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Smart Solutions for Wellbeing Service Development and Management

– Winternational 7.0

Moisanen Kirsi, Huhtala Saija (ed.)

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Content

Foreword

In recent years, the social and health care environment has faced significant changes and challenges due to an ageing population, scarce resources and growing service needs. At the same time, technological developments and the opportunities offered by digitalization have opened new perspectives for the provision, organization and development of services.

The development of innovation in social and health care has become a critical theme at both national and international level. Key megatrends - such as ageing populations, increasing prevalence of chronic diseases, staff shortages and financial pressure on the sustainability of systems - require systems to be able to continuously innovate. Innovation can help to meet these challenges more efficiently and effectively.

Research evidence strongly supports that innovation increases access, accessibility, effectiveness and efficiency of services. For example, the OECD (2023) has found that technological and organizational innovations can reduce waiting times, promote patient safety and strengthen the targeting of resources where they are most needed. At the same time, they can support staff well-being by automating routine tasks and freeing up time for human interaction.

Intelligent systems, such as AI-based analytics and decision support tools, enable a proactive, personalized and data-driven service. For example, WHO (2021) has highlighted that digital innovations can significantly contribute to the accessibility of services, especially for vulnerable populations such as the elderly or those living in remote areas.

Moreover, innovations at the interface of social and health services - such as integrated service models or multidisciplinary teams - support holistic citizen well-being and prevent costs in the long term. According to European Commission reports (2023), systemic innovations can deliver significant societal value when embedded in structures and everyday activities.

However, developing innovation is not just a technical process, it is also fundamentally linked to the development of organizational culture, leadership and ethical principles. Research highlights that user-centered development, a culture of experimentation and multidisciplinary collaboration are key prerequisites for successful innovation (see Greenhalgh et al., 2017; Nielsen & Sahay, 2022). Innovation development is not an optional aspect of social and health care, but a necessary condition for the system's vitality, sustainability and ability to meet future needs.

The Smart Solutions for Wellbeing Service Development and Management (5 credits) course, implemented in cooperation between teachers from Kajaani University of Applied Sciences and Neu-Ulm University of Applied Sciences, was offered for the eighth time in the academic year 2024-2025. The publication describes four different innovations in the field of social and health services and their development in a joint article. We hope that this publication will provide our readers with new insights, stimulate debate and, above all, encourage bold development work that will move social and health care towards a smarter and more humane future.

Happy reading!

Kajaani 11.6.2025

The content of this foreword has been designed using the AI tool ChatGPT. The authors have edited the content and reviewed and updated the sources used.

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1 “MediAssist” - empowering yourself to use your medical equipment correctly

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Abstract

Demographic change is creating new challenges for the service system, particularly for social and healthcare services, which must be constantly adapted to the changing needs of the population. In addition, the Finnish population is ageing and diversifying rapidly. The existing problems and the associated challenges were investigated, a comprehensive literature review was conducted, and interviews were held with experts in the field. The innovative solution “MediAssist” helps to improve communication between healthcare professionals, especially between nurses and patients. The innovation aims to minimize language barriers and improve the quality of care for patients who provide care themselves. The focus of the application is on the one hand to relieve the burden on healthcare professionals, especially nursing staff, and on the other hand to support patients in providing independent care, especially in the context of chronic illnesses. The core function of the application is video instructions that explain treatment procedures in an easy-to-understand but detailed manner. The gamification approach supports deepen knowledge and increase the confidence in the patient’s selfcare. This should reduce treatment errors and uncertainties and enable patients to use medical devices independently and correctly and thus manage their own health more effectively.

Keywords: health app, self-care, patient safety, effective communication

1.1 Introduction

Finland's population is ageing and diversifying rapidly (Dufva & Rekola, 2023). Demographic change creates challenges for the service system, especially social and health services, which must adapt to the changing needs of the population (Parry & Salmi, 2021, 1). Demographic change also has broad implications for society, the workforce and the financing of the welfare state (Dufva & Rekola, 2023). The main driver of Finland's demographic development is immigration. Low birth rates and an ageing population are creating pressure for population growth. If immigration remains high, the number of people of working age may increase in the coming years, offsetting the ageing of the demographic structure. (Traficom, 2024.)

Demographic changes will bring new challenges for the development of health services. An ageing population and cultural differences among migrants will affect how people access the care they need (Dufva & Rekola, 2023). Migrants may have challenges with language skills, traumatic experiences and integration difficulties, which can make access to health services and care more difficult. This is influenced by the health system's ability to meet the needs of different populations. For example, the attitudes of care staff and the availability of interpretation play an important role in the quality of the care experience patients receive and how well they understand the care instructions they receive. (Koponen et al., 2013.) In healthcare, it is important that patients and healthcare staff communicate and inform clearly and effectively (Kvarnström, 2022, 8). In Finland, nurses are the health professionals who are largely responsible for patient guidance and discharge instructions. Poor communication between patient and caregiver can lead to patients not following care instructions or recognizing emergencies, which can exacerbate health problems. Studies have shown that a language barrier can lead to misunderstandings and even medical errors, which can, in the worst case, endanger the patient's well-being (Marriott, 2020, 22-24).

The importance of communication is particularly important when a patient has been discharged from hospital and is receiving home care instructions. More and more patients are receiving advanced medical and nursing care in home care and outpatient settings. Patients are going home more quickly after operations and procedures. This is due to efforts to improve efficiency and contain costs. As a result, the content and delivery of discharge instructions to patients by staff is more important than ever. (Krohn, 2008.) Managing chronic conditions and changing behaviour is challenging and time-consuming for both patients and carers. However, patients need to be able to manage many of the factors that affect their health. To do this, they need support from healthcare professionals to manage their conditions as effectively as possible. Supporting self-care in healthcare can have a positive impact on the healthcare of people with chronic conditions, on health outcomes and on patient satisfaction. This requires cooperation between healthcare professionals, patients and their relatives. Research has shown that the more patients receive patient education and self-care education, the more effectively they manage themselves (Agency for Healthcare Research and Quality, 2016).

The aim of this article is to develop the quality of care of patients who are doing their own care/treatment. Further, the purpose of the article is to describe how the quality of care can be enhanced through the use of technology to educate patients, empowering them to independently and correctly use their medical equipment and manage their health more effectively. The innovation, called “MediAssist”, is an app that promotes the quality of patient care through clear and illustrative videos. Patients receive instructions on how to manage their own care, while caregivers can monitor whether patients have understood the instructions they have received.

1.2 Background

In social and healthcare services, increasing attention has been given to patient-centered care. Active patient involvement in their own care is seen as a key factor influencing the perceived quality and effectiveness of treatment (World Health Organization [WHO], 2016, 2–5). At the core of patient-centered care and the collaboration between healthcare professionals and patients is the involvement of patients in their own care. Adherence to care requires collaboration with healthcare staff, as well as the patient's knowledge, skills, and confidence, along with their beliefs about the importance of their role in managing their health (Paukkonen, 2023, 18). A high-quality and effective care relationship is characterized by an atmosphere in which alternative treatment options are explored, care plans are made collaboratively, treatment adherence is discussed, and follow-up is planned (World Health Organization [WHO], 2003, 3). These practices also enable the inclusion of disadvantaged and marginalized populations, ensuring equitable access to services and that all individuals benefit from high-quality care tailored to their specific needs (WHO, 2016, 2–5).

In recent years, technological innovations have advanced rapidly. They are a significant factor influencing both the health and economic well-being of patients (Greenhalgh, 2017). Technological development has enabled new approaches to support patients’ self-care in their care processes (Kuusi et al., 2006, 3). For example, mobile applications and remote monitoring devices facilitate real-time health data tracking and improve communication between patients and healthcare professionals. Mobile health services are increasingly used in patient communication, monitoring, education, improving access to services, clinical diagnosis, treatment adherence, chronic disease management, and in reducing the burden of disease associated with poverty. They effectively improve the quality of care (Marcolino et al., 2018) and efficiency (Bergschöld, 2018, 3-4) while expanding the reach of services at lower costs (Marcolino et al., 2018). Technology also has a positive impact on mental health and social participation (Agree, 2014, 4).

As chronic diseases become more common, the importance of lifestyle and self-care grows in promoting population health and patient care (Absetz & Hankonen, 2017). Technology improves patients' health and quality of life and enhances their independence. However, the effective use of technology requires consideration of patients' individual preferences and needs. New smart technologies offer more personalized solutions, but their accessibility and usability still need development. Generations with more experience in using technology benefit more from these methods, which is why investing in this area is essential. (Agree, 2014, 1-4.) Technology is also seen as freeing up resources for caregiving (Bergschöld, 2018, 3-4).

1.3 Methods

This chapter provides a deeper theoretical foundation for the research and development process that ultimately led to the creation of the "MediAssist" application. A structured research process of the team led to key insights relying on evidence-based literature, expert opinions and market conditions. Agile project management was followed to ensure that the invention "MediAssist" effectively meets the needs of patients and healthcare professionals. The following findings resulted from the applied methods.

Literature research

The review of the academic sources revealed significant challenges in patient care, especially in treatment adherence and the use of medical devices. Research shows that inadequate patient education can lead to misuse of medical devices and due to that to reduced treatment outcomes. (Fabbri et al., 2015; Barnason et al., 2017; Bonds et al., 2014.) Additionally, multimedia helps to support patients' comprehension and supports effectiveness of learning how to use their medical equipment (Mayer, 2009, 105f). Studies showed that educational videos improve patients' knowledge (Brunner-La Rocca, 2016). Furthermore, literature provides evidence that gamification functions improve health behaviors (Johnson et al., 2016).

Interviews

Interviews with professionals provided insights to specific needs in the healthcare sector. This highlighted the need for clearer and more accessible guidance for patients and pointed out the use of gamification to consolidate the knowledge of the patients. Additional, the healthcare and business expert stressed several core challenges like the elderly target group, suggesting simple interfaces and visual clarity and legal requirements.

Market research

The market for digital health innovations is scalable, especially for solutions which can be adapted across regions (Schlieter et al., 2022). An analysis of the existing digital health solutions showed some existing apps but none with individualization and the educational functions to teach patients to use their medical equipment correctly. This information was used to define “MediAssists’” unique selling point.

The “MediAssist” application is designed to improve the quality of care by educating patients and empowering them to use their medical devices correctly. The methods to develop the innovation mentioned in this chapter helped to ensure “MediAssist” addresses all the issues mentioned by providing personalized video instructions and guidance, ensuring that patients correctly operate their medical devices. In addition, the application supports patients with interactive simulations to ensure correct use in the long term. In this way, “MediAssist” not only contributes to increasing patient safety, but also promotes independent healthcare.

1.4 “Medi Assist” – A smart Solution

“MediAssist” is an innovative application designed to empower patients in managing their own healthcare. Through step-by-step video tutorials, users are guided on how to independently care for themselves from the comfort of home. Additional features, such as a direct chat function with their assigned nurse, ensure continuous support and personalized care, always enabling a high standard of treatment. In the following chapters “MediAssists” functions and technical implementation will be explained in detail.

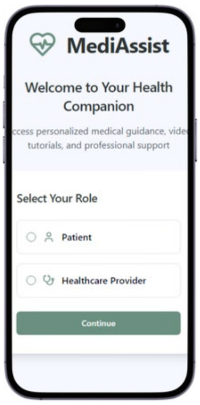
Functionality and mockup

The application is designed for use by both patients and healthcare professionals. During a doctor’s appointment, the nurse creates a user profile for the patient within the app, entering relevant medical conditions and assigning educational video content tailored to their needs. In this setup, the nurse acts as the administrator and care coordinator, while the patient is the end user. After a one-time registration, patients gain access to a library of video tutorials activated by their nurse and can choose their foreign language. The language is only used for headlines and navigation in the app but not needed for understanding medical issues.

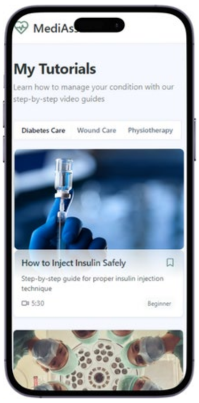
The assigned tutorials offer practical guidance on managing specific illnesses. For example, a patient with diabetes can access videos demonstrating how to properly monitor blood sugar levels or administer insulin. Educational content also includes information on the progression and symptoms of the illness to deepen patient understanding. (Brunner-La Rocca, 2016.) The individuals featured in the tutorials are chosen to reflect the age, appearance, and circumstances of the target patient group, making it easier for users to identify with them. This personalization enhances emotional engagement and helps patients relate more closely to the condition being demonstrated, thereby increasing the relevance and impact of the educational content. After watching each video, patients can directly contact their nurse through the integrated chat feature to ask follow-up questions or request further clarification. A short quiz after each tutorial helps assess the patient's learning progress. To ensure ongoing quality and relevance of the content, users are regularly invited to complete feedback surveys. Healthcare providers can track engagement by viewing how often a patient watches each video, whether they complete them, and how long they spend on each. This data helps evaluate the effectiveness of the content and its contribution to the patient’s overall care journey.

One standout feature of “MediAssist” is the scan function. Patients can use their smartphone camera to scan a medication or healthcare product, and the app will identify whether it is part of their prescribed treatment and explain how to use it properly. This minimizes confusion—especially in households where multiple people take medications—and enhances safety.

“MediAssist” offers tailored views based on user role and device type. Healthcare providers, such as nurses, access the system via a web-based dashboard. Patients can choose between the mobile app and a web version for flexibility. Upon accessing “MediAssist”, users first select their role (healthcare provider or patient) (Pic. 1). Nurses are then directed to a dashboard displaying a chronological list of patients under their care, including details such as diagnosed conditions, active tutorials, and prescribed medications. From here, they can easily add new content or manage existing plans. A search function allows for quick navigation, and a dashboard summary displays key metrics such as total patients, active tutorials, and pending reviews. New patient profiles can be created at any time via a button in the top-right corner.

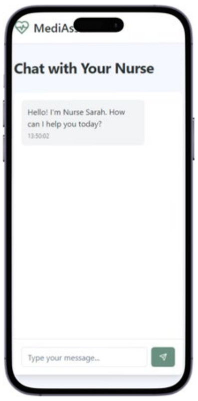


Picture 1. Log-in page

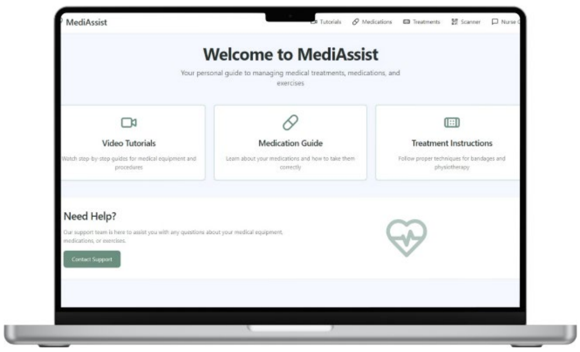


Picture 2. Patient overview

Patients, on the other hand, are welcomed with a clear overview of their health conditions on the app’s home screen. Navigation tabs provide quick access to features such as scanning products, browsing educational videos (Pic. 2) and chatting with their nurse (Pic. 3). With just a tap, they can start watching tutorials that support their journey to better health.



Picture 3. Patient view chat function



Picture 4. Patient start page web version

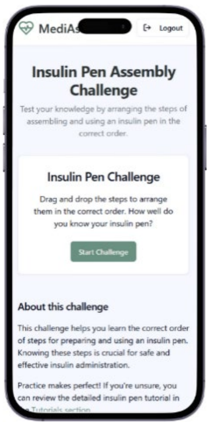
Picture 4 shows the landing page of the patients after their login. The simple design ensures that the patient can navigate easily through the application. This picture also makes clear, that “MediAssist” can be used either on a desktop PC, a laptop or a smartphone. This also ensures that everyone can use the application.

Gamification

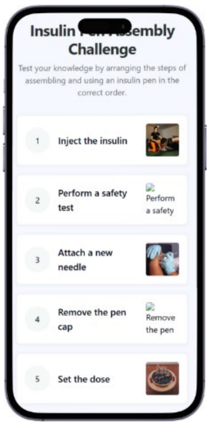
Gamification refers to the use of game design elements in non-game contexts. It can help develop patients’ potential and provide positive encouragement to improve their performance (Che et al., 2023). Furthermore, gamification can increase patients’ interest and motivation to engage in self-care, enhance concentration and the meaningfulness of learning, and promote effective learning (Wang, 2024, 1). The use of gamification is intended to make using the app more attractive, create incentives for patients and the patients' understanding of the treatment process should also be improved. Studies have shown that gamification has the potential to make applications for chronic diseases more attractive because the self-management of the patient is increased. (Miller et al., 2022.)

As “MediAssist” is a knowledge app, the gamification content aims to deepen knowledge (Capatina, 2024). This content is therefore based on interactive widgets that allow patients to playfully engage with the commissioning process of an insulin pen, for example by simulating each step in a safe, virtual environment. Through these gamified simulations, users can explore and repeat the process at their own pace, which enhances both confidence and long-term retention. Further, users have the opportunity to test their acquired knowledge through engaging step-by-step instruction exercises, where they must independently arrange the correct sequence of actions. This challenges their understanding while promoting active recall. A third interactive element is the linking of associated images to specific components or functions of the insulin pen, encouraging visual learning and pattern recognition. To further enhance motivation and engagement, users may receive immediate feedback or hints to improve the learning experience more adaptive.

Furthermore, levels and points can be integrated as an approach (Miller et al., 2014). This can be used in “MediAssist” for taking meds on time or doing their training. Each time the patient takes his medicine on the right time, he gets a reward. This also helps the nurses to check if the patients take their medicine regularly or not. Collecting points also motivates the patients to stick to taking medicine on time or doing their physiotherapy regularly. Pictures 5 and 6 show a possible structure of the step-by-step assignment of the insulin pen.



Picture 5. Example page of description



Picture 6. Example quiz

Figure 1 shows another example for a gamified approach which teaches the patients how to put together their insulin pen in the correct order. The patient can tick the different parts of the insulin pen and use drag and drop to put the pieces in the right order.

