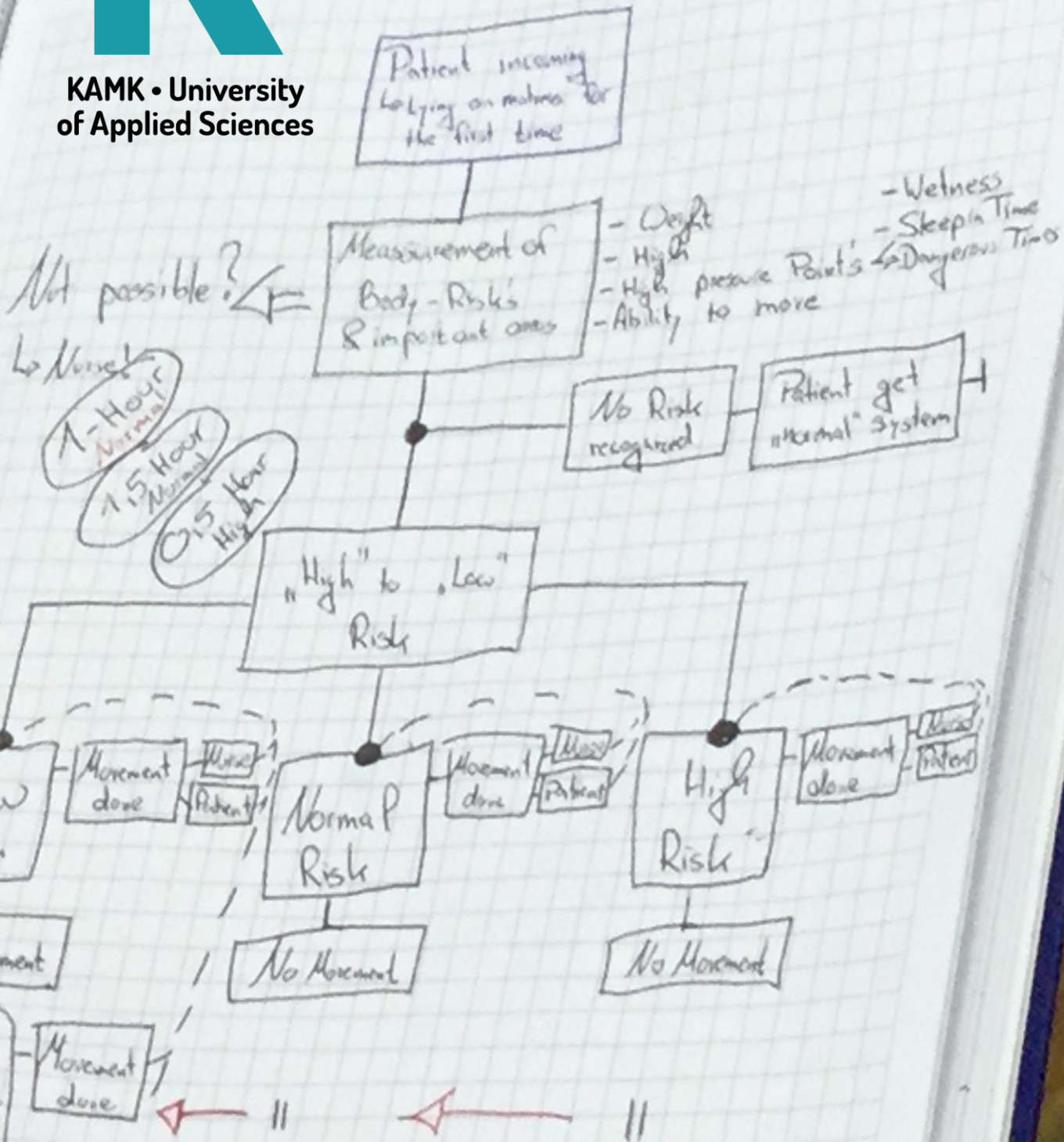




KAMK • University of Applied Sciences



Smart Solutions for Wellbeing Development and Management

- developing social and health care innovations in multidisciplinary student teams

Härkönen Jaana (ed.)

Smart Solutions for Wellbeing Development and Management
– developing social and health care innovations in
multidisciplinary student teams

Härkönen Jaana (ed.)

Kajaani University of Applied Sciences publication series B

Reports and surveys B 85

Contact:

Kajaani University of Applied Sciences Library

PO Box 240, 87101 KAJAANI

Tel. +358 44 7157042

Email: amkkirjasto@kamk.fi

<http://www.kamk.fi>

Kajaani University of Applied Sciences publication series B 85 / 2018

ISBN 978-952-7219-32-4

ISSN 1458-9141

Content

Preface	1
1 Smart Solutions to Improve Nursing Care: conceptualizations developed by multidisciplinary student teams	3
1.1 Background.....	3
1.2 Methods	4
1.3 Results	5
1.4 Discussion.....	7
Sources	8
2 The Nursing Priority Application – an innovation for easier everyday nursing.....	10
Abstract	10
2.1 Introduction.....	11
2.2 The Screen in the Nurses’ Office	13
2.3 Health Care Smart Card – ID Card for Healthcare Professionals.....	15
2.4 Improved Patient Safety – Risk and Quality Management	15
2.5 Management Tools.....	16
2.6 Further Innovation Ideas.....	17
2.7 Conclusion	18
Sources	20
3 Smart Sheet as a Solution to Aid the Prevention of Pressure Ulcers	23
Abstract	23
3.1 Introduction.....	24
3.2 Current Knowledge of Pressure Ulcers	25
3.3 Why Is Smart Sheet Needed?.....	26
3.4 Technical Information	26
3.5 Process Model – How the Smart Sheet works	28
3.6 Benefits.....	29
3.7 Conclusion	30
Sources	31
4 Triage Application for Smart Devices	33
Abstract	33
4.1 Starting to Innovate a Simple Tool to Do Triage at Home	34

4.2	Digitization in Health Care	35
4.3	Innovation	36
4.4	Evaluation.....	38
4.5	Conclusion.....	39
	Sources	41
5	Increasing Patient Awareness with a Patient Guidance Tablet.....	44
	Abstract	44
5.1	Dedicated Purpose Tablet for Patient Guidance.....	46
5.2	Tablet and Application Requirements	47
5.3	Challenges and Benefits of the Tablet	48
5.4	A New Innovation to Promote Client-Centered Services.....	49
5.5	Conclusion.....	50
	Sources	51
6	MEEDO – supporting people with memory disorders	53
	Abstract	53
6.1	Introduction	54
6.2	Aging population	54
6.3	Basis of the Innovation.....	56
6.4	Care Guidelines for Patients with Memory Disorder.....	57
6.5	Evidence on Benefits from Previous Studies.....	58
6.6	Innovation Tool as a Process.....	59
6.7	Drawing of the Device.....	60
6.8	Conclusions	61
	Sources	63

Preface

Changes and challenges in social and health care call for new and effective solutions. Practical problems are usually complex, intertwined and dynamic. A key objective is to develop citizens' possibilities citizens to take care of their health self-directedly or supported by professionals and to participate actively in the planning and implementation of their own services. Smart solutions and new innovations play a major role in responding to changes. Smart solutions refer to innovative ideas that reform social and health care functions and services. It is essential to identify smart ideas and use these ideas not only to develop social and health care services and structures but also to promote entrepreneurship. It is important to make use of different actors' multidisciplinary competencies when developing new solutions.

Smart solutions introduced in this publication are based on innovations originally presented by Master of Social and Health Care students and later developed in unprejudiced cooperation with Bachelor of Engineering (information and communication) students and German Master of Health Management and Health Information Management students. First Master of Social and Health Care students explored which issues and phenomena in their work communities needed to be solved and what could be solved with smart solutions. Then Bachelor of Engineering students commented on which ideas could be realized by technological solutions. In addition to students, lecturers from three different schools at Kajaani University of Applied Sciences (KAMK) participated in the innovation. Over 40 persons were involved in the process. According to the KAMK '24 Strategy, smart solutions is a profile that cuts through all operations and steers all activities including education at KAMK. Smart solutions are also the profile that distinguishes KAMK both nationally and internationally.

Solving complex problems requires finding new solutions and cooperating with many different actors. An outstanding example of this new form of cooperation is multidisciplinary student teams which sought solutions to presented ideas. The five innovations planned multidisciplinary have sparked interest and even confusion; one of the innovations is resulting in a new business enterprise.



Image 1. Students and teachers

We need a positive outlook and hope-evoking solutions to maintain our faith in the future. We also need innovation competence so that we can respond to complex challenges. Novel competence can only arise when different actors share their competence and contemplate future challenges together. We here at Kajaani University of Applied Sciences – and in the 100-year-old Finland – have the courage to make new educational choices together with experts and believe on working together. The future of social and health care is built together.

Kajaani 10.11.2018

Rauni Leinonen, Kirsi Moisanen and Jaana Härkönen

1 Smart Solutions to Improve Nursing Care: conceptualizations developed by multidisciplinary student teams

Holl Felix, Scientific Assistant, Neu-Ulm University of Applied Sciences, Germany
Würfel Alexander, Professor, Dr., Neu-Ulm University of Applied Sciences, Germany
Leinonen Rauni, Principal Lecturer, Kajaani University of Applied Sciences
Moisanen Kirsi, Senior Lecturer, Kajaani University of Applied Sciences
Swoboda Walter, Professor, Dr., Neu-Ulm University of Applied Sciences, Germany

1.1 Background

The population of high-income countries like Finland and Germany is aging. This demographic change is caused by decreasing birthrates and prolonged life-expectancy (Birdsall, Kelley, & Sindling 2001). With aging populations, the number of ill and multimorbid patients is increasing (Marenconi et al. 2011). As a result, the number of patients who require nursing care in hospitals, retirement homes and their own homes is growing continuously (Kovner, Mezey, & Harrington 2002). Health care professionals are also aging, which increases the severity of the shortage of nurses (Schofield & Beard 2005). This trend also applies to general practitioners, primarily in rural areas. Increasing number of patients are seeking care in emergency departments instead of relying on primary care structures, due to long waiting times, limited hours of service and convenience or general practitioners not taking new patients (Weinick, Burns, & Mehrotra 2010).

Another issue that healthcare systems globally are facing is rising costs. Demographic change and increasing multimorbidity are one reason for this trend. (Lehnert et al., 2011) In Finland, the Social Insurance Institution paid 1.3 billion euros in medical reimbursements in 2017. The reimbursements grew by 2.65% from the previous year. (“Lääkekorvaukset kasvoivat viime vuonna maltillisesti | Lääketeollisuus ry” n.d.) New drugs and technological innovations are another driver of costs (Bodenheimer 2005a, 2005b). As a result, there is increasing pressure to contain cost.

The use of mobile devices in healthcare delivery can be a means to improve access to care, foster patient engagement and contain costs (Hamine, Gerth-Guyette, Faulx, Green, & Ginsburg 2015; Martin 2012; Schweitzer & Synowiec 2012). The number of mobile cellular subscriptions has dramatically increased from under 500 million globally in 1999 to 7.5 billion in 2016 (“The World Bank: Mobile cellular subscriptions” n.d.). The availability of devices is dramatically increasing with decreasing prices and increases in performance of mobile devices (mobile phones and tablet

computers). Therefore, the main two prerequisites for mHealth are fulfilled. Smart solutions targeted at the consumer market have substantially gained in popularity over the past years, driven by the advances and decreasing prices of wearables. (Jung, Kim, & Choi, 2016; Piwek, Ellis, Andrews, & Joinson, 2016) In order for smart solutions for nursing care to be as successful as those for the consumer market, they need to address pressing issues and be designed in a context appropriate manner including by developing international cooperation and training.

1.2 Methods

Multidisciplinary teams consisting of Master of Health Management and Health Information Management students from German, and Master of Social and Health Care students and Bachelor of Engineering (information and communication engineering) students from Finland and were formed for the purpose of an elective course. The course was set up as a semester-long blended learning course by Kajaani University of Applied Sciences in Finland and Neu-Ulm University of Applied Sciences in Germany.

The course started off with an eLearning phase from October 2017 until February 2018. The phase included a series of introductory lectures on current issues in healthcare, and project management and design thinking techniques. This phase also included the formation of multidisciplinary teams. The teams were formed and had a series of virtual meetings where they got to know each other, learned about each other's background and discussed possible issues to focus on. At the same time, the Finnish master social and health care students who were all working as registered nurses in healthcare facilities around Finland were asked to identify pressing issues in their facilities. The study instruction describes:

“Survey employees orientated towards innovation in and connected to your work community and form an innovation team within your work community. Discuss who should be selected for the innovation team and what the team's targets will be with your immediate boss or supervisor. Led by the university of applied sciences master student, the innovation team will seek agile development methods using innovations within their organization/work community supporting smart solutions, in cooperation with the staff, clients and representatives of connected parties (the innovation is a new product, service, process or practice that has been adopted for use). The university of applied sciences master

student compiles an initial innovation pilot plan with the support of the innovation team at work and other students in their team.”

An in-person project week was held in Kajaani, Finland in February 2018. The week started with team building exercises and in-person lectures highlighting recent technological developments in healthcare such as the electronic health card in Germany and teaching the students project management techniques. The teams then had multiple working sessions where each team developed a concept of a technological solution to solve or alleviate the issue the team had previously identified. They applied a design thinking approach and used their project management knowledge to develop a sound project concept note.

The multidisciplinary teams worked well, and different skillsets and experiences amended each other well. The most notable issue was to be expected: language barriers as the project was conducted in English which was the second language for each participant.

1.3 Results

The teams identified issues typical for the healthcare settings in rural Finland, driven by the experience of the nurses in each group, but the generalizability to other high-income countries was verified in discussion with the international team members and by the instructors. The groups identified the following issues and envisioned and conceptualized solutions.

The workload for nurses in hospital wards is increasing. With the current system of a simple call button for patients to get the attention of a nurse, it is impossible for the nurse to determine the urgency of a call, for example whether a patient is in acute pain or just needs a glass of water. Thus, it is impossible to prioritize calls simply based on the notification; instead the nurse always needs to check the nature of the request in the patient room first. The solution intended to help solve this issue is a smart call button and a corresponding application on a dedicated purpose tablet for nurses. With the application, patients do not simply call a nurse but give details about their request through a menu. The corresponding application for the nurses shows the request type and room number for each call and classifies urgency. This allows the nurses to prioritize the calls without first having to go and see the patients. (*The Nursing Priority Application - an innovation for easier everyday nursing.*)

An increasing issue among patients (often multimorbid patients) in prolonged bed rest is the risk of developing pressure ulcers if they are not repositioned on a regular basis and monitored for pressure points. Prevention of pressure ulcers is, therefore, labor-intensive and costly. The solution to support nurses in the prevention of pressure ulcers is a smart sheet with a corresponding application. The smart sheet is placed underneath the mattress in the hospital bed and contains an array of pressure sensors. If increased pressure is detected, an early warning sign of risk for pressure ulcers, the nurse is alerted through the app. *(Smart Sheet as a Solution to Aid the Prevention of Pressure Ulcers)*

Patients with non-acute medical problem seeking care in emergency department. This leads to a dramatic increase in patient volume. The cost for the provision of treatment capacities in emergency department is much higher than in urgent care centers, which is why treatment capacities are limited and bottlenecks occur on a regular basis because of this trend. The solution to help patients more easily find the source of appropriate care for their condition and reduce the number of unnecessary emergency room visits is a triage application for smart phone and tablets for patients to self-triage themselves at home. *(Triage Application for Smart Device.s)*

Patients are eager for information about their health condition and upcoming tests and treatment. Nowadays patients research internet or consult consumer health applications for information. The information they uncover is not always correct and does not account for the specifics of the patient's condition and situation. This can cause frustration for both patients and providers. The solution to help improve the quality of information patients receive is a dedicated purpose patient guidance tablet for patients to provide verified information to patients about their illness and treatment and connect them with their care team. *(Increasing Patient Awareness with a Patient Guidance Tablet.)*

The prevalence of a long-term memory disorder, dementia, is continuously rising. Patients with long-term memory disorders require continuous treatment to prevent a common complication: the development of behavioral disorders. The solution is a non-medical treatment for memory disorder. It is a customizable application that will run on a dedicated purpose tablet. Information about the patient's condition, history, family and personal preferences can be entered. *(MEEDO - supporting people with memory disorders.)*

1.4 Discussion

The identification of issues in nursing care that could be supported by smart solutions was led by the Finnish master social and health care students, and while the issues were derived from the setting of rural Finland, they are generalizable to most settings in high-income countries which follow the same pattern. The international students were able to reaffirm this in the discussion through their professional background and personal experiences as patients in their own healthcare systems.

Two themes can be observed among the solutions that the student teams conceptualized and underlying issues they attempted to address: firstly, tools to support the work of nurses by reducing their workload and giving them a tool to plan their tasks in a more efficient manner, and secondly, tools for patient engagement and patient empowerment to involve and inform patients about their treatment. The development of client participation opportunities is topical in social and health care services. (Moisanen, 2018.) By participating, clients can engage in their own care, commit and influence on their own matters and take responsibility for the consequences (Närhi, Kokkonen, & Matthies 2015).

