

Breakthrough scenarios to Finnish elderly and home care diabetes treatment system with a new mHealth glucose measurement solution Mendor Balance & Mendor Smart

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<p>This paper is a qualitative market segment research of an existing product combination for monitoring blood glucose values of diabetic people with a cellular network connected device with cloud application on reporting and analysis. Research attempts to answer to four main questions. What are the current and future technological requirements from glucose measurement devices, services and diabetes home care solutions? Which specific groups of customers or other stakeholders in assisted living or care of elderly people would be gaining the most advantage in using new generation of cloud connected glucose meters? Who are the decision makers responsible of procurement of these products in Finland and what are the best means and arguments to positively influence purchasing of certain product or service? What type of effect do the recent and upcoming changes in legislation and operating environment have in the business?</p> <p>The questions are previously unanswered, because such devices and services have only been in the market for a short time and the changes in the operational environment have just recently emerged. In this paper, ten theme interviews are presented in which the problematics relating to these questions are being discussed. With opinions of participants from every side of the industry, this work covers most of the likely viewpoints that can be considered regarding the topic area. Old and new action model for measuring glucose are presented to visualize the differences in the methods, distribution of information and failure possibilities involved. Healthcare, legislative, state organizational and technological aspects are considered as part of the study.</p> <p>This work concludes to suggesting some sub-segments of most advisable target groups and pointing out main influencers in decision making for purchases. Technical and integration requirements regarding also the current and future operational environment are presented. Certain marketing strategies are recommended with a few specific sales arguments.</p>	
Keywords glucose measurement, mHealth, diabetes, cloud services, assisted living, home care	

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1 Introduction

Diabetes is one of the most rapidly increasing diseases in Finland and in the world. There is some contradictory statistical information about it concerning Finland, but it is clear that it has massive impact on the health of the nation and economy as a whole. Suomalainen Lääkäriseura Duodecim (2013) states in its "Käypä hoito" - roughly translated "recommended treatment" - guidance for medical professionals that over 500000 Finns have diabetes and the care for diabetes takes 15% of the total Finnish healthcare budget. Traditionally diabetes is divided into type 1 and type 2 forms, but in reality these are only the extreme ends and there are plenty of cases with attributes from both of these main types.

According to Novo Nordisk (2015) 319800 Finnish adults have diabetes, i.e., 8,3% of the total population. An additional 339200 citizens (8,8% of the population) suffer from impaired glucose tolerance (prediabetes). 2608 Finnish citizens die due to diabetes every year. This is 7 citizens every day. Diabetes costs the Finnish healthcare budget at least 9% of its resources. This is over 844,7 million € a year or 96400 € every hour. Effective treatment of diabetes significantly reduces diabetes complications, such as heart attack, stroke, and serious deterioration of vision. Effective treatment involves close monitoring and control of blood glucose levels, blood pressure, and lipids. Finland is the first country in the world to have introduced a comprehensive diabetes programme. Its effectiveness reflects continuous monitoring, evaluation, and revision in line with national developments.

"Internet of Things (IoT) devices can be used to enable remote health monitoring and emergency notification systems." ... "Distinct advantages over similar products from the US and Europe are cost-effectiveness and personalisation for chronic patients. Doctors can monitor the health of their patients on their smartphones after the patient gets discharged from the hospital." (Wikipedia, 2016 d) New technologies in IoT and mobile healthcare offer great opportunities in making healthcare more efficient and preventive, instead of the traditional model which can be seen in modern terms somewhat slow, bureaucratic and reactive.

1.1 Mendor Oy, Mendor Smart and Mendor Balance

Mendor (2016) presents itself as a Finnish company, committed to the design, development and marketing of advanced diabetes management products. Mendor has launched a revolutionary, discreet, easy to use, portable all-in-one blood glucose meter and web-based software application for the daily management of diabetes. Mendor has designed

its products together with users and diabetes experts to address the needs of people with diabetes requiring regular blood glucose monitoring.

Latest Mendor product Mendor ONE is a hybrid product, including a second generation cloud service application platform for storing personal diabetes-related health records and a blood glucose measurement device that uses cellular network to automatically upload measurement data into the cloud service. The automation of the measurement data collection is the centric innovation in the concept. Complete service includes offering visibility of the records to treatment personnel, mobile application for the individual, giving advice to the diabetics. In short: "Mendor ONE is a comprehensive diabetes management solution including 3G-connected meter, smart cloud, mobile application and education services." (Mendor, 2016 a) Service package contents may be adjusted according to the needs of the customers. Service might or might not include test strip home delivery, which could possibly be triggered automatically from the amount of measurements done as in used test strips. The service might be charged with a monthly fee or the pricing model could be formulated differently. (Mäkelä, P., 2016)