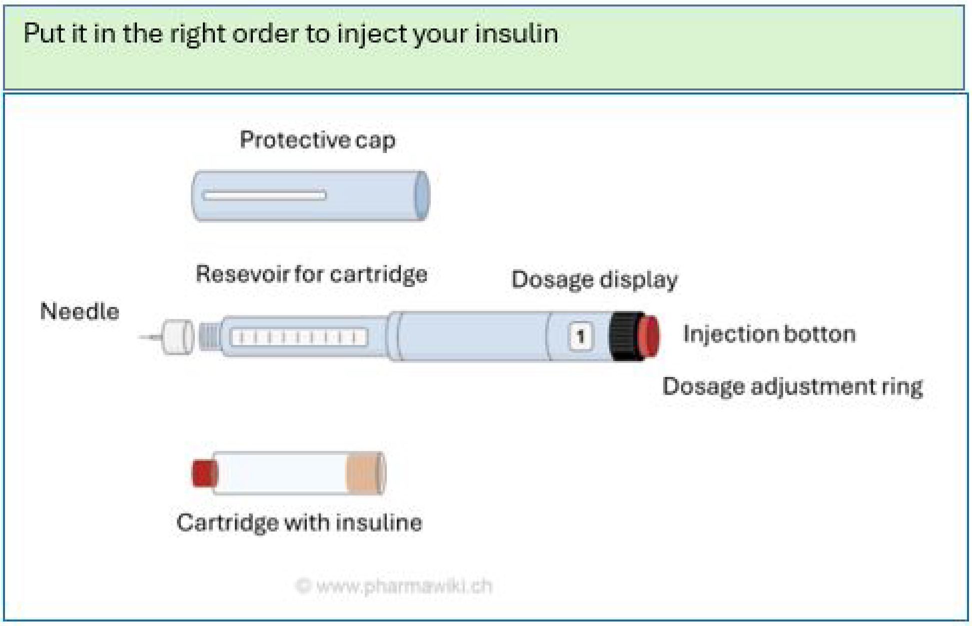


Figure 1. Gamification tool to improve knowledge based on Vögtli (2023)

Another approach which is used in the app is a situated learning approach that places users in realistic scenarios. Virtual interactive practices in a simulated surrounding help users develop confidence and competence. (Lin et al., 2024.) This encourages independent action in real life. One example is a simulation that guides users through the correct use of an inhaler within a realistic, interactive scenario. After watching the instructional video, users are placed in a virtual setting where they must follow each step—shaking the inhaler, exhaling fully, placing the mouthpiece correctly, activating the device while inhaling deeply, holding their breath, and then exhaling slowly. Real-time feedback, such as visualizations of medication reaching the lungs, helps reinforce proper technique. This immersive experience fosters both confidence and competence, enabling users to perform the task independently in real-life situations.

Technical background/implementation

A modern and secure technology stack is used as a base for “MediAssist”. Due to the easy and lean layout of the frontend it is easy to use for patients of all age groups and all kinds of diseases. It provides a seamless experience over multiple platforms such as iOS, Android and desktop. In the following the main technological components are further explained.

The app is built in the frontend using React Native (Java Script) for a cross over platform development (JetBrains, 2025). This ensures that the application can be used on all kind of platforms and all kind of devices. The backend of “MediAssist” is built with Node.js and Express.js. Node.js is a JavaScript runtime which allows to run JavaScript code on the server. It is used because of the advantages of being fast and efficient especially when handling many connections or requests simultaneously. Express.js is a web framework which is built on top of node to simplify functions of “MediAssist”. For example, handling questions like what happens when a user enters URL and what kind of data will be provided in return (Peters, 2017). Express.js also helps with the healthcare system integration like integrating Kanta. Such systems often use data formats like FHIR. Express.js makes it easy to exchange and communicate with the Kanta to transfer patient data if needed.

“MediAssist” handles data according to the current data protection laws and takes data security seriously. The patient data is stored in a cloud using HIPAA-compliant infrastructure (AWS HealthLake). This ensures that the data is encrypted and accessible to the patient and the healthcare provider from everywhere and anytime (Amazon Web Services, 2025). The app also employs a 2-factor-authentication system to ensure secure access to their accounts. This authentication is for both patients and healthcare providers to guarantee a high standard of data protection.

Data privacy

Under European law, the app takes place in the category of apps that process “data concerning health”, that means it is a mobile health app (European Commission, 2021, 2). As the videos and information content offered in the app can be used to draw conclusions about personal health data and therefore the state of health, it is important to protect this sensitive data adequately. In order to do justice to the topic of data security and data protection within the app, far-reaching considerations were made on this topic right from the start. As a first step, it is crucial to sufficiently inform the patient about the processing of the data as well as its extent and purpose. Consent must then be given. The user must also be free to object to this consent at any time. This procedure is necessary to comply with the General Data Protection Regulation agreements (European Commission, 2024).

Personal data that is irrelevant for the use of the app is not listed to keep the amount of data as small as possible. Examples of this would be dates of birth, insurance status and the real name. The focus here is on “privacy by design”. This means that every consideration in the design of the app will be made to ensure that everything is set up in such a way that the data is protected in the best possible way (European Commission, 2021, 8). In addition to the specialist staff who activate the content for the patient, only the patient himself has access to it. Due to the planned connection of the app to the electronic patient file “MyKanta”, it would make sense to store the login data for the initial registration for “MediAssist” in the corresponding user profiles. The user profile is operated under a pseudonym, which only the service providers can decrypt to fill the app. For subsequent logins, access is to be made more secure by means of two-factor authentication. In addition to setting a secure password, users are also permitted to open the app using a fingerprint or face ID.

The provision of videos and information material by the nurse for the patient should ensure that only relevant and technically accurate content reaches the patient, thereby increasing trust in the app. It is also important to make the sources of the information transparent for the patient (c/o sanawork GmbH, 2024). As a chat is also integrated for queries, the data should be made confidential via end-to-end encryption. This means that only the patient and staff are able to read the messages, uninvolved third parties cannot view the content due to the encryption (Kraft et al., 2015, 36). As accessibility plays a central role in European law alongside data protection, great importance is attached to implementing this regulatory requirement through a wide range of functions (Europäische Union, 2019). In addition to content in the form of videos and easy-to-understand texts, attention is paid to simple, structured navigation, a reading function is offered for written content, and the font size should be adaptable within the app. Additionally, when creating the content, care should be taken to ensure that it can also be understood by assistive technologies. This should comply with the 4 principles of the guideline for accessibility, perceptibility, usability, comprehensibility and robustness (Europäische Union, 2019).

Evaluation

The objective of the "MediAssist" application is to improve communication between patients and healthcare professionals efficiently and sustainably, particularly in the context of existing challenges such as demographic change. A central concern is to relieve the burden on specialist staff, especially nursing staff, while at the same time encouraging patients in their ability to care for themselves, particularly in the case of chronic illnesses. The focus here is on the quality of care, which is to be optimized through the use of "MediAssist". In addition, the application is intended to strengthen patient self-care, increase patient safety and ensure effective communication between all those involved. In the long term, it is intended that the application will reduce the need for nursing support, minimize treatment errors and improve patient safety.

With its comprehensive functions, "MediAssist" is designed to efficiently and sustainably improve communication between patients and medical staff while minimizing treatment errors. In the context of demographic change and an ageing society, this is of considerable importance. A central objective is to relieve the burden on healthcare professionals, especially nursing staff, while simultaneously promoting patients' ability to manage their own care, particularly in cases of chronic illness. As routine tasks in the self-care of chronically ill patients are carried out by the patients themselves with the help of the app, the burden on healthcare staff is reduced, allowing them to focus more intensively on other tasks (van de Vijver et al., 2022). Ideally, this can lead to savings in resources such as personnel, reduce hospital stays, and decrease the number of medical appointments ultimately resulting in cost savings. These savings are particularly important in the healthcare sector, where resources are often limited. In addition to reducing the workload of medical staff, the focus is also on improving the quality of care, which is to be optimized through the use of "MediAssist". The app enables better disease management through professional and regular patient-led care, which in turn leads to improved therapeutic outcomes. Furthermore, through its customizable features and integrated medical expertise, the application promotes patients' confidence in managing their health, potentially improving overall quality of life (Pong et al., 2024). "MediAssist" strengthens patient empowerment by enabling users to actively participate in the treatment process. This makes a significant contribution to allowing patients to fulfil their role as competent partners in the healthcare system. Without the "MediAssist" application, there is a risk that the health of chronically ill individuals may deteriorate or that new complications may arise, both of which would increase the demand for nursing care. In summary, the application reduces the need for nursing support, minimizes treatment errors, ensures effective communication among all parties involved, and increases patient safety all of which lead to significant savings.

As part of the development process, interviews were conducted with technical experts in which a prototype was presented that deals with improving treatment processes through the use of images and videos as well as overcoming language barriers. These interviews contributed significantly to the modification and further development of the application. Especially the second interview with a Finnish expert helped to validate the basic idea of the "MediAssist" app by discussing potential challenges as well as further development possibilities and suggestions for improvement.

In view of the future prospects, there are numerous possibilities for further developing the app. For example, artificial intelligence could be implemented, which is integrated into the app's chat function and is used when no specific expertise is required. If the integration of AI proves to be beneficial, it could also be incorporated into other areas of the app, such as gamification. Another potential development is the connection of the app to medical devices, whereby important assistance could be transmitted directly from the device to the patient and simultaneously documented in the app. These medical devices could, for example, support the patient with visual signals or symbolic instructions on the display to ensure high-quality execution of the treatment process. Documentation in the application would enable healthcare professionals to identify important indications of recurring application or treatment errors by viewing the patient's app and user interface, which could be corrected in face-to-face appointments between patients and professionals (Raizmam et al., 2024).

In addition to opportunities, the development of the innovation also presents challenges that need to be overcome. Moreover to ensuring data security and the connection to the Kanta.fi electronic patient record, one of the biggest challenges is user-friendliness for older people, as their use of new technologies is often characterized by uncertainty. This could be particularly problematic when it comes to using technologies that work with sensitive health-related data. To avoid potential acceptance problems, the target group, especially older people and those with chronic illnesses, should therefore be actively involved in the app development process. The different linguistic requirements for communication within the app must be taken into account, in particular that the medical vocabulary and content is rendered correctly and comprehensibly for the target groups in order to ensure effective communication and not jeopardize the quality of treatment. Furthermore, the sources for the professional knowledge that is passed on to patients through the app must be clearly defined and made transparent (Gomez-Hernandez et al., 2023). Another important issue is the financing of the innovation. Various financing options need to be considered, such as loan financing, support from the ELY center, the “Bisnes Finland - Start-up Tempo” program or participation in “Pitchaus” competitions. Direct contact with investors could also play an important role in raising capital for the development and market launch of the app. Strategic partnerships are also of great importance as they can facilitate access to important resources and networks and support the market launch of the innovation. In addition, the long-term competitiveness of the “MediAssist” app must be ensured through continuous adaptation to market requirements and technological developments. In this context, the possibility of transferring the app to international markets could also be considered in order to expand its market power and exploit its potential on a global level. (Palo-oja, 2025.)

Compared to conventional methods such as printed discharge instructions or verbal explanations, a digital application like “MediAssist” offers significant advantages in data processing and accessibility. By storing patient-specific instructional content and device usage data in the cloud, information becomes instantly available across devices—whether on Android, iOS, or desktop platforms. This ensures continuity of care, as patients and healthcare professionals can access relevant materials anytime and from any location. Additionally, anonymized aggregated data can be used for research, public health monitoring and prediction models. The collected data enables to detect patterns such as difficulties with a specific kind of inhaler. His feedback loop allows companies to improve their medical devices. Also data can easily be used as a controlling instrument making sure that patients stick to their treatment and get the support, they need at this point data-driven-care can be implemented easily. This dynamic, centralized approach not only improves adherence and understanding but also enables better monitoring and long-term support for self-care (Kayser et al., 2015).

1.5 Conclusion

This article describes the obstacles that the changing social structure in Finland poses to the healthcare system, which include an ageing and diversified society (Dufva & Rekola, 2023). The declining availability of healthcare resources and rising treatment costs amid the increasing prevalence of chronic diseases have become a growing global issue. As a result of these changes, interest in utilizing advanced healthcare information systems and technological applications has increased. These tools aim to improve access to care while simultaneously reducing overall costs (Kao, 2018, 815). The development of the innovation should reduce the pressure on healthcare professionals by focusing on training patients to manage their self-care in a quality and efficient way. Key point is to reduce the language barrier by finding a solution that is language-independent and does not require the use of medical aids (Koponen et al., 2013).

Mobile health (m-health) methods enable access to healthcare services for anyone, anytime and anywhere, by removing geographical, temporal, and other barriers (Abbaspur-Behbahani, 2022). Through the m-health, it is possible to avoid common tests, prepare care on time and prevent errors in patient treatment (Shabazi, 2021). This is where the described innovation came in. “MediAssist” helps to improve the quality of the medical self-care that patients provide for themselves. The app can clarify the use of medical aids and devices and thus helps to cushion the increasing demand for support from medical professionals. Especially for chronically ill people, the app can be a real gain (Brunner-La Rocca, 2016). The aim of this consideration is to relieve some of the burden on specialist staff, especially the nurse. The central focus here is how the intervention helps overcome the language barrier. With a simple used app including videos which are created to understand without any language the patient can replicate the care they saw. Misunderstandings are reduced, which leads to an improved quality of care and fewer cases of incorrect use. (Seale et al., 2022, 906.)

Results of using illustrations or videos to explain patient’s treatment or medical indications are already available, studies show that educational videos have a positive impact on patients’ understanding (Monterio Grilo et al., 2022). In this case it makes no difference if the communication problems are based on language barrier or the gap of medical terms between the staff and the patient. Solutions like “talking pictures” show how this kind of innovations can help to overcome, especially the thematic of language barriers. “Talking pictures” was developed to support caregivers in communicating with non-native speakers. Patients describe their symptoms or pain by pointing on pictograms. Although the aim of the app is different, the results of the test can be applied to all image-rich tools. Specialists who have tested the app confirm that this tool can save important time in the treatment process and makes a decisive contribution to the quality of treatment. In addition, the development team states that errors can be avoided, thus increasing patient safety (Talking Pictures n.d.).

Remote digital services are effective methods, but healthcare professionals should ensure that they are suitable for the older population and that both the necessary technology and technical support are available for their implementation (Abbaspur-Behbahani, 2022). By connecting “MediAssist” to “MyKanta”, a higher level of acceptance is expected. On the one hand, it emphasizes the professional character of the app, and, on the other hand, it is also expected that the app will be used more by the elder generation. 73% of the “MyKanta Pages” users are over 66 years old, which shows that this generation is quite willing to benefit from digital solutions (Kanta, 2025).

In the future could be considered if the chat function can be assisted by artificial intelligence, maybe some kind of questions are repeating and do not need professional expertise. In this case the nurse could be relieved of answering all the chats. As well as the question if there are other parts in the app, in which the use of artificial intelligence can lead to improvement. A direct connection of the app to the corresponding medical devices would also be an idea for further development of the innovation. In this case, the device could help the patient to use it correctly by lighting up or giving instructions on the display in the form of symbols.

In summary, the “MediAssist” application is a promising solution for improving communication between patients and healthcare professionals. It promotes patient self-care, relieves the burden on healthcare professionals and improves patient safety. The app was further developed through expert interviews, with the use of artificial intelligence and connection to medical devices being discussed as possible future enhancements. However, acceptance among older people and people with chronic illnesses, language requirements and funding are significant challenges that need to be overcome. Successful implementation requires sustainable financing, strategic partnerships and a long-term competitive strategy in order to successfully position the app on both national and international markets.

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2 Vision Flow – A concept for advanced bed capacity management

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Abstract

This article explores how artificial intelligence [AI] can improve patient pathway management and optimize healthcare resource utilization. Inpatient care faces persistent challenges such as staff shortages, limited bed capacity and inefficient coordination, particularly during transitions between hospitals and rehabilitation facilities. These structural issues expose the limitations of manual planning. Using the AI-based system, VisionFlow example, the article illustrates how digital tools can enable proactive and integrated planning, reduce administrative burden and support more strategic workforce management. Research supports the potential of AI to enhance infrastructure use and ease staff workload. However, successful implementation requires not only technological solutions but also systemic change and appropriate policy incentives. The article highlights the need to shift from organization-centered processes to patient pathway-centered planning to achieve sustainable improvements in efficiency, transparency and care continuity.

2.1 Introduction

Healthcare systems worldwide are under growing pressure to improve patient care while optimizing resource utilization and reducing administrative burdens (Manning & Islam, 2023, 806). In both countries, Finland and Germany, patient transfers and bed allocation are still heavily reliant on manual coordination, often causing delays, errors, and inefficiencies (Klein & Thielen, 2024, 30). Digitalization and artificial intelligence are increasingly seen as essential tools in addressing systemic inefficiencies in healthcare systems (Topol, 2019). To fully realize this potential, healthcare providers must overcome organizational boundaries and shift towards-oriented management (Maier et al., 2025, 3, 19-27).

In Finland, the wellbeing area reform has led to centralization of inpatient care, resulting in increased patient transfers between municipalities. Nurses are burdened with time-consuming tasks like making repeated phone calls to check bed availability, which detracts from patient care (Eskola & Rintala, 2024). In the same way, many hospitals in Germany face similar challenges, where manual procedures and fragmented communication systems hinder the effective management of bed capacity and patient transfers (Welz-Spiegel & Spiegel, 2023, 285). The lack of real-time bed tracking and fragmented processes makes effective patient pathway management difficult, negatively impacting the quality of care. These issues result in longer wait times, reduced operational efficiency and a fragmented healthcare experience, ultimately compromising patient outcomes. (Otten et al., 2021.) Emergency department [ED] overcrowding is a global issue driven by staff shortages, surges in patient volume and delays in care processes. However, the most significant cause of ED overcrowding is the lack of inpatient beds for patients who cannot be discharged home. Notably, ED overcrowding intensified during the COVID-19 pandemic. (Nattino et al., 2023.)

