007).

Thematic Analysis is a method for analyzing qualitative data that is both organized and adaptable. It gives a clear and logical process to work through, making it easier to study the data. This approach helps you describe, explain, and even build theories based on the patterns or themes you find in the data (Saunders, Lewis, & Thornhill 2007).

Market research comes from studying marketing and focuses on understanding what the market or consumers think. It provides important information to help with marketing problems or decisions. In simple terms, it's a structured process where data is collected, analyzed, and reported to better understand specific marketing situations (Kotler & Keller 2009).

A research design is a plan or blueprint for how to carry out a study. It helps researchers decide how to collect and analyze data, starting from big ideas and narrowing down to specific methods. Choosing the right design depends on several factors, like the research topic, the researcher's

perspective and experience, the methods they plan to use, and who the research is for. The process doesn't have to follow a strict order, but it involves making thoughtful decisions to fit the purpose of the study (Silverman 2010).

The qualitative research method is widely used in marketing to explore detailed and in-depth information. It helps to understand people's behaviors, motivations, and experiences. Instead of focusing on numbers or statistics, it answers questions like "how" and "why" by providing detailed insights (Silverman 2010, 118-119).

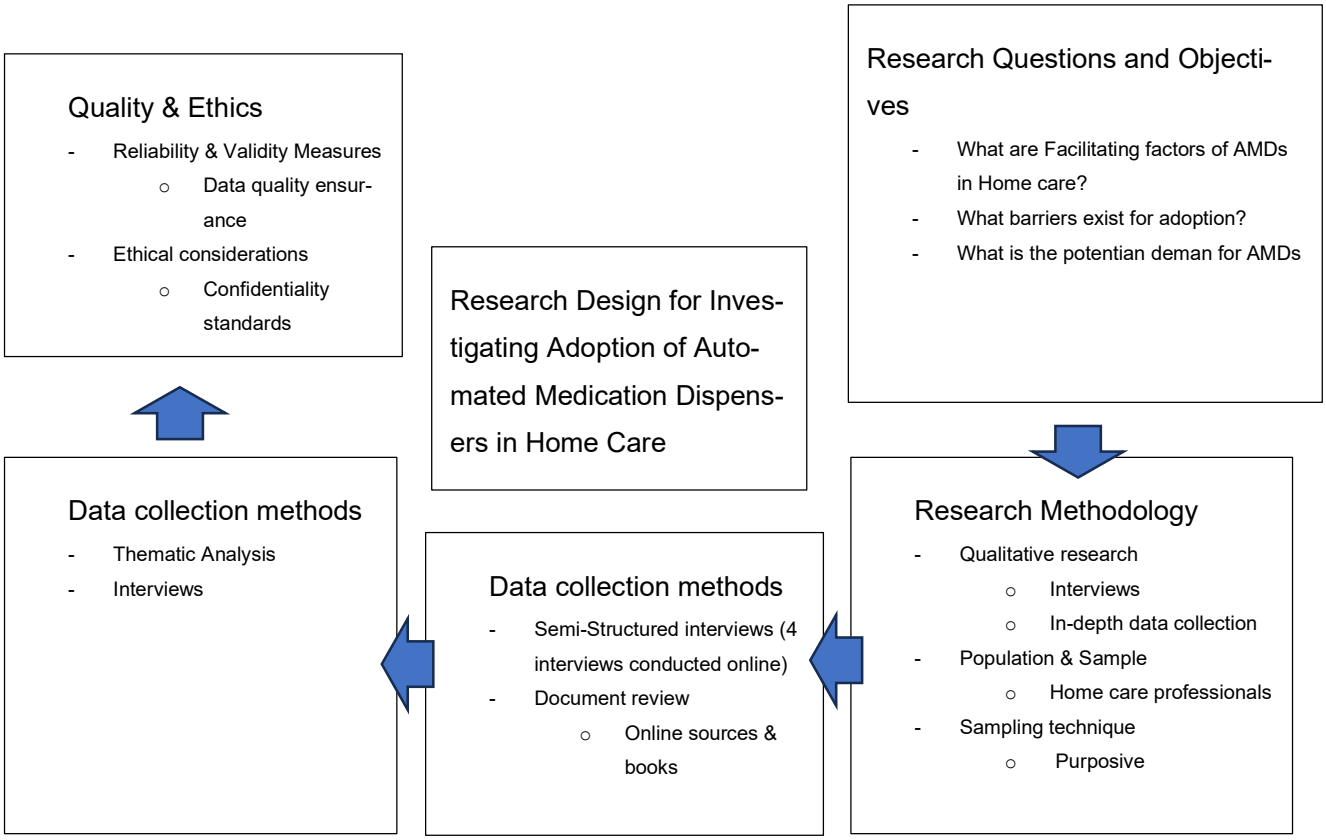

Figure 7. Research methods framework

3.2 Population and Sample

The study involves participants who are important people from home care organizations, specifically those who are directly involved with or affected by the use of AMDs (assistive medical devices). Since it's not possible to include all stakeholders from Finland, the researchers used a purposive sampling method. This means they choose people who have the most relevant knowledge and experience to help answer the research questions fully.