The solutions that the teams envisioned and conceptualized are innovative but also technically feasible and outcome-oriented to address the issues they were intended to resolve. This speaks of the success of the idea of the course and the concept of having multiprofessional, international teams trying to solve issues in nursing care. The teams were encouraged to apply for seed funding to develop prototypes of the solutions to test them in real world healthcare settings.

Innovation development work continues in the Business Incubator at Kajaani University of Applied Sciences.

Sources

Birdsall, N., Kelley, A. C., & Sinding, S. W. (2001). *Population matters : demographic change, economic growth, and poverty in the developing world*. Oxford University Press.

Bodenheimer, T. (2005a). High and Rising Health Care Costs. Part 1: Seeking an Explanation. *Annals of Internal Medicine* 142(10), 847. Retrieved from <http://doi.org/10.7326/0003-4819-142-10-200505170-00010>

Bodenheimer, T. (2005b). High and rising health care costs. Part 2: Technologic innovation. *Annals of Internal Medicine*. American College of Physicians. Retrieved from <http://doi.org/10.7326/0003-4819-142-11-200506070-00012>

Hamine, S., Gerth-Guyette, E., Faulx, D., Green, B. B., & Ginsburg, A. S. (2015). Impact of mHealth chronic disease management on treatment adherence and patient outcomes: A systematic review. *Journal of Medical Internet Research* 17(2), 1–23. Retrieved from <http://doi.org/10.2196/jmir.3951>

Jung, Y., Kim, S., & Choi, B. (2016). Consumer valuation of the wearables: The case of smartwatches. *Computers in Human Behavior* 63, 899–905. Retrieved from <http://doi.org/10.1016/j.chb.2016.06.040>

Kovner, C. T., Mezey, M., & Harrington, C. (2002). Who cares for older adults? Workforce implications of an aging society. *Health Affairs* 21(5), 78–89. Retrieved from <http://doi.org/10.1377/hlthaff.21.5.78>

Lääkekorvaukset kasvoivat viime vuonna maltillisesti | Lääketeollisuus ry. (n.d.). Retrieved 18.9.2018 from <http://www.laaketeollisuus.fi/ajankohtaista/nakokulma-utiskirjeet/nakokulma-4-2015/laakekorvaukset-kasvoivat-viime-vuonna>

Lehnert, T., Heider, D., Leicht, H., Heinrich, S., Corrieri, S., Lupp, M., ... König, H. H. (2011). Review: Health care utilization and costs of elderly persons with multiple chronic conditions. *Medical Care Research and Review* 68(4), 387–420. Retrieved from <http://doi.org/10.1177/1077558711399580>

Marengoni, A., Angleman, S., Melis, R., Mangialasche, F., Karp, A., Garmen, A., ... Fratiglioni, L. (2011). Aging with multimorbidity: A systematic review of the literature. *Ageing Research Reviews* 10(4), 430–439. Retrieved from <http://doi.org/10.1016/j.arr.2011.03.003>

Martin, T. (2012). Assessing mHealth: Opportunities and Barriers to Patient Engagement. *Journal of Health Care for the Poor and Underserved* 23(3), 935–941. Retrieved from <http://doi.org/10.1353/hpu.2012.0087>

Moisanen, K. (2018). Asiakaslähtöisen osaamisen johtaminen vanhuspalveluissa. Publications of the University of Eastern Finland. Dissertations in social sciences and business studies No 170. Kuopio: The University of Eastern Finland.

Närhi, K., Kokkonen, T., & Matthies, A.-L. (2015). Asiakkaiden osallisuus ja työntekijöiden harkintavaltalta palvelujärjestelmässä. *Janus Sosiaalipolitiikan Ja Sosiaalityön Tutkimuksen Aikakauslehti* 22(3), 227–244.

Piwek, L., Ellis, D. A., Andrews, S., & Joinson, A. (2016). The Rise of Consumer Health Wearables: Promises and Barriers. *PLoS Medicine* 13(2), 1–9. Retrieved from <http://doi.org/10.1371/journal.pmed.1001953>

Schofield, D. J., & Beard, J. R. (2005). Baby boomer doctors and nurses: Demographic change and transitions to retirement. *Medical Journal of Australia* 183(2), 80–83. Retrieved from http://doi.org/sch10269_fm [pii]

Schweitzer, J., & Synowiec, C. (2012). The economics of eHealth and mHealth. *Journal of Health Communication* 17(SUPPL. 1), 73–81. Retrieved from <http://doi.org/10.1080/10810730.2011.649158>

The World Bank: Mobile cellular subscriptions. (n.d.). Retrieved from <https://data.worldbank.org/indicator/IT.CEL.SETS>

Työ- ja elinkeinoministeriö. (2018). Ammattibarometri 2018: työvoimapula laajenee uusiin ammatteihin - Artikkel. Retrieved from https://tem.fi/artikkeli/-/asset_publisher/ammattibarometri-2018-tyovoimapula-laajenee-uusiin-ammatteihin

Weinick, R. M., Burns, R. M., & Mehrotra, A. (2010). Many emergency department visits could be managed at urgent care centers or retail clinics. *Health Affairs* 29(9). Retrieved from <http://doi.org/10.1377/hlthaff.2009.0748>

2 The Nursing Priority Application – an innovation for easier everyday nursing

Bezenka Anna, Master of Health Management and Health Information Management student, Neu-Ulm University of Applied Sciences, Germany

Katajisto Päivi, Master of Social and Health Care student, Kajaani University of Applied Sciences

Maaninka Satu, Master of Social and Health Care student, Kajaani University of Applied Sciences

Nissi-Lämsä Jaana, Master of Social and Health Care student, Kajaani University of Applied Sciences

Romppainen Riina, Master of Social and Health Care student, Kajaani University of Applied Sciences

Leinonen Rauni, Principal Lecturer, Kajaani University of Applied Sciences

Moisanen Kirsi, Senior Lecturer, Kajaani University of Applied Sciences

Holl Felix, Scientific Assistant, Neu-Ulm University of Applied Sciences, Germany

Würfel Alexander, Professor, Dr., Neu-Ulm University of Applied Sciences, Germany

Abstract

The healthcare sector faces a lot of challenges at the moment and possibly even more so in the future. One challenge will be the aging of the population. Innovations and technological solutions are needed to overcome these challenges. The objective of this article is to present an innovation called Nursing Priority Application and offer one possibility to consider while reflecting the challenges of healthcare. This innovation provides a system that helps nurses to prioritize their tasks and focus on patients needing care most urgently. While the main feature of the innovation is to provide a tool to organize work in healthcare, it also provides information that can be utilized in placement of personnel. This article also discusses other uses for the innovation when developed further. This innovation was developed in an innovation workshop during the 2018 International Week at Kajaani University of Applied Sciences. The innovation team included Master of Social and Health Care students, Master of Health Management and Health Information Management student and Bachelor of Engineering (communication and information technology) students.

Keywords: healthcare professionals, work management, smart solution for healthcare, patient call, evaluation of needs, prioritization of treatment, application, innovations

2.1 Introduction

In healthcare and nursing the principal values and core of all functions should be about producing value to patients. But it is a well-known fact that nurses have heavy workloads and work with lots of responsibility and also with strict schedules. At hospital wards nurses have their scheduled tasks and, in addition to those tasks, they answer to patient's requests. The amount of those request calls is difficult to predict, and they can make the work feel hectic and out of control. Nurses are burdened by the simultaneity of several things, such as a constant shift of attention from one thing to another and keeping many unfinished matters in mind simultaneously. (Kalaoski, Käpykangas, Valtonen, Selinheimo, Koivisto, Paajanen & Louhimo 2018, 13.)

Lavander (2017) notes in her dissertation that "all professional groups spent less than half of their working time on direct patient care duties. Registered nurses spent one fifth of their working time on documentation. All nurses also had a lot of non-nursing tasks".

Physical and psychological strain of the work poses a continuing threat to the coping and health of employees. In the future the number of retiring healthcare professionals is high, and every fourth healthcare professional has considered changing their profession. (Kröger, Leinonen & Vuorensyrjä 2009, 112.)

At the same time as the high number of healthcare professionals are retiring, the share of elderly population is increasing. Changes in the age structure will have a special impact on healthcare. Effects will occur in two waves. The first wave is related to aging of staff and the second wave to a growing demand for services. (Elovainio, Forma, Halmeenmäki & Sinervo 2000, 125.) The ageing of Europe's population will also have significant implications for its labor force. The total supply of labor among those aged 20 to 64 in the EU is expected to fall by 9.6% and by 9.7% in the euro area between 2016 and 2070. (The 2018 Ageing Report 2018.) In the second wave, social and health care staff with a high middle age are faced with the increased need for services (Elovainio ym. 2000, 125). On the other hand, health expenditure calculated on the basis of the change in the age structure alone did not take into account the improvement of the health of the population as the life expectancy increases. Improvement of human health is reflected in population statistics, for example in terms of prolonged life expectancy and decreasing mortality among elderly people (excluding the eldest, i.e. over 75 years old). Aging alone does not increase costs. (Tuovinen 2013, 18; The 2018 Ageing Report 2018.)

Although the aging of the population leads to an increase in the demand for services, the change in treatment patterns does not necessarily mean that there is a need for care and a need for labor in the same proportion. The number of treatment days in many areas of specialized healthcare has declined significantly during the 21st century, and development can be expected to continue. (Rehunen, Reissell, Honkatukia, Tiitu & Pekurinen 2016, 39.) Therefore, we need innovations that help the actual nursing care and innovations that enable nurses to provide more care remotely and consequently provide more possibilities for telecommuting.

With these challenges in mind we innovated a prioritizing application that tells nurses how urgent patients' needs are when they call for a nurse. The Nursing Priority Application assists nurses to decide the priority of tasks without going through patient rooms. This article describes and explains the innovation and the possibilities for further development. The objective of this article is to introduce one possibility to consider while reflecting the resource problems and challenges of healthcare.

The main idea of this innovation is that every patient has the application downloaded to a dedicated purpose tablet with topic buttons which display common reasons to call for a nurse (e.g. 'pain'). Patients use the topic buttons to call for a nurse. All topics have an urgency definition which would be color-coded. The needs are divided into three groups with traffic light colors informing the degree of urgency. Screens placed in ward corridors display only the number of a patient's bed and the color code whereas the screen in the nurse's office shows the topic and possible additional information. When a patient has, for example, pains and chooses the 'pain' topic, the application asks the patient to assess their pains using a pain scale from 0 to 10. The topics can be customized to suit every hospital's ward's needs.

This application also informs nurses if a call has not been answered in the ideal time period (e.g. within 10 minutes) by thickening the font. If the call is not answered within 15 minutes, the application informs again about the delay by marking an X by the bed number. The call is marked as 'started' in the application by the nurse's professional ID-card. When a task is completed, the nurse will mark the call as 'completed' again with their ID-card. Only after then does the call disappear from the application and the screens. This way patients cannot be forgotten.

The application also offers an option to answer calls remotely. Calls to talk to a healthcare professional or have information can be handled remotely by a telecommunication application. This option would give nurses time to do tasks at the ward that need their presence and to give enough attention to patients, which would also provide content to compensatory tasks. It can be assumed

that the need for meaningful compensatory tasks is growing as more and more healthcare professionals are approaching retirement age. The application also collects data from the calls and can help to pinpoint, for example, rush hours. The data will help management to organize and locate staff most effectively: temporary staff could be placed using the data together with patient classification data.

2.2 The Screen in the Nurses' Office

The Nursing Priority Application shows nurses the urgency of every patient call. Every patient has a dedicated purpose tablet next to their beds instead of the usual call button. With the application, patients can give a good overview of every problem to the nurse in the nurses' office because after pressing a button on the tablet, the problem appears on the screen in the nurses' office (Image 1.). The advantage is that the nurse does not have to go to the patient room first to check what the problem is because they can see it in order of priority (traffic lights) on the screen. They can also see the room number, actual time and time when the patient pressed the button. If the nurse has not attended the patient within 10 minutes, the letters will be bolded, and after 15 minutes an X appears at the end of the row. The screen does not only show the priority order; it also shows which room the call comes from and what the patient needs whether it is painkillers or water. This can save a lot of time during the day and make it more stress-free for nurses when they do not have to run back and forth between the patient rooms and office.

Room number	Problem		Time 3:00 pm
7	Patient emergency		3:00 pm
18	Patient emergency		2:59 pm
20	Painkiller		2:57 pm
13			
15	Painkiller		2:48 pm
8			
2	New bandaid		2:54 pm
7			
15	Water	X	2:42 pm
12			

Image 1. Screen in the nurses' office

Data security is very important for patients. Therefore, details of their problems can be shown only on the screen in the nurses’ office but not in the corridors (Image 2). Screens placed in the corridors show the numbers of the rooms where calls were made from and the actual time when the patient pressed the button. The same traffic lights as on the screen in the nurses’ office indicate the priority of patient calls, and letters are bolded after 10 minutes and an X appears in the middle of the screen after 15 minutes.

Room number		Time 3 pm
7		3:00 pm
18		2:59 pm
20		2:57 pm
13		
15		2:48 pm
8		
2		2:54 pm
7		
15	X	2:42pm
12		

Image 2. Screen in the corridor

Image 3 illustrates the interface of the patient tablet. The application displays the main topics. When the patient tabs a main topic, more specialized topics appear on their screen. However, priority colors, i.e. traffic lights, are not shown on patients’ screens.

I want to talk to a nurse	Pain	I don't feel well
I want to sleep	I need help to go to the Bathroom	Water and others

Image 3. Interface on the patient tablet

More buttons can be included in the application and shown on the screen. If a patient wants to talk to the nurse, buttons can specify if the patient’s questions focus on medication, discharge practices, worries and fears. The Visual Analogue Scale (VAS) can be used to describe pain. The VAS scale has endpoints which define extreme limits such as ‘no pain’ with 0 and ‘worst possible pain’ with 10. If the patient does not feel well, they can press a button to specify that they feel cold, hot, dizzy, nauseous or sick. The application can also have a button that signals that the

patient is sleeping so that nurses can bring medicines or meal later and not disturb the patient. If a patient needs help going to the bathroom, they can choose if they want to take a shower or if they want to go to the toilet. For example, if the patient wants to take a shower, their request appears colored green on the screens in the nurses' office and corridor. If the patient wants to go to the toilet, their request is more urgent and thus colored yellow. Requests for water and meals can also have their own more specific buttons such as 'breakfast', 'lunch' and 'dinner'.

2.3 Health Care Smart Card – ID Card for Healthcare Professionals

The health care smart card is used for reliable electronic identification of healthcare operators and electronic signature of patient documents and prescriptions. Smart cards are issued by the Population Register Centre. Every healthcare professional has their own card. Encrypted ID data is transferred between the healthcare system, pharmacies and Prescription Centre between identified parties. Healthcare professionals only need one card because it can be used in every healthcare organization or pharmacy. The ID card is issued by the police and requires identification from a valid passport. Health care smart cards are issued only to persons who are listed in Terhikki which is the register of social welfare and healthcare professionals. (Kansallinen terveysarkisto 2018, 1.)

Under the Act on Electronic Processing of Client Data in Social and Healthcare, organizations are obliged to enter patient records in the nationally centralized archive. A further aim of the Act is the data security of patient information processing, patients' access to information, and provision of healthcare services with better safety and efficiency. (Laki sosiaali- ja terveydenhuollon asiakastietojen sähköisestä käsittelystä 159/2007; Kansallinen terveysarkisto 2018, 1.)

2.4 Improved Patient Safety – Risk and Quality Management

The application is connected to an electronic patient information system which contains all medical information of a patient. Information is entered to KANTA, the national patient data repository in Finland. According to Kangasniemi and Andersson (2016a, 38), nurses spend a lot of time on patient care which also requires a lot of manual work to document all patient data into the electronic patient information system. Another aspect is the fact that technologies can memorize

much more information. With the new innovation, the Nursing Priority Application, data can smoothly be documented in the patient information system.

If a patient asks for some medicine (e.g. painkillers), the nurse can easily document this information with the Nursing Priority Application. Furthermore, the nurse cannot forget to document the medicine given to the patient because the information is documented in the patient information system while the nurse is administering the medicine. This promotes risk management as other nurses can also see that the patient was given the medicine. Risk management includes the process of identification, evaluation, controlling and monitoring risks. Risk reduction is very important for patients. (Krystek & Fiege 2018.) This application ensures that the nurse cannot forget to give medication or treatments or see to other wishes that a patient has expressed: the request does not disappear from the screen before the nurse has checked out, i.e. marked the call as completed, with their ID card. The application not only saves time but also acts as a reminder for nurses so that they do not forget someone or something, which improves the quality of patient care.