This social phenomenon of inefficient patient pathway leads to gaps in the care pathway, which can negatively affect patients (Manning & Islam, 2023, 806). VisionFlow addresses these challenges by automating bed allocation and ensuring timely patient transfers between hospitals and rehabilitation centers, effectively closing these care gaps. This results in better care for patients by enhancing the continuity of their treatment, reducing wait times, and supporting a more sustainable and patient-centered healthcare system. (UNITY Consulting & Innovation, n.d; Tlapa et al., 2020, 267.) However, to achieve meaningful improvements, a shift is necessary from an organization-centric focus to one that emphasizes the patient pathway. By focusing on the patient pathway, healthcare systems can better harness data to improve both care delivery and operational efficiency. (World Health Organization [WHO], 2021.)

The aim of this article is to improve patient pathway management and optimize resource utilization in healthcare. The purpose of the article is to describe how artificial intelligence [AI] can be used to improve patient pathway management and resource utilization in healthcare. Using VisionFlow as a case example, the paper illustrates how automation and predictive analytics can enhance care coordination and reduce administrative workload.

2.2 Background

Effective patient pathway management requires overcoming fragmented care structures and ensuring continuity across healthcare settings. Theoretical frameworks such as integrated care models, sociotechnical systems theory and health systems analysis emphasize the need for coordinated, data-driven solutions to improve outcomes and optimize resource use (Okwor et al., 2024, 1933; Welz-Spiegel & Spiegel, 2023, 208). Digital tools that incorporate predictive analytics are seen as essential in bridging institutional divides and supporting efficient care delivery.

In Finland, the centralization of inpatient care following the wellbeing area reform has increased the volume and complexity of intermunicipal patient transfers. Yet, capacity planning often remains manual, lacking real-time data integration and creating bottlenecks in the care process. (Eskola & Rintala, 2024). Similarity, in Germany, transitions between hospitals, rehabilitation centers and long-term care facilities are hindered by sectoral silos and administrative fragmentation. Despite legal frameworks mandating discharge management (SGB V, § 39 (1a), 2023), limited data sharing and poor capacity transparency delay patient transfers and weaken care continuity (Welz-Spiegel & Spiegel, 2023, 348). These structural limitations reinforce the case for intelligent, AI-based systems, like VisionFlow to streamline coordination and support sustainable healthcare delivery.

Structure and Challenges of the Finnish Healthcare System

The Finnish healthcare system is globally distinctive in its strong reliance on publicly funded services. Care is organized into two tiers, primary care provides by health centers and specialized medical care delivered in hospitals, based on the level of treatment required. Since the nationwide reform of health and social services, responsibility for organizing care has shifted to 21 self-governing wellbeing areas, including the Kainuu wellbeing area. (Terveydenhuoltojärjestelmä, n.d.; Sosiaali- ja terveysministeriö [STM], n.d.)

While the wellbeing area reform aimed to improve efficiency and equality of access, it has also brought significant challenges. Many regions are struggling financially and have been forced to implement budget cuts, including the centralization of inpatient wards. (Eskola & Rintala, 2024.) In Kainuu, the reduction of inpatient wards has led to and increased need to transfer patients between municipalities. Nurses now spend a considerable amount of time calling various healthcare centers to locate available beds. As Appelgren (2024) notes, “Very often, you have to call every health care center, only to get the response, no availability”. This manual process is frustrating, time-consuming and inefficient.

These operational inefficiencies not only burden staff but also compromise patient safety. Time spent on administrative tasks is taken away from direct care (Hyytinen, 2024). To address this, alternative solutions have been considered, particularly digital tools that would allow real-time visibility and reservation of inpatient beds, ideally integrated directly into existing patient information systems. This would eliminate unnecessary “media breaks” and allow data to be used more effectively.

Efficient resource use is crucial in responding to the economic pressures faced by wellbeing areas. Optimizing staff time, improving information flow and enhancing transparency in care capacity can significantly improve care continuity and quality. Reducing manual workload not only saves time but support nurse well-being and patient safety. Implementing digital solutions to support capacity planning helps ensure that limited resources are used where they bring the greatest benefit, for patients, professionals and the sustainability of the healthcare system. (Tietoevry, 2025.)

Fragmentation and Inefficiencies in the Patient pathway

The structural fragmentation of the patient's pathway, especially at transition points between different sectors and levels of care, often results in time-consuming and manual coordination processes, such as frequent phone calls to check bed availability (Welz-Spiegel & Spiegel, 2023, 347). Systemic inefficiencies constitute a critical barrier to ensuring continuity of care. Transitions between different phases of treatment, particularly the shift from acute inpatient care to outpatient services or rehabilitative follow-up, are frequently inadequately coordinated. Such discontinuities pose substantial challenges for both patients and healthcare professionals, potentially compromising treatment outcomes and the overall quality of care delivery. The consequences of these inefficiencies include delays, increased workload, suboptimal resource utilization and elevated risks to both the quality and safety of care. (Satake & McElroy, 2024.)

Contemporary healthcare systems face growing pressure to deliver efficient, patient-centered and high-quality services (WHO, 2021). Changing demographics, workforce shortages, and rising financial constraints demand new approaches to the planning and coordination of care processes. Gaps in the patient pathway, from hospital admission and intra-facility transfers to discharge and post-acute care, have evolved into systemic inefficiencies that hinder continuity and delay treatment. (Satake & McElroy, 2024.) These challenges are especially pronounced when transitions span across sectoral or institutional boundaries (Welz-Spiegel & Spiegel, 2023, 347-348).

Inefficiencies are often due to outdated coordination practices based on manual, phone-based communication, limited interoperability between health IT systems and a lack of real-time visibility into available care capacities. While many healthcare providers have introduced digital tools, these systems often operate in isolation and fail to support predictive, cross-sector planning. As a result, the full potential of digital transformation in healthcare remains untapped. Key concepts such as resource-efficient process design**,** integrated care and patient-centered care can help here. (Holden, et al., 2013; WHO, 2021.)

The key challenge is shifting from reactive to proactive, data-driven coordination across institutional boundaries. Existing solutions, such as UOMA (Axel Health, 2025) and Tietoevry´s Lifecare platform, used in the Kainuu wellbeing are, allows coordination of staff, rooms and equipment. However, these systems still lack AI-powered forecasting and prescriptive planning tools that can anticipate capacity needs over time (Tietoevry, 2025). To address these limitations, healthcare systems require intelligent tools that go beyond basic scheduling, systems that can learn from historical data and algorithmically predict case-specific bed availability. This would enable truly proactive care coordination, reduce administrative burden and enhance both efficiency and patient outcomes.

Defining Patient pathway management

For many years, the concept of patient pathways has been covered in the literature on healthcare. Zander (1988) used the phrase "critical pathways" in the late 1980s to standardize treatment procedures and lessen variation in clinical practice. Clinical pathways became more widely recognized in the 1990s as instruments for interdisciplinary coordination, resource management and quality enhancement (Campbell et al., 1998). These days, systematic, coordinated care processes across various care settings are referred to by terminology like "patient pathways," "clinical pathways," and "care pathways" interchangeably.

Patient pathway management refers to the timely and efficient movement of patients through the different stages and settings of care, including outpatient clinics, emergency departments, inpatient wards and rehabilitation centers. It encompasses the entire care pathway from admission to discharge and potentially to follow-up care. Effective patient pathway ensures that patients receive the right care at the right time and in the right place, without delays or unnecessary transitions. (Richter and Schlieter, 2024, 120-124.) In addition to these aspects of patient centered care, transparency and the collection of data for research are among the goals of successful and digital patient pathway management (Richter & Schlieter, 2024, 120-121). Managing patient pathway is a complex task involving multiple stakeholders, processes and information systems. Inefficiencies at any point can trigger cascading delays, overcrowded emergency departments, extended hospital stays and discharge bottlenecks. Such disruptions not only strain healthcare resources and increase staff burnout but also place patients at risk of suboptimal care and potential harm. (Rutherford et al., 2020, 5-11.)

Patient pathway is increasingly recognized as a key performance indicator for hospital operations and system-wide efficiency. According to El-Bouri et al. (2021,2), machine learning can be effectively applied to analyze flow patterns, identify bottlenecks and forecast demand. These predictive models allow healthcare providers to anticipate patient surges, improve bed utilization and allocate staff and equipment more effectively (Canadian Agency for Drugs and Technologies in Health [CADTH] 2024, 5). As healthcare systems generate increasing volumes of data, intelligent approaches to patient pathway management are essential for delivering high-quality, sustainable care (El-Bouri et al. 2021, 1).

The Role of Artificial Intelligence in Optimizing Patient pathway

Artificial Intelligence describes computer-based systems that can learn from data, recognize patterns and make decisions, similar to how humans reason. In healthcare, these learning systems are used to analyze complex medical information, predict events, and support clinical and operational decisions. This makes them especially useful for managing and optimizing patient pathways. (Bhagat et al., 2024, 134.) AI-based tools for patient pathway management can forecast patient volumes and transitions across care settings, particularly for complex cases. They predict admissions, discharges and intra- or inter-hospital transfers and have shown effectiveness in emergency, cardiology and mental health departments (CADTH, 2024, 2-3). Studies have shown that in Canada, systems like these are already being used to optimize care pathways, including in oncology and surgical scheduling. While the initial investment required for implementation is significant, these tools are designed to enhance efficiency and reduce long-term operational costs. Modern healthcare systems generate vast amounts of data through digital platforms such as electronic health records and imaging systems. AI can harness this data to enhance and streamline patient pathways across care settings. (CADTH, 2024, 2-4.) Data sets of dwell times are necessary for the application of such artificial intelligence systems. Such datasets could, for example, be derived from international and standardized classification models such as Diagnosis-Related Groups (DRGs) and ICD-10 (Wiemschulte, 2024, 44-46).

However, despite the potential of AI in healthcare, a well-known challenge remains: the productivity paradox of information technology. This paradox, described by scholars such as Picot, Reichwald and Solow, highlights a gap between the technological advancements in information systems and their actual utilization in terms of process redesign (Picot, Reichwald, & Wigand, 2008, 158-159). In healthcare, this underutilization is particularly evident due to the lack of a comprehensive process view, particularly regarding the patient pathway. This lack of process orientation is a major reason why digital technologies often fail to deliver productivity gains, a phenomenon that has been widely discussed in the literature. (Brynjolfsson, 1993, 67.) By leveraging AI to predict patient pathway, healthcare systems can begin to close this gap, but a deeper integration of process-oriented thinking is needed to fully realize the potential of these tools. In the context of patient pathway, AI can optimize hospital resources, enhance operational planning and healthcare quality and enable more efficient resource allocation and utilization. (Ellahham & Ellahham, 2019, 4.)

Accurately predicting hospital length of stay (LoS) is a crucial element in healthcare resource planning and improving care delivery. Such predictions provide policymakers and healthcare professionals with insight into service demands, care burden and opportunities for optimizing clinical workflows. Accurate LoS forecasting enables hospitals to better allocate resources, reduce unnecessary inpatient days and develop novel strategies for managing patient pathway. Model-based approaches represent a shift toward data-driven, personalized and more effective healthcare systems. (Rajkomar et al., 2024.)

2.3 VisionFlow: Innovation Description and Core Design

Based on the previously discussed challenges in most of the healthcare systems, including fragmented care coordination, inefficient bed management and the lack of predictive planning, this chapter introduces VisionFlow as a potential solution. VisionFlow is an AI-supported predictive capacity planning tool that aims to improve patient pathway and optimize resource use across care settings. VisionFlow is an AI-supported predictive capacity planning system designed to improve care coordination in decentralized healthcare systems. It addresses inefficiencies caused by fragmented communication and lack of transparency in bed availability and patient transfers.

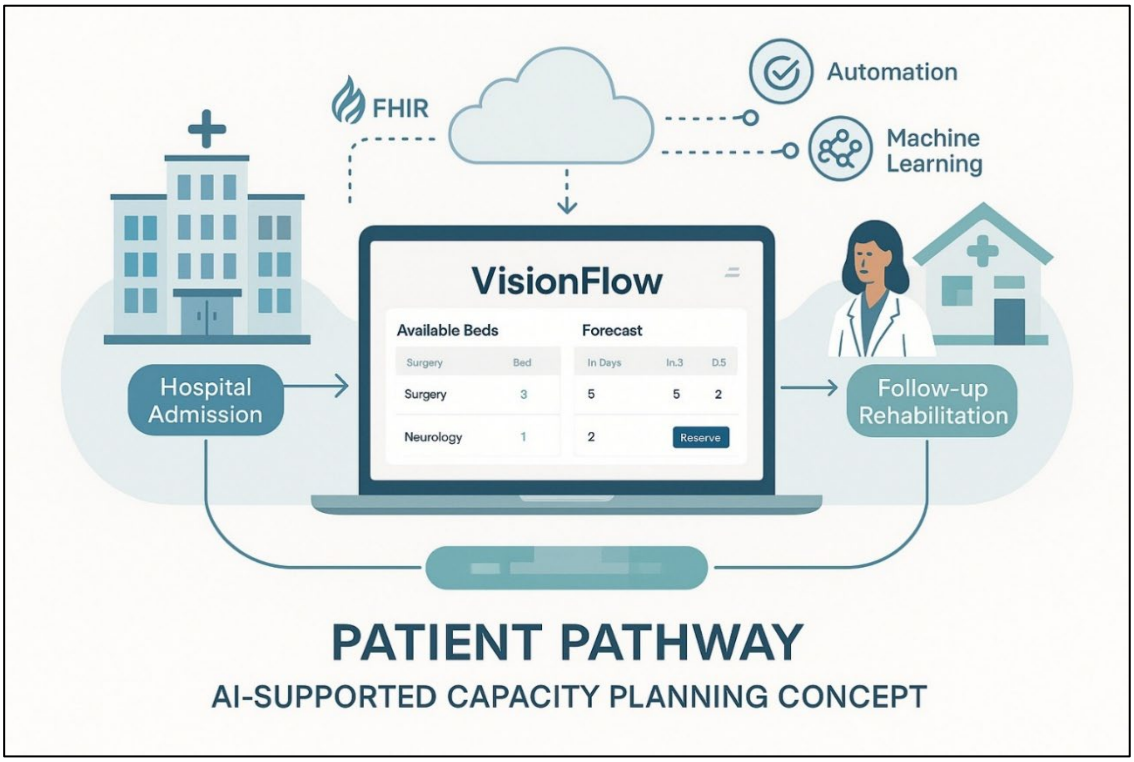

Figure 1. Mockup of the patient pathway within the VisionFlow concept

By integrating automation, machine learning and real-time analytics, VisionFlow enables predictive modeling of bed occupancy and transfer needs, optimizing patient pathway. The system enables seamless data exchange between hospitals, rehabilitation centers and other providers through standardized interfaces such as FHIR. This facilitates faster, safer and more efficient care transitions while simultaneously reducing administrative burdens (Kasparick et al., 2018). Figure 1 shows how patients are guided through the treatment process by using the VisionFlow tool. The idea is that this software solution is used by healthcare staff throughout different healthcare facilities.

Functional Design and Workflow Integration

The following figure 2 presents a visualization of the VisionFlow concept, showing the workflow within the healthcare system. It illustrates the integration of automated data from health information systems (HIS) into VisionFlow to enhance bed management. The figure compares the current process with two proposed steps: Step 1 automates the listing of free beds, while Step 2 uses a machine learning algorithm to predict future bed availability. This system facilitates real-time communication between healthcare providers and customers, optimizing resource allocation and improving patient pathway management.

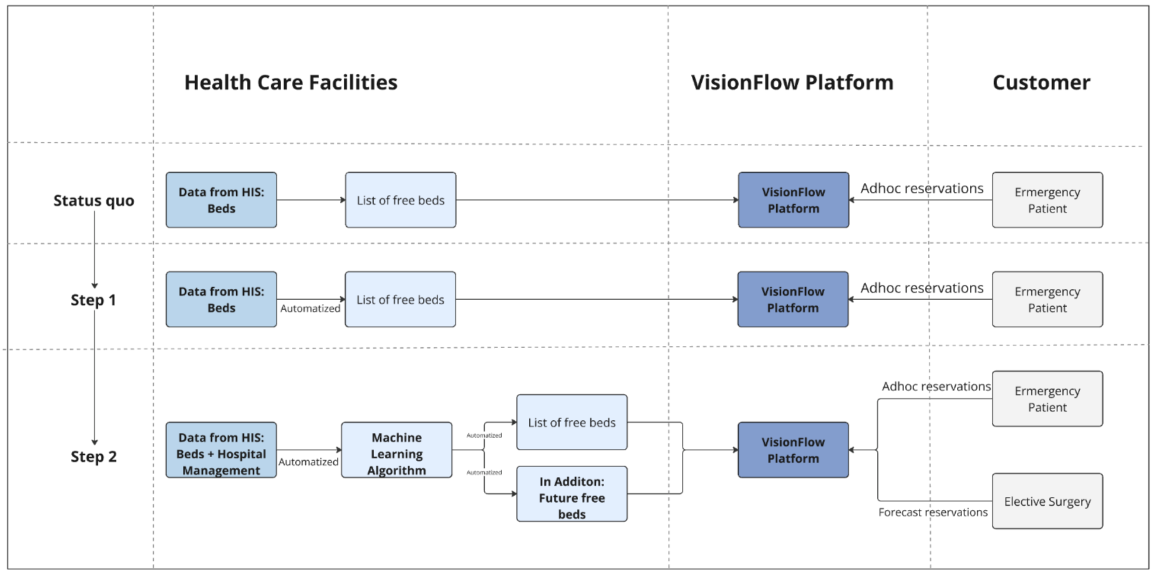

Figure 2. Visualization of the VisionFlow concept

Step 1 is the introduction of Automation in VisionFlow. The VisionFlow innovation involves the implementation of an automated bed capacity management system. The automation of bed allocation is achieved through the seamless integration of data from Hospital Information Systems, which continuously and in real-time update bed availability. This automated data integration allows the real-time creation of a list of available beds without the need for manual intervention.

By utilizing modern interoperability standards such as FHIR, data can be seamlessly transmitted between the HIS and the VisionFlow platform. This data transfer occurs in real-time, ensuring that information is always up to date, allowing immediate responses to patient requests. An additional benefit of this automation is the ad-hoc bed reservation for emergency patients. Through the platform, patients requiring immediate admission can access available beds in real time. This significantly reduces administrative overhead as hospital staff no longer need to manually search for available beds but instead have immediate insights into bed availability. By automating and expediting the bed allocation process, the speed of patient intake is increased, enhancing the overall responsiveness of the healthcare system.