3.2.1 Table 1. List of interviewees

Name of interviewee	Organization	Title	Location	Time	Language
Piritta Mattila	Päijät-Häme Municipality	Area Director, Home services	Teams	29/04/2022	Finnish
Jukka Penttinen	Axitare LTD	CEO	Helsinki	01/05/2022	Finnish
Riikka Nieminen	Päijät-Häme Municipality	Remote Care, Supervisor	Teams	13/04/2022	Finnish
Johanna Lehosmaa	City of Jyväskylä	Wellbeing-technology coordinator	Teams	10/04/2022	Finnish

3.3 Data Collection

The data was collected through semi-structured interviews with professionals from different home care organizations. These interviews were done online to make them easier and more accessible. Each interview was recorded to keep the information accurate. To make the data more detailed, the researchers also used observations and reviewed relevant documents. The entire process followed strict ethical rules to make sure the study can be repeated and the results are clear and trustworthy.

3.3.1 Table 2. Interview questions

	Questions
1	What are the reasons that you have decided to use AMDs?
2	What kind of results have you achieved by using AMDs?
3	Are automated medication dispensers reducing costs?
4	How do you see the future-plans of your organization in terms of using automated medication dispensers?

5	What factors facilitate using AMDs?
6	What are the barriers for using AMDs?
7	Would you recommend using AMDs in you and other organizations in the future?

3.3.2 Table 3. Interview answer

Question	Respondent 1	Respondent 2	Respondent 3	Respondent 4
1	The home care organization serves nearly 1,800 customers across 20 areas, including specialized units like distant care, homecoming, labor division, and backup. Despite having approximately 750 employees, the workforce is shrinking each month, even as the customer base grows. This dynamic highlights increasing pressure on resources due to a rising demand for services amid declining staff numbers	The main reason was to manage the increasing number of customers and reduce the workload of nurses	To increase the use of technology, as we know the number of elderly people is increasing while the number of nurses is decreasing. Of course, it also brings other benefits when we automate our services.	The goal of this concept is to improve the productivity and efficiency of organizations, from the organization's point of view.
2	Significant reduction of physical visits by nurses, increased medication safety.	There are several factors indicating this, but many nurses would be needed to handle 69 physical visits in a day. The 23	The majority of customers have performed very well, and we have seen positive results in terms of achieving our goals.	. Despite insufficient personnel resources, we can expand the customer base. This is one way of measuring productivity from the

		automated medication dispensers that replace these 69 visits represent a significant impact.		organization's point of view.
3	If we didn't have 300 automated medication dispensers, each customer would need at least one visit per day for medication care, and some would require 2-3 visits a day. Altogether, over 500 visits are avoided by using medication dispensers, so it has reduced out costs significantly.	when we analyzed the reduced number of visits in one of our units area, automated medication dispensers replaced 69 physical nurse visits. When 69 visits are reduced, it is obvious that this has financially positive consequences because the monthly cost of automated medication dispensers is not even close to the cost of nurses	Yes, we have cheived significant results of reducing physical visits by using AMDs.	If we didn't have service technology and wanted to provide care services to the growing number of customers without losing the quality of service, in practice, it would mean we'd have to hire more personnel. Hiring more personnel means more expenses for the organization.
4	Our goal is that we have 18 percent of our customers using medication dispenser by the end of the year and next yearly we will increase it.	Our plan is to continue using and expanding the use of automated medication dispensers.	Currently, we have around 1,700 regular customers in our home care organization and	This is a broad question. The current situation regarding nurse availability is not good throughout

			we need many more AMDs in orer to provide care services for them.	Finland. It seems that we won't have enough nurses for the next ten years. Thus, we must use technology in broader aspect.
5	Nurse shortage and legal obligation is a factor to provide care services with high quality, and AMDs are good solution for that.	Good results from pilots, and reports that shows how much we have been able to reduce physical visits. This is our direction to reduce even more.	Medication safety by using AMDs have improved beside reducing physical visits and saving money. This is the future of our organization.	
6	Since this technology this technology is new, it needs awareness and increase of training for nurses. Some nurses are worried that if automated dispensers take over the task of dispensing medicines automatically, they might lose their jobs	Elderly people refuse to use it due to lack of knowledge. Nurses also are not familiar with them and it causes prevention sometimes.	Some technical issues with AMDs causes fear for nurses to handle it. As well lack of trainings for some nurses are an obstacle	
7	Definetly	Yes	Numbers do not lie	Of course

3.4 Reliability, Validity and Relevance

The study ensures good data quality by using methods like triangulation, which means using different sources of data, tools for collecting data, and ways to analyze it, all focused on answering the research questions. This helps make the results more reliable and accurate. The study also followed ethical rules, like getting permission from participants and keeping their information private, to build trust and make sure the study is credible.