Quality is very important in healthcare, and quality management ensures that the quality of patient care is provided. Quality management refers to planning, controlling and monitoring the quality of a process or result of a process. It also includes guidance, review, improvement, and assurance of the quality (Terveydenhuollon laatuopas 2011; Voigt 2018.) Healthcare operations must be based on evidence and good management and operational practices and be of high quality and safely and properly implemented. (Terveydenhuoltolaki 1326/2010.) With the new application, quality of care can be improved because nurses do not have to concentrate on what they need to do next: they can concentrate on actual patient care. In future this application could also include a feature that would allow patient feedback, which would improve the quality of care further.

2.5 Management Tools

The Nursing Priority Application gathers a lot of information some of which can be forwarded directly to managers. Information about the busiest times in the hospital, most commonly used medications and number of emergencies a day can also improve the quality of patient care. The application can also gather information on e.g. how long nurses need for showering a patient on

the condition that this type of information does not put too much pressure on the nurses. Managers can also use the information to plan the use of resources and place staff in wards where more staff is needed as suggested by Lavander (2017).

In their article 'More Human Care', Kanganiemi and Andersson (2016b) state that only three days of a five-day week are used on actual contact with patients. With the help of robotics direct patient care could be increased up to four days. Robots or technology cannot be used for everything in healthcare. Direct patient care requires nurses' expertise and human assessment. It refers to taking care of patients actively, which includes healthcare, nursing, helping, guidance and interaction.

The future work environment is very mobile, and division of labor and staff organization have to adapt to this mobile environment (Kangasniemi, Voutilainen, Kapanen, Tolmala, Koponen, Hämäläinen & Elovainio 2017). Models for division of labor need to be flexible, which means that duties and responsibilities are divided differently in different environments and levels. Further training and education need to be organized for nurses as part of their self-development.

2.6 Further Innovation Ideas

In future healthcare, virtual and programmable robots are used to document and analyze information more effectively. Internet and clouds are used to store information. If it is safer for patients to use robots, is it unethical to use technology? User interfaces have to be partly intuitive, because we can't expect that people who need care and help are able to give commands or program a robot (Kangasniemi & Andersson 2016b, 43, 47, 48.) Research shows that medical robots increase patient safety and minimize in accurate drug delivery and time which nurses spend on medication (Kangasniemi ym. 2017, 16). The Aging Policy published by the Finnish Ministry of Social Affairs and Health states that automation and robots can be used for purposes such as duties indirectly connected with patients. Technology can be an expensive investment first, but its usefulness realizes in the long run. (Van Aerschot, Turja & Särkikoski 2017, 630.)

In future every nurse can have a device with an alarm, showing them room numbers in cases of emergency. The system locates and alarms the nearest nurse who is available automatically. In addition to new technologies of telemedicine, a further innovation could include the possibility for nurses who are off work due to health issues (e.g. backache) to receive calls from patients,

e.g. elderly people needing attention and someone to talk to. Another idea is that applications are developed to collect patient feedback.

2.7 Conclusion

The purpose of this innovation was to introduce one digital tool to assist direct patient care and management of patient care. The objective was that by relieving the sense of urgency nursing staff will have more time to focus their attention on each individual patient and on the person behind the symptoms. This would improve the quality of care and care would be more patient-oriented.

The Nursing Priority Application offers new technology designed to prioritize nursing. According to the results of the KASTE project (The National Development Programme for Social Welfare and Health Care), technological solutions must be seamlessly integrated into the everyday life of nursing. Technology must not replace people or override human care and encounter. Instead, technology and robots allow nurses to focus on patient care and urgent presence that requires expertise and human presence (Kangasniemi & Andersson 2016, 3).

Patients appreciate the professional skills of staff, pleasant treatment and receiving help for their needs. The amount of staff has a major impact on quality of care, and staff satisfaction is closely linked to the quality of care. Hospitals must ensure the high level of professionalism and staff retention. (Kvist 2004, 5). The Nursing Priority Application contributes both to the high level of professionalism by helping nurses to organize their work and to high level of staff retention by helping management to organize the staff most efficiently.

As it has been stated previously in this article, the population is aging and it brings challenges to healthcare. Therefore, every innovation or development idea that can contribute to or improve efficiency should be considered with close attention. In the EU the old-age dependency ratio (people aged 65 and above relative to those aged 15 to 64) is projected to increase by 21.6%, from 29.6% in 2016 to 51.2% in 2070. This implies that the EU would go from having 3.3 working-age people for every person aged over 65 years to only two working-age persons. (The Ageing Report 2018.) More attention should be paid to the general economic dependencies: income growth and improved standard of living, high production costs for health services and low productivity. (Tuovinen 2011.)

The Nursing Priority Application is downloadable on a dedicated purpose tablet. It is easy to use as many patients already know how to use tablets. Some patients who are reluctant to utilize health technology may have their prejudices and fears dispelled by using the tablet in a safe hospital environment where guidance and help is always close. This would be very beneficial considering the future where smart solutions are quite likely to become part of everyday life.

The use of technology in healthcare should be utilized by existing technology applications. Use of technology does not automatically require large financial investments. Patients and staff are already fairly committed to using technology. Patients' experience of the ease of use and benefits of technology is an important prerequisite for high-quality technology use. (Kannisto 2016, 1–2.)

Complexity of information and increasing quality standards force healthcare providers to utilize technology. The role of the public sector in a knowledge-based society is to create and develop both cultural and material infrastructure. The electronification of services will lead to changing public sector operating methods and content development of services. In order to achieve the principles of fairness, citizens should be able to access the information society and its services regardless of where they live. At the same time, conditions for using technology are being created. (Ryynänen, Kinnunen, Myllykangas, Lammintakanen & Kuusi 2004, 76.)

The aim of the Nursing Priority Application is to reduce the pressure the nursing staff is facing at work. With this innovation, nurses can easily see how they can work most efficiently and which duties should be done first. The application helps to decide between different tasks and set priorities. A further advantage is the improvement of risk and quality management. A patient or a task cannot be forgotten because the application will remind of the tasks until they have been completed. This innovation and the spread of new health technology will improve patient care and increase the productivity and quality of nursing.

Sources

Elovainio, M., Forma, P., Halmeenmäki, T. & Sinervo, T. (2000). Sosiaali ja terveysalan henkilöstön ikärakenne ja eläkkeelle siirtyminen. Yhteiskuntapolitiikka.

Kalakoski, V., Käpykangas, S., Valtonen, T., Selinheimo, S., Koivisto, T., Paajanen, T. & Louhimo, R. (2018). Kognitiivisen ergonomian parantaminen hoitotyössä. Satakunnan sairaanhoitopiirin kehittämishanke. Retrieved from http://www.julkari.fi/bitstream/handle/10024/136179/Kognitiivisen_ergonomian_parantaminen_hoitotyossa.pdf?sequence=1

Kangasniemi, M. & Andersson, C. (2016a). Enemmän inhimillistä hoivaa. Robotit töihin. Koneet tulivat—mitä tapahtuu työpaikoilla, 38. Retrieved from <http://www.eva.fi/wp-content/uploads/2016/09/Enemm%C3%A4n-inhimillist%C3%A4-hoivaa.pdf>

Kangasniemi, M. & Andersson, C. (2016b). Enemmän inhimillistä hoivaa. Robottien avulla voitaisiin jo nyt tehdä viidennes sairaanhoitajien ja lähihoitajien töistä. Retrieved from <https://www.eva.fi/wp-content/uploads/2016/09/Enemm%C3%A4n-inhimillist%C3%A4-hoivaa.pdf>

Kangasniemi, M., Voutilainen, A., Kapanen, S., Tolmala, A., Koponen, J., Hämäläinen, M. & Elovainio, M. 2017. Työn uusjako. Sosiaali- ja terveydenhuollon ammattiryhmien työnkuvien ja keskinäisen työnjaon kohdistaminen ja tehostaminen SOTE-reformissa. Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja 66. Helsinki.

Kannisto, K. (2016). Terveystieteissä tulisi hyödyntää olemassa olevia ja käyttäjille tuttuja teknologiasovelluksia. Väitöskirja. Hoitotiede. Turun yliopisto. Turun yliopiston tiedote, 15.6.2016. Turku. Retrieved from <https://www.utu.fi/fi/Ajankohtaista/mediatiedotteet/vaitostiedotteet/Sivut/terveydenhuollossa-tulisi-hyodyntaa-olemassa-olevia-ja-kayttajille-tuttuja-teknologiasovelluksia.aspx>

Kansallinen Terveysarkisto. 2018. Retrieved from <http://www.kanta.fi/fi/web/ammattilaisille/varmennekortti>

Krystek, U. & Fiege, S. (2018). Risikomanagement. Retrieved from <https://wirtschaftslexikon.gabler.de/definition/risikomanagement-42454/version-265802>"<https://wirtschaftslexikon.gabler.de/definition/risikomanagement-42454/version-265802>

Kröger, T., Leinonen, A. & Vuorensyrjä, M. (2009). Hoivan tekijät. Suomalainen hoitotyö Pohjoismaisessa tarkastelussa. Jyväskylän Yliopisto. Jyväskylä.

Kvist, T. (2004). Hoidonlaatu-potilaiden ja henkilöstön yhteinen asia? Väitöskirja. Yhteiskuntatieteet. Kuopion yliopisto. Retrieved from <http://urn.fi/URN:ISBN:951-27-0062-X>

Laki sosiaali- ja terveydenhuollon asiakastietojen sähköisestä käsittelystä 159/2007. Retrieved 31.5.2018 from <https://www.finlex.fi/fi/laki/ajantasa/2007/20070159>

Lavander, P. (2017). Nimikesuojattujen ja laillistettujen ammattihenkilöiden työnjako yliopistosairaaloiden muuttuvassa toimintaympäristössä. ACTA UNIVERSITATIS OULUENSIS D Medica. Oulun yliopisto. Lääketieteellinen tiedekunta. Juvenes print. Tampere.

Rehunen, A., Reissell, E., Honkatukia, J., Tiitu, M. & Pekurinen, M. (2016). Sosiaali- ja terveyspalvelujen tarpeen, käytön ja tuottamisen alueelliset muutokset ja tulevaisuuden vaihtoehdot. Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja 41. Helsinki.

Ryynänen, O-P., Kinnunen, J., Myllykangas, M. Lammintakanen, J. & Kuusi, O. (2004) Suomen terveydenhuollon tulevaisuudet. Skenaariot ja strategiat palvelujärjestelmän turvaamiseksi. Esiselvitys. Tulevaisuusvaliokunta teknologian arviointeja. Eduskunnan kanslian julkaisu. Eduskunta.

Terveydenhuollon laatuopas. (2011). Helsinki: Suomen Kuntaliitto. Retrieved from http://shop.kunnat.net/product_details.php?p=2597

Terveydenhuoltolaki 1326/2010. Retrieved from <http://www.finlex.fi/fi/laki/ajantasa/2010/20101326#a1326-2010>

The 2018 Ageing Report Economic and Budgetary Projections for the EU Member States (2016-2070). (2018). European Commission Directorate-General for Economic and Financial Affairs. Institutional Paper 079. Retrieved from https://ec.europa.eu/info/sites/info/files/economy-finance/ip079_en.pdf

Tuovinen, M. (2013). Terveysmenojen kasvu. Kansalaisaloite 1. Valtiovarainministeriö. Helsinki. Retrieved from <file:///C:/Users/jaana/Downloads/Terveysmenojen%20kasvu.PDF>

Van Aerschot, Turja, T. & Särkikoski, T. (2017). Roboteista tehokkuutta ja helpotusta hoitotyöhön? Työntekijät empivät, mutta teknologia ei pelota. Yhteiskuntapolitiikka 82 (6), 630–640.

Voigt, K. (2018). Total Quality Management (TQM). Retrieved from <https://wirtschaftslexikon.gabler.de/definition/total-quality-management-tqm-47755/version-271017>

3 Smart Sheet as a Solution to Aid the Prevention of Pressure Ulcers

Bier Laura, Master of Health Management and Health Information Management student, Neu-Ulm University of Applied Sciences, Germany

Hegele Florian, Master of Health Management and Health Information Management student, Neu-Ulm University of Applied Sciences, Germany

Heino Jere, Bachelor of Engineering student (Information and Communication Technology), Kajaani University of Applied Sciences

Jäppinen Minna, Master of Health Care student, Kajaani University of Applied Sciences

Kervinen Katja, Master of Health Care student, Kajaani University of Applied Sciences

Moilanen Aleks, Bachelor of Engineering student (Information and Communication Technology), Kajaani University of Applied Sciences

Sirviö Minna, Master of Health Care student, Kajaani University of Applied Sciences

Leinonen Rauni, Principal Lecturer, Kajaani University of Applied Sciences

Moisanen Kirsi, Senior Lecturer, Kajaani University of Applied Sciences

Holl, Felix, Scientific Assistant, Neu-Ulm University of Applied Sciences, Germany

Wüffel, Alexander, Professor, Dr., Neu-Ulm University of Applied Sciences, Germany

Abstract

An international group of healthcare and ICT students completed an innovation and development project. As the result of this international and multidisciplinary cooperation Smart Sheet was developed to assist in the prevention of pressure injuries. Pressure ulcers are common among patients all over the world; approximately 60% of pressure ulcers go undetected so this innovation answers to a global problem. Smart Sheet is an innovation that can be used in hospitals or in homecare. It can be used under the mattress in an ordinary bed. It is an aid for patients and healthcare professionals and can be assessed and further developed for wider uses in patient care. The aim of this article is to describe how a group of students with different professional backgrounds can innovate a new way to prevent pressure ulcers.

Keywords: smart sheet, pressure ulcers, prevention, risk assessment, sensors

3.1 Introduction

Kajaani University of Applied Sciences and the German Hochschule Neu-Ulm University of Applied Sciences organized a course called Smart Solutions for Wellbeing Development and Management. The course consisted of independent studies and project work. Master of Social and Health Care students and Bachelor of Engineering (information and communication engineering) students, and Master of Health Management and Health Information Management students from Germany formed the project groups. At first, we designed and innovated this smart solution together using our web platform on Moodle and developed Smart Sheet that can be used in hospitals and homecare as an aid to help prevent pressure injuries. During the International Week in Kajaani (week 8/2018) we met with our project group face to face. During this week we planned, developed and tested our innovation and on the last day of the International Week we presented our Smart Sheet project in a seminar.

In social and health care we live a time of change especially here in Finland. The forthcoming reform of social and health care will bring about changes in legislation and funding as well as in service structures, operational processes and ways in which services are produced (Sote-uudistus 2018). Healthcare and medical care as well as nursing are developing at a fast pace and we as healthcare professionals must stay involved in development. We need to be innovative so that we can find new ways to treat patients better by using the latest technology. (Nissinen & Tillander 2018, 9 - 11.) Patients are nowadays equipped with smart devices, and they are more interested and aware of their care. We need to improve and update our practices so that they respond to the needs of today's patients. (Welling, Kinnunen, Aaltonen & Roine 2018, 861–862.)

This article discusses what can be developed by combining different specialties. Everyone is an expert from the point of view of their own profession and in cooperation the development of innovations can be raised to a higher level. The purpose of this article is to explain what an amazing innovation called Smart Sheet we developed as an international multidisciplinary project on the Smart Solutions for Wellbeing Development and Management course and why it is needed in healthcare. We need to provide safe and high-quality nursing using the latest technology (Welling et al. 2018, 861–862). In our opinion this device can be used to prevent ulceration more effectively and thus improve patients' quality of life, and by using this device, we can also give healthcare professionals more time to treat patients.

3.2 Current Knowledge of Pressure Ulcers

Pressure ulcers are common in healthcare patients all over the world. They have a negative impact on the quality of life of patients with advanced illnesses and they make patients' already complex and burdensome situation worse. (Artico, Dante, D'Angelo, Lamarca, Mastroianni, Petitti, Piradda & Grazia De Marinis 2017.) Treating pressure ulcers is time-consuming and expensive. In Finland it is estimated that about 55,000-85,000 patients a year develop ulcers, and the annual costs are 420 million euros per year. Prevention costs are only a tenth of all treatment-related costs. (Kinnunen, Ahtiala, Hynninen, Iivanainen, Seppänen & Tervo-Heikkinen 2015, 5.) The cost of treating one pressure ulcer is approximately 5,000-6,650 euros (Soppi & Korhonen 2010).

5-15% of pressure ulcers occur in patients in homecare, health institutions and hospitals. In the future incidences of pressure ulcers may even be increasing (Soppi 2010, 1–7). Prevention of hospital-acquired pressure ulcers has become a priority in all healthcare settings, as it is a sign of provision of high quality care. Patients in intensive care units have a higher risk of developing pressure ulcers. (Tayyib & Coyer 2016.) Therefore, risk factors for pressure ulcers must be known in all healthcare units and hospitals (Soppi 2010, 1). It is important to know, for example, that the risk is increasing when patients are acutely ill or cannot move by themselves (Kinnunen et al. 2015, 4; Soppi 2014, 2).