As a second step in the system's development, the VisionFlow platform is further optimized by integrating machine learning (ML) to generate predictions of future bed availability. By leveraging historical data and real-time information, a predictive model is developed to forecast patient discharges and bed availability for the upcoming days. This allows for more accurate bed occupancy planning and a better understanding of future resource requirements.

The machine learning algorithms analyze patterns in bed occupancy history, patient data and discharge forecasts to generate time-specific predictions for bed availability. These predictions are automatically incorporated into the system and continually updated, enabling dynamic adjustments to the current patient pathway. The automation of these forecasts ensures that the platform not only considers current bed availability but also anticipates future bed occupancy. This proactive capacity planning allows healthcare providers to be better prepared for upcoming demands, optimizing resources over the long term. Customer access (i.e., hospitals, clinics and emergency departments) is expanded so they can not only view available beds in real-time but also those likely to become available in the coming days.

By integrating predictive algorithms and machine learning, VisionFlow evolves into an intelligent system that not only reacts to current circumstances but also anticipates future resource needs. This enhances long-term operational efficiency and sustainability within the healthcare system, ensuring better resource management and improved patient care outcomes.

Data Requirements, Sources, System Architecture and Technical Framework

In figure 3 it can be seen which kind of data is needed to provide predictive functions. In addition, the source of each data is displayed there. To build VisionFlow, several types of data are needed. First, general administrative data is required that describes each patient’s hospital visit. This includes information like admission and discharge dates, the department they were treated in, ICD-10 diagnoses and treatment classifications. These are essential for tracking how long patients stay in the hospital and for training the prediction model. In addition, clinical data refelcting the patient’s health status is required. This may include lab results, vital signs at admission, any chronic conditions and information about the level of care or support needed. These health-related details help the model understand why some patients stay longer than others. In addition, demographic data like age, gender, living situation and insurance type can influence the length of stay and are important to include. Finally, process-related data such as transfers between departments, delays in discharge, or waiting times for rehab or follow-up care are useful for improving hospital coordination and planning. (Chowdhury, et al., 2025.) Altogether, these data points help us build a system that shows real-time availability across hospitals and allows us to predict how long a patient might need to stay. This makes resource planning more efficient and supports better patient care.

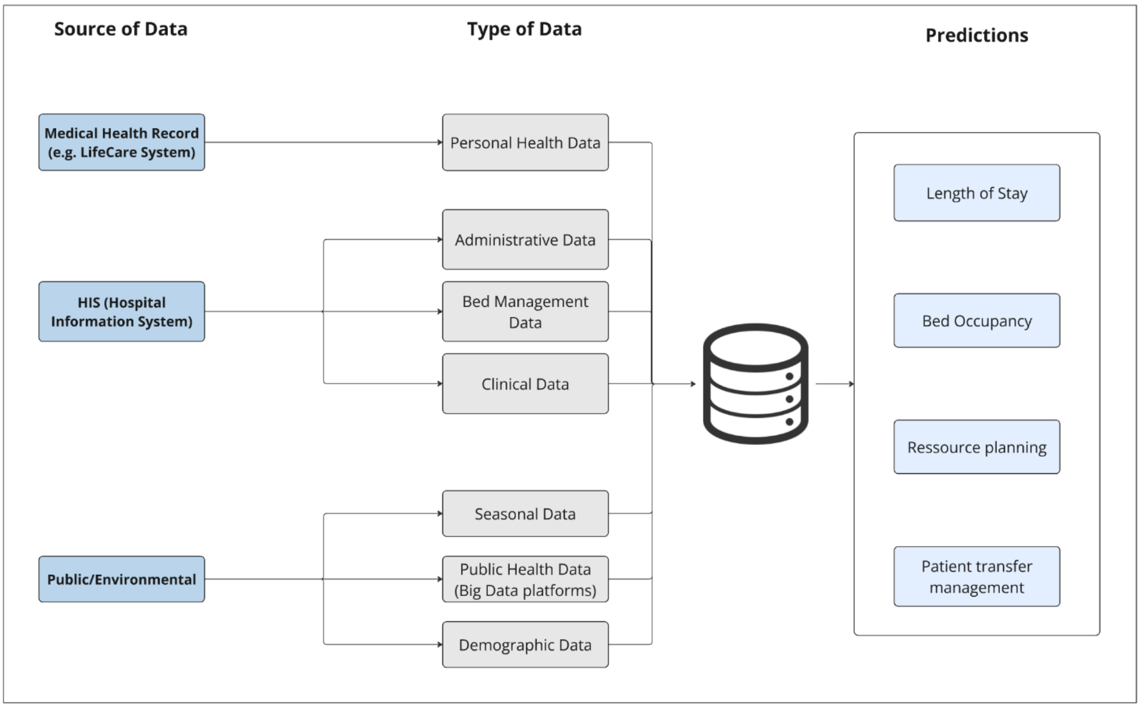

Figure 3. Visualization of the data flow of the concept VisionFlow

The VisionFlow system is built on a modular architecture that aligns with the current integration strategies employed in the Finnish public healthcare system, particularly in the Kainuu welfare region. The architecture is designed to ensure scalability, interoperability and security across multiple healthcare facilities and information systems. All system integrations are implemented using a centralized information-sharing platform (e.g. HealthShare Ensemble), which is already in use in regions like Kainuu. VisionFlow uses standardized integration technologies to ensure compatibility with existing infrastructures and eliminate the need for custom data conversions.

To provide this standardized technology VisionFlow is designed to be based on HL7 FHIR standard to define the structure and rules for exchanging clinical and administrative data. HL7 is already applied in most of the Finnish Healthcare integrations and provides a secure and reliable communication channel for real-time capacity and discharge data. Besides that, VisionFlow could also be integrated by using web service interfaces, SFTP transfers or customized integration. When it comes to data security VisionFlow complies with the EU General Data Protection Regulation (GDPR) and Finnish data protection legislation. (Malinen, 2023.)

Anticipated Impact on Healthcare Delivery and prospects

VisionFlow aims to improve capacity management in inpatient care facilities using digital technologies. The system is directly connected to the hospital information system (HIS) using a standardized FHIR interface, allowing for the automated and real-time transfer of patient and capacity data. Combined with machine learning, this integration enables not only a response to current capacity demands but also a forward-looking approach to planning. Predictive models help hospitals estimate when beds will become available several days in advance, allowing earlier and more informed decisions regarding patient transfers.

This results in more reliable planning, reduced waiting times and more efficient use of resources. Clinical staff can prepare in advance for discharges and admissions and the allocation of specific bed types such as intensive care or general care can be managed more effectively. Overall, VisionFlow supports a transparent, data-driven and future-oriented healthcare system that benefits both patients and professionals.

To ensure the successful adoption of VisionFlow, it is crucial to incentivize healthcare professionals and institutions. Incentives for better resource planning, such as improved working hours and clearer care pathways, can encourage the implementation of digital tools. These incentives align with the overall goal of improving patient pathway and resource utilization, ensuring that the benefits of VisionFlow are fully realized.

VisionFlow offers an innovative solution for optimizing healthcare resource management. Effective planning along the care pathway enhances operational efficiency and boosts staff satisfaction by better utilizing resources such as personnel and equipment. This approach lays a sustainable foundation for continuous improvement in care quality and operational processes. The system can also interface with the hospital pharmacy, enabling proactive adjustments to inventory. By integrating real-time data, the pharmacy can be automatically informed of medication and supply needs, allowing dynamic inventory management and preventing shortages. These data-driven processes eliminate delays and create a more efficient supply chain. In the long term, artificial intelligence could be incorporated to refine demand forecasting and optimize the entire process.

2.4 Discussion and Conclusion

Persistent challenges in inpatient care, such as staff shortages, limited bed capacity, and time-consuming coordination, continue to expose the structural limitations of current hospital infrastructures (Manning & Islam, 2023, 806). Considering these pressures, optimizing patient flow is increasingly recognized as a key strategy for improving care delivery and addressing systemic inefficiencies.

The aim of this article is to improve patient pathway management and optimize healthcare resource utilization. The purpose is to describe how artificial intelligence (AI) can support this development by addressing current systemic challenges. Persistent issues such as inefficient coordination, capacity constraints and delayed care transitions, particularly between hospital and rehabilitation facilities, highlight the limitations of manual, reactive planning approaches (Satake McElroy, 2024). This article explores how AI-based solutions can enable more efficient management of patient pathways and enhance the strategic use of healthcare resources.

In the context of the ongoing healthcare workforce shortages, the ability to plan capacity effectively is becoming increasingly crucial. Digital systems designed to optimize patient pathways could not only mitigate workload peaks but also foster work models that promote a better work-life balance for healthcare professionals. Furthermore, services that are currently difficult to plan, such as early rehabilitation or short-term care, could be better organized and more effectively utilized from a patient-centered perspective. This approach contributes to improve efficiency and enhanced care quality (El-Bouri et al., 2020). Using VisionFlow as a case example the article illustrated how digital AI-supported capacity planning can mitigate these issues. By reducing reliance on phone calls and manual workflows, such system free up clinical staff to focus more on patient care (Hyytinen, 2024; Otten et al., 2021). Tools like VisionFlow represent a shift from fragmented coordination to proactive, intelligent planning. Plannable patient pathways also contribute to more strategic human resource management, an especially valuable advantage amid ongoing healthcare labor shortages (Deutsche Gesellschaft fur Integrierte Versorgung im Gesundheitswesen e.V.[DGIV], 2023). Research on AI-driven hospital planning and forecasting supports the potential of these technologies to optimize infrastructure use and reduce the burden on healthcare staff (El-Bouri et al., 2021; Rajkomar et al., 2024; CADTH, 2024).

A central finding is the need to reframe care delivery from an organization-centered model to a patient pathway-centered perspective (Maier et al., 2025, 3: 19-27). Only when the care journey is managed as an integrated, end-to-end process, digital tools can realize their full potential. This shift requires not only technical changes but also systemic and cultural transformation (Richter and Schlieter, 2024, 120-124). However, improved coordination does not automatically result in direct benefits for healthcare providers. Hospitals, for example, continue to receive patients regardless of how efficiently transfers are organized. Without clear incentives, motivation to adopt such systems may remain low. Therefore, studies showed that a whole system approach is required to improve patient pathway flow in public hospitals (Manning & Islam, 2023, 826). Greater transparency in patient pathway also enables more targeted capacity planning, such as early rehabilitation or specialized care offerings (DGIV, 2023). For providers, this creates opportunities in referral management and hospital marketing as reliable forecasts can strengthen communication with referring physicians and enhance service appeal.

In Germany, the Hospital Structural Fund Regulation already supports digital transformation measures aligned with the VisionFlow concept (Bundesministerium der Justiz & Bundesamt für Justiz, 2024). Similar funding mechanisms may exist in countries like Finland. Embedding such innovations into formal funding frameworks could drive both implementation and long-term sustainability. Finally, data-driven approaches are essential for overcoming inefficiencies and fragmentation in care systems. Amid demographic shifts, financial pressures and staff shortages, the intelligent use of health data is critical to improving care continuity, safety and efficiency. (OECD, 2017; WHO, 2021.) At the same time, ethical and legal frameworks such as the EU General Data Protection Regulation (GDPR, 2016) and national laws (Ministy of Justice, 2018) must be respected to ensure responsible and sustainable implementation.

If supported by effective policy instruments and economic incentives, AI-powered systems hold significant potential to enhance the efficiency, transparency and patient-centeredness of modern healthcare (El-Bouri et al., 2021, 16). Yet there is limited literature available to prove those new approaches and strategies (Manning & Islam, 2023, 826). In addition to organizational and systemic benefits, AI-supported patient pathway management has the potential to improve the overall care experience from the patient´s perspective. More predictable transitions, reduced waiting times and better information flow can enhance continuity and patient safety. However, successful implementation requires not only technical infrastructure but also investment in staff training, change management and user acceptance. These aspects are crucial to ensure that digital tools are integrated meaningfully into clinical workflows. Future research or pilot projects, for instance in a Finnish primary care or rehabilitation setting, could provide valuable insights into the practical feasibility, acceptance and outcomes of AI-based planning systems in real-world healthcare environments. (Nair et al., 2025.)

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3 MediSkill – A Gamified Application for Safe and Structured Medication Training Integrating Gamification and Regulation in the Finnish Healthcare System

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Abstract

Medication safety is an important element of patient care, particularly in complex healthcare environments such as those in Finland, where regulatory frameworks require rigorous training and certification for medication administration. Traditional training methods, often paper-based and fragmented, fail to provide interactive, practical learning experiences that match the dynamic demands of modern healthcare. MediSkill is a digital innovation designed to address these gaps by offering a gamified, mobile, and web-based platform for medication training and assessment. Targeting healthcare professionals, MediSkill leverages scenario-based simulations, interactive quizzes, and a digital "four-eyes principle" to enhance engagement, knowledge retention, and practical competence. The development process integrated legal, technical, and educational frameworks to ensure compliance and effectiveness within the Finnish healthcare system. Early results, including reductions in medication errors following the introduction of simulation tools, highlight the potential of MediSkill to improve patient safety, support professional development, and streamline the licencing process. This article details the rationale, design, and implementation of MediSkill, demonstrating how gamification and digitalisation can transform medication safety training and contribute to safer pharmacotherapy practises.

Keywords: Gamified Learning, Pharmacotherapy Training, Medication Safety, Healthcare Professionals

3.1 Introduction

The safety of medication is a critical component of patient care, particularly in contexts characterised by an increase in complexity and workload. In Finland, healthcare professionals are legally required to pass specific licencing procedures in order to be authorised to administer medications (Finlex, 1994). These procedures include both theoretical and practical assessments. However, current approaches to training are often fragmented, paper-based, or lack opportunities for interactive learning (Valvira, n.d.a).

The present digital healthcare innovation, MediSkill, was conceived to address the identified gap in the field by creating a mobile and web-based training platform for medication. The application uses gamification and learning paths to enhance user engagement and knowledge retention (Ozemir & Dinc, 2022). The innovation has been designed to address healthcare professionals, including nurses, who are in the process of renewing their medication licences.

The aim of the article is to improve the safety of the patients by supporting healthcare providers in delivering safer, more competent medication practises. As stated in the Ministry of Social Affairs and Health's Safe Pharmacotherapy Guide (Ministry of Social Affairs and Health, 2021, 11), all activities must support high-quality and safe pharmacotherapy. The purpose of this article is to describe how patient safety is improved by developing drug handling skills of professionals through an interactive, gamified learning experience. The article presents the rationale, development process, and structure of the MediSkill application. It outlines the legal and technical frameworks required for successful implementation in the Finnish healthcare system and discusses how digital tools like MediSkill can improve medication safety, clinical decision-making, and professional development.

3.2 Background and Theoretical Framework

Background and Importance of the Subject

In Finland, all social and healthcare institutions that provide pharmacotherapy are obliged to possess a pharmacotherapy plan that guides the practical implementation of pharmacotherapy (Valvira, n.d.a). The Wellbeing Services County of North Savo has established a pharmacotherapy plan that defines the categories of medication permits necessitated for nursing staff. Completion of these permits includes an oral or written theoretical examination. Furthermore, the demonstration of practical competence is to be achieved through three to five assessments in pharmacotherapy-related tasks that are part of a nurse's responsibilities (Regional State Administrative Agency, 2023). These competence assessments include the preparation and administration of medications via subcutaneous and intramuscular injections. Moreover, the scope of their work encompasses the identification of oral medications, the resolution of issues in medication lists, and the distribution of medicines.

Harmonising practises in the handling of medicines is instrumental in creating a safer environment for residents from the perspective of pharmacotherapy. Furthermore, it has been demonstrated that a uniform approach to nursing practises facilitates the transition of new nurses between different units. The implementation of agreed practises is conducive to the assurance of safe pharmacotherapy (Santavirta et al., 2020, 113). The Wellbeing Services County of North Savo has already transitioned, or is in the process of transitioning, to fully automated dose dispensing (Wellbeing Services County of North Savo, 2024). The transition to automated dose dispensing has been demonstrated to engender enhancements in the safety of pharmaceuticals (Sinnemäki, 2020, 86). Initially, however, the advent of this change has led to a concomitant increase in the complexity of the verification process. The novel element of this advancement concerns the management of pre-packaged bags and the expertise required to handle them.

In the summer of 2024, the Virrankoti work unit aimed to develop an operational model to ensure nurses' competence in medication dispensing within elderly care housing units. It is evident that, as a consequence of this development process, competence can now be verified using simulated tasks related to medication handling. In support of this assertion, the Medis Basket (see Figure 1) was developed as a tool designed to assess practical medication handling skills. The Medis Basket facilitates the realistic practise of interpreting medication lists, resolving various problem scenarios, dispensing medications into dispensers, aseptic handling of medications, and utilising assistive devices. It also provides guidance on appropriate actions to take in the event of medication falling on the floor. The Medis Basket facilitates the provision of the necessary practical evidence for medication permits to the relevant nurse in charge or supervisor (Regional State Administrative Agency, 2023).

The implementation of the Medis Basket initiative has led to significant enhancements in the safety of medication management at Virrankoti. For Virrankoti, information was available from the HaiPro and Laatuportti deviation reporting programmes (Kauppinen, 2025), which included searches for medication deviations from January 2024 to March 2024, when the Medis Basket was not in use, and from January 2025 to March 2025, when the Medis Basket was in use. It was observed that there was a marked enhancement in the diminution of medication discrepancies. Statistical analysis revealed a 42% decrease in drug deviations during the period in which the Medis Basket was utilised, in comparison with the preceding period. Due to constraints imposed by data protection regulations, it is not possible to furnish a more detailed account of the number of deviations (Kauppinen, 2025).