This is very different service or product package compared to the traditional product used in the Finnish healthcare system. Traditionally the companies that offer the glucose measurement devices and test strips, give the cheap bulk devices free or with a minimal fee to the patients via the treatment staff, but the test strips cost more. Finnish healthcare authorities, usually cities and municipalities, organize offering competitions for medical companies between 2-3 year periods to purchase these products for their customers. Between these offerings, the purchasing authorities or officials are reluctant to discuss anything related to such products and participating in the offerings does not give proper evaluation for service products differing from the traditional model. Costs go to the authorities and customers or diabetics get these for free. It is a major challenge to be able to disrupt this traditional system with a new innovative hybrid product/service package such as the Mendor ONE. A more expensive, high tech measurement device doesn't fit into the traditional equation and the healthcare authorities or their procurement processes do not entirely comprehend the service model of the package. (Mäkelä, P., 2015 b)

Mendor ONE is being advertised with the following statements. (Mendor, 2016 b) "Mendor ONE automatically connects individuals with care providers and empowers them with real-time actionable insights.

- Provides real-time data. Get up-to-date glucose data from anywhere, anytime. 3G-connected meter automatically sends all values to cloud without a need for paper logbooks, cables or additional devices. A Mobile app enables secure messaging.

- Identifies individuals needing support. Set personal targets together with individuals and identify the ones needing your support. The service automatically monitors if individuals are meeting their targets. Your patients also receive automated alerts and notifications about their progress.
- Makes improvement areas visible. Understand individual glucose trends and follow intervention effectiveness. The service provides insight on how daily routines, such as meals and overnight sleep affect glucose levels.
- Individuals. Feel safe and empowered. Get visibility and control over your condition, don't let it control you. Set personal goals and receive actionable insight and guidance. Avoid hassle and increase comfort.
- Clinics and Care Providers. Focus on your patients, not cables or paper notes. Engage with individuals needing you the most. Get actionable information to provide outstanding care in real-time.
- Payers. Achieve measurable outcomes and manage your spending. Get fully informed about the most urgent population's health challenge. Be a part of digital health revolution.
- Mendor ONE is a complete package provided as a service. The next great innovation in diabetes care has arrived: real-time, outcome-driven and individualized diabetes care with Mendor ONE.

What's included?

- 3G-connected glucose meter with data plan
- Lancing device and case
- Cloud platform, unlimited number of professional user accounts
- Mobile application for the individual
- Software updates and improvements
- Consultation and training, on-site and online”

Mendor ONE device is designed by Mendor and made in co-operation with a South Korean manufacturer. (Mäkelä, P., 2016) South Korea is ranked as top 1 country in the world on IoT devices online per 100 inhabitants by the OECD statistics in 2015. Finland is not mentioned on the list, but this is most likely because there are no statistics, because generally in information society statistics Finland does rank quite high as all Nordic countries in general. (Wikipedia, 2016 d) South Korea is the pioneer of the IoT age, which gives a good assumption that their businesses have a strong expertise on the matter.

Mendor ONE marketing concept has being dissolved during the making of this thesis and now the measurement product - *Mendor Smart* - and service for collecting and reporting

on the results - *Mendor Balance* - are being marketed on their own names as parts of the Mendor complete solution, but also separately to offer best flexibility for customer needs. (Mäkelä, P., 2016)

1.2 Basis of the project

1.2.1 Thesis objectives

This work is initially meant to study and discuss the current market for glucose measurement devices in Finland especially focusing on the treatment of diabetic patients receiving assisted living services in home care. Inside that specific segment this paper attempts to find out and suggest the most productive sales arguments, correct stakeholder target groups in the market and the likely scenarios how more advanced glucose measurement services and products - especially *Mendor Balance* and *Mendor Smart* - would be able to penetrate the traditional market where cheap and simple bulk solutions have been dominating for extended period of time.

Additionally, and tightly relating to the main research points, this work looks into the technical requirements and integrations of these devices now and in the nearest future by the opinion of the potential buyers as well as observing recent changes in the operational environment and legislation that reshape the market for the future opening new possibilities. Often studying these aspects will enable finding out a certain “sweet spot”, which is then usable for some competitive advantage in marketing and offering. Also, another important matter is to just engage in conversation with the industry stakeholders on the necessity of improvement in the existing processes and tools, thus possibly even planting the seed of need or increasing the demand of those modern solutions and having everybody put some more thorough thought on where the industry is actually going towards.

1.2.2 Stakeholders

Main stakeholders in this project are the author, Mendor Oy and Haaga-Helia school. School would like the author to graduate. Author wants to gain better knowledge of ICT management and sales processes considering the diabetic niche and graduate also by getting the thesis work done. Mendor would like to get better insight and more ideas on marketing their products and driving business forward.

Diabetes generally is a major health issue in many western nations and in Finland especially. Proper diabetes healthcare in Finland basically has stakeholders in all taxpayers, the government and municipalities as well as the public sector and community as a whole. Better treatment results in less health complications, making the patients more able to continue in working life for as long as possible and live at home for as long as possible when elderly and on pension. This adds up to less strain on the healthcare system itself. Authorities could clearly save money, which can be put to any other good purpose. In Finland, it is mainly the cities and municipalities