In healthcare 60 % of pressure ulcers go undetected and there are difficulties in identifying them. To prevent pressure ulcers, it is essential to identify the patients at risk and minimize or eliminate pressure at the sites of protruding bones. (Kinnunen et al. 2015, 4.) Despite the availability of published prevention strategies, there is little evidence about which strategies can be safely integrated into routine standard care and have an impact on prevention of pressure ulcers (Tayyib & Coyer 2016).

Pressure ulcers occur when patients of different ages are treated, for example, in acute, long-term and community care. An evidence-based guideline has been published to prevent and identify pressure ulcers in adult patient care. With the help of this guideline patients at risk for pressure ulcers can be identified. (Kinnunen et al. 2015, 4–5.) Artico et al. (2017) and Tayyib and Coyer (2016) provide evidence-based guides to help prevent the development of pressure injuries. For example, the Body Mass Index, Braden Scale and Karnofsky Performance Scale are tools to assess the pressure ulcer risk (Artico et al. 2017). In their review Tayyib and Coyer (2016) demonstrated different prevention strategies that reduce the incidence of hospital-acquired pressure ulcers in

intensive care units (ICUs). For example, a silicon foam dressing had a positive impact in reducing sacrum and heel ulcer incidences in the ICU.

3.3 Why Is Smart Sheet Needed?

Prevalence of pressure ulcers led us to develop Smart Sheet. Its purpose is to help healthcare professionals, patients and patients' relatives to prevent pressure ulcers. Smart Sheet is a technological aid which can measure patients' position in their hospital beds, and it recognizes when the pressure is getting too high and the patient must move or change their position. The measurement is based on pressure. According to Soppi (2010, 5) repositioning the patient every two hours reduces the pressure and helps reduce pressure ulcers. With Smart Sheet, we can reduce and prevent pressure ulcers. Smart Sheet forces patients to move themselves or alarms healthcare professionals to change patients' position when pressure is getting too high, or time limit is up. Smart Sheet alarms until the patient's position is changed. Healthcare professionals must assess patients' risk of developing pressure ulcers using guidelines and then determine if they benefit from Smart Sheet.

A trial is needed to assess the functionality of Smart Sheet in a homecare setting and on a hospital ward. Data can be collected from different patient groups that use this device and later analyzed. A versatile study comparing the experiences of patients who use and do not use Smart Sheet, their family members and healthcare professionals would provide information and user feedback about the functionality of Smart Sheet. Data collected by Smart Sheet itself can be used to promote the prevention of pressure injuries and for further development of Smart Sheet.

3.4 Technical Information

Flexible pressure sensors are increasingly being used in medical applications and in innovative health monitoring (Khodasevych, Parmar & Troynicov 2017). Pressure mapping is a method for determining the pressure on a person from a platform (Kärki, Lehto & Lekkala 2006, 671). Our platform innovation was at first a mattress. The size was 2000x900mm. We changed it into a sheet so that it would be versatile to use and cheaper to develop. Sensors (Image 1.) are inserted within the sheet and are used to measure and predict the change of pressure when the patient is lying

in the bed. With further development there is a possibility to measure, for example, patients' weight and temperature at the same time.



Image 1. FlexiForce Pressure Sensor (100lbs)

Pressure mapping systems almost always contain certain basic components and usually include sensor mat and associated electronics as well as a computer analysis program by which the data obtained from the sensor matrix may be presented and used, for example, in nursing assistance. (Kärki et al. 2006, 673.) The problem in current systems is that some of them have been developed for over 20 years, and during that time they have achieved a measure area of only 1cm². Some systems use more than 16,000 sensors. The problem associated with so many sensors is that more power is needed to process the huge amount of data received. Data is usually processed with expensive commercial programs which are heavy to run. Commercial pressure mapping programs also have compatibility problems with analytical programs since they have primarily been developed to aid in product design and are therefore not suitable for use, for example, in physiological measurements analysis without further development (Kärki et al. 2006, 674–675).

Smart Sheet uses modular design that can be implanted for a variety of beds. The basic size for one modular unit is 500x500mm, and one bed will have five modular units. Sensor units are placed under a normal mattress, which improves the usability of Smart Sheet. The prototype has a 50x50mm area for one sensor, which matches the accuracy of current commercial products and also keeps the costs low. Smart Sheet is to be used in home care and in hospitals, and therefore the transfer of measurement data must be considered. An interface that will show the measurement data from Smart Sheet and be accessible on smartphones, tablets or laptops is being developed.

3.5 Process Model – How the Smart Sheet works

To show the implementation of Smart Sheet in hospital, a process chart was drawn with the Business Process Model and Notation (BPMN). Image 2 illustrates this process chart.

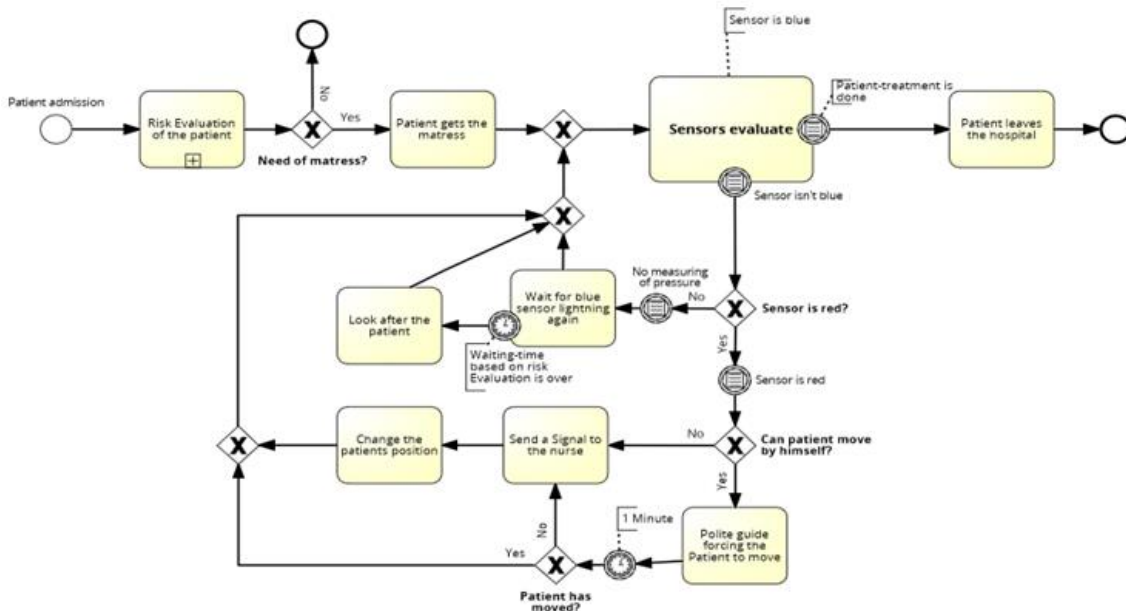


Image 2. Process model of Smart Sheet used in hospital

The process starts with the admission of a patient. The normal process in the hospital includes an admissions interview. This step is part of the necessary risk assessment that determines the whole process of treatment. The first active Smart Sheet process step is the individual risk assessment of the patient. Similarly to the admissions interview, Smart Sheet collects important information about the patient. The most important piece of information about the patient is the question if he or she needs a Smart Sheet or not. If the risk assessment automatically shows that the patient can move by himself, the answer is ‘no’ and the process stops. If the risk assessment shows that the patient needs a Smart Sheet (the answer being ‘yes’), the process continues. The next step should be done as soon as possible by looking on the risks of getting an ulcer. A Smart Sheet is provided to the patient.

Sensors inserted in the Smart Sheet collect data on the patient’s position constantly and are lighted blue or red on the screen of a computer, tablet or smartphone. If the sensor is not red, no pressure is detected and the sensors are switched off. This can happen, for instance, when the patient has stood up to go to the toilet. In this case, nurses should wait some time for the sensors to light blue again. How long they wait depends on the patient’s risk assessment made in the

beginning of the process. So, it is possible to divide patients into different risk groups and treat every patient individually. For demented patients the waiting time should be much shorter than for non-demented patients. After the nurse has attended the patient or the patient has gone back to bed by himself, the sensors turn blue again and evaluate the pressure.

A sensor lighted red indicates that there is too much pressure on a body part and the patient should move to avoid pressure ulcers. First the nurse must clarify whether the patient can move by himself. If the patient is unable to move, the sensors send a signal to the nurse who changes the position of the patient. If the patient is able to move, there will be a polite guideline on their TV or tablet that shows how they should move correctly. The movement is estimated to take one minute. Afterwards the sensors evaluate if the patient has moved by measuring the new pressure.

The sensor evaluation will go on and on like an infinite loop until the patient's treatment is completed and the patient leaves the hospital, which ends the process.

3.6 Benefits

The most important benefit considering the risk of developing a pressure ulcer an ulcer is reduction in the number of pressure ulcers. In a context where 55,000–85,000 patients a year get an ulcer and the annual costs are 420 million € per year (Kinnunen et al. 2015, 5), reducing the number of ulcers is one of the main benefits of Smart Sheet. In addition to reducing costs, patients do not need to suffer from prolonged wound care procedures and pressure injuries causing pain. Smart Sheet and the process of protecting the patient provides nurses and all staff involved in the treatment process an essential instrument to reduce the amount of pressure ulcers. In addition to the improved quality of treatment Smart Sheet also enhances patients' quality of life. The benefit of Smart Sheet for the healthcare system is that it gives healthcare professionals more valuable time to treat patients and is also an ecological choice. A further benefit is the automatic data collection system of Smart Sheet. This data is useful for further treatment of patients, and healthcare professionals can use it to draw treatment guidelines and implement nursing care. (Kärki et al. 2006, 671–672.)

In addition to quality benefits, Smart Sheet offers a quantity benefit, too: Smart Sheet reduces healthcare costs. Prevented pressure ulcers save the costs of wound dressings and wound care itself.

3.7 Conclusion

Identifying pressure ulcers is sometimes difficult and pressure ulcers may be confused with, for example, skin dermatitis caused by incontinence. Elderly people and patients who have impaired mobility and ability to withstand the effects of pressure injuries are at higher risk getting pressure ulcers, but these ulcers can develop to anyone and, therefore, it is important to assess the patient's risk factors as soon as possible, preferably within eight hours after treatment. (Soppi & Korhonen 2010.)

The Smart Sheet innovation has a wide range of applications, which is largely due the fact that it was developed in cooperation with experts from different professional fields. It can be used in home care as well as in hospitals or nursing homes. Additionally, it can improve the quality of life of bedridden patients and patients at a high risk of developing pressure injuries. Pressure ulcers are painful for patients and increase prevalence of inflammations, which diminish patients' quality of life. (Soppi 2010, 1.) As a pressure sensing device Smart Sheet can be used in patient care. Use of Smart Sheet also has economic benefits (Kärki et al 2006, 672). With the help of this Smart Sheet we can improve patients' quality of life and give healthcare professionals more time for patient care. The evaluation of Smart Sheet will show its usability and impact on patient treatment. In the future Smart Sheet sensors can be developed further to measure weight, temperature or vital signs such as blood pressure. All in all, Smart Sheet will be a further step into smarter solutions in the healthcare sector. (Zang, Zhang, Di & Zhu 2015.)

Sources

Artico, M., Dante, A., D'Angelo, D., Lamarca, L., Mastroianni, C., Petitti, T., Piredda, M. & Crazia De Marinis, M. 2017. Prevalence, incidence and associated factors of pressure ulcers in home palliative care patients. *Palliative Medicine*. Retrieved from <https://doi.org/10.1177/0269216317737671>

FlexiForce Pressure Sensor – 100lbs. N.d. Sparkfun. Retrieved 18.3.2018 from <https://www.sparkfun.com/products/8685>

Khodasevych, I., Parmar, S. & Troynikov, O. 2017. Flexible sensors for pressure therapy: Effect of substrate curvature and stiffness on sensor performance. *Sensor* 17(10), 2399. Retrieved from [doi:10.3390/s17102399](https://doi.org/10.3390/s17102399) and www.mdpi.com/journal/sensors

Kinnunen, U-M., Ahtiala, M., Hynninen, N., Iivanainen, A., Seppänen, S. & Tervo-Heikkinen, T. 2015. Painehaava ehkäisy ja tunnistaminen aikuispotilaan hoitotyössä. *Hoitotyön tutkimussäätiö*.

Kärki, S., Lehto, M. & Lekkala, J. 2006. Painekartoitus painehaavojen ehkäisyn apuna. *Duodecim* 122, 671–676. Retrieved from <http://www.ebm-guidelines.com/xmedia/duo/duo95612.pdf>

Nissinen, A. & Tillander A. 2018. Minne tulevaisuus vie? *Suomen hammaslääkärilehti* 25(3), 9–12.

Soppi, E. 2014. Ehkäise painehaavojen syntyminen. Helsinki. *Lääkärilehti* 69 (46), 2.

Soppi, E. 2010. Painehaava-esiintyminen, patofysiologia ja ehkäisy. *Lääketieteellinen aikakauskirja Duodecim* 126 (3), 1–7.

Soppi E., Korhonen P. 2010. Braden ja Shape Risk Scale (SRS) painehaavamittareiden vertailututkimus. Retrieved from http://www.medimattress.fi/images/02_pdf/Poster1%20Braden%20ja%20SRS%2090x120%201_2010.pdf

Sote-uudistus. 2018. Terveiden ja hyvinvoinninlaitos. Retrieved from <https://thl.fi/fi/web/sote-uudistus/ajankohtaista>

Tayyib, N., Coyer, F. 2016. Effectiveness of Pressure Ulcer Prevention Strategies for Adult Patients in Intensive Care Units. *Worldviews on Evidence-Based Nursing*. Retrieved from <https://doi.org/10.1111/wvn.12177>

Welling, M., Kinnunen, M., Aaltonen L.-M. & Roine R. 2018. Parasta ennen- osaamista on päivitettävä. *Lääkärilehti* 73(14), 861–862.

Zang, Y., Zhang, F., Di, C-a. & Zhu, D. 2015. Advances of flexible pressure sensors toward artificial intelligence and health care applications. *Mater. Horiz* 00 (1-3), 140–156. Retrieved from <http://pubs.rsc.org/-/content/articlehtml/2015/mh/c4mh00147h>

4 Triage Application for Smart Devices

Haverinen Merja, Master of Social and Health Care student, Kajaani University of Applied Sciences

Nikula Maarit, Master of Social and Health Care student, Kajaani University of Applied Sciences

Ruuskanen Mira-Maria, Master of Social and Health Care student, Kajaani University of Applied Sciences

Schloesser David, Master of Health Management and Health Information Management student, Neu-Ulm University of Applied Sciences, Germany

Leinonen Rauni, Principal Lecturer, Kajaani University of Applied Sciences

Moisanen Kirsi, Senior Lecturer, Kajaani University of Applied Sciences

Holl Felix, Scientific Assistant, Neu-Ulm University of Applied Sciences, Germany

Würfel Alexander, Professor, Dr., Neu-Ulm University of Applied Sciences, Germany

Abstract

The closest health center can be located on your smartphone in the future. Health and well-being mobile applications and measuring one's own vital signs are already a routine part of everyday life for many people worldwide. Emergency rooms are increasingly facing the issue that emergency services are being utilized by patients who are not in a state of emergency. The aim and purpose of this innovation was to prevent unnecessary visits to emergency rooms and to prevent or ease the fear of illness when patients are at home. This innovation gives patients the possibility to undergo a simple triage at home before heading to the hospital. Triage is a process that determines the treatment priority based on the severity of condition. It is used to allocate resources to those in most urgent need if there are not enough resources to take care of everyone immediately. In fact, triage is and should be an ongoing process during a patient's treatment. This article introduces an innovation which is an application that can be downloaded onto a smartphone and tablet. This application does not make any diagnoses; it only gives suggestions of what can be done in an unclear situation. The application only asks closed yes and no questions, which are the fastest and easiest questions in such stressful situations. The application also aims to solve the issue of triage transparency: triage and, consequently, waiting times tend to be long, which causes dissatisfaction among patients and complaints are usually handled by nurses. A self-assessment tool could be very useful for patients to understand the urgency of treatment. The aim and purpose of this innovation is also to prevent unnecessary visits to emergency rooms and to prevent or ease the fear of illness when patients are at home. This innovation will have to be tested in the right environment by a group of people which represent the majority of society.

New innovative solutions are needed for health care. Innovative thinking should be self-evident in work communities and be also taught in schools.

Keywords: triage, application, emergency room, self-assessment

4.1 Starting to Innovate a Simple Tool to Do Triage at Home

Patients do not usually know how urgent their situation is; therefore, the original idea was that an application would ask some questions and then make an appointment with the nurse or guide patients straight to the emergency. Triage typically fails for one of the two basic reasons: "underestimation and overestimation". (Rutschmann, Kossovsky, Geissbühler, Perneger, Vermeulen, Simon & Sarasin 2006, 1.) Underestimation may mean, for example, that the patient's need is not recognized when they would benefit from the use of scarce medical resources, such as a victim of a serious accident whose life would be saved by rapid evacuation and emergency surgery. Underestimation also refers to a weak sensitivity to see the critical state of those patients who would benefit from available medical resources while overestimation occurs when patients who do not, in relative terms, benefit from scarce resources and receive this resource, i.e. non-critical patients who receive immediate treatment even if they can safely wait. A self-assessment tool used at home can also reduce the feeling of dissatisfaction experienced by patients as they are waiting for an evaluation in the emergency room. An evaluation of the need for treatment is always made by an experienced clinician. (Foley & Reisner 2016, 337.) Concerned patients can form a large part of the patients who receive treatment urgently without needing it. (Kanter 2011, 190.)