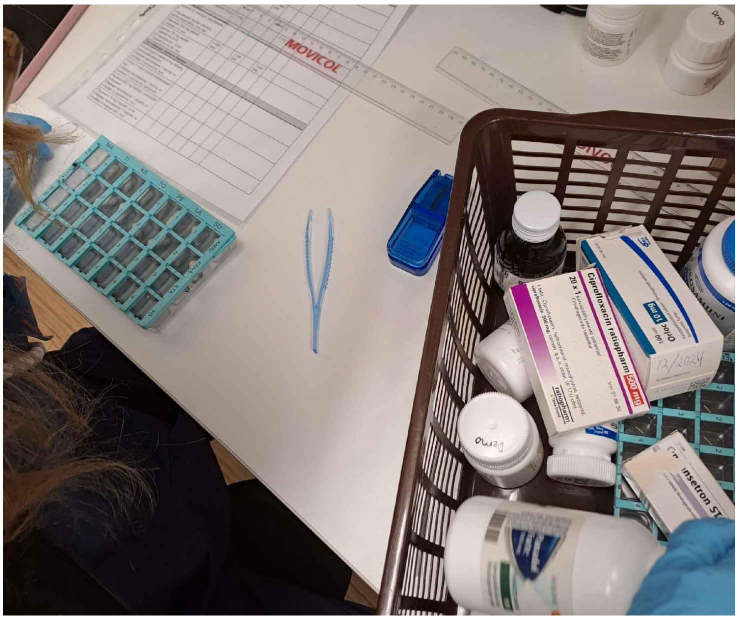

Figure 1. Medis Basket and Related Aids

However, as digitalisation continues to shape modern practices, it is essential to integrate user-friendly digital solutions for training and assessment in pharmacotherapy. Digitalisation signifies a comprehensive societal transformation, reconfiguring conventional working methodologies through technological innovations (Finnish National Agency for Education, n.d.). Traditionally, training in pharmacotherapy often relies on so-called "training baskets," which involve sending or handing out physical training materials to participants. This approach not only represents a significant cost factor but also inherently limits the scope of training, as only a restricted number of medications can be included. These limitations highlight the need for more flexible and scalable solutions. Therefore, it is imperative that the processes involved in ensuring and verifying competence are both simple and efficient. At the present time, there is an absence of a dedicated computer programme or application for this purpose. The adoption of digital solutions could address these challenges by enabling broader access to training materials, reducing costs and expanding the range of medications and scenarios available for practise.

Ensuring Patient and Medication Safety

Patient and medication safety are essential pillars of healthcare systems worldwide. According to the World Health Organisation (WHO), patient safety refers to “the absence of preventable harm to a patient and the reduction of risk of unnecessary harm associated with healthcare” (WHO, 2023). Despite significant advances in medical science, preventable adverse events and errors remain a persistent global challenge, undermining patient outcomes and trust in healthcare systems (WHO, 2021). Recognising the urgency of this issue, the WHO has made patient safety a global health priority (WHO, 2023).

Medication safety is a crucial aspect of the broader patient safety agenda. Unsafe practises and medication errors are among the leading causes of avoidable harm in healthcare, occurring at all stages of the medication process—from prescribing and transcribing to dispensing, preparation, administration, and monitoring (NPSA, 2007; WHO, n.d.). Globally, one in 30 patients suffers medication-related harm, with over a quarter of these incidents being serious or life-threatening (Hodkinson et al., 2020). Overall, medication use is implicated in approximately half of all preventable harm in healthcare, and medication incidents are estimated to account for 10-20% of all adverse events (DoH, 2004, 17). These errors are often rooted in prescription mistakes, incomplete information, or communication failures. Vulnerable populations, particularly older adults and those taking multiple medications, are at heightened risk, underscoring the need for targeted, patient-centred safety strategies (Garcia, 2017). Beyond the human cost, the financial burden of medication errors is substantial, with global estimates reaching $42 billion USD annually (WHO, n.d.).

Use of Gamification in Medical Training

Many conventional training methods do not adequately prepare nurses for examinations or their later professional life, which can affect the quality of patient care in the long term. A key problem with traditional forms of learning is that they are often not flexible enough to adapt to the dynamic changes in the healthcare sector. In addition, traditional training situations can only teach important soft skills such as communication, empathy, and teamwork to a limited extent and are often not realistic. Spontaneous, critical decision-making situations, which frequently occur in everyday nursing care, are also difficult to simulate in traditional teaching. These limitations require new, innovative approaches in the education and training of nursing staff, especially in the sensitive area of medication administration (Iliescu, n.d.). The gamification method offers a promising solution here. Gamification and digital simulation have been found to be good learning methods for those working in the care sector (Saastamoinen, 2023, 85). This involves integrating playful elements into non-playful contexts in order to convey learning content in a motivating, interactive and practical way (Basten, 2022).

The effectiveness of gamified learning can be explained by the uses and gratifications theory, which states that people actively choose media and applications to satisfy specific needs, such as entertainment, achievement, or social interaction. Immediate feedback and rewards, as found in digital games and apps, provide instant satisfaction and thus motivate users to continue engaging with the learning content. The widespread success of mobile devices is also linked to their ability to offer these quick, immersive experiences at any time and place, directly fulfilling users' needs for flexibility and engagement (Ruggiero, 2000; Sundar & Limperos, 2013).

Gamified applications appeal in particular to the intrinsic motivation of learners, promote active learning and improve the long-term retention of knowledge (Basten, 2022). The potential of gamification in healthcare education is also supported by recent studies. For instance, the study by Saja Al-Rayes et al. (2022) showed that gamified learning environments significantly improved the health-related behaviours and learning outcomes of nursing students. This confirms the positive influence of game-based methods on learners' engagement and skill development. However, the study also notes the need for further research to optimise game design in a way that limits misuse, protects user privacy, and sustains long-term interest (Al-Rayes et al., 2022). Similarly, Muangsrinoon & Boonbrahn (2019) also emphasise how gamified digital platforms enhance learner autonomy and adaptability in diverse nursing education settings (Muangsrinoon & Boonbrahn, 2019). Especially scenario-based online learning methods have proven effective in improving clinical reasoning and decision-making, making them particularly valuable for training in medication safety. These findings show that gamification can play a crucial role in modern nursing education. It not only increases motivation and practical engagement but also offers a structured, evidence-based pathway to better prepare nurses for the complex situations (Kırmacı & Kılıç Çakmak, 2024).

3.3 Innovation

MediSkill is a gamified training and certification application designed to digitally replace the traditional Medis Basket used in Finnish medical education. It enables professionals to practise and renew their licences for administering medication through realistic simulations that incorporate safety protocols such as the four-eyes principle. The app guides users through everyday medication scenarios, recognising errors or critical steps such as opening a new pack. To enhance safety, MediSkill requires users to actively confirm important decisions and actions, mirroring clinical practice where high-risk procedures are double-checked by two professionals (ISIMP, 2019, 16). This digital safeguard helps to reduce stress, increase user confidence and systematically build practical competence (Sippola-Kauppi, 2009, 46).

The present case includes a variety of professionals: doctors, registered nurses, public health nurses, midwives, and paramedics who have obtained degrees from universities of applied sciences, such as a Bachelor of Elderly Care or a Bachelor of Science. It also covers practical nurses and other social welfare and healthcare professionals whose qualifications include pharmacotherapy studies that meet the competence requirements for a practical nurse. The case also covers professionals whose degrees lack pharmacotherapy studies, as well as students who are temporarily working in healthcare positions while training for these professions (Valvira, n.d.a).

The purpose of the MediSkill programme is twofold: firstly, to enhance the safety of medication for residents and patients, and secondly, to reduce the threshold for professional medication handling practise. Human error poses a significant challenge to the realm of safe pharmacotherapy (Hughes & Blegen, 2008), underscoring the necessity for effective remedial measures. In this context, the MediSkill programme emerges as a valuable tool, facilitating the implementation of safer pharmacotherapy practises. Incorrect administration of medicines, for instance the administration of the incorrect dose or to the incorrect patient, has the potential to result in fatality in the most severe cases (Hughes & Blegen, 2008). In the context of pharmaceutical management, it is imperative to exercise caution and ensure the possession of the requisite competencies. The successful implementation of safe pharmacotherapy is contingent on the adept handling of medicines, which in turn fosters confidence in the safety of pharmacotherapy. There are several different problem situations where the safety of pharmacotherapy is compromised (Tariq et al., 2024). The MediSkill programme facilitates the rehearsal of numerous problematic scenarios.

Methodological approach

The basis of the MediSkill innovation was the development of a gamified application and computer-based programme for healthcare professionals. The application is designed to support licenced professionals in Finland in renewing their medication administration credentials while simultaneously allowing them to train practical skills related to medication dispensing. As part of the first phase of the project, a comprehensive market and literature research was conducted in order to systematically analyse existing digital solutions, regulatory frameworks and scientific findings in this area. The literature research was divided into three main topics: technical implementation, medical aspects and licencing. The technical implementation focused on the evaluation of existing digital and simulation-based training tools, including the potential of virtual reality for skill-based training. The medical perspective included the investigation of relevant medical concepts, in particular with regard to medication lists and their potential integration into the planned application. Licencing aspects were also considered to identify regulatory requirements and legal frameworks for the proposed solution. Key terms such as “medication dispenser”, “medication training”, “nursing education”, “digital medication management”, “medication safety”, “gamified learning”, “pharmacotherapy training”, “medication dispensing regulations” and “licensing” were used to ensure a comprehensive and well-founded search. The search was carried out in German, English and Finnish in order to generate the broadest possible database. The analysis was based on a large number of scientific databases, including Google Scholar, SpringerLink and PubMed. In addition, relevant publications from national health ministries like Valvira in Finland and relevant holdings from the university libraries of the participating project partners were consulted.

The market research revealed that there is currently no similar app in Germany or Finland that focuses specifically on simulation-based, gamified training for medication administration for nursing staff and at the same time offers the possibility of licencing. In the context of the German market, the research identified that existing digital health applications are primarily focused on medication reminders on the patient side. Apps such as Medisafe support patients with individually configurable medication schedules and reminder functions to take medications correctly (Medisafe, n.d.; Kahl, 2019). However, these tools are not designed for healthcare professionals, and do not offer interactive, simulation-based training features or licencing functionality. Further analyses showed that digital learning platforms for professional health and nursing in Germany, such as CNE.online (Certified Nursing Education), primarily provide theoretical content and general pharmacological knowledge (Thieme, n.d.). They do not simulate the complex, hands-on process of medication administration or evaluate practical competence in real time. MEDCH, a German-language mobile trainer for medication safety, provides practical knowledge on key clinical drugs and is directly linked to the evidence-based medication database of the Diagnosia application (MEDCH, n.d.; Diagnosia, n.d.). Through personalised AI-driven challenges, MEDCH presents speciality-specific questions (MEDCH, n.d.). It uses personalised AI challenges to pose discipline-specific questions but does not offer a gamified simulation environment or practical competency tests with licencing options (MEDCH, n.d.).

In Finland, existing digital applications related to medication handling include The Master of Medicine game (Savonia, 2020), which allows users to practise drug dosage calculations in a gamified setting. Another example is IMAGINE (Interactive Medication Administration Game Intervention for Nurses Education), a 3D simulation game developed at the University of Eastern Finland as part of the MASI (Medication Administration Safety and Interventions) project (Härkänen, 2025). While both tools take a different approach compared to MediSkill, IMAGINE is more closely aligned, as it also aims to enhance the safety of pharmacotherapy through gamification. However, no existing programme in Finland currently offers a comprehensive, simulation-based platform for practising and validating medication administration competencies in nursing. The requirements for the planned application were systematically determined through a comprehensive analysis. The first step was a structured collection of ideas in the form of brainstorming sessions, in which existing problems and potential functions and requirements of the application were discussed. This allowed central areas of application and essential design elements to be narrowed down at an early stage.

In order to validate the requirements that had been developed, qualitative interviews were conducted with nurses in Finland. The purpose of conducting such interviews was twofold: firstly, to gain a more in-depth understanding of the challenges that users were facing; and secondly, to identify any needs and expectations that the users had. Three nurses from the Virrankoti unit were interviewed about the MediSkill programme, providing valuable insights into current issues.

Since the summer of 2024, a manual Medis Basket has been utilised for medication handling, which has resulted in slow training due to the reliance on real products and equipment. It is evident from the interview that the MediSkill program facilitates more efficient practice and demonstration delivery (Kauppinen, 2025). The results of the interviews are summarised in Table 1 with regard to the advantages and disadvantages of the Medis Basket.

Table 1. Advantages and Disadvantages of the Medis Basket

Advantages	**Disadvantages**
Provides a realistic simulation of medication handling, allowing users to gain practical experience in a controlled environment.	Presents potential safety concerns, particularly regarding the risk of handling actual medications during training exercises.
Incorporates the use of supportive tools and aids, which can enhance the learning process and mirror real-world medication administration scenarios.	Identification of medications can be challenging, as the use of candy or placebo substitutes may not accurately replicate the appearance of real pharmaceuticals, potentially limiting the fidelity of the simulation.
Offers an authentic representation of medication administration, contributing to a more immersive and effective training experience.	

The primary benefit identified was the realistic experience of handling medicines, although with placebos and candies. Nevertheless, the principal disadvantage is that the products in the Medis Basket do not accurately resemble real medicines, which makes it difficult to learn what each medicine looks like. Table 2 outlines the advantages and disadvantages of the MediSkill programme based on the interview.

Table 2. Advantages and Disadvantages of the MediSkill Programme

Advantages	**Disadvantages**
Facilitates efficient and accessible training due to its user-friendly structure.	The simulation does not accurately replicate the complexities of real medication handling, potentially limiting skill transfer to clinical settings.
The visual characteristics of medications can be modified, enabling tailored educational scenarios and correction of appearance-related errors.	The programme does not adequately address the correct use of assistive devices, which may impede comprehensive skill acquisition.
Enables individuals without professional qualifications to engage in practice sessions, broadening accessibility and inclusivity.	
Provides a safe training environment by eliminating the risk of confusion with actual pharmaceuticals, thereby preventing medication errors during practice.	

A significant benefit of this approach is that the medications can be made to appear realistic. Furthermore, the issue of safety was emphasised, as the MediSkill programme eliminates any risk of interference with real medications.

Application requirements

As mentioned in chapter three, the licencing of nursing staff for the administration and dosing of medication is mandatory in Finland. The MediSkill app offers an interactive, gamified learning platform that specifically prepares users for this licencing examination and supports the training of relevant skills through playful elements. To ensure that the training content is used efficiently and appropriately, a clear introduction is essential when the app is first started. Intuitive instructions ensure that professional caregivers understand the full range of functions of the application and can make optimum use of them. For professionals, the app must clearly outline how the learning content is structured and how the licencing process works after successful completion (Krath & Korflesch, 2021).

According to Eurostat (2024), around 70,800 nurses were employed in Finland in 2022, with the age group varying from under 35 to over 65. The majority of nurses were between 35 and 54 years old and the predominant gender was female. In order to reach this broad target group, the application must be designed in such a way that different age groups and users with different levels of digitalisation are addressed equally (Eurostat, 2024). In addition to age, general accessibility and user-friendliness also play a key role. The application must be designed in such a way that people with sensory impairments such as hearing or visual impairments can also work with it without any problems. This requires the integration of functions such as voice output, screen reader compatibility and subtitles for audiovisual content. In addition, alternative forms of presentation such as simple language or visual instructions could further facilitate access (Spencer, 2024).

Another fundamental aspect is adapting the level of difficulty to the respective learning level of the user. Learning units that are too easy can be perceived as boring, while content that is too difficult can cause frustration and lead to a loss of motivation. Research shows that engagement is achieved when the challenges match the individual skill level of the user. The MediSkill app should therefore support adaptive learning by offering different levels of difficulty and learning methods, including interactive videos, texts, images and audio files (Nicholson, 2015). To ensure a high degree of flexibility and location-independent use, MediSkill must be able to function without the need for a specific environment or additional devices. This means that users can access the app regardless of their location and do not need any physical aids such as dummy medicines. This makes it much easier to access the training content. The specific aspects of flexibility and location-independent use in mobile applications are discussed in the systematic review by Chandran et al. (2022). The study highlights that mobile applications in medical education provide high versatility and reduced dependency on regional or site boundaries, allowing users to access training content both online and offline. This flexibility is crucial as it enables healthcare professionals to engage with educational resources without the need for specific environments or additional physical aids (Chandran et al., 2022).

In addition, studies indicate that long-term integration of gamified elements improves motivation and learning performance (Attali, 2015). MediSkill should therefore not only offer gamified features on a one-off basis but also develop them over longer periods of time and adapt them to the needs of users. Continuous evaluation of the app through user data analysis and feedback mechanisms is essential to ensure that it fulfils its purpose optimally (Attali, 2015). Only anonymised or aggregated data is used, while real patient data is not processed in the application. Furthermore, the collection, storage and utilisation of the necessary user data must comply with the applicable data protection guidelines in Finland in order to ensure the security and protection of users (refer to chapter 4.3).

Statutory and legal requirements

MediSkill needs to be officially recognised by Valvira, the National Supervisory Authority for Welfare and Health in Finland. Valvira is responsible for the regulation, licencing, and supervision of healthcare and social services. They also ensure compliance with healthcare laws and professional education standards, and they manage the Terhikki register, which tracks licenced healthcare professionals. For MediSkill to be an accepted training and certification platform, it must align with Valvira's standards for professional education and digital health tools (Valvira, n.d.b; Valvira, n.d.d; Valvira, n.d.e).

As a digital healthcare solution, MediSkill must strictly adhere to the European General Data Protection Regulation (GDPR) to ensure secure storage & handling of personal and patient-related data, the user content management (allowing individuals to control their data usage) and the encryption & access control to prevent unauthorised access. If real patient data is processed, additional legal requirements from Finnish data protection authorities must be followed (DLA PIPER, n.d.; Office of the Data Protection Ombudsman, n.d.). To enhance practical training and real-world application, it could be beneficial to integrate MediSkill with MyKanta, the national electronic health record (EHR) system in Finland, managed by Kanta Services. This would allow access to real or simulated patient cases for training, verification of professional licences via existing healthcare databases and compliance with Finnish health IT interoperability standards. A legal assessment would be required before working with actual patient records, as additional security and data access restrictions apply (Kanta-Palvelut, Kansaneläkelaitos, 2024; Milieu Ltd. & Time.lex, 2013).