3.5 Data Analysis

Thematic Analysis is a way of analyzing qualitative data by looking for patterns or themes in the information you've collected, like interviews, observations, or diaries. This process involves organizing the data by coding, which means labeling pieces of information that relate to your research question. The goal is to find common themes that appear across the data to help you better understand and analyze it (Saunders, Lewis, & Thornhill 2007).

Thematic Analysis is a method for analyzing qualitative data that is both organized and adaptable. It gives a clear and logical process to work through, making it easier to study the data. This approach helps you describe, explain, and even build theories based on the patterns or themes you find in the data (Saunders, Lewis, & Thornhill 2007).

The researchers used thematic analysis to understand the qualitative data, which helped them find repeating themes and patterns related to the use and challenges of AMDs (assistive medical devices). They used tools like coding software or manual coding to organize the data and pull-out important insights. This made sure the analysis was thorough and focused on the study's goals. The following themes were identified during this analysis:

Workload Management: One main reason for using AMDs was to help manage the increasing number of elderly people needing care, along with a decreasing number of workers. AMDs were expected to make nurses' jobs easier by reducing the need for them to visit patients in person as often.

Customer Independence: Organizations wanted to use AMDs (assistive medical devices) to help customers manage their own medication, allowing them to take care of themselves and be more independent

***Medication Safety*:** Another goal was to make medication safer by ensuring the right amount and timing, without mistakes from people. AMDs helped avoid errors and misuse of medication, leading to safer experiences for patients and more trust in how medication is managed by the organization

Results and outcomes of the interviews regarding AMDs are presented below:

Reduced Physical Visits**:** AMDs significantly reduced the need for in-person visits, with some reports indicating a decrease of 69 nurse visits in one area.

Enhanced Care Efficiency**:** AMDs helped deliver medication on time and accurately, which supported patients in following their medication routines. This also reduced the need for nurses to be available for every dose.

These results confirm that AMDs are successful in reducing nurses' workloads and improving medication safety. By achieving these goals, the organization was able to shift resources to other areas that needed more attention, without affecting the quality of care.

Financial Impacts of the research will be mentioned below:

Cost Reduction**:** Initially, saving money was a clear goal, which was achieved by reducing the number of nurse visits and using resources more efficiently.

Shift in Financial Focus**:** Because there are more customers and the needs of the aging population are more complex, saving money has become a main goal as well. However, AMDs still help save money by reducing the need for physical visits.

AMDs help save money by lowering operating costs. However, because there is more demand for healthcare services, the organization has moved its focus from saving money to ensuring that the quality of care remains high, even with limited resources. The money saved helps the organization manage some of the extra challenges without reducing the level of care provided.

Future Plans of Organizations regarding AMDs are mentioned below:

Increased Usage and Device Variety**:** The goal is to increase the use of AMDs, aiming for more than 20% of clients to use them. They also plan to work with different device suppliers to better meet the unique needs of patients.

Expansion of Technological Integration**:** AMDs are seen as an early step toward creating more advanced digital and automated care systems in the future.

The organizations see AMDs as part of a bigger plan to use technology in healthcare over the long term. This approach helps manage limited resources and keep up with changes in healthcare, using technology to create lasting, effective solutions.

Factors that facilitate the use of AMDs are mentioned below:

***Staff Training and Familiarity*:** Educating staff on the advantages of AMDs helps build acceptance and comfort with technology.

***Customer Suitability and Early Adoption*:** Selecting customers who are comfortable with technology or introducing AMDs early in their care helps patients get used to them more easily, reducing any pushback or difficulties.

***Positive Recommendation and High Satisfaction*:** Interviewees expressed overall satisfaction with AMD performance and indicated a willingness to recommend AMDs to other organizations.

Successful AMD implementation relies on both staff and customer adaptation. Ensuring that both parties are comfortable with the technology is essential for maximizing the benefits of AMDs. Staff training and targeted customer selection make technology adoption smoother and more sustainable.

High satisfaction and positive endorsement of AMDs reflect the perceived value these devices bring to the organization and the broader healthcare system. This positive feedback reinforces the notion that, despite challenges, AMDs are viewed as beneficial and a valuable long-term investment

Barriers to AMD implementation are mentioned below:

***Staff Resistance and Job Security Concerns*:** Some staff, particularly nurses, worry about job security and the potential loss of professional skills due to automation.

***Technical Issues*:** Connectivity problems and device-specific issues occasionally disrupt AMD effectiveness, necessitating backup solutions and manual interventions.

***Customer Acceptance*:** Customers who are used to having direct interactions with nurses might be hesitant to switch to technology-based care, which could make it harder for AMDs to be adopted by them.