The Finnish Emergency Regulation (782/2014) says that "primary assessment of the urgency of treatment means a definitive assessment of the urgency of treatment for a patient arriving at the emergency unit. There should evaluate the urgency of the treatment and the place of care needed for all treatment careers based on the outcome of the patient, other illnesses and status findings. The guidance must consider the urgency categories to be followed in the emergency unit and the unique need for care and risk assessment". (Asetus kiireellisen hoidon perusteista ja päivystyksen erikoisalakohtaisista edellytyksistä 782/2014.)

Promotion of evidence-based activities in Finland is enshrined in the following key national health policy documents:

The Health Care Act (1326/2010, 8§) requires that health care operations must be based on evidence, good management and operational practices. The law also obliges the operation to be quality, safe and properly implemented in healthcare.

According to an action plan for years 2009-2011 published by the Finnish Ministry of Social Affairs and Health, "Leadership of effectiveness and attractiveness to nursing is evidence-based activity and dissemination of evidence-based practices identified as a key focus area (Increasing the Effectiveness and Attraction of Nursing Care by Means of Management 2009). The goal is to create functional practices and support structures to make recommendations for nursing and nursing. The aim is also to create structures and procedures for transmitting evidence-based information to organizations and units to transfer information to staff."

There are many opportunities for wellbeing innovations and applications. For example, Finland has My Kanta Service which is a national online archive of health information in which citizens may enter information on their own health and wellbeing. (Oma kantapalvelu 2018.) It is estimated that in ten years' time almost a half of health center visits can be replaced by e-services if we begin acting now. This will also help to save healthcare professionals' time which can then be devoted to patients with multiple or urgent health needs. (The Finnish Innovation Fund Sitra n.d.)

Finland faces major challenges to which digitalization can be one solution. The population is aging and needs more support for wellbeing and health promotion. (Digitalisaatio terveyden ja hyvinvoinnin tukena 2016, 4.)

4.2 Digitization in Health Care

The whole health care model is radically transformed by new technologies, and we have to prepare for this transformation which requires flexible attitudes and ability to use different digital innovations from nurses. They also need to learn how to work across professional boundaries and take advantage of each other's expertise to network with each other. The course 'Smart Solutions in Wellbeing Development and Management' opened our eyes to this opportunity. Social and health care services have traditionally been based on hierarchical operating models. Provision health care services has been strongly focused on organizations. (Nykänen & Ruotsalainen 2012, 280.) In the future, the client is in the center and is actively involved in the design of services. Therefore, health care professionals should try to change their own way of thinking. Competence

is ensured, for example, by providing change-based training on digital tools. It is also essential to evaluate the digital levels of digital competence, both at expert and organizational levels. Involvement of professionals in the digitalization of an organization helps to find internal motivation and also acts as an alteration driver. (Digitalisaatio terveyden ja hyvinvoinnin tukena 2016, 24–25.)

Clients hope to receive high quality services easily, quickly and cheaply. Often self-service is the best service when it works and is well designed. Digitalization aims to change public administration practices. The goal is also to broadly change the way of thinking, operating models, structures and interaction between them. (Kaivo-Oja 2016, 85.) In social and health care, client involvement is the key. The concept of involvement is context-oriented and often refers to active influence on the content and development of services at the individual level. (Kiilakoski, Gretscher & Nivala 2012, 5-6; Korhonen & Virtanen 2015.) Client involvement in digital services at the individual level means gaining and producing health information about themselves and deciding on how to use it. Looking at one's own health data, making appointments and finding reliable health information are the most important digital services from a client perspective. (Hyppönen, Hyry, Valta & Ahlgren 2014, 70.) Home measurements and various tools are a growing sector in the identification of the patient's health problem and assessing their need for care. This requires a variety of tools to support self-care. (Kaivo-oja, Salanterä, Mieronkoski, Terävä, Suhonen 2016, 94.)

4.3 Innovation

The aim and purpose of this innovation was to prevent unnecessary visits to emergency rooms and to prevent or ease the fear of illness when patients are at home. This innovation provides the possibility for patients to undergo a simple triage at home before heading to the hospital. This is possible to do with an application that will provide a triage solution for people who are not sure if they should go to the hospital or not. The application can have an impact on the number of unqualified patients in emergency rooms. The application does not tell patients how they should treat themselves. Treatment paths in the innovation model are not complete, but it is easy to add symptoms and instructions to the application later. We were able to develop a clear structure for the system so that when the system is ready, the home user knows when help is required immediately or whether he or she needs to contact the healthcare provider within a few days. Care recommendations are based on Finnish current care guidelines which are evidence-based guidelines. Similar guidelines are used in most European countries. The goal is to respond to the need

for care by using effective methods and treatment practices. (Current care guidelines in Finland 2017.)

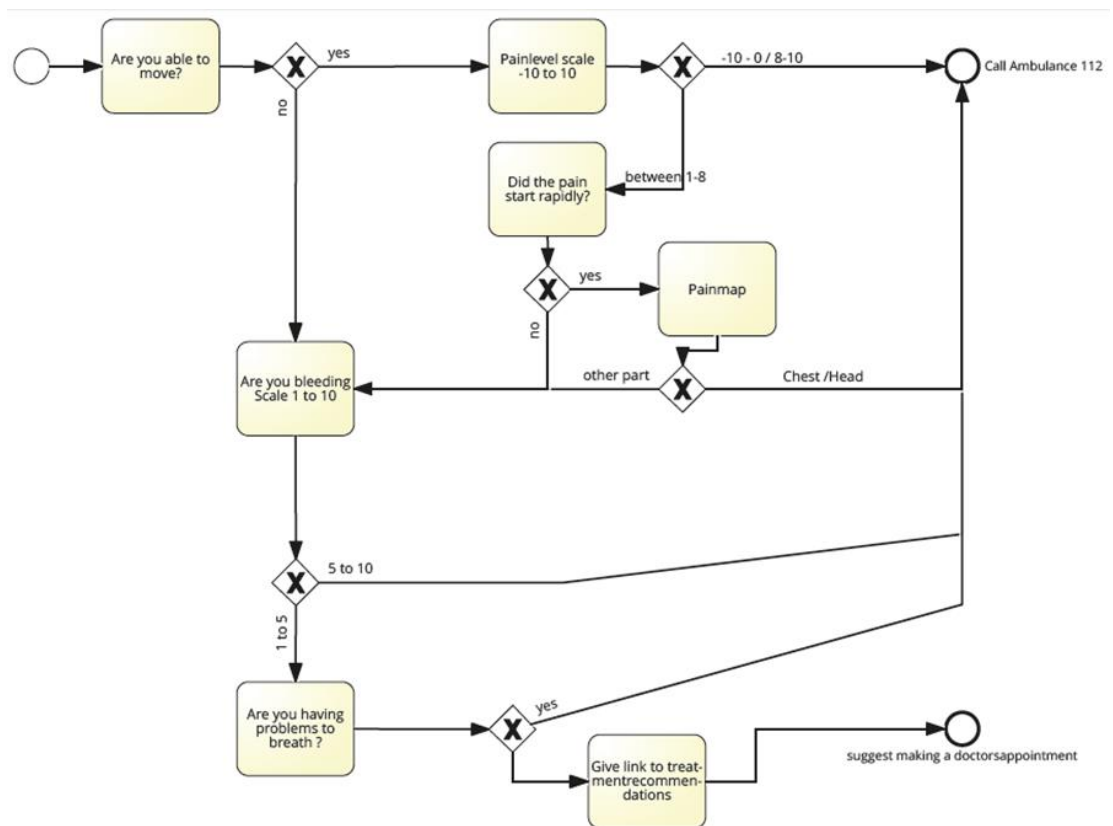


Image 1. Process model of the simple triage application

Image 1 above shows the process diagram of the triage application. The process diagram was made using the Business Process Model and Notation (BPMN) which is a graphical representation to depict business processes and to close the gap between IT and business (von Kossak, Illibauer, Geist, Kubovy & Natschläger 2014, 1). In the BPMN, gateways are used to define the next step after a question. We decided to only use OR-Gateways which are defined by the fact that only one path can be taken after splitting up (Gruhn & Laue 2007, 1). The first question in Image 1 is “Are you able to move?” If the answer is yes, the next question according to the process diagram above can only be “On a Scale from -10 to 10, how would you describe your pain? -10 refers to total numbness as if paralyzed and 10 the highest imaginable pain.” After this question we decided to specify the OR-gateway with a different definition where the parameters are marked by numbers: depending on what number one is giving, he or she is asked another question or the application suggests calling an ambulance right away. The application has two possible endings: one should either call an ambulance or to make an appointment with the doctor.

4.4 Evaluation

An innovation should be quick, easy to use and inexpensive for both the user and the innovation provider (Antikainen et. al. 2017, 21). Our project was quite timely because we had to think what kind of patient is directed to the emergency room: do people know how to assess their symptoms at home? A project should always be a learning process where the plans will be refined as the project progresses (Kiuru 2011, 15). We learned a lot of new things about multiprofessional cooperation. Collaboration is enriched by cooperation in various fields; it gives perspectives for the implementation of the work. Our project team had four ICT students, a German Master student of management and three Master students of social and health care development and management.

The primary goal of the innovation is to create a simple, quick, easy to use and clear application that can be used with a smartphone, tablet or computer. The application is available to download and has customer support service. The project follows an interdisciplinary approach, bringing together both ICT, management and nursing perspectives.

This innovation needs to be tested in the right environment in the future and testing needs to be extensive enough. Testing requires a permission from the hospital management and users. The application will be inexpensive to make and free for users. Testing and evaluation of the application should take place in a real hospital environment with real customers who have access to use the application. It takes at least six months to see if the application reduces the number of patients who do not need medical help urgently in the emergency room. A SWOT analysis (Image 2) was made to support the evaluation of this application.

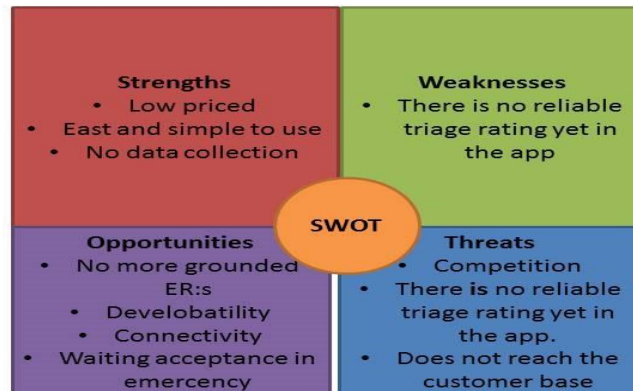


Image 2. SWOT analysis at an early stage of the process

The SWOT analysis highlights the strengths and weaknesses of the application and makes it easier to further develop the application. The SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) is a four-field method developed by Albert Humphrey and used to formulate a strategy as well as to identify, evaluate and develop learning or problems. It is a useful and simple tool for planning operations. (Strategic planning 2018.)

4.5 Conclusion

The development and growth of digital services, renewed approaches, and new ways of working will require experts in the field of new skills and constructive attitudes. Digital health services, applications and tools can be used to benefit citizens and specialists through training, enhanced competence and changing attitudes. This triage application gives both citizens and experts new methods for health and wellbeing promotion and treatment of illness. Primary care emergency rooms are often congested as access to emergency services is hampered by employee shortages and, on the other hand, it is difficult for the patient to assess if the situation calls for a visit to the emergency rooms. In addition, on-call receipts are concentrated in increasingly large units, resulting in staff turnover. Training in the assessment of need for care is also not consistent. Thus, there is a need to develop e-health services for primary health care to increase the fluency of operations. (Yhtenäiset kiireettömän hoidon perusteet 2010, 2014, 3.)

The purpose of this innovation was to find ways to prevent unnecessary contacts to the emergency room and to prevent/ or ease the fear of illness when the patient is at home. Technological advances also bring new ways to control demand for on-call duty. For example, symptomatic assessments that help clients assess their needs for care can provide them with good interface instructions on self-care or primary care, and thus prevent unnecessary visits to the emergency room. (Malmström, Hörhammer, Peltokorpi, Linna, Koivuranta-Vaara, Mikkola 2017, 14.)

If patients know where and when they can seek proper care, it will be safe and effective and save resources. Preventive care and new approaches and services will play a growing role in future health issues. The health care sector must develop new technologies without delay, because the society around it is already digitized. (Untapped potential in digital health and well-being services n.d.) However, there is a risk that using self-triage advice from symptom checkers encourages users to seek treatment for conditions where self-care is reasonable (Semigran, Jeffrey, Linder, Gidengil & Mehrotra 2015). Therefore, it is important to create an application that will guide the user to seek help at the right time from the right place. This innovation does exactly that.

"Digitalization brings the services near, reduces costs and streamlines processes. Digitalization can have a great impact in the countryside where the pace of service structural change is quicker and distances to physical service points grow." Digitalization is progressing technologically more rapidly, but it is difficult to show the benefits, especially the financial ones. Digitalization is an important opportunity to develop the accessibility of services and reduce costs. (Antikainen et al. 2017, 7, 21.)

Sources

Asetus kiireellisen hoidon perusteista ja päivystyksen erikoisalakohtaisista edellytyksistä 782/2014. (Decree of the Ministry of Social Affairs and Healthcare the basics of emergency care and the special conditions for emergency duty. 782/2014). Sosiaali- ja terveysministeriö: Helsinki.

Antikainen, J., Honkaniemi, T., Jolkkonen, A., Kahila, P., Kotilainen, A., Kurvinen, A., Lemponen, V., Lundström, N., Luoto, I., Niemi, T., Pyykkönen, S., Rehunen, A., Saukkonen, P., Viinamäki O-P & Viinikka, A. 2017. Smart Countryside. Maaseudun palveluiden kehittäminen ja monipuolistaminen digitalisaatiota ja kokeiluja hyödyntämällä. Valtioneuvoston selvitys- ja tutkimustoiminnan julkaisusarja 9. Helsinki. Retrieved from <http://urn.fi/URN:ISBN:978-952-287-338-5>

Current care guidelines in Finland. n.d. Käypähoito -suositukset. Retrieved from <http://kaypa-hoito.fi/web/kh/etusivu>

Digitalisaatio terveyden ja hyvinvoinnin tukena. 2016. Sosiaali- ja terveysministeriön digitalisaatiolinjaukset 2025. Sosiaali- ja terveysministeriön julkaisuja. Helsinki. Retrieved from <http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/75526/JUL2016-5-hallinnonalan-ditalisaation-linjaukset-2025.pdf>

Foley, E. Reisner, A.T. 2016. Chapter 54 - triage. In: Ciottone GR (eds). Ciottone's disaster medicine (second edition). Philadelphia: Elsevier; 2016:337-343. Retrieved from <https://www.sciencedirect.com/science/article/pii/B9780323286657000546>

Freund, J. & Rücker, B. 2010. Page 18 Praxishandbuch BPMN: Incl. BPMN 2.0.

Gruhn, V. & Laue, R. 2007. What business process modelers can learn from programmers. Computer Science Faculty, University of Leipzig, Science of Computer Programming 65, 4–13.

Hyppönen, H, Hyry, J, Valta, K & Ahlgren, S. 2014. Sosiaali- ja terveydenhuollon digitaalinen asiointi. Kansalaisten kokemukset ja kehittämistarpeet. Raportti 33. Terveyden ja hyvinvoinnin laitos: Helsinki. Retrieved 5.4.2018 from <http://urn.fi/URN:ISBN:978-952-302-410-6>

Increasing the Effectiveness and Attraction of Nursing Care by Means of Management. Action plan for years 2009-2011. Julkaisuja 18. Social- and healthcare ministry of Finland (STM): Helsinki. Retrieved from <https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/74335/URN%3ANBN%3Afi-fe201504226780.pdf?sequence=1>

Kanter, RK. 2011. Chapter 18 - critical care in public health emergencies. In BP. Fuhrman & JJ. Zimmerman (eds.) *Pediatric critical care (fourth edition)*. Saint Louis: Mosby. 190-195. Retrieved from www.sciencedirect.com

Kaivo-Oja, J. Salanterä, S. Mieronkoski, R. Terävä, V. Suhonen H. 2016. Sairaanhoidaja tulevaisuuden ympäristössä- miten työ ja osaaminen muuttuvat? Teoksessa *Hoitotyön vuosikirja. Teknologia sosiaali- ja terveydenhuollossa*. Bookwell Oy: Porvoo. 91–97.