Since MediSkill assists in medical decision-making (e.g., drug dosing, therapeutic training), it likely qualifies as a medical device under the EU Medical Device Regulation (MDR). The app must be classified and regulated by Fimea (Finnish Medicines Agency), which oversees medical devices. Depending on its risk level, MediSkill may require certification (e.g. CE marking). A risk assessment must be conducted to determine whether it falls under Class I, IIa, IIb, or III according to MDR. For full compliance, collaboration with regulatory consultants and legal experts may be required (European Commission, 2021; Fimea, n.d.; RegDesk, 2019).

Functionality and mockup of the application

The application is thoughtfully designed to ensure a smooth and intuitive user experience. Each page provides step-by-step guidance with clearly marked touchpoints, making navigation simple and efficient. Informative images and instructional videos enhance understanding, while an integrated speaker icon, as shown in Figure 2 and 3, on every page allows users with visual impairments to access audio explanations of the learning content (Torres-Carazo, Rodriguez-Fórtiz & Hurtado, 2016). The user journey begins with the creation of an individual account. Users must be registered with JulkiTerhikki, the official register maintained by Valvira in Finland (Valvira, n.d.). Once registered, professionals can log in to the MediSkill app using their personal identification number. Upon login, a verification code will be sent to the email address provided during registration. This code must be entered to complete the login process, ensuring a high level of authentication security.

The practise component of MediSkill is designed for professional caregivers with foundational knowledge in medication management. It offers advanced, practise-oriented content that addresses real-world clinical challenges. Users engage with complex case scenarios requiring clinical reasoning and critical thinking - such as managing polypharmacy in geriatric care or identifying contraindications in patients. The curriculum includes interactive modules on pharmacodynamics, drug interactions and strategies for risk prevention. Additionally, it covers key areas such as legal responsibilities, documentation standards and ethical considerations in medication administration (National Center for Biotechnology Information, n.d.). Hands-on simulations and quizzes, like in Figure 3, support skill development in emergency response, injection administration and patient-specific medication planning. These scenarios are designed to sharpen decision-making and improve the detection of medication-related risks and errors. The training is structured across multiple levels, each building on the previous, covering advanced topics like dosage calculations and pharmacological principles (OpenStax, 2024). A final assessment concludes each level to ensure knowledge retention and competence. Figure 1 illustrates the structure of one such level.

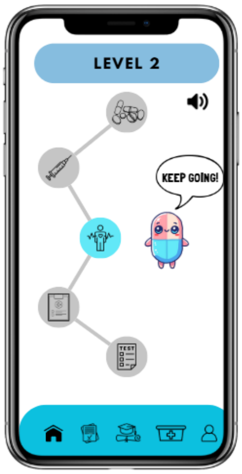

Figure 2. Mock-Up from Level Overview

Figure 3. Mock-Up from Quiz

Upon completion, participants have the opportunity to take an exam and earn the certification for their medication licence, which may enhance their professional qualifications and career prospects. A key feature of the app is Medi, a mascot designed to motivate users throughout their learning experience as shown in Figure 2. At the same time, Medi functions as an interactive chatbot, answering medication-related questions and providing immediate support.

Technical background

The following section presents the technical background of the MediSkill application, including the back and front ends, a technical overview and the database. MediSkill is a healthcare software application designed to support health and medical services. It will be available on mobile devices, such as smartphones and tablets, and computers. Healthcare apps aim to support the professionals and ensure patient safety (Pihtovnicov, 2025).

The application employs a client-server model; as such, it necessitates both a technical back end and front end. Server-side is the back end with the logic, the user management and the data storage of the application. The back end provides an Application Programming Interface (API) to which the front end can connect. Regarding the exchange of medical data, it is recommended that FHIR (Fast Healthcare Interoperability Resources) be utilised, as this is the standard for data exchange within the Finnish healthcare system (HL7 Finland, 2025; Lamprinakos et al., 2014). It is imperative that the back end of the system is designed to guarantee the security of the application, including the authentication of users and the protection of data (Sánchez et al., 2017; McMurry et al., 2024). It is also recommended that the application be hosted on a cloud service such as Google Cloud, on account of the prevalence of cloud usage in Finland, as exemplified by the Kanta Services, the national digital health service (Gómez et al., 2021; Lee & Kim, 2024).

The front end constitutes the user interface, with which users interact via buttons, menus and screens. In the context of this study, MediSkill will be available on both mobile devices and on computers. The primary emphasis will be on the area of usability, gamification and language options.

It is imperative that a straightforward and intuitive interface is developed for medical professionals and trainees, with the objective of ensuring the usability and acceptance of the professionals who utilise MediSkill (Balakrishnan, 2024; Pihtovnicov & Teres, 2025). In order to guarantee the aforementioned points, it is recommended that gamification elements such as progress bars, badges and various levels for the current state of knowledge be employed (Lee et al., 2017). In relation to the linguistic options, it would be logical to incorporate Finnish, Swedish and English (Tallroth, 2012). The database is responsible for storing user progress, licencing information and training records. To guarantee the security of the app users, the data storage is encrypted and regularly backed up (Dias, et al., 2021; Pihtovnicov & Teres, 2025).

The Innovation and its Effectiveness

The employment of the innovative and gamified MediSkill application not only digitises the Medis Basket training method and the licencing of healthcare professionals but also contributes to other important and relevant outcomes in this healthcare sector. These impacts are discussed and explained in the following. The transfer of the Medis Basket to a digital application leads to a reduction in expenditure within the area of training and licencing of healthcare professionals. On the one hand, the cost of sample medicines can be saved, and on the other hand, fewer staff are needed to provide training and licencing to healthcare professionals, as this is handled through the app. The financial benefits of this approach include the capacity to increase the number of healthcare professionals who can be trained and licenced. Furthermore, the staff savings can be utilised for other tasks. In addition, continuous digital training has the potential to significantly reduce medication errors, which, as mentioned in chapter 3.2, are a major source of avoidable costs in healthcare systems. Continuous, app-based skills training can reduce the rate of medication administration errors, helping to reduce these significant costs and improve overall patient safety.

Another relevant and sustainable effect is the collection of data through the digitalisation of the training and licencing process. All data generated during the process can be stored and processed. For instance, the data collected can be utilised to generate statistics that can be employed to determine which errors are common, which medications are implicated in causing the errors, and the context in which the errors are made. The subsequent analysis of this data can facilitate the development of the application and the training process as well as the adaptation of the scenarios. This approach is founded upon the PDSA cycle which is defined as "to adapt changes aimed at improvement". In this context, PDSA signifies a set of steps comprising Plan, Do, Study, Act (Taylor et al., 2013, 2.) The planned training scenarios and exercises are carried out by the healthcare professionals and the exercises can then be evaluated and adapted based on the data collected. In relation to the licencing aspect, data can be collected in order to demonstrate healthcare professionals' performance in the examination and identify any areas of difficulty. The utilisation of this data facilitates the enhancement of training scenarios and the more effective preparation of healthcare professionals for the examination.

Furthermore, MediSkill streamlines the process by integrating different departmental Medis Baskets within a unified application. Healthcare professionals can select which department they belong to at the start and receive the appropriate Medis Basket. The functionality of MediSkill also enables healthcare professionals to undertake the training for licencing without the necessity of physical presence or temporal constraints. They are not tied to a schedule, do not need to be in the hospital and do not need a free workstation. Finally, the application facilitates the expeditious and effortless updating of information. Consequently, new medications and changes to medication dosages can be seamlessly integrated into the application, along with the capacity to add new contraindications. It is also possible to record and implement changes to the training and licencing process in a timely manner. Digital solutions such as MediSkill have been developed for the purpose of ensuring that healthcare professionals receive training at the latest level of knowledge and that new information is incorporated directly into the app. This immediacy is crucial, as it not only enables evidence-based clinical decisions, but also makes a significant contribution to preventing medication errors and improving patient safety (refer to chapter 3.2). In summary, the implementation of MediSkill leads to several positive effects that extend beyond the digitisation of the training and licencing process. These include cost savings, the processing and utilisation of collected data and its subsequent development, streamlining of the process, straightforward updating and expansion of information, and independence from time and place.

3.4 Future Development

Expansion to Non-Professional Users

In addition to licenced healthcare professionals, MediSkill also addresses a wide range of non-professional users who play a vital role in medication management (Finnish Association of Family Carers, 2015). These include family members caring for elderly or chronically ill relatives, patients managing their own long-term therapies (Sosiaali- ja terveysministeriö, n.d.), nursing students, career changers in the healthcare sector, and international professionals undergoing orientation in the Finnish system. For these user groups, MediSkill provides a safe, structured, and intuitive environment to learn how to handle medications correctly in everyday situations. The app's user-friendly design, step-by-step instructions, and visual feedback make it accessible even without a formal medical background. By offering tailored training paths and practical simulations, MediSkill empowers non-professionals the opportunity to build competence and trust in medication-related tasks, just like professionals (Saastamoinen, 2023, 10) - helping to reduce errors, increase patient safety, and support continuity of care across diverse settings. Beyond being a learning and certification platform, MediSkill supports users in their daily routines through a range of practical tools. Family caregivers can manage medication schedules, receive automated reminders, and log symptoms or side effects. Also, for non-professional users, a simple reminder function could be added to alert them when the medication is nearly empty, ensuring timely replacement.

Technical and Functional Enhancement

To ensure the continuous development of the app, several additional features could be integrated. An important improvement would be the implementation of a feedback mechanism that allows users to evaluate the app and suggest improvements. In-app feedback tools such as surveys, live chat, and usability tests are crucial for healthcare app development. These methods help identify bugs, improve user engagement, and ensure that the app evolves according to the needs of users - including both professional and non-professional caregivers. Their insights could be valuable in tailoring the app more closely to users' needs (Dogtown Media, 2023).

Furthermore, the number of foreign-born nurses in Finland is steadily increasing, which highlights the need for better linguistic support in training tools. Integrating additional languages into MediSkill would be essential to support international healthcare professionals, such as nurses from Norway, Germany, or Estonia. Providing multilingual options would not only enhance usability for a diverse workforce but also facilitate the app's adoption and distribution in other countries, thereby broadening its overall impact (Nana & Abbie, 2025; Sairaanhoitajat, n.d.; Tallroth, 2012).

In terms of user engagement and practical training, augmented reality (AR) could be used to simulate simple tasks such as drawing up a syringe or dosing medication. Virtual reality (VR), on the other hand, could be applied for more complex simulations - such as administering emergency medication. These technologies would enhance the gamification aspect of the app and make it even more valuable for professional users (Tene et al., 2024; Xu et. al, 2021). The inclusion of interdisciplinary training modules - where teams of doctors, nurses, and pharmacists work together on case studies - could also be beneficial. This would emphasise teamwork, communication, role understanding, and process coordination in a healthcare setting (Agbo et al., 2021).

Professional caregivers can upload patient-specific medication lists, track available stock, and generate dosage reports. These functions improve workflow efficiency, enhance communication with healthcare providers, and strengthen medication safety through structured digital documentation. By integrating intelligent, context-aware checks throughout the medication process, MediSkill meaningfully extends the traditional four-eyes principle (Ministry of Social Affairs and Health, 2021, 66; Kinlay et al, 2021). Instead of relying solely on the physical presence of a second verifier, the app performs intelligent, context-sensitive verifications throughout the entire medication workflow, both during training and in real-life use. In daily use, MediSkill becomes a digital companion that supports carers in routine tasks. It prompts users to confirm critical actions such as opening a new pack or checking the dosage and expiry date before administration. The system automatically alerts users to inconsistencies, missed steps or potential interactions based on the medication profile. This virtual verification layer ensures that safety protocols are consistently adhered to, even in high-pressure or low-staffed environments. It enables professionals to work more autonomously while maintaining strict standards of care. MediSkill also reinforces best practise through instant feedback and structured documentation, helping to prevent errors in real time and reduce the mental strain of complex medication routines. In this way, the app not only educates users, but also actively supports and safeguards the medication process as an integrated part of daily care practise (Medisafe, n.d.b). The integration of MediSkill into the existing purchasing management systems to facilitate the procurement of medications within the application process is a viable option, although it is beyond the scope of this article to delve into such intricate details.

3.5 Conclusion

The aim of the article was to improve patient safety by supporting healthcare professionals in delivering safer and more competent medication practises. Medication errors are a major cause of preventable harm in healthcare, leading to extended hospital stays, long-term disabilities, and even death (Courtenay, 2009; Casallas, 2017). In Finland, legislation (Finlex, 1994; Valvira, n.d.a) requires both theoretical and practical competence from healthcare professionals before they are authorised to administer medications. Despite these requirements, current training methods are often outdated, fragmented, and lack interactive or practical elements, making it difficult to ensure consistent medication competence and patient safety (Regional State Administrative Agency, 2023). To address these challenges, the purpose of the article was to describe how medication safety can be enhanced by developing drug handling skills through an interactive, gamified learning experience. The primary focus is to demonstrate how gamification - the use of game-like elements in non-game contexts - can be leveraged to enhance medication management training for both healthcare professionals and informal caregivers. Focusing on the development and implementation of the MediSkill application, the article shows how digital, gamified learning tools can improve knowledge retention, motivation, and practical skill acquisition. Ultimately, these approaches can reduce medication errors and promote patient safety (Ministry of Social Affairs and Health, 2021).

MediSkill is presented as a digital solution designed to replace traditional manual training tools such as the Medis Basket. The application offers a mobile and web-based platform that incorporates gamification elements - such as quizzes, realistic simulations, and scenario-based learning - to create an engaging and interactive training environment (Ozemir & Dinc, 2022; Saastamoinen, 2023). A key innovation is the digital implementation of the “four-eyes principle,” which prompts users to confirm critical steps in medication administration, reflecting real-world safety protocols (Sippola-Kauppi, 2009). This interactive approach supports the development of both technical and soft skills, including communication, teamwork, and decision-making, which are essential in clinical practise (Kırmacı & Kılıç Çakmak, 2024). The app is designed for a wide range of users - including nurses, doctors, practical nurses, and non-professional caregivers - guiding them through everyday medication scenarios and helping them identify and manage potential errors or critical steps, such as opening new medication packs. Additionally, MediSkill provides instant feedback to reinforce learning (Valvira, n.d.a).

The innovative MediSkill application not only digitises the Medis Basket training and licencing process but also delivers significant benefits for healthcare organisations and professionals. By transitioning to a digital platform, MediSkill reduces training costs, minimises the need for physical resources and staff, and enables a larger number of healthcare professionals to be trained and licenced efficiently. The app's continuous, data-driven training approach has the potential to significantly reduce medication errors - one of the leading sources of avoidable healthcare costs - while improving patient safety. Moreover, MediSkill's digital infrastructure supports the collection and analysis of training data, facilitating the continuous refinement of training scenarios and enabling rapid updates to reflect new medications or protocols. Its flexibility allows healthcare professionals to complete training anytime and anywhere, without being tied to physical locations or fixed schedules. This comprehensive digital solution streamlines processes, enhances data utilisation, and ensures that training remains current and effective in a dynamic healthcare environment.

The article places MediSkill within the broader context of digital transformation in healthcare education, highlighting the growing need for scalable, user-friendly, and effective training solutions (Finnish National Agency for Education, 2025). Evidence from real-world data, such as the 42% reduction in medication deviations at the Virrankoti elderly care unit following the introduction of the Medis Basket (Kauppinen, 2025), underscores the potential of structured, simulation-based training - whether physical or digital - to improve medication safety. The article also draws on recent research showing that gamified and scenario-based learning methods significantly enhance engagement, autonomy, and clinical reasoning skills, especially in high-stakes areas like medication safety (Al-Rayes et al., 2022; Muangsrinoon & Boonbrahn, 2019).

In conclusion, the article successfully achieved its aim of improving patient safety by supporting healthcare providers in delivering safer and more competent medication practises. It also fulfilled its purpose by demonstrating how the development of drug handling skills through an interactive, gamified learning experience can effectively enhance medication safety. By presenting the MediSkill application as an innovative digital solution, the article illustrated how modern training methods can reduce medication errors, strengthen professional competence, and promote safer pharmacotherapy in everyday healthcare settings.

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4 HätäAPU: A Community-Based Digital Emergency Application for Aging Populations in Finland

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Abstract

Finland's aging population and declining healthcare workforce pose major challenges to emergency care, especially in rural areas where delayed responses can be life-threatening. Most elderly individuals prefer to age at home, valuing autonomy, safety and social connection. The aim of this article is to promote the quality of life for patients receiving home care. The purpose of the article is to describe how to enhance the quality of life for older people by promoting life-saving methods through the integration of social support from the neighborhood and healthcare workers. The HätäAPU application was developed as a solution to bridge this gap by enabling timely, community-based emergency support. HätäAPU is an artificial intelligence (AI)-supported mobile and wearable solution for emergency detection and response. It enables users to activate help via voice command or sensor alerts. Based on triage logic (Levels I-III), trained neighbors and caregivers are engaged to respond quickly. The app integrates user health data (with consent), geolocation and real-time communication features, ensuring a fast and structured response.

Keywords: Hätäapu application, quality of life, home care

4.1 Introduction

Finland is currently facing a healthcare challenge that stems from its rapidly ageing population and its geographically sparse settlement structure. By 2030, over 26 % of Finland's population will be over 65 years old, significantly increasing the need for efficient and timely emergency care services, particularly in rural areas where the distances to hospitals and care facilities are considerable and response times can be critical. The shortage of caregivers, estimated to reach 30,000 by 2030, and the lack of immediate assistance in many emergency cases, contribute to a growing burden on the Finnish health system. (Global Coalition on Aging, 2018, 10.) The quality of life, understood as encompassing an individual's physical, mental, and social well-being, with components including health, safety, social relationships, and self-determination stated by the World Health Organization [WHO] in 2012 (WHO, 2012, 3). The concept of quality of life has been defined from the perspectives of various academic disciplines, and there is no single unified theory of the concept. Despite the differing views across disciplines, there is a shared understanding that quality of life encompasses both objective and subjective dimensions. It is a multidimensional concept that concerns everyone. (Räsänen, 2011, 70.) Quality of life may hold slightly different meanings for individuals of different ages. For older adults, key contributors to quality of life include independent management of daily activities, engaging in meaningful tasks, social relationships, and access to care and support when needed. (Tikkanen et al., 2023, 54.) Well-being can be considered a related concept to quality of life (Räsänen, 2011, 68). In her dissertation, Räsänen (2011, 68) defines one perspective of well-being in older adults as the ability to live independently, safely, healthily, and socially within their own residential, living, and service environment.