Barriers to using AMDs come from both people and technology. To reduce resistance, it's important to communicate clearly with staff and show that AMDs are meant to assist, not replace, their work. Technical problems also show that a strong, dependable system is needed to make sure the AMDs work properly all the time.

Table 4. Theme grouping

Theme Grouping	**Theme**	**Description**	**Relation to Diffusion of Innovations**
Motivations for Adoption	Workload Management	Reducing nurse workload by minimizing physical visits.	Relative Advantage: Highlights clear benefits of reduced effort and costs.
Motivations for Adoption	Customer Independence	Enabling patients to manage their medication autonomously.	Compatibility: Aligns with societal values of patient autonomy.
Motivations for Adoption	Medication Safety	Preventing errors and misuse for safer patient experiences.	Observability: Clear evidence of improved safety aids adoption.
Outcomes of Implementation	Reduced Physical Visits	Fewer in-person visits needed for medication management.	Trialability: Demonstrates how benefits can be experienced early.
Outcomes of Implementation	Enhanced Care Efficiency	Timely, accurate medication delivery supporting routines.	Relative Advantage: Efficient care is a measurable improvement.
Financial Impacts	Cost Reduction	Savings achieved through fewer nurse visits and better resource allocation.	Relative Advantage: Economic savings appeal to adopters.
Financial Impacts	Shift in Financial Focus	Moving from cost-cutting to maintaining service quality	Complexity: Indicates challenges as adoption scales with demand.

		amidst rising demand.	
Future Planning	Increased Usage and Device Variety	Expanding AMD usage and diversifying supplier options.	Compatibility: Fits with the long-term vision of integrated care.
Future Planning	Expansion of Technological Integration	Integrating AMDs into broader digital healthcare solutions.	Innovation Complexity: Indicates scalability of AMDs in digital evolution.
Facilitators	Staff Training and Familiarity	Building acceptance and comfort with AMDs through education.	Knowledge: Essential for diffusion as early adopters need clear training.
Facilitators	Customer Suitability and Early Adoption	Targeting tech-ready customers and gradual adaptation to AMDs.	Early Adopters: Addresses readiness of initial users to adopt innovation.

4 Data and Results

In chapter 3, we have covered the detailed methodology and initial findings of interviews with stakeholders in home care offering insights about workload management, customer independence and medication safety. All of these align well with the **Diffusion of Innovation Theory** (DOI) i.e "*the adoption rate of automated medication dispensers (AMDs) based on factors like relative advantage*, *compatibility*, *trialability*, and *observability"* as explained in chapter 2.

Table 5. Interview findings

Workload Management	*Customer independence*	*Medication safety*
• Reduce physical nurse visits • Postponing peak times, nurses can visit the elderly later when it's the best suitable	• An elderly person can participate and have a role in its own medication treatment	• Elderly person can take the right medicine at the right time • Reduce of risk that customer takes the wrong medicines

Relative Advantage: Findings show a reduced number of visits by nurses and increased independence by patients with use of AMD. This demonstrates a clear advantage of AMD over the conventional support methods supporting relative advantage as discussed in **Diffusion of Innovation Theory.**

Potential adopters seek evidence for higher profitability, profitability, reduced discomfort, time svaing or other immediate benefits. Greater perceived benefits increases the probability of adopting innovation. For these reasons, relative advantage is a key predictor of adoption rates. However, innovations with delayed benefits, like preventive innovations (e.g., insurance or vaccinations), often encounter slower adoption due to difficulty in demonstrating immediate benefits (Everett 1983).

Compatibility: The highlights from interviews suggest alignment of dispensers with organizational goals of safety and efficiency as well as patient goals of independence indicating the easier adoption of compatible innovations.

Compatibility of new innovations is important for quick adoption as it makes the process less disruptive and easy for evaluation. The accomplishment of specific needs of adopters increases the

rate of adoption. However, the previous poor performance or bad experience of past innovations impact the future adoption negatively. This is often called as “innovation negativisms”. In short, although compatibility is not a major predictor, it plays an important role in easy adoption of new innovation (Everett 1983).

4.1 What are the perceptions of stakeholders in the homecare industry in Finland regarding facilitating factors towards the adoption of AMD in Finland?

In Finland, the advancement and rise in care demands of aging population has led to an increase in adoption of advanced technology in social and healthcare sectors. Technological advancement plays a crucial role in this scenario as the increasing elderly population need home care for longer periods. The shortage of healthcare workers presses the need for such technological advancements. However, these advancements raise the question of ethical concern about proper planning, application and the impact of technology. Projects like Kan Ta focusing on electronic health document management are initial steps taken up by Finland’s National Advisory Board on Social and Health Care Ethics (ETENE) to address such issues beginning 2009 (Teknologia Ja Etiikka Sosiaali- Ja Terveysalan Hoidossa Ja Hoivassa 2010).