Kiilakoski, T. Gretschel, A. & Nivala, E. 2012. Johdanto. Teoksessa *Muistiinpanoja demokratiaopitunnista, Millainen on lasten ja nuorten kunta 2010-luvulla? Nuorisotutkimusverkosto/ Nuorisotutkimusseura Verkkojulkaisuja 57*. Helsinki.

Kiuru, L. 2011. Strategisten kehittämissuunnitelmien onnistumisen ehdot. Case Pirkanmaan sairaanhoitopiiri. Pro gradu. Hallintotiede. Tampereen yliopisto. Tampere.

Korhonen, M. & Virtanen, T. 2015. Digitaalisuus ja asiakaslähtöisyys sosiaali- ja terveydenhuollossa – kansalaisen omat tiedot hyötykäyttöön. *Finnish Journal of eHealth and eWelfare*, 7(4), 237–239. Retrieved from <https://journal.fi/finjehew/article/view/53522>

Malmström T., Hörhammer I., Peltokorpi A., Linna M., Koivuranta-Vaara P., Mikkola T. 2017. Päivystyksen kysyntä ja sen hallinta ikääntyneet potilaat. Kuntaliitto. Julkaisu 8. Retrieved from file:///C:/Users/MH/Downloads/1831paivystyksenkysynta_nro8_ebook.pdf

Nykänen, P. & Ruotsalainen, P. 2012. Kansalaisen luotettava eterveyspalveluympäristö. School of Information Sciences. Article in *Compiled Work*. Tampere University Press. Tampere. Retrieved from <http://urn.fi/URN:NBN:fi:uta-201406091698>

Oma kantapalvelu. 2018. Kansallinen terveysarkisto "KANTA". Retrieved from <http://www.kanta.fi/en/web/ammattilaisille/omakanta2>

Rutschmann, O. T., Kossovsky, M., Geissbühler, A., Perneger, T. V., Vermeulen, B., Simon, J., & Sarasin, F. P. 2006. Interactive triage simulator revealed important variability in both process and outcome of emergency triage. *Journal of Clinical Epidemiology* 59 (6), 615–621. Retrieved from doi: <http://dx.doi.org.ezproxy.hs-neu-ulm.de/10.1016/j.jclinepi.2005.11.003>

Semigran, H.L. Jeffrey, A. Linder, J.A. Gidengil, C. & Mehrotra, A. 2015. Evaluation of symptom checkers for self-diagnosis and triage: audit study. *BMJ* 2015; 351. Retrieved from doi: <https://doi.org/10.1136/bmj.h3480>

Strategic planning. 2018. Britannica Academic, Encyclopædia Britannica. Retrieved 18.4.2018 from academic-eb-com.ezproxy.hs-neu-ulm.de/levels/collegiate/article/strategic-planning/601044 RTO-FRE

Terveydenhuoltolaki 1326/2010. Helsinki. Retrieved from <https://www.finlex.fi/fi/laki/ajantasa/2010/20101326>

Untapped potential in digital health and well-being services. n.d. The Finnish Innovation Fund Sitra. Retrieved from <https://www.sitra.fi/en/news/untapped-potential-digital-health-and-well-being-services/>

von Kossak, F., Illibauer, C., Geist, V., Kubovy, J. & Natschläger C.A. 2014. Rigorous Semantics for BPMN 2.0 Process Diagrams. Springer. (forthcoming).

Yhtenäiset kiireettömän hoidon perusteet. 2010. AT-julkaisupaino Oy: Helsinki. Retrieved from <http://urn.fi/URN:ISBN:978-952-00-3520-4>

5 Increasing Patient Awareness with a Patient Guidance Tablet

Heikkinen Virpi, Master of Social and Health Care student, Kajaani University of Applied Sciences
Kuikka Samuel, Bachelor of Engineering student (Information and Communication Technology),

Kajaani University of Applied Sciences

Malinen Sinikka, Master of Social and Health Care student, Kajaani University of Applied Sciences

Renoth Robin, Master of Health Management and Health Information Management student, Neu-Ulm University of Applied Sciences, Germany

Väisänen Heli, Master of Social and Health Care student, Kajaani University of Applied Sciences

Leinonen Rauni, Principal Lecturer, Kajaani University of Applied Sciences

Moisanen Kirsi, Senior Lecturer, Kajaani University of Applied Sciences

Holl Felix, Scientific Assistant, Neu-Ulm University of Applied Sciences, Germany

Würfel Alexander, Professor, Dr., Neu-Ulm University of Applied Sciences, Germany

Abstract

Innovation is a way to discover new ideas, create new methods and products. It is a change of mind, open mind, entrepreneurialism, and creativity. Introduction of innovations requires creativity and innovation. (Juuti 2015, 69.) Innovations seek to make positive changes, promote workplace learning design processes or further develop workplace learning. Therefore, an innovation does not have to be all new – it is enough if the innovation produces something new to the individual, unit or organization (e.g. a company). Client-centered organizations must be constantly innovative, because by renewing their operations and developing the quality of their services they can ensure that clients are provided with added value. This article introduces a dedicated purpose tablet for patient guidance that provides comprehensive, easily accessible and understandable information to patients and their relatives. Patients can use the tablet to search for information while waiting for their appointments and during treatment, which makes waiting and treatments more entertaining and time goes faster. The tablet can be customized according to the needs of different hospitals and departments, and it is also a useful tool for nurses. Kainuu Central Hospital will introduce the application at their Day Hospital. The introduction depends on various factors such as costs and schedules. The purpose of this article is to introduce opportunities that innovations offer and future possibilities that innovations facilitate.

Keywords: patient guidance, dedicated purpose tablet, information

Introduction

The idea for this innovation was introduced nurses working in the Day Hospital at Kainuu Central Hospital. First, the idea was discussed among a group of Master students, and later a student from Neu-Ulm University of Applied Sciences and an ICT student from KAMK joined the group.

The Day Hospital is a unit that treats different types of patients including cancer patients, performs minor procedures and provides postoperative treatment for surgical patients. The unit is open from Monday to Friday between 8am and 7pm. Patients are adults aged 18-95 years.

The purpose of this innovation is to give patients and their relatives more information about, for example, diseases, social security and guidance that they can have access to as easily as possible. In patient guidance, patients are experts of their own lives and nurses are experts in guidance. The role of the nurse is to identify the patient's need for guidance together with the patient. (Hirvonen, Johansson, Kyngäs, Kääriäinen, Poskiparta & Renfors 2007, 26.) When using this innovation, the nurse still gives information to the patient, but this innovation helps the patient get specific information that they need. This innovation also allows the patient to peacefully concentrate on the information at their own pace. Guidance should take into account patients' unique need for information about their illness and its management as well as the opportunity to learn new things (Lundh, Rosenhall & Törnkvist 2006; Kääriäinen & Kyngäs 2010).

According to a hypothetical model introduced by Kääriäinen in her dissertation (2007), the quality of guidance refers to interaction-based, active, goal-oriented and context-related activity implemented effectively with appropriate and adequate resources. Guidance is the professional responsibility of the nursing staff. Respect for patient individuality, self-determination and privacy requires the nursing staff to identify and reflect on their own personal and professional values. In addition, professional responsibility implies that the nursing staff know the matters that guidance focuses on well, are familiar with principles of learning and management methods, and possess necessary interaction and managerial skills. (Kääriäinen 2007, 116–117.) It is important for the nursing staff to reform control methods and develop their own skills as patients change and patients' knowledge increases, for example, with technological advances. (Lundh et al. 2006). According to Lipponen (2014) nursing staff should develop a variety of patient education methods and utilize different equipment in patient guidance.

Guidance skills are an essential part of nursing care. Each nurse is involved in development work in accordance with their own skills, needs and competence, and also in accordance with the organization's needs. It is important that the organization provides employees an opportunity to develop their competence and is grateful for the implementation of innovations. Every need has to be assessed individually so that they can be implemented.

5.1 Dedicated Purpose Tablet for Patient Guidance

The idea of innovation came from the Day Hospital at Kainuu Central Hospital. Nurses use a lot of time to guide their patients, and they have noticed that they need to develop patient guidance and find new methods to implement patient guidance.

Nowadays the client is involved in their own care much more than earlier. This means that we need to create client-oriented and high-quality services that emphasize the client's right to be involved in making decisions that have an impact on them and emphasize the empowering role of inclusion. Now the client is an active actor and the owner of the transaction, and healthcare professionals are involved in the care of the client. For this to happen, dialogue is needed. In order to be able to participate and to become an agent, the client must have network knowledge which includes technology utilization and critical content analysis skills and knowledge of the web. In order for these to develop, active online mobility and communication are needed. (Ahonen, Kinnunen & Kouri 2016, 23–24.) Many clients in the healthcare sector are not active IT users and rulers, which was taken into account in the development of this innovation.

The main objective of this innovation is to help patients find correct information about their illness, medication and care and to engage them in their own recovery through a connection between them and their care team provided by a tablet application. The dedicated purpose tablet, which is aimed for different patient groups at the Day Hospital only, provides an easy access to correct information. A dedicated purpose tablet is a tablet that is locked to run only one application. The first version of the tablet includes links to websites where patients find easily all information that they need. They can study these websites at the Day Hospital and later find the same websites easily at home. Patients can also introduce the websites to their family members. An example of a website is Terveyskylä, an online service that provides information and support for patients and tools for healthcare professionals (Terveyskylä 2018). Patients are better prepared for treatment when they have more information of their illness and medication.

The tablet is to be used in the Day Hospital when patients are waiting for their appointments or are having treatment. Patients, family members and staff can only access applications that are locked on the tablet, not internet. The Hospital's ICT department is responsible for tablet protection, applications and maintenance. One of the challenges is to keep information updated, which is to be solved with the Hospital's ICT department.

5.2 Tablet and Application Requirements

The tablet should be water-resistant so that it can be cleaned easily. It needs to be large enough so that it is easy to handle. It doesn't need much processor power since it is only designed to run one application at a time. The tablet is to be secured to a stand so it should be adjustable and sturdy. Because the tablet is locked to a stand, it can't be dropped or stolen easily.

The user interface should be easy to use for all age groups. The font should be clear and easy to read also for patients with poor eye-sight. Buttons should be easy to reach and be positioned to the sides of the tablet. The application aims to present information logically and clearly for patients. Image 1 illustrates what the user interface could look like.

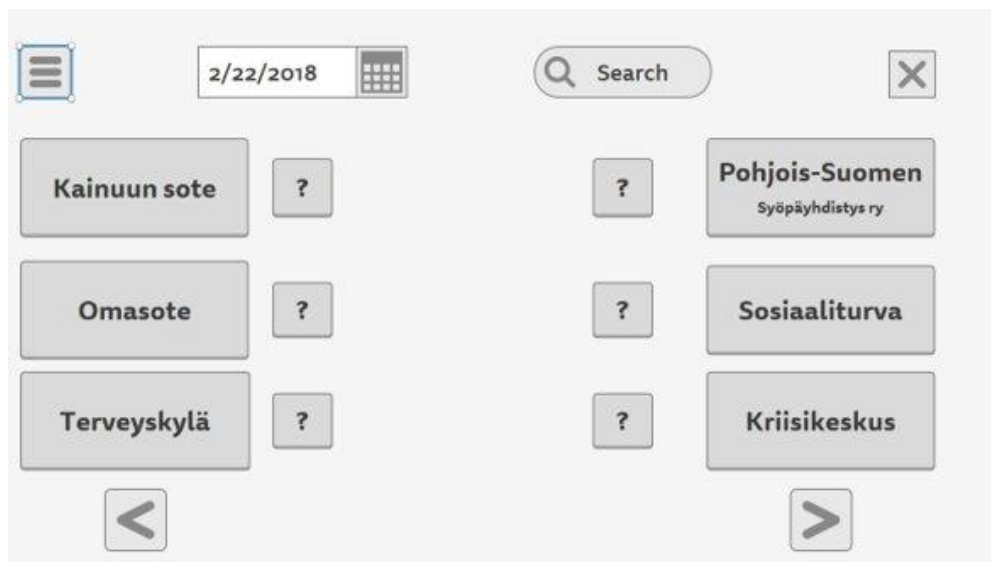


Image 1. Illustration of the user interface

The functions available on the tablet are limited, for example, by Android's parental control system. This system allows to create secure and password-protected user profiles. Patients can only

use applications which they have the permission to use. Internet use can also be limited and users blocked from downloading applications from Appstore.

5.3 Challenges and Benefits of the Tablet

One challenge is to make the patient and relatives aware of the possibility to use the tablet to find information. Although the tablet helps nurses and doctors explain treatments and procedures to patients at the Day Hospital, they may feel that they are losing an important competency. This loss of information brokerage can lead to rejection. Demonstration methods and technological tools, such as internet, are used as guidance for individual and group guidance (Lundh et al. 2006; Eckman, Wise, Leonard, Dixon, Burrows, Khan & Warm 2012). Control time and high quality control methods and guidance materials support patients' access to information (Lundh et al. 2006; Kääriäinen & Kyngäs 2010).

Another challenge is to be precise in explaining and supplying information. If this aspect is not considered properly, the hospital staff may be asked to explain information available on the tablet, which is at the end more time-consuming than giving information directly, without the tablet. A more structural challenge is to keep the applications updated. It is important to have access to the latest information about treatments and medicines. Otherwise the reliability and credibility of this innovation are lost.

Information is an important aspect for patients. Therefore, the tablet should bridge the gap between the professional staff at the hospital and the patient. The information is available for the patient via an application, which gives the patient access to personalized information packages. This information is selected from a large general database and is filtered regarding the patient's disease, health status, age, gender and different other parameters. With this specialized input the patient finds customized and precise information about the status of the actual treatment, the upcoming procedure and processes. There is also the possibility for answers to questions the patient may have. The answers and explanations might even be better than those given by the professional staff, because charts and diagrams can be used in small clips to illustrate the explanations. With this application the transparency of the treatment and hospital stay at increases. In addition, the application saves the hospital staff, patients and their relatives' time. The hospital staff can use the time saved to increase the quality of treatment.

Because processes at the Day Hospital are complicated and difficult, it is important to explain terms and treatments in a non-professional way using lay terminology. (Banchinger 2012, 33.) The contents of the tablet are intended for patients. Vocabulary used is not too professional, which makes it easier for patients to understand the information.

The possibility for modifications or add-ons is another benefit. Because the application is simple, there are no concerns about space in the device, and the basic program can be used and modified for different stations and different patients. It is important that updating the tablet is easy, because technology is developing constantly and patients need different information in the future.

5.4 A New Innovation to Promote Client-Centered Services

Client-centeredness refers to focusing on service users (Moisanen 2018, 35). Client-centered organizations are innovative because by modernizing their operations and developing their services to meet client needs, they can provide added value to their clients (Juuti 2015, 75). Client-centeredness requires organizational renewal, hierarchy reduction, service sectors opening up, and new, innovative solutions for delivering services (Hakari 2009, 91). In addition to client-orientation, the development of client access opportunities is topical in social and health care services (Moisanen 2018, 37). Innovation can also promote learning processes in work communities and develop staff skills (Achrén, Dágostino, Hohan, Humpl, Koski, Polzin, Voicu & Väyrynen 2010, 9). The tablet is a new innovation that can provide options for client guidance and facilitate client participation.

Transparency increases the satisfaction of patients and relatives, because they know and understand why and how the treatment proceeds and do not feel that they have not been told everything by the hospital. Transparency can give a hospital a competitive edge: satisfied patients can promote the hospital and its services to prospective clients and enhance the good reputation of a hospital. (Schmola & Rapp 2014, 130–131.) The importance of client experiences is also increasing in the social and healthcare sector as service providers are increasingly competing for clients and clients may have difficulties distinguishing products and services. Today clients are looking for organizations that will benefit from the best client experiences. (Juuti 2015, 40.) This challenges organizations and their staff to innovate and adopt new practices to ensure that they offer clients the best services and quality available.

5.5 Conclusion

The goal of the Finnish eHealth and eSocial Strategy 2020 is to promote online patient guidance and service coordination 2020. Thus, interaction between citizens and nurses will be multiplied. Multidisciplinary cooperation improves people's health, provision, effectiveness and productivity of health services, and the social and economic value of health. (Ahonen, Kinnunen & Kouri 2016, 12–13.) The Health and Social Services Reform focuses on the entire public social and health care system operated by the state and municipalities. At present, municipalities are responsible for providing public social and health services. (Mikä on sote-uudistus? n.d.) People need reforms and innovations, and innovations need people who can implement them.

It was originally intended that the tablet and its features would be utilized in various hospitals and outpatient departments in the future. New features can be added and programs can be customized according to the needs of hospitals, departments and their clients. Hospitals can also extend the use of the tablet via a chat service that patients could use to contact a healthcare professional and get answers to specific questions that they have on their minds. Outpatient departments and patients would be able to make appointments electronically.

This tablet can be modified as needed: e.g. if a patient is unable to use their hands, they may use the tablet with their eyes. Similarly, visually impaired patients could use the tablet with the embedded hyphen tags and listen to the subject areas with a headset. These issues need more time for development, but they are not impossible to realize.