Finland's current national policy emphasizes providing care and rehabilitation for older adults at home. The objective is to reduce the reliance on 24-hour institutional care and enable individuals to live in their own homes for as long as possible. Efforts are being made to develop services that support living at home. (Tikkanen et al., 2023, 54.) According to the Act on Supporting the Functional Capacity of the Older Population and on Social and Health Services for Older Persons (980/2012), wellbeing services counties are obligated to provide high-quality social and health services to older individuals. These services must support the wellbeing, health, independent functioning and participation of older persons. Particular attention must be paid to preventive and rehabilitative measures and services provided at home. (Vanhuspalvelulaki 980/2012.)

Digital solutions have been developed to address similar challenges in other countries. Germany, for instance, has implemented the Nora Notruf-App for barrier-free digital emergency calls (Nora Notruf-App, n.d.) and Region der Lebensretter, a volunteer-based system that alerts nearby trained first responders (Region der Lebensretter, 2024). In Finland, apps such as FirstAid Finland prioritise education and self-help (Suomen Punainen Risti, n.d). Nevertheless, none of the aforementioned solutions fully integrate community-based triage and real-time support between neighbors, caregivers, and emergency services, especially in the Finnish rural context. The aim of this article is to promote the quality of life for patients receiving home care. The purpose of the article is to describe how to enhance the quality of life for older people by promoting life-saving methods through the integration of social support from the neighborhood and healthcare workers. The application presented in this project, termed HätäAPU, the app presented in this project, aims to close this gap. It combines automated emergency detection, voice-controlled communication, and a neighborhood-based response network.

4.2 Background

People are now living longer and the population is aging. Most people are expected to live to at least 60 years old or even older. One in six people will be over 60 by the year 2030. It is estimated that by 2030 there will be 1.4 billion people over the age of 60, and this number is expected to double by 2050 to 2.1 billion. The number of people over 80 is projected to triple between 2020 and 2050. (WHO, 2024.) In Finland too, the number of people over 65 is increasing in proportion to other age groups. The growing number of older people also increases the need for elderly care services. On the other hand, the decreasing number of working-age people affects productivity and the funding of the welfare state. (Dufva & Rekola, 2023.) The sustainability of the current service system already requires that people maintain their functional capacity for a longer time, thereby reducing the burden on the system. (Sosiaali-ja terveysministeriö [STM], 2020, 30.) In the future, a focus on holistic well-being will become more important, including prevention of problems, ethical practices, inclusion, community, and strengthening happiness. This requires a shift in current mindsets and ideals. Well-being is not only an individual matter but also involves the well-being of the environment and the community. (Dufva & Rekola, 2023.)

According to WHO, quality of life is an individual’s perception of their position in life in relation to their goals, expectations, and concerns. This perception is influenced by the culture and value systems in which the person lives. (WHO, 2012.) The quality recommendations of the STM (2024,

11) regard the process of aging as valuable, meaningful, and worthy of respect. An older person should have their place in society and feel confident that they will receive support when needed. The voices of older people must be heard in order to identify factors that affect their daily life and promote their well-being. Older people themselves consider it important to have control over their own lives (Eloranta, 2009, 35). Many wish to be able to live in their own homes for as long as possible. Staying active was seen as an important way to maintain functional ability. (Eloranta, 2009, 35; Jaakkola, 2015, 192.) According to Eloranta's (2009, 35) study, older people want to do everything they can in their own lives and accept help only when their own resources have been completely exhausted. Taking care of their own affairs gives them goals and a sense of purpose in life. In Nosraty's (2018, 76) study, the factors related to successful aging were explored. The interview participants highlighted the same physical, psychological, and social elements that have emerged in other studies as well. An interesting finding was that no one mentioned physical illness as impairing good aging; rather, dementia and memory disorders were seen as factors that negatively affected aging. A positive attitude toward life and a sense of humor are seen as ways to support the well-being of older people (Peltomäki, 2014, 55). According to a study by Pernambuco ym. (2012) quality of life is also related to physical quality, independence and autonomy. Lyyra's (2006, 41) study also found that low life satisfaction predicted increased mortality among older people. Community spirit is also seen as an important part of a good life in many studies. In Jaakkola's (2015, 185) study, the interviewees described community spirit as activities done together, selfless reciprocity, and volunteer work. Community spirit provided the participants with a sense of security, familiarity, and comfort. It was reflected in practical ways such as neighborly help, friendships, and regular meetings. Similar themes emerged in Peltomäki's (2014, 82) study, such as feeling needed by others, receiving security, and offering reciprocal help. Close social relationships are seen as giving meaning to life (Eloranta, 2009, 35).

In recent years, client-centeredness has become a key focus in elderly care. Client-centeredness means that people have the opportunity to influence their own lives, opportunities, and activities, as well as the services they receive and shared societal matters. In client-centered care, the self-determination of the elderly is respected, and they are seen as active participants. Studies show that working in a way that considers the wishes and goals of the client improves satisfaction with care and enhances overall quality of life. (Josefsson et al., 2021, 217–218.) Providing high-quality and adequate healthcare services requires sufficient and skilled personnel. However, the adequacy of the workforce has significantly declined across the country in recent years, especially in elderly care. The growing number of elderly people and challenges related to staffing require the development of better care and support systems. Technology, artificial intelligence, and robotics can help improve the well-being of older adults, promote health, and support care and assistance. Digitalization can, in part, help address these many challenges. (Anttila, 2023, 24–26.)

The need for rapid and effective emergency response is a global healthcare priority, particularly in aging societies. In Finland, long travel distances in rural areas, combined with a declining number of healthcare professionals, create dangerous delays in urgent situations. Studies show that in remote areas, emergency response times can exceed 20–30 minutes, depending on infrastructure and staffing (European Commission, 2023, 15). In life-threatening conditions such as cardiac arrest or severe falls, every minute without assistance can reduce survival rates by 7–10 % (Wanis, 2007, 1). To tackle such challenges, countries have begun to explore the integration of digital technologies and community-based solutions. In Germany, the Region der Lebensretter program activates trained volunteers via mobile apps and has shown measurable success in reducing time to first contact (Deutsches Rotes Kreuz [DRK], 2023, 15). Similarly, the Nora Notruf-App provides an accessible and location-based emergency communication platform, especially for people with disabilities such as limited speech and hearing abilities (Nora Notruf-App). However, these apps are either limited to communication (Nora) or require prior certification (Region der Lebensretter) and lack an integrated triage logic or neighborhood involvement in caregiving. (Nora Notruf-App, n.d.; Region der Lebensretter, 2024). In Finland, the FirstAid Finland app focuses mainly on educational content and does not offer real-time emergency interaction or AI-based triage support (Suomen Punainen Risti, n.d). This reflects a broader gap on the market. There is currently no system in Finland that combines automated emergency recognition, personalized risk assessment, neighborhood-based assistance, and scalable professional handoff. The concept of triage-classifying emergency situations by severity and urgency - is a fundamental principle in clinical emergency medicine (Iserson et al., 2022). HätäAPU digitizes this principle by assigning response protocols based on severity levels (I–III). Furthermore, community-based healthcare, as seen in models like Buurtzorg in the Netherlands, has been shown to improve outcomes and satisfaction by decentralizing care delivery and increasing patient autonomy (KPMG, 2019, 4).

Despite these innovations, there are significant limitations. Data privacy concerns under GDPR (General Data Protection Regulation), varying levels of training or certification among community responders, and the potential for misuse or excessive alerting all present risks to successful implementation. Moreover, health system interoperability, especially with existing national eHealth services like Kanta in Finland, remains a barrier to seamless integration. Another critical aspect is user acceptance. Research suggests that while digital tools are increasingly accepted by younger populations, elderly users may face digital literacy challenges. (WHO, 2012). On the other hand, attitudes toward older adults' technological competence can sometimes be biased and generalized. However, age is not a barrier to adopting technology. Among older individuals, technological proficiency varies widely. Research indicates that older adults can be enthusiastic about adopting new technologies, especially when they perceive clear benefits. Therefore, training and onboarding support must accompany any technological rollout. Technology should be sufficiently simple and practical. (Tikkanen et al., 2023, 62.)

The main benefit of involving laypersons is the ability to deliver faster, on-site assistance. The neighbor becomes a first point of contact, providing basic support, bridging time until professional help arrives, and helping assess the urgency of the situation. This creates an important control layer that improves triage accuracy and enables timely, appropriate responses. In summary, while digital and community-based emergency solutions have shown promise in other countries, a holistic, integrated system adapted to Finland’s unique geographic and demographic conditions is still missing. HätäAPU has been developed with the express aim of addressing this specific gap in the market.

4.3 Methods

The present article is based on a qualitative data collection approach, that is founded upon a literature analysis and expert consultation, which particular attention paid to the innovation management structure (Borchert & Hagenhoff, 2003, 74-75; Schilles, 2011, 24). Commencing in November 2024, the primary undertaking was a comprehensive literature review, undertaken to examine the prevailing challenges and structural deficits in Finnish pre-hospital emergency care. In addition, the formulation of a strategic plan was imperative to ascertain the existence of a market gap for this innovation and to assess the requisite technical methods and constraints that exist. The review places particular emphasis on rural accessibility, demographic trends, and the integration of digital health technologies. A systematic analysis was conducted of peer-reviewed articles, policy papers and official statistics from sources including Terveyden ja hyvinvoinnin laitos [THL], STM and international journals on emergency medicine and digital health. Additionally, an investigation was conducted into the existence of analogous innovations or concepts, as well as resources that accentuate the merits of the innovation in question.

To further support the development and conceptualization of the HätäAPU app, two semi-structured expert interviews were conducted. The first was held with an AI professor from HNU University with expertise in in adaptive algorithms for healthcare applications. This conversation provided valuable input regarding the feasibility, transparency, and potential limitations of using AI for risk prediction and triage in emergency contexts. The second interview was conducted with a representative of the German initiative Region der Lebensretter, an established digital first responder system. The discussion focused on operational workflows, legal considerations, data protection, and the motivation of volunteer helpers. The interview insights offered practical guidance on how to build and maintain a trustworthy, scalable responder network. Both interviews were transcribed and thematically analyzed to identify relevant design implications and to derive key success factors for the adaption of such systems to the Finnish context. Together, the literature findings and expert perspectives formed the methodological foundation for the app's concept and feature development.

4.4 Innovation description process

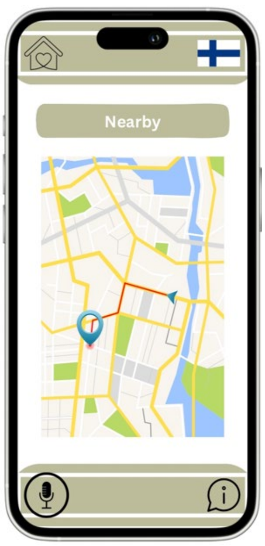
HätäAPU represents a transformative leap in emergency response by introducing a community-integrated, AI-supported system designed to address the realities of aging populations and healthcare workforce shortage in Finland. The HÄTÄAPU is comprised of multiple interconnected modules. Firstly, the Mobile App Interface (iOS/Android): The user has the capacity to instigate a request for assistance via voice command, manual SOS button, or automatically triggered alerts based on behavioral anomalies. The wearable integration facilitates compatibility with smartwatches and fitness trackers (e.g., Garmin, Apple Watch). The application monitors motion, heart rate, and fall detection. Furthermore, the AI-Driven Decision Engine employs structured data, predefined thresholds, and individual risk profiles.   At the heart of the innovation is a novel service model that prioritizes coordination through proximity by integrating trained laypersons, like neighbors within a specified radius, as first-line responders. These individuals are mobilized based on their geographical proximity, availability, and basic emergency readiness. If an incoming call is inconvenient or overwhelming for a neighbor, there is the possibility to decline the call and send the call to a professional first responder. Thanks to GPS tracking (Picture 1) the neighbor himself can call a nearby nurse and nominate her as a first responder. The helping system creates a pool out of neighbors and nurses who register with the system to ensure a better outcome. The dissemination of alerts to the designated helpers is contingent upon geographical location and triage level, with the allocation of assistance being a key consideration in this process. Furthermore, caregivers and professionals have the option to participate voluntarily. The patient is also permitted to view a map indicating the nurse's location. Should the patient be near the nurse, it is possible that the nurse will initiate a direct approach. In contrast to the neighbors, caregivers have access to notifications and health data, contingent on the patient's consent, and can provide remote consultations or direct interventions. Furthermore, the patient has the capacity to save their private contacts as emergency contacts (Picture 2). With the neighbor's agreement, the patient can also save their contact as one.

The primary objective of the app is to reduce the time lag between the occurrence of an emergency and the arrival of the ambulance. The neighbor's actions are instrumental in alleviating the patient's distress. By maintaining a calm and supportive presence, providing information regarding how to react until the arrival of professional assistance, the neighbor plays a crucial role in the management of the situation. At the same time, neighbors are encouraged to stay present during first aid to observe and learn, turning the situation into a learning opportunity for future emergencies. This model ensures that emergencies are prioritized effectively, false alarms are filtered, and response times are drastically reduced. Additionally, HätäAPU introduces real-time video assistance, which enables professional caregivers to remotely supervise and guide neighbors through critical interventions, marking a shift toward a hybrid care system that blends physical presence with tele-expertise. Secondly, HätäAPU employs a learning artificial intelligence system that continuously improves emergency recognition, triage accuracy, and decision-making processes based on prior cases. The AI in question has been demonstrated to possess the capacity for speech-to-text functionality, thereby enabling it to generate a classification within one of the three triage levels. This adaptive AI enhances the ability to recognize subtle deviation in behavior, detect high-risk situations, and dynamically assign triage levels (I-III) to tailor appropriate responses. In Level I (non-critical) scenarios, users receive self-help guidance through a checklist. Level II (moderate) activates a video consultation with a caregiver. This can take place with the caregiver who then visits the patient or with a caregiver in a central location. Level III (critical) triggers direct emergency service involvement with comprehensive data sharing. Each level of the system is characterized by the implementation of a color-coding system, automated checklists, and protocols for escalating risks. These mechanisms are designed to ensure clarity and to minimize miscommunication. This structured yet evolving system ensures not only fast but contextually intelligent interventions. To provide effective first aid, it is essential that responder can accurately categorize the emergency using standardized templates. This enables them to access comprehensive, step-by-step instructions, which are fundamental to the effective management of the situation. Furthermore, caregivers and emergency service personnel receive structured information via Application Programming Interfaces (API). The Dashboard is a system that is designed for professional use. It is imperative to note that all systems are encrypted end-to-end and hosted on servers based in the European Union. This ensures full compliance with data protection laws.

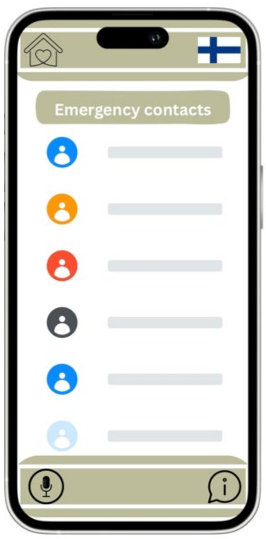
Thirdly, the app integrates health education and micro-training modules targeted at neighbors and informal caregivers. These include interactive checklists, emergency simulation videos, and virtual reality (VR)-based tutorials, accessible via the app's user-friendly interface. Community members can earn digital badges or certifications, incentivizing ongoing learning and participation. This aspect of the platform not only builds basic first-aid competence but also promotes lifelong learning and health literacy, both of which are essential for aging populations managing chronic conditions at home. In the HÄTÄAPU app, the user can also book a first aid course appointment (Picture 3). Users are permitted to elect a date from the calendar and confirm their booking by means of the "Select date and book!" button. First-aid training courses are frequently offered by nurses or Red Cross Finland to provide reassurance to caregivers and neighbors. Additionally, users have the option to educate themselves with the aid of concise instructional videos on specific emergencies. Should the necessity for first aid persist, the nurse will be available to offer assistance to the individual concerned, guiding them through the emergency. To test their knowledge on a particular topic, users can answer quiz questions and testates and reinforce their basic skills and coordinate the process. To facilitate reinforcement learning, users can earn points and progress through levels by successfully completing certification programs in partnership with local Red Cross chapters or municipalities. Furthermore, the American Red Cross [ARC]. (2015) incorporates simulation learning into its training programs, allowing learners to engage in interactive, scenario-based simulations that test their knowledge and decision-making skills in a risk-free environment. Additionally, the Red Cross has developed VR training tools, such as the Lifeguard VR Scanning Simulation, which immerses users in realistic emergency scenarios to enhance surveillance and scanning skills. These VR simulations provide dynamic, real-world scenarios that stimulate learners to retain information more efficiently and effectively, leading to confident and automatic responses essential for first responders. (ARC, 2024).

At the point of registration, users are permitted to select one of three options at the point of registration. The following three core user types have been identified: Patients, helpers/ neighbors, caregivers/ professionals. In order to enhance the level of security, it is necessary to implement a dual authentication process that incorporates both a personal identification number (PIN) and a near-field communication (NFC) login through their passport. This multifaceted approach serves to mitigate the risk of unauthorized access by external parties. The initial page contains a designated “home” button that, when selected, enables the user to disseminate their information. As illustrated in Picture 4, the home screen of the *HÄTÄAPU* application is designed to facilitate connections between users in need of nurses or nearby volunteers. The interface provides three distinct role options, namely nurse, neighbor and user, with a clear, touch-friendly layout. (Picture 4) Icons situated at the bottom of the screen facilitate access to voice input and information.