1. Rising Need Due to Workforce Shortage

The interviewee identifies a significant shortage in healthcare staff. Although there are around 750 employees, this number is decreasing monthly with rising customer numbers. Over 150 new customers were added last year, with projections indicating a further increase by 2030 (Mattila, 2022). With temporary staffing solutions and additional shifts unable to keep up with demand, the situation becomes worse as many clients left without services due to understaffing.

This response aligns well with the perspective presented in literature about the aging population creating a rising demand for homecare services. The fact about the shortage of healthcare workers, particularly in homecare services, is a well-documented issue in Finland and other countries, driven in part by an aging population (Pesonen et al. 2024). This highlights the urgent need for technological interventions such as Automated Medication Dispensers (AMD) and considered as potential solution for this issue (Peltola et al., 2020). It is important that healthcare provides a switch to the use of advanced technology to address staff shortage and maintain consistent delivery of services to patients.

2. The Role of Technology in Meeting Care Demands

The interviewee stresses the need for AMD as part of a potential strategy to support existing customers by minimizing the need for frequent nurse visits. For example, AMD can optimize the available resources efficiently by rescheduling the visits of less critical cases.

This further aligns well with literature emphasizing the importance of technology in homecare to meet the increasing demands of an aging population. AMD, is considered as a potential solution to alleviate workload pressures on an overstretched workforce. Recent research suggests that AMD and other similar technologies can provide automation in tasks such as medication management and resource allocation. This can significantly reduce the burden on healthcare professionals allowing for better utilization of time and resources in tasks requiring critical care (Fengling Li et al. 2021).

3. Practical Acceptance and Ethical Concerns

While the interviewee personally advocates for technology, they mention that some supervisors and staff are uncomfortable with machines taking over certain tasks. However, there is a general acceptance of the need for technology to ensure quality care.

This goes with the acknowledgement in literature about the ethical concerns related to the use of technology in healthcare and aligns well with Finland's efforts (such as ETENE and the Ministry of Social Affairs and Health) to address these concerns. Ethical concerns regarding technology in healthcare are well-documented. The literature discusses major concerns such as patient autonomy, privacy, and the role of human caregivers arising with the use of technology like AMD (Cresswell et al., 2021). In Finland, institutions such as the Ministry of Social Affairs and Health have been working to address such concerns by emphasizing the importance of human-centered technology and that technological intervention act to improve services rather than replacing human care (Ministry of Social Welfare and Health 2023). This aligns with the interviewee's suggestion that, despite some discomfort, the necessity of technology for quality care is broadly accepted.

4. Stakeholders' Support

The interviewee demonstrates a proactive attitude toward adopting technology by stating their support using AMD even if it weren't mandatory. This highlights a positive outlook towards the use of AMD among stakeholders.

This aligns well with the literature that Finnish institutions recognize the necessity of adopting technology for a sustainable and long-term solution. This is in line with previous studies suggesting the support of Finnish institutions for technological interventions in healthcare (Toppinen et al., 2017).

Furthermore, the literature stresses that the dedication to enhance quality care and sustainability in challenging demographic landscapes brings motivation for such support (Clemens et al., 2018).

Facilitating Factors for AMD Adoption: Staff training and patient compatibility emerged as key facilitators in the findings (Explain in detail what are the description). These support DOI's principles of *observability* and *trialability*, as interviewees expressed greater acceptance when they observed AMDs' effectiveness or had a chance to try them in specific scenarios.

4.2 What are the perceptions of stakeholders in the homecare industry in Finland regarding barriers to the adoption of AMDs in Finland?

A lot of valuable information was gathered from the interviews in response to questions about adoption of AMD. The discussion revealed the requirements association with AMD adoption. For example, continued staff training, technical reliability and patient education would be needed for successful adoption. This brings the point that AMD adoption is not just technological decision but also a cultural and organizational one, echoing points from Chapter 2.

Barriers to AMD Adoption: Interviews pointed out major barriers as the resistance coming from staff, technical challenges, and some patient's reluctance, aligning with DOI's concepts of *complexity* and *cultural belief barriers*. The complexity of managing technology-related issues, as well as traditional patient care norms, slowed adoption

1. Impact on Nurses' Workload and Potential Resistance

The interviewee confirms that using AMDs can cut down the need for daily medication-related visits. For instance, an estimated over 500 visits can be freed by utilizing 300 automated dispensers (Mattila, 2022). This can lead to fear among staff about job loss due to the use of AMD, resisting the adoption. The organizational perspective emphasized the need to free up nurses to address the care demands of patients who require in-person support.