Sources

- Achrén, P., Dágostino, S., Hohan, I., Humpl, S., Koski, L., Polzin, M., Voicu, O. & Väyrynen, P. 2010. Käsikirja työpaikalla tapahtuvan oppimisen hyvien käytäntöjen siirtoon. Helsinki: Opetushallitus. Retrieved from http://www.oph.fi/download/130440_kasikirja_tyopaikalla_tapahtuva_oppiminen.pdf
- Ahonen, O., Kinnunen, U-M.; Kouri P & Pirhonen, K (toim.) 2016. Teknologia sosiaali- ja terveydenhuollossa. Hoitotyön vuosikirja 2016. Porvoo: Bookwell Oy, 12–24.
- Bachinger, G. 2012. Die Beteiligung (Partizipation) des Patienten: Der lernende Patient, in: Holzer, E., Offersmanns, G., Hauke, E. (Publisher). *Patientenperspektive: Ein neuer Ansatz für die Weiterentwicklung des Gesundheitssystems*. Wien: Facultas, 29–40.
- Eckman, MH., Wise, R., Leonard, AC., Dixon, E., Burrows, C., Khan, F. & Warm, E. 2012. Impact of health literacy on outcomes and effectiveness of an educational intervention in patients with chronic diseases. *Patient Education and Counseling* 87 (2), 143–151.
- Hakari, K. 2009. Tampereen toimintamallin uudistus – vastaus tulevaisuuden haasteisiin. Teoksessa A. Haveri, K. Majoinen & A. Jäntti (toim.) *Haastava kuntajohtaminen*. Helsinki: Suomenkuntaliitto, Edita Prima, 84 - 92.
- Hirvonen, E., Johansson, K., Kyngäs, H., Kääriäinen, M., Poskiparta, M. & Renfors, T. 2007. *Ohjaaminen hoitotyössä*. Helsinki: WSOY Oppimateriaalit Oy.
- Juuti, P. 2015. *Johda henkilöstö asiakaskeskeisyyteen*. Juva: Bookwell Oy.
- Kääriäinen, M. 2007. Potilasohjauksen laatu: Hypoteettisen mallin kehittäminen. *Lääketieteellinen tiedekunta*. Oulun yliopisto. Hoitotieteen ja terveyshallinnon laitos. Oulu. *Acta Universitatis Ouluensis Medica* 937. Retrieved from <http://jultika.oulu.fi/files/isbn9789514284984.pdf>
- Kääriäinen, M. & Kyngäs, H. 2010. The quality of patient education evaluated by the health personnel. *Scandinavian Journal of Caring Science* 24 (3), 548–556.
- Lipponen, K. 2014. Potilasohjauksen toimintaedellytykset. *Lääketieteellinen tiedekunta*. Oulun yliopisto. Terveystieteiden laitos. Oulu. *Acta Universitatis Ouluensis D Medica* 1236.

Lundh, L., Rosenhall, L. & Törnkvist, L. 2006. Care of patients with chronic obstructive pulmonary disease in primary health care. *Journal of Advanced Nursing* 56 (3), 237–246.

Mikä on sote-uudistus? N.d. Hallituksen reformi. Maakunta- ja soteuudistus. Retrieved from <http://alueuudistus.fi/mika-on-sote-uudistus>

Moisanen, K. (2018). Asiakslähtöisen osaamisen johtaminen vanhuspäalveluissa. Publications of the University of Eastern Finland. Dissertations in social sciences and business studies No 170. Kuopio: The University of Eastern Finland.

Schmola, G. & Rapp, B. 2014. *Grundlagen des Krankenhausmanagements*. Stuttgart: Kohlhammer.

Terveyskylä. 2018. Retrieved from <https://www.terveyskyla.fi/>

6 MEEDO – supporting people with memory disorders

Isoräsy Satu, Master of Social and Health Care student, Kajaani University of Applied Sciences
Kukkonen Saija, Master of Social and Health Care student, Kajaani University of Applied Sciences
Marttinen Heli, Master of Social and Health Care student, Kajaani University of Applied Sciences
Pietilä Sanni, Master of Social and Health Care student, Kajaani University of Applied Sciences
Regamendu Adina, Master of Health Management and Health Information Management student,
Neu-Ulm University of Applied Sciences, Germany
Turunen Taru Bachelor of Engineering student (Information and Communication Technology),
Kajaani University of Applied Sciences
Leinonen Rauni, Principal Lecturer, Kajaani University of Applied Sciences
Moisanen Kirsi, Senior Lecturer, Kajaani University of Applied Sciences
Holl Felix, Scientific Assistant, Neu-Ulm University of Applied Sciences, Germany
Würfel Alexander, Professor, Dr., Neu-Ulm University of Applied Sciences, Germany

Abstract

The objective of this article is to describe a smart solution for cognitive rehabilitation and the context, benefits and target groups of an activating device and innovation. Patients need to have recreational activities and maintain their functional capacity and, therefore, there should be new effective tools. The aim of the use of this application is to enhance functional rehabilitation and reduce the use of central nervous system (CNS) acting medications among patients with dementia. Smart devices are increasingly used in healthcare to facilitate and enhance rehabilitation. This article describes the benefits of using this type of application and introduces previous studies and guidelines for treatment of dementia that support the use of smart devices. The purpose of this article is to describe a mobile innovation that is designed to be a recreational application for people with dementia. The idea for this innovation was presented by people working with demented people. Dementia is an increasing problem in the world. Dementia care has to base on approved, safe and newly developed methods. The innovation is designed as a tool for healthcare professionals and people who are taking care of demented people. Patients with mild dementia can be guided to operate the device independently but the innovation can also be considered one tool for prevention of dementia.

Keywords: memory disorder, dementia, behavioral disorders, non-medical treatment, functional rehabilitation, recreational activity

6.1 Introduction

In Finland there is currently more than 190,000 people with memory problems (Prince 2015a). Their ability to maintain relationships or to handle different tasks and activities deteriorates progressively and, thus, reduces their quality of life (Need for action on dementia recalled 2016). In dementia care there will be increased requirement for additional tools to treat the behavioral problems caused by the disorder and maintain functional ability without medication, while maintaining the dignity of the people.

6.2 Aging population

The population in Finland is ageing rapidly because people are living longer. The number of over-65-year-olds will increase from the current 20% to 26% by 2030 and to 29% by 2060. A vast majority of people with a memory disorder is over 80 years old, but more than 7,000 people in working age (35-65 years old) have been diagnosed as progressive memory disorders. Three out of four elderly persons in long-term care suffer from a memory disorder. (Ageing and memory 2017; Prevalence of Memory diseases 2018.) It has been estimated that there are now 46.8 million people with dementia worldwide. There was an estimate that 9.9 million persons were diagnosed with dementia in 2015, equivalent to one person every 3.2 seconds. (Prince 2015a.)

Alzheimer's disease is the most common cause of dementia, and vascular dementia is the second most common. In addition to dementing disorders, there are also several other reasons for cognitive problems, including other diseases, depression, sleep disorders or certain medications. (Ageing and memory 2017.) Dementia is a syndrome caused by a disease of the brain, usually of a chronic or progressive nature, in which there is a disturbance of multiple higher cortical functions, including memory, thinking, orientation, comprehension, calculation, learning capacity, language and judgement (Dias, Ferri, Graham, Ineichen, Prince & Uwakwe 2006).

Between 2015 and 2050, the number of older people living in higher income countries is forecast to increase by just 56%, compared with 138% in upper middle-income countries, 185% in lower middle-income countries, and by 239% (a more than three-fold increase) in low-income countries (Prince 2015a). We can understand the impact of dementia at three inter-related levels: 1) the individual with dementia, 2) their family and friends, and 3) wider society. While dementia does

shorten the lives of those affected, its greatest impact is upon quality of life, both for individuals living with dementia and for their family and carers. (Prince 2015b.)

Dementia affects 6.4 million people in Europe, and worldwide 44 million people suffer from dementia (Image 1). In 2010 the annual costs of dementia care were estimated at 604 billion dollars (Dementia A global epidemic 2014). It is important to recognize that non-drug interventions are often highly effective and should generally be the first choice when managing behavioral problems. Also, persons with dementia and family carers need to be supported over the longer term. People with dementia always need to be treated with patience and respect for their dignity and personhood. (Dias etc. 2006.)

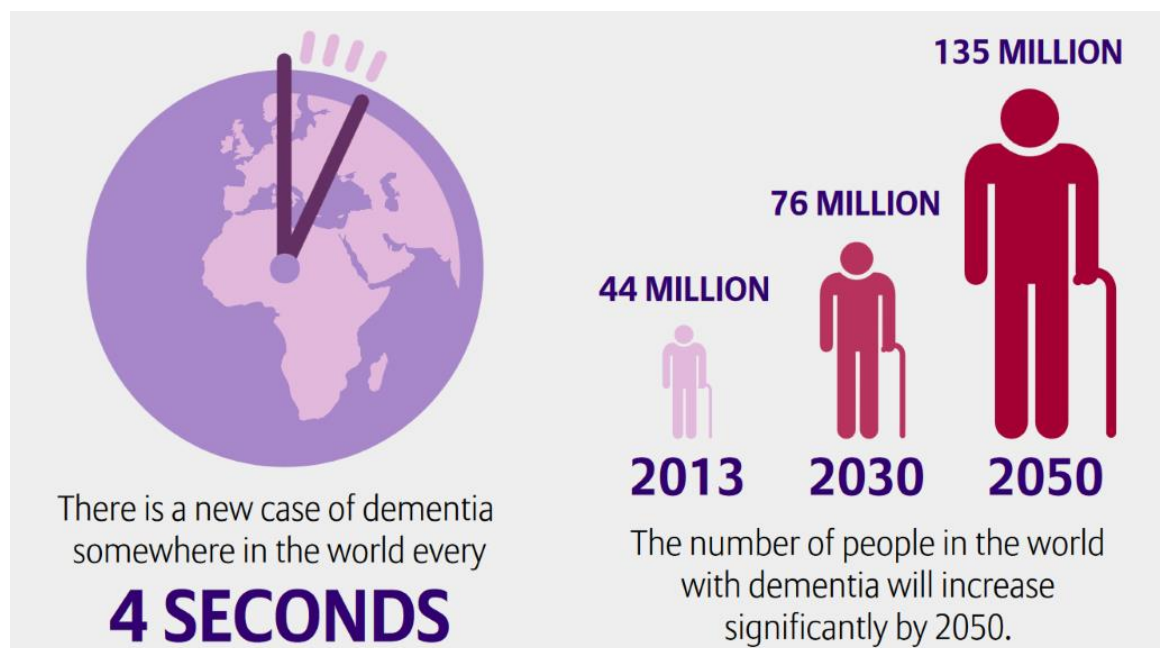


Image 1. A global epidemic (Dementia A global epidemic 2014)

Social and health care costs can be reduced by producing innovative and effective services for older people. The strategy of social and health care policy is to promote older people's functional ability, independent living and active participation in society. Each year up to 14,500 new cases of dementia are diagnosed in Finland. Three out of four patients in 24-hour care suffer from a memory disorder. The National Memory Programme 2012-2020 aims to create a "memory-friendly" Finland. One action included in this program is the development of a system that ensures provision of rehabilitation systematically and at the right time. (Ageing policy 2017; Prince 2015a.) In light of above-mentioned facts this innovation is important and useful.

6.3 Basis of the Innovation

The idea for the innovation called MEEDO was presented by the staff at a long-term memory disorder unit that is a home for 18 residents with various types of memory disorders. Many of them suffer from behavioral disorders such as agitation, restlessness or aggressiveness. 90% of people with memory disorders suffer from behavioral symptoms at some point. According to studies, music therapy, group activities and interventions promoting communication and patient-centered care with relatives or nursing staff are effective in treating behavioral symptoms associated with memory disorders. (Memory disorders 2017.)

Non-medical treatment methods are nowadays commonly first recommended for patients with behavioral problems related to a memory disorder (Memory disorders 2017). When we talk about non-medication for dementia, we should understand that memory disorder medications such as cholinergic drugs, not tranquilizing drugs, are the first choice for medication. Tranquilizing agents usually weaken patients' performance and overall prognosis and major tranquilizers increase the risk of death and stroke. (Vataja n.d.)

Customized settings refer to patients' personal profiles, for example the degree and type of memory disorders and preferred activities. Patients and family members can choose what kind of content they want to include in the patient profile. Information about a patient's illness, life and childhood is given by family members and care workers. Life histories of elderly and specially people with a memory disorder are a very important tool for everyday care. Histories tell care providers a lot about people's personal values and ways how to see them, how to cooperate with them, how to avoid conflicts and how not to offend.

Different activities such as music, memory, coloring and puzzle games have been recreated for people with memory disorders. Virtual games are also worth trying among persons with mild dementia. The type of game depends on the disorder and goals of rehabilitation. Games like other rehabilitative activities must be chosen under the supervision of a specialist, which requires multiprofessional cooperation.

People with memory disorders can listen to their favorite music or sing-along, listen to books and poems and newspapers using smart devices in which game technology can be utilized. Skype is already used for keeping contact with family members, so it can also be used in smart devices: people with memory disorders can watch their favorite movies and old home videos or talk to their family members in real-time. People with dementia are not different from people who do

not have dementia; they have the same needs and wishes. Family and social life are still as important as before and spouses love their spouses more after diagnosis. (Brod, Steward, Sands & Walton 1999, 32.)

In addition to above-mentioned activities, MEEDO also has a projector which projects live pictures or videos, for example a view of the countryside with birds singing, pastures with animals or memories from the old days, on the wall.

MEEDO offers a tool for functional rehabilitation and recreational activities right here and now. Finding appropriate activities and drafting materials for activities usually take time; with the smart device it would be easier and quicker.

6.4 Care Guidelines for Patients with Memory Disorder

Care of patients with memory disorders should promote their rehabilitation and ability to perform daily activities. The objective of care is to improve their quality of life. It is achieved by respecting patients' individual histories, way of life and personal values, allowing them to maintain dignity and social networks and securing their self-determination. Listening to and considering the thoughts of patients' family members is also vital. In Finland it is recommended that individual treatment and rehabilitation plans are drawn to patients with memory disorders. The plan should include patients' current status of health, living will and prognosis of the patient's condition. The plan helps to anticipate the changes that a progressive brain disease might cause; it also helps the patient's family to cope with increasing and worsening symptoms. (Memory disorders 2017.)

The use of different technological interventions and applications in the rehabilitation of patients with memory disorders can delay their need for long term care in high-dependency assisted living facilities. Technological devices can also improve the quality of life of patients and their families. With technological and smart solutions, rehabilitation can be planned more individually from patients' personal abilities and needs in co-operation with multiprofessional teams. (Memory disorders 2017; Union of memory disorders 2017a.)

The Alzheimer Society of Finland recommends non-medical care specially for patients with memory disorders. Making their environment as calm and familiar as possible is the most effective way to treat behavioral disorders and symptoms such as agitation or aggressions or obsessive-compulsive. These symptoms can be caused by somatic reasons and also by a lack of activities

or frustration. Music, arts and occupational therapy are very effective ways to impact patients' undesired behavior if there is no physical reason to be treated or medicated. Offering meaningful activities relieves behavioral symptoms. (Union of memory disorders 2017b.)

6.5 Evidence on Benefits from Previous Studies

Our objective was to develop a valid and reliable easy-to-use device called MEEDO which can be integrated into a digital platform and which recognizes critical changes in the status of patients with memory disorders, helps and supports quality of life, functional and recreational activities. This innovation aims to improve nurses' time management and relieve work pressure. In addition, this non-medical treatment innovation will reduce the costs of medication and rehabilitation when its potential is used efficiently.

To support this innovation, evidence was searched in previous studies. The Finnish National Institute for Health and Welfare (THL) participated in a project called ENABLE (Enabling Technologies for People with Dementia) funded by the European Union. The objective of ENABLE was to develop a test series of products that aimed to enable persons with dementia to keep themselves occupied with activities which give pleasure, support memory or facilitate communication. One part of the project was testing a picture gramophone with a tool called Dementia Care Mapping. The results were said to be exceptionally good. Most of the patients experienced positive benefits, and none gave negative feedback. (Topo, Saarikalle, Mäki & Parviainen 2004, 4-20.) The town of Juankoski has developed a Caring-TV service for home care clients. According to a study on this service, home care clients' relatives experienced that clients' social relationships and safety had increased and their sense of loneliness had decreased. (Jauhiainen, Hirvonen & Kemppainen 2013, 15.)