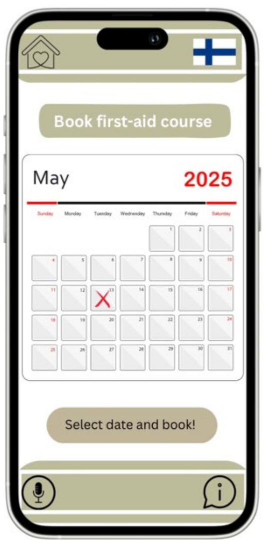
The process is initiated when the patient triggers an emergency, either by pressing the emergency button on a portable device connected to the app or when an automatic emergency is generated. When a user presses the SOS button (Picture 5), it displays a warning message and automatically alerts nearby helpers, speeding up the emergency response and improving safety for users in critical situations. In the case of an automatic alert being triggered, the patient is prompted to either confirm or deny it. Upon confirmation the emergency, the app automatically notifies the nearest neighbor and caregivers. If the neighbor accepts the emergency alert, they must use the checklist in the app to assess the situation. Picture 6 gives you a simple step-by-step guide to what to do if someone has a stroke e.g. It helps the user by explaining what to do in an emergency. The caregiver will also be told how the patient is doing.



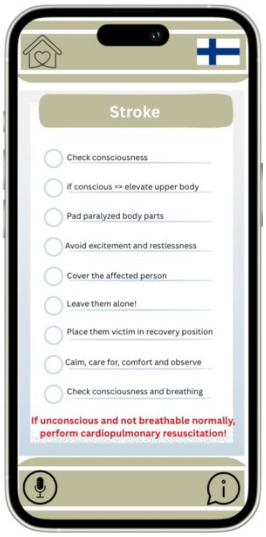
Picture 1. Shared location



Picture 2. Emergency contacts



Picture 3. Booking course



Picture 4. Selection User

Picture 5. AI generated triage

Picture 6. Checklist

In order to illustrate the application of HätäAPU a process chart was created using Business Process Model and Notification (BPMN). The process description is illustrated in Figure 1.

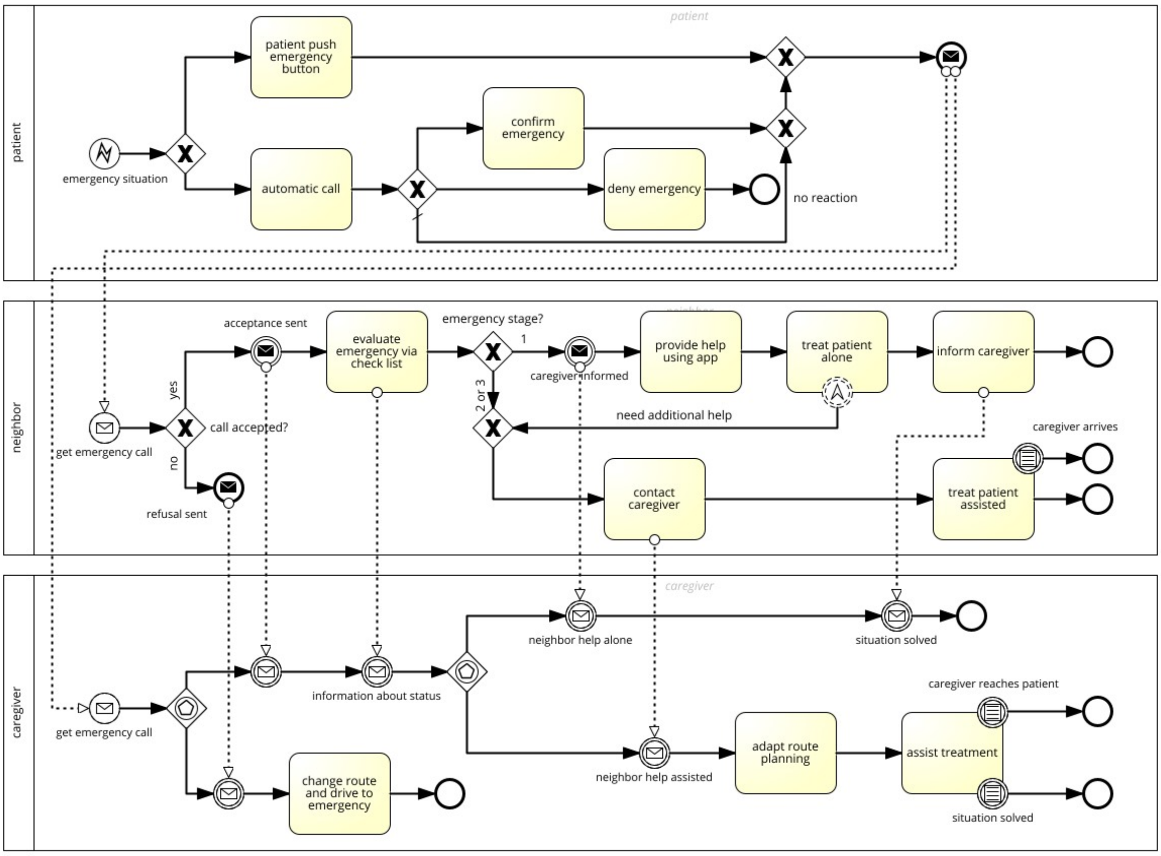


Figure 1. Process chart of the HätaAPU app

The BPMN model illustrates the emergency response process of the HätäAPU app as a structured workflow involving three key participants: the patient, a nearby layperson (neighbor) and professional caregivers. The process begins when the patient experiences an emergency. This can be triggered either manually by pressing an emergency button or automatically via sensors. In both cases, the patient is prompted to confirm or deny the emergency. If there is no response, due to unconsciousness or cognitive impairment, the system proceeds automatically to avoid delays. Once the emergency is confirmed, an alert is sent to registered nearby neighbors. These neighbors can choose to accept or decline the call. If accepted, the neighbor assesses the situation using a checklist provided in the app. Based on the outcome of this triage: in minor cases, the neighbor helps independently using app-guided instructions. If the situation is moderate or critical, the neighbor contacts a professional caregiver for support. In all scenarios, the caregiver is informed of the emergency and the neighbor's actions. If additional help is needed, the caregiver adjusts their route and travels to the emergency site. Upon arrival, they assist the neighbor or take over the treatment, resolving the situation. The process flow emphasizes fast response times, scalable coordination between informal and formal helpers, and structured decision-making based on severity. It reflects the app's core philosophy: combining AI, neighborhood support and professional care into an integrated, community-based emergency system.

Finally, HätäAPU directly addresses the healthcare staffing crisis by redistributing low-complexity emergency care tasks to trained community members. By empowering neighbors to act confidently within predefined, low-risk protocols, the burden on professional responders is reduced, particularly in rural or resource-constrained areas. This distributed model of care delivery ensures that professional healthcare workers can focus on the most critical cases while the community supports non-urgent or moderate scenarios. In doing so, HätäAPU enhances system resilience, builds social capital, and fills structural gasps caused by workforce shortage. In sum, HätäAPU combines technology, trust and training to enable a decentralized, community-powered emergency response ecosystem. It is not merely an app but a rethinking of emergency care delivery, where AI, proximity and participation converge to promote autonomy, safety, and connectedness for older adults.

4.5 Evaluation

Currently, there is no comparable product on the market that integrates local community members into an emergency response chain without requiring formal medical qualifications. The underlying philosophy of the app is predicated on inclusivity and empowerment. It helps mobilize community members in critical situations by providing them with essential guidance and educational resources, empowering them to respond independently and proactively. The present approach eliminates the obstacle and prioritizes accessibility and education over certification. Providing step-by-step instructions during active cases, along with access to structured learning materials, supports the creation of a more comprehensive and inclusive support network. This is of particular importance in rural or underserved areas, where the availability of professional responders may be limited (Johnny, 2024).

One of the most compelling aspects of HätäAPU is its triage-based model of care. The application's classification of emergencies into three levels- minor, moderate, and critical- allows for a more precise allocation of resources and helps prevent unnecessary escalation. Stat Pearls Publishing (2024) posited that analogous stratified care models have demonstrated efficacy in reducing pressure on emergency services. According to a study, the use of digital clinical decision support systems (CDSS) significantly improves the quality of triage documentation, laying the groundwork for faster interventions and better patient outcomes (North et al., 2014). HätäAPU builds on this approach by adding an innovative element: the integration of the local community into the emergency response chain – a concept that has received little attention in the field of digital healthcare applications. Nevertheless, the integration of non-specialists, such as neighbors, into emergency care processes is not without challenges. Notwithstanding the provision of first-aid instructions and video support by the app, the assumption that non-professionals can reliably manage emergencies introduces risks.

Raita ym. (2021) studies have shown that in high-stress environments, poorly designed digital tools can increase technostress and cognitive overload, impairing decision-making processes. Therefore, user-centric and intuitive design is essential (Shao et al., 2022). It is evident that while the empowerment of community members constitutes a fundamental strength of the application, it is imperative that this is complemented by the provision of comprehensive training, onboarding procedures, and rigorous usability testing. Another significant consideration is digital accessibility. While a growing number of older adults are becoming increasingly proficient in the use of technology, a digital divide remains prevalent, particularly in rural and low-income areas

(Mojtahedi et al., 2024, 5). To ensure inclusivity, it is recommended that future iterations of HätäAPU incorporate voice-based commands, passive monitoring tools (e.g. automatic fall detection), or integrations with smart home systems. The purpose of these additions would be to minimize the cognitive and physical burden on patients (O'Brien et al., 2020).

Furthermore, ethical concerns regarding data privacy and consent are of the utmost importance. In light of HätäAPU's role in facilitating the exchange of sensitive medical data among patients, neighbors, and caregivers, compliance with the GDPR is not merely a legal obligation but rather a matter of establishing and maintaining trust. Digital health research has repeatedly demonstrated that transparency regarding data usage and the inclusion of users in consent dialogues can enhance both trust and adoption (O'Connor et al., 2016). This is a particularly relevant issue in apps such as HätäAPU, where the involvement of third parties (e.g. neighbors) complicates the traditional patient-provider confidentiality models. The success of HätäAPU is heavily dependent on community structure and social capital. The premise of the idea is that there is a willingness among neighbors to engage in acts of care, which may vary significantly by geography and culture. In closely-knit rural communities, however, the model may be successful. However, in more urban, anonymous settings, where social cohesion is lower, the concept may require parallel initiatives—such as community-building workshops or volunteer incentive programmes, which have been shown to foster the necessary engagement (OECD, 2021, 22). The WHO (2024) asserts that community-based health interventions are most efficacious when synchronized with local initiatives aimed at building trust and interdependence.

Another salient aspect that merits consideration is the legal and moral responsibility of neighbors who assume the role of first responders. A key concern for prospective volunteers pertains to the apprehension of potential legal ramifications in the event of an untoward occurrence during their engagement. It is imperative to emphasize that HätäAPU is designed to guide users through clearly defined protocols and low-risk interventions. Furthermore, in numerous European legal systems, including Finland, Good Samaritan laws protect individuals who voluntarily assist others in emergencies, if they act in good faith and within the limits of their training and knowledge. The objective of these legislative provisions is to promote civic responsibility, with the aim of ensuring that individuals are not subject to legal repercussions. (Merritt & Stubbs, 2011) There is a significant increase in public willingness to intervene in emergencies significantly increases when individuals are made aware of the existence of legal protections. Consequently, the integration of a comprehensive explanation of legal rights and responsibilities into the HätäAPU onboarding process has the potential to mitigate any hesitation that may be present among neighbors, thereby fostering a greater willingness to engage in community-based care. (Sari et al., 2024.)

The concept of HätäAPU encapsulates a promising convergence of technology, community, and care. The success of the programme will be contingent on iterative design improvements, inclusive user testing, and the careful balancing of innovation with the lived realities of both patients and community members. It is imperative that further empirical studies are conducted, with particular emphasis on pilot trials across a range of settings. These studies will play a crucial role in evaluating the efficacy, scalability, and ethical robustness of the app in real-world contexts.

4.6 Conclusion

The aim of this article was to promote the quality of life for patients receiving home care. The purpose of the article was to describe how to enhance the quality of life for older people by promoting life-saving methods through the integration of social support from the neighborhood and healthcare workers. The development of HätäAPU is a direct response to the urgent need for more inclusive, efficient and responsive care systems in an ageing society. In the context of Finland's evolving healthcare landscape, characterized by mounting pressure from demographic shifts a workforce shortage, there is an imperative for innovative solutions to prioritize not only the clinical effectiveness but also the broader concept of quality of life (Lersilp et al. 2020, 6). In doing so, HätäAPU aligns with the WHO's definition of quality of life as a person's perception of their position in life, shaped by health, security, participation and dignity (WHO, 2012). Moreover, WHO (2024) asserts that all individuals, including the elderly, should be entitled to a long and healthy life. The promotion of independent living in the home environment is of paramount importance, with the objective of ensuring the well-being of dependent individuals (Bhattacharjee, 2015, 58). The utilization of a fall detector application has the capacity to facilitate evidence-based decision-making processes, thereby empowering older individuals receiving home assistance services to maintain a greater degree of autonomy in their daily lives (Bjerk et al., 2017, 6). Application of technologies such as HätäAPU, which incorporates an emergency access button, has been demonstrated to reduce emergency response time and to engender a sense of safety and community belonging. As demonstrated in the extant literature, these are two of the key elements that older adults consistently associate with well-being. As demonstrated in the study such an application has been shown to enhance satisfaction and promote feelings of safety among users (Ebert et al., 2020, 8-10).

The integration of AI, neighborhood-based support, and real-time triage is a key feature of HätäAPU, a system designed to provide older individuals, particularly those residing in rural or underserved areas, with timely assistance that is tailored to the urgency of their situation. The app under discussion here has been developed to promote autonomy, safety, and social connectedness. It achieves this by empowering patients to remain in control of their lives and by actively involving neighbors and caregivers in care delivery (Bhattacharjee, 2015, 9). A study by Mirza et al. (2024, 9) shows that the integration of technology and training is expected to serve as a catalyst for the establishment of a comprehensive support system, with the objective of safeguarding the safety and well-being of elderly individuals living in solitude. Furthermore, the research will enhance public awareness of the conditions and challenges faced by solitary elderly people and motivate individuals to provide further support. The implementation of suitable technologies has been demonstrated to function as an effective facilitator, enhancing the engagement of individuals in activities that are perceived to be meaningful (Lersilip et al. 2020, 6).

In term of user acceptance, previous research highlights the importance of involving end-users throughout the development process. Rose et al. (2019) demonstrated that applying lean software methodologies and iterative user feedback significantly improved the adoption of the Basic Emergency Care App in diverse, resource-limited settings. Similarly, Ehrler et al. (2021) emphasized that understanding caregiver needs an including them in the early design and usability testing phases led to higher acceptance of mobile apps in emergency department. These findings support the user-centered approach taken in the development of HätäAPU, where stakeholder input, including patients, neighbors and professionals, played a central role. By emphasizing usability, contextual relevance and community integration, HätäAPU align with established best practices for improving digital health technology acceptance. As the app scales, continued feedback loops and adaptive development will be essential to sustain trust, engagement and long-term adoption-particularly among older adult and healthcare professionals.

Another benefit of using the application is the lifelong learning which plays a critical role in promoting health, autonomy and well-being across the lifespan. Engaging in continuous learning activities, whether formal, informal or community based, has been linked to improved cognitive functioning, mental health and self-efficacy in managing health-related challenges (Formosa, 2012). Health literacy, as a central outcome of lifelong learning enables individuals to make informed decisions about prevention, treatment and care, thereby reducing healthcare costs and improving outcomes (Nutbeam, 2008). WHO (2015) also emphasizes the importance of “health-promoting education” as part of its healthy aging strategy, highlighting the need to empower individuals with knowledge and skills to maintain functional ability, adopt preventive practices and remain active participants in their community. It is important to determine the future of elderly caregiving and well-being monitoring by the ability to create digital environments which are characterized by increased sensitivity, responsiveness and adaptability to human needs. Furthermore, Sixsmith and Gutman (2013) say in their book that it was recognized the importance of returning to the home environment.

There might be some limitations here. How well HätäAPU works depends on whether there is a good network of trained neighbors. However, the consistency of volunteers’ availability, motivation and capacity to respond cannot be guaranteed. The presence of social inequalities and differences in the types of people living in different regions can sometimes mean that some people receive less equal healthcare. The article did not include any more information about the nurse’s initial skill adaptation training. It seems hard to teach someone else to do it in an emergency because the focus is on reacting correctly and professionally. Sometimes, in an emergency, you need a quick and a careful professional response that doesn’t need to be thought about too much or have reasons for it. Nonetheless, even basic support from a neighbor is better than no help at all, it can stabilize the situation, buy time, calm the patient and give safety and provide comfort until professionals arrive. It is important that healthcare professionals develop a high degree of trust in and acceptance of the system as a reliable instrument. Integration with existing platforms, such as Kanta, remains technically and institutionally complex. In the absence of interoperability, HätäAPU faces the prospect of evolving into a parallel system rather than an embedded one.

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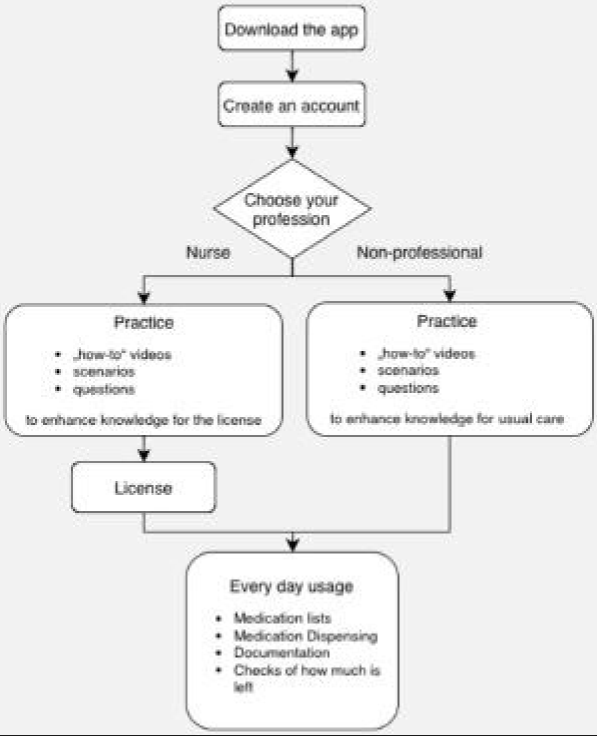
RESULTS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questions
to enhance knowledge for usual care
License
Every day usage
Medication lists
Medication Dispensing
Documentation
Checks of how much is left