This aligns with the point in literature highlighting staff resistance as a barrier to adoption. As described in the literature, complexity and cultural beliefs impact acceptance. Here, despite the dispensers' operational benefits, staff may take it as a threat to their job contributing to resistance, This is in line with existing literature, which identifies resistance from healthcare staff as a significant barrier to technology adoption (Elg et al., 2017). Resistance is often linked to cultural beliefs, including concerns over reduced human interaction and shifts in job responsibilities, which can hinder the smooth adoption of automated systems (Jalo & Pirkkalainen 2024). Furthermore, healthcare

institutions often struggle to balance technological efficiencies with the need to maintain a personal, human touch in patient care, particularly for complex care tasks.

2. Technical Reliability and Device Integration

The interviewee points out the integrating AMDs with other technological devices, not just save time but also addresses workforce shortages and effectively meet customer demands. This indicates an organizational commitment to AMD along with highlighting the dependence on smooth technological functioning and effective integration for widespread acceptance.

Technical issues are a major issue about the consistent reliability of devices as mentioned in literature. The interview presents the need for seamless integration with other technologies is essential, which may otherwise hinder adoption if not managed well. The literature identifies poor integration as key factor for operational inefficiencies and disrupted workflow, leading to reluctance in adoption. Holthe et al. (2018) found device malfunctions or failures as key inhibitors to the successful implementation of new technologies in healthcare. Additionally, ensuring seamless integration with other healthcare IT systems is critical for securing wide range acceptance among healthcare workers and administrators (Jalo & Pirkkalainen 2024).

3. Patient and Staff Acceptance through Cultural Adaptation

The interviewee notes that their organization values the use of pioneering technology and aims to establish AMDs as a future-oriented solution. However, some reluctance among staff and patients may resist or be unfamiliar with automated systems. This cultural aspect underscores the importance for a process with gradual adaptation of AMDs to align with organizational goals.

This response aligns well the perspective of literature describing the importance of cultural and organizational adaptation in adoption. Resistance rooted in traditional care norms and unfamiliarity can hinder the acceptance of AMDs, a challenge that literature ties back to broader cultural and organizational factors influencing technology adoption. Both cultural and organizational adaptation are considered crucial to the successful adoption of new technologies in healthcare. Resistance due to unfamiliarity and cultural norms appears to be a common barrier in healthcare settings (Harrison et al., 2019). Martin et al. (2018) highlights how the cultural context of healthcare organizations and willingness of their staff affects the adoption of new technologies. Nevertheless, gradual integration and adequate training are suggested to reduce resistance and increase the acceptance of automated systems, particularly when the technology is aligned with the organization’s mission and values (Sunny, Patrick & Rob. 2018).

4. Decision-Making Factors in AMD Acquisition

Decision-making for adopting AMD requires a pioneering mindset within the organization as it aims to adopt new technology. It comes with a high-risk approach as decisions may need to bypass the traditional methods of referencing. The interviewee suggests that legal procedures such as piloting are often required unless a direct acquisition is permitted due to a lack of similar services.

Decision-making in adopting new healthcare technology is challenging and often influenced by organizational culture, regulatory bodies and legal considerations. All these aspects add to the organizational barriers already discussed in literature, making innovative adoption a rather complex and slower process. Although a fast- forward approach has been taken by the interviewee's organization to minimize some of these barriers, the legal considerations and compliance with regulatory procedures remains major consideration in AMD adoption. Literature indicates while such bureaucratic procedures make the adoption slower, the need for piloting, bidding, or compliance with legal standards adds to the complexity in spite of the strong internal enthusiasm for accepting new technology (Venkatesh, James, & Xu 2016).

4.3 What are the perceptions of stakeholders in the homecare industry in Finland regarding the potential demand for AMDs

With these interviews, it is evident that a widespread adoption of AMD require a balanced approach addressing both technological and human factors, reflecting a nuanced understanding of healthcare technology adoption. Insights from current learning align well with both the theoretical perspectives in Chapter 2 and practical findings in Chapter 3, emphasizing successful implementation of AMDs is not about introducing technology only but also effectively managing organizational change.

Perceived Demand for AMDs: Stakeholders acknowledged the potential demand for AMDs to address workforce shortages and rising care needs. However, this demand is contingent on continued compatibility with patient care models and robust support systems.

1. Growing Elderly Population and Workforce Challenges

The interviewee describes a major concern associated with the rapidly increasing elderly population combined with a shortage of healthcare staff. With the projections indicating that Päijät-Sote will rank as one of the top municipalities with an aging population and increasing demands of around 1,800 homecare clients and combined with reducing workforce, the interviewee explains the need of AMDs adoption (Mattila, 2022).

This response aligns with the literature, identifying workforce shortages and rising care needs as key factors for adopting AMDs. Several studies have highlighted the challenges associated with increasing aging population in European countries, including Finland. The falling workforce just aggravates these challenges (Lund, 2020). Considering these challenges, AMDs are considered as potential long-term solution to alleviate the burden on limited workforce and healthcare systems. Rissanen et al. (2021) has pointed to the particular importance of these technologies in rural areas with acute staff shortages.