A research project called COGKNOW (2006-2009), comprising a multidisciplinary research consortium of scientists from across Europe, developed a successful ICT solution named Cogknow Day Navigator. The focus of the project was on how technologies could support people suffering from mild dementia. (Mulvenna, Nugent, Moelaert, Craig, Dröes & Bengtsson 2010, 3-4.) The prototype of Cogknow Day Navigator, which was tested, consisted of a touch screen workstation for home use, a mobile device for use outside home, and sensors and actuators integrated in the house (Meiland et al. 2012). The purpose of the project was to assess the Cogknow Day Navigator, to support persons with mild dementia in their memory issues, social contacts, daily activities and

safety. In the project a user-driven design was applied with three iterative development cycles each of which were evaluated separately: 1) assessment of user needs among people with dementia and their (in)formal carers; 2) development of a prototype; 3) a field test in Amsterdam, Belfast and Luleå. Data on the usability of the Cogknow Day Navigator were collected by means of semi-structured interviews, observations, logging and diary reports. The results showed that the Cogknow Day Navigator gives personalized support with four functions which are reminder and time orientation, picture dialing, media player and safety. The conclusions were that the COGKNOW Day Navigator is easy to use by persons with mild dementia and their carers. The majority of the users regarded the different functions and their integration into one system as useful. Further development and longer and wider user tests are needed to gain knowledge on the impact of the device on daily life. (Dröes, Meiland, Sävenstedt, Bentvelzen, Bouaman, Hettinga, Moelaert, Craig, Hoelthe, Andersson, Davies, Donnelly, Andersson, Bengtsson, Mulvenna, Nugent 2009.)

MEEDO is developed for people whose memory disorder is rated more progressive than the memory disorder of COGKNOW users with the Clinical Dementia Rating (Instructions for CDR classification 2016) grade 1-2 or even 2-3.

6.6 Innovation Tool as a Process

Wouldn't it be good to have a device which is programmed for the special needs of the patient on an individual basis? To give an overview of how the process of designing an individual tool looks like, let's look at the next two images.

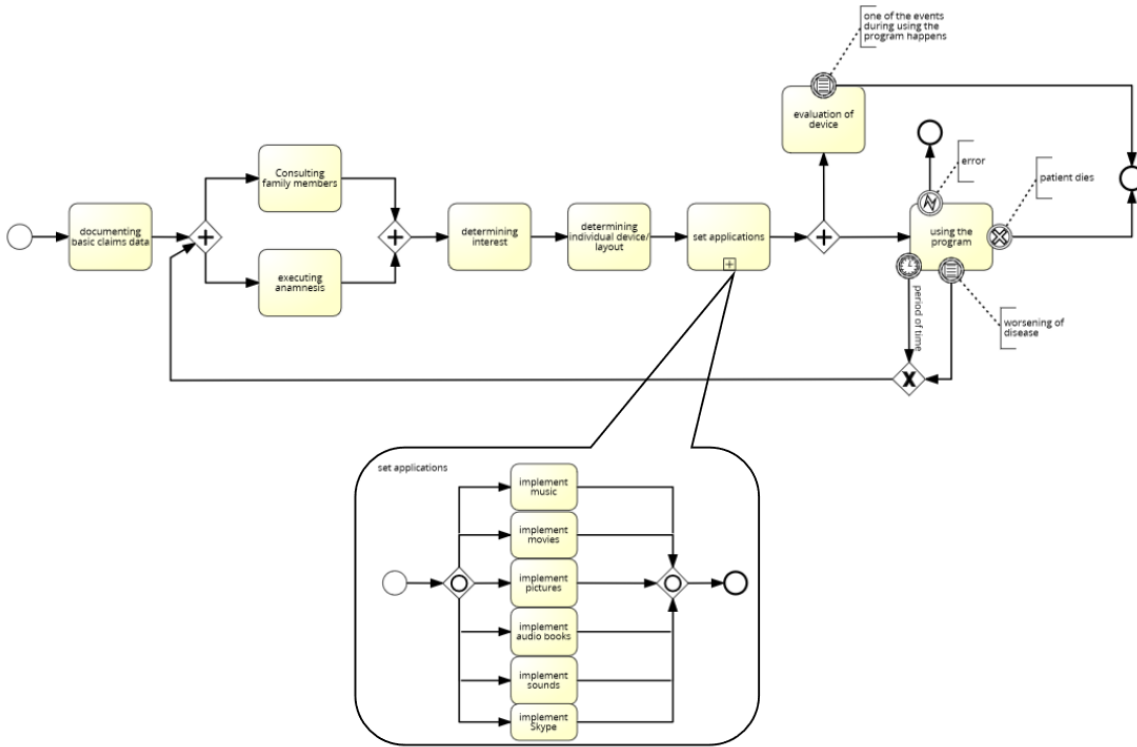


Image 2. The process chart of the function of the application

First, it is important to document the master file data of a patient. After that the following two tasks must be completed: firstly, family members must be asked about the patient’s interests and characteristics, and secondly an anamnesis must be performed to find out the current health state of the patient. After that the applications and individual layout of the device can be determined. Different applications that can be downloaded are, for example, music, games, movies and pictures. There is also the possibility to implement a skype account for the patient so that they can stay in contact with family members or friends. Now the device is ready to be used by the patient. When a certain period is passed or the patient’s condition deteriorates, the process is started again by interviewing family members and updating the anamnesis to adapt the patient’s health status.

6.7 Drawing of the Device

The innovation also includes a protective cover for tablets, which is meant to prevent the tablet from breaking when it's dropped or thrown away. Intended users of the device can be clumsy and unpredictable, and thus the tablet is at risk of damages. The cover or case of the device is designed to be made of silicone, so it will be comfortable to hold and not slippery when handled. The ball-

shaped structure allows the tablet to be used, for example, on hospital bed. It is designed to be a of stand for the tablet (Image 3). Silicone cover with handles and soft, formable pillow-like back with polystyrene balls inside it.

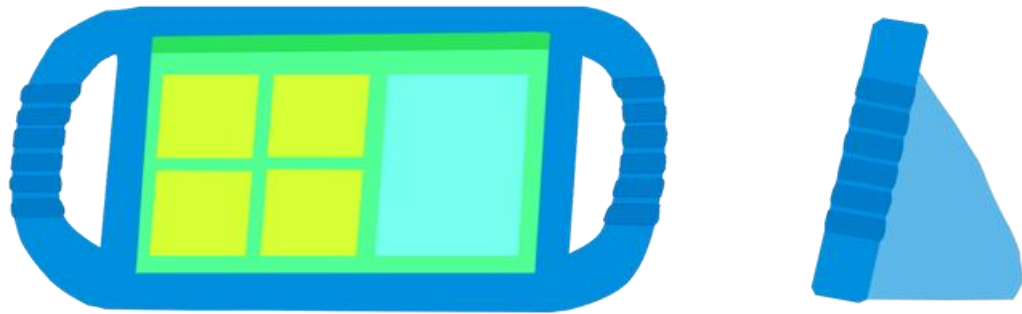


Image 3. Rough draft layout of the device

6.8 Conclusions

Future healthcare has five key elements: a global approach to a global problem; the need for ‘care now, cure later’; a public health orientation (awareness, accessible services, and prevention); a focus on equity and rights; and a rational approach to research prioritization. Now care, not cure, is the main healthcare cost, and costs are likely increase because of rapidly aging populations. (Meerding, Bonneux, Polder, Koopmanschap & van der Maas 1998, 114.)

The purpose of this innovation is to be a functional and cognitive rehabilitation and recreational activity tool for nurses and family members who take care of people with various forms of dementia. There is a significant demand to develop nursing care and increase non-medical treatment in dementia care. Demented patients take a greater number of central nervous system (CNS) acting medications, antidepressants, antipsychotics and anxiolytics than their cognitively intact counterparts. These drugs, because of their potent anticholinergic properties, are known to increase the risk of delirium and further cognitive deterioration. CNS-acting drugs can accumulate in amounts that lead to delirium, sedation, and falls. (Doug, Clare, Litaker, Fick, Kolanowski & Boustani 2011, 2.)

In the future the whole population in Europe and other Western countries will be more and more accustomed to using mobile and other digital devices. Studies have shown that dementia can be avoided even at a very old age, for example, through various memory-stimulating activities such as games (Qiu & Fratiglioni 2017, 939). The innovation can also be one of the tools to prevent dementia.

Through our work with demented patients we think that the most difficult problem with patients is agitation and frustration, which has been the most challenging to treat. Agitation also increases insomnia, but calming activities can be a more helpful and more safe option than sleeping pills. This type of gaming approach could be the response to the lack of means to tackle behavioral disorders. Until now tranquilizers have been the only available form of treatment. Recreational activity supervisors offer some help in the care of demented patients, but unfortunately their input takes money and time. Equipment for activities and practices have been old and time-consuming; therefore, new ways are needed in healthcare now. Being able to reduce the use of medications to behavioral symptoms and ease human suffering is also our key objective for this innovation. Using brain activating applications daily may slow down the progression of memory disorders, which is one of the key elements mentioned above.

Digitalization is and will be more involved with the health and care of elderly people. Elderly people are already users of mobile and other smart devices. There are studies about accessibility requirements for stimulating digital applications among elderly users, and the results showed that applications, e.g. games, which require memory and cognitive skills stimulate their players. Elderly users can easily learn to handle user interfaces, NFC tags and NFC technology (Near Field Communication). (Komulainen 2013.) In future there will be more demented people who are familiar with digital devices which are part of their everyday living.

Sources

Ageing and memory. (2017). National institute for health and welfare. Retrieved from <https://thl.fi/fi/web/thlfi-en/research-and-expertwork/projects-and-programmes/finger-research-project/ageing-and-memory>

Ageing policy. (2017). National institute for health and welfare. Retrieved from <https://thl.fi/en/web/ageing/ageing-policy>

Dröes, R., Meiland, F., Sävenstedt, S., Bentvelzen, S., Bouaman, A., Hettinga, M., Moelaert, F., Craig, D., Hoelthe, H., Andersson, A., Davies, R. Donnelly, M., Andersson, S., Bengtsson, J., Mulvanna, M., Nugent, C. (2009). Assistive technology for people with mild dementia: results of the COGKNOW project. Retrieved from <http://www.em-consulte.com/en/article/225725>

Dementia A global epidemic. (2014). Retrieved from https://www.allianz.com/v_1403080960000/media/press/document/other/Dementia_InfoGraphic_EU-ROPE_102.pdf

Brod, M., Stewart, A.L., Sands, L. & Walton, P. (1999). Conceptualization and Measurement of Quality of Life in Dementia: The Dementia Quality of Life Instrument (DQoL). *The Gerontologist*. 39(1), 25-35. Retrieved from https://watermark.silverchair.com/39-1-25.pdf?token=AQEC-AHi208BE49Ooan9kkhW_Ercy7Dm3ZL_9Cf3qfKAc485ysgAAAAbQwggGwBqkqh-kiG9w0BBwagggGhMIIBnQIBADCCAzyGCSqGSib3DQEHATAeBglghkgBZQMEAS4wEQQMKYmLN-rl dzQFwkFEAgEQIIBZ9imMmp80zS0Ztz7ZtftSjB_E_O_jxsBy-iqC1K_il1RXfRLn_u6JM36UyDJYIhirX8wbuhLOPzKSYF4BcTs8fu4eOQ15Cod-kuLTxZpIW6J0ROWxQKRjO0-3oG2BFAR2833OlyiFwWez5rNmdPN-UYem5GsRBADXF622zTkstDbGacy8brlOsBRZ1IK4bhtlIborPfmfsNu0EmXE-l4diKkgEbjqgDewxim-bOfGoQstajgnYIDyKphr-4V1rYqQQPOLMSQTl4-GpwKw8IAHgfJyASeyR6_fIU-drs_JVP1jFqQHHLH5iRNhnytY5feDpazhUR2IYFVRXZHMf3151KEqwzuE-mqbHguGySgfixisYzhF1U7fvMw-kWykG-BaT2KM5_lAhrP9j8H127fqsRgTG2y4q46Kn_pI5rzABCPPvVTX-WHvQYpcE-VaQN5S_p39vkf1p1ZwT7AAB3vCmmuilyjqWbdboilAO

Dias, A., Ferri, C., Graham, N., Ineichen, B., Prince, M. & Uwakwe, R. (2006). Dementia. In *Neurological disorders public health challenges*, 42-55. World Health Organization. WHO Library Cataloguing-in-Publication Data. Retrieved from

https://books.google.fi/books?hl=fi&lr=&id=Z8uwPwIPUw4C&oi=fnd&pg=PR1&dq=the+challenges+of+managing+memory+disorders&ots=ggnCDaXxQn&sig=ulCFMO-ht59N40dbqQO-IE-CUjVs&redir_esc=y#v=onepage&q=the+challenges+of+managing+memory+disorders&f=false

Doug, L., Clare, L., Litaker, M.S., Fick, D.M., Kolanowski, A.M. & Boustani, M. (2011). Study protocol for the recreational stimulation for elders as a vehicle to resolve delirium superimposed on dementia (Reserve For DSD) trial. *Trials*, 12(1), 119. Retrieved from <https://trialsjournal.biomedcentral.com/track/pdf/10.1186/1745-6215-12-119>

Introduction for CDR classification. (2016). Current Care Guidelines. Working group set up by the Finnish Medical Society Duodecim and the Finnish Cardiac Society. Helsinki: The Finnish Medical Society Duodecim. Retrieved from www.kaypahoito.fi/web/kh/suosituksset/suositus?id=nix00512

Jauhiainen, A., Hirvonen & Kemppainen, H. (2013). Sähköisillä hyvinvointipalveluilla tukea ja turvaa kotihoidon asiakkaille Omaisten kokemuksia Hyvinvointi-TV-palvelusta. *Finnish Journal of eHealth and eWelfare* 5(1), 10–17.

Komulainen, O. (2013). Ikääntyneille virikkeitä tarjoava NFC-sovellus. IT Master's thesis. University of Oulu. Retrieved from <http://jultika.oulu.fi/files/nbnfioulu-201304241202.pdf>

Meerding, W.J., Bonneux, L., Polder, J.J., Koopmanschap, M.A. & van der Maas, P.J. (1998). Demographic and epidemiological determinants of healthcare costs in Netherlands: cost of illness study, 111-115. (317). Retrieved from doi: <https://doi.org/10.1136/bmj.317.7151.111>

Meiland FJ, Bouman AI, Sävenstedt S, Bentvelzen S, Davies RJ, Mulvenna MD, Nugent CD, Moelaert F, Hettinga ME, Bengtsson JE, Dröes RM. (2012). Usability of a new electronic assistive device for community-dwelling persons with mild dementia. *Aging Mental Health* 16(5), 584 - 91. Retrieved from doi: 10.1080/13607863.2011.651433.

Memory disorders. (2017). Current Care Guidelines. Working group set up by the Finnish Medical Society Duodecim and the Finnish Cardiac Society. Helsinki: The Finnish Medical Society Duodecim, Retrieved 1.3.2018 from <http://www.kaypahoito.fi/web/kh/suosituksset/suositus?id=hoi50044>

Mulvenna, M.D., Nugent, C.D., Moelaert, F., Craig, D., Dröes, R.-M. and Bengtsson, J.E. (2010). *Supporting People with Dementia Using Pervasive Healthcare Technologies*. Springer-Verlag: London.

Need for action on dementia recalled. (2016). European Parliament. Retrieved from [http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/577959/EPRS_BRI\(2016\)577959_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/577959/EPRS_BRI(2016)577959_EN.pdf)

Prevalence of Memory diseases. (2018). Retrieved from <https://thl.fi/fi/web/kansantaudit/muistisairaudet/muistisairauksien-yleisyys>

Prince, M. (2015a). Dementia and ageing in a developing world. In book World Alzheimer Report 2015 The Global Impact of Dementia an Analysis of prevalence, Incidence, cost and Trends. Alzheimer's Disease International (ADI): London, 6–8.

Prince, M. (2015b). The impact of dementia worldwide. In book World Alzheimer Report 2015 The Global Impact of Dementia an Analysis of prevalence, Incidence, cost and Trends. Alzheimer's Disease International (ADI): London, 46–55.

Qiu, C & Fratiglioni, L. (2018). Aging without dementia is achievable. *Journal of Alzheimer's Disease*. (62), 933-942. Retrieved from doi:10.3233/JAD-171037

Topo, P. & Saarikalle, K. (2004). Enabling Technologies for People with Dementia. Report of Picturegramophone assesment: National findings from Finland, Ireland, Norway and UK and cross-national results. Retrieved from <http://www.enableproject.org/download/Enable%20-%20Report%20-%20PG%20hybrid10.5.pdf>

Union of memory disorders. (2017a). Memory disorders. Care and rehabilitation. Tools and technology. Retrieved from <https://www.muistiliitto.fi/fi/muistisairaudet/hoito-ja-kuntoutus/apuvaiheet-ja-teknologia>

Union of memory disorders. (2017b). Memory disorders. Care and rehabilitation. Non-medical care. Retrieved from <https://www.muistiliitto.fi/fi/muistisairaudet/hoito-ja-kuntoutus/laakkeeton-hoito4>

Vataja, R. (N. d) Medication of memory diseases. Retrieved from http://www.mikkelinkesayliopisto.fi/resources/public/pdf-tiedostot//Muistisairauksien%20I%C3%A4%C3%A4kehoito_vataja.pdf



**KAMK • University
of Applied Sciences**