2. Technology as a Solution to Meet Customer Needs

Finland's social care law make it mandatory that all clients must be served regardless of staff shortages. The interviewees emphasize the use of AMDs in this aspect. The suggestion to use AMDs would help the organization in better management of resources which in turn would enable nurses focus on patients needing physical visits.

This aligns well with the literature highlighting the efficient resource allocation in the healthcare sector. Studies suggest that automation allows efficient management of resource allocation and routine medical visits by patients not requiring urgent attention. This ensures that staff can focus on urgent care needs (Haukkala et al., 2019). This is considered as a potential strategic solution addressing staff shortage and increasing homecare services (Korpela, 2018).

3. Acceptance and Integration Challenges Among Staff

While AMDs are recognized as necessary, there is some hesitancy among staff members who worry that technology will reduce their roles or lead to job losses. The interviewee mentions that some nurses still prefer traditional medication management and worry that AMDs will lessen their expertise in handling medications (Mattila, 2022).

This aligns with literature that highlights the importance of staff acceptance and cultural adaptation as crucial factors in AMD adoption. According to literature, the demand for AMD depends on its compatibility with existing care models, as well as the willingness of staff to integrate technology into their routines. These concerns about staff resistance and cultural adaptation are in-line with literature (Martin et al., 2018). Elg et al. (2017) further suggests this perceived threat as a significant barrier to adoption, particularly among healthcare workers who feel their roles may be diminished.

4. Incremental Adoption Goals

The organization has set clear targets for AMD usage, aiming to increase AMD adoption among 18% of clients by the end of the year. The interviewee notes steady progress toward these goals, with

last year's adoption rate exceeding their target marginally at 15.4%. Nevertheless, the dependence of AMDs effectiveness on client need bring uncertainty about the overall percentage of clients who could benefit from AMDs (Mattila, 2022).

This aligns well with the literature on incremental adoption and demand forecasting highlighting the flexible and gradual adoption of AMDs. The adoption should consider feedback from clients according to their needs and goals. Studies indicates a successful technology integration often requires pilot testing with gradual and incremental adoption meeting the specific needs of different clients (Venkatesh, James, & Xu et al. 2016). Moreover, these feedback loops ensure that technologies like AMDs are adapted based on their practical outcomes (Pesonen et al. 2024).

5. Financial Implications and Organizational Priorities

Initially, cost savings were a priority when AMDs were introduced, but as client needs have grown and staffing has declined, financial considerations have become secondary to operational needs. The interviewee points out that, while AMDs do bring some savings, their primary purpose is to ensure that essential services are provided to all clients (Mattila, 2022).

This observation aligns well with the literature suggesting that financial demand drivers are often secondary to operational needs in healthcare technology adoption. As AMDs increasingly address the functional need, demand is driven more by service delivery requirements rather than cost-saving motives. The literature indicates a shift from financial savings to operational efficiency as a driver for AMD adoption (Thimbleby 2013). While cost savings remain an attractive feature, the rising burden on healthcare system often give importance to operational efficiency and service community over immediate financial rewards (Lund et al. 2020).

6. Overall Satisfaction with AMD Performance and Recommendations

The organization expresses overall satisfaction with AMDs, despite occasional technical and connectivity issues that require manual intervention. The interviewee notes AMDs remain a critical part of organization’s strategy for coping with workforce shortages. They would also recommend AMDs to other organizations facing similar challenges (Mattila, 2022).

This reflects the importance of technological satisfaction and scalability as crucial elements of demand as mentioned in literature. Organizations see AMDs as effective solutions to problems of workforce shortage. Despite some minor technical issues, there is an overall satisfaction driving continued demand for usage and further adoption (Obal 2017). This sense of satisfaction is especially strong when technology overcomes critical workforce shortages and enhances service delivery.

5 Conclusions

The findings from the interviews with homecare stakeholders in Finland highlight the growing importance of Automated Medication Dispensers (AMDs) in addressing the challenges faced by the healthcare sector, particularly considering an aging population and workforce shortages. The adoption of AMDs is seen as a necessary innovation to improve care efficiency, support patient independence, and reduce the burden on healthcare professionals.

While stakeholders generally support the use of AMDs, barriers such as staff resistance, technical reliability, and patient hesitation persist. The integration of AMDs also requires organizational adaptation and a commitment to staff training, technical reliability, and patient education. Interviews emphasized the importance of gradual adoption, with organizations setting incremental adoption goals. The demand for AMDs is driven by the need to address rising patient numbers and workforce shortages, but success hinges on ensuring that the technology complements existing care models and is accepted by both staff and patients.

This chapter covers Key findings, Reliability, validity and relevance of this research, as well as Further Research and Reflecting on Learning.

5.1 Key findings

IQ 1. What are the perceptions of stakeholders in the homecare industry in Finland regarding facilitating factors towards the adoption of AMD in Finland

Workload Management: Automated Medicine Dispensers have great impact to reduce the physical visits required by nurses, It allows to ease workforce shortages and free up resources for critical tasks.

Medication Safety: AMDs dispense medication accurately which results in preventing medication errors caused either by the elderly person themselves or by nurses,

Customer Independence: AMDs enable elderly people to take role in their medication intake, which results in creating more feeling of independence.

IQ 2. What are the perceptions of stakeholders in the homecare industry in Finland regarding barriers to the adoption of AMDs in Finland

Staff Resistance: Nurses are perceiving AMDs as a factor which can risk their jobs and reduce their skills and knowledge regarding medication

Technical Issues: Any technical issues that can erupt the operation of the technological devices and require nurses to take part in solving these particular issues. Taking part in solving these issues prolongs the working day of nurses,

Customer Resistance: Some customers of Home Care may show reluctance towards accepting AMDs due to lack of knowledge regarding the functional reliability of devices.

IQ 3. What are the perceptions of stakeholders in the homecare industry in Finland regarding the potential demand for AMDs

Increasing elderly population and nursing shortages increase the demand for AMDs in Finland

Organizations foresee expanding the use of AMDs to over 20% of their client base, integrating them further into homecare strategies.

Positive user experiences with AMDs support the case for broader adoption

5.2 Recommendations

The main purpose of this thesis was to provide understanding concerning the need of Automated Medicine Dispensers primarily in Finland. It pursued to cover the factors that anticipate and act as barrier for implementation of AMDs in Home Care organizations. These factors were aimed to understand by interviewing multiple Home Care professionals from different cities, hierarchy level and theoretical resources.

Based on the research findings and literature, the following recommendations are offered to the case company to effectively enhance the adoption and utilization of Automated Medication Dispensers in collaboration with Home Care Organizations.

1. Conducting continuous Staff training to ensure ability to use AMDs effectively. It enables staff to feel confident and understand the functional reliability of AMDs which increases acceptance, leading to stronger adoption and improved utilization.
2. Strong Technical support reduces reluctancy and improves user satisfaction. It ensures seamless integration of AMDs into care routines.
3. Collaboration with external stakeholders enables to spread the word regarding reliability of AMDs. Engaging with policymakers can secure funding opportunities which in long-term serves the goals of all stakeholders.
4. Constant monitoring and evaluation of AMDs on Home Care organizations. Data-driven results can enhance the efficiency and effectiveness of AMD deployment.

5.3 Reliability, Validity & Relevance

Theoretical studies and interview results of Home Care professionals supports reliability, validity and Relevance of this thesis. Interviews were conducted online with several Home Care professionals from executive to operational levels. Interviews were semi-structured containing the main elements of answering the research questions and conducted online to support the documentation. Interview results support the validity and relevance of the thesis by providing up to date and concrete experience of using Automated Medicine Dispensers. Implementation of AMDs globally is very hard to understand due to lack of experience, Finland is the Pioneer in comparison to other countries globally.

The validity of the research is ensured by similar responses received from different Home Care professionals as well as using theoretical resources supporting the validity of the research.

5.4 Further Research

Since Automated Medicine Dispensers are still in its very early stages and there is not much user experience data available, continuous research must be conducted. From the writer's perspective, Home Care Organizations need to work more closely with AMD service providers in order to effectively indicate the impact and benefits of AMDs for Home Care Organizations. So far there are no Data available from a third party who has indicated the results that Home Care organizations have achieved by using AMDs, these results could impact the decision-making process of executive level in order acquire AMDs for larger group of Home Care's Customer base. Welfare service counties have achieved positive advancement and have started to more effectively follow up the results, but in order to maximize the effectiveness, there are more data needed to be collected in order to prove the effectiveness of AMDs to the executive level of Welfare service counties.

5.5 Reflecting on Learning

Qualitative research provides in depth information regarding the topic that needs to be researched. It helps to understand the topic fundamentally. During this research the researcher gains understanding on how similar qualitative research is conducted regardless of how fields of studies differ from each other. Qualitative research has helped the researcher to plan a research process, apply theories to support the result, understand data collection methods and analyze data. The researcher has gained deeper understanding as far as usage of Automated Medicine Dispensers are concerned in Home Care organizations. Due to early stage of AMDs operating in Health Care sectore, there are not enough studies to support the theoretical part of the research, this can be noted as one of the challenges during the research.

Usage of AMDs are at very early stages both in Finland and Globally, thus it requires commitment from executive level of the organization to lead and support the operational level of the organization in order to maximize the outcomes of AMDs to support the staff and the organizational goals and.

The research provides deep understanding to the writer that how qualitative research demonstrates the current situation of what challenges are within the field of study to analyze and understand the best way possible to overcome and maximize results. These results would be beneficial both for the service provider and Home Care organization to achieve mutual goals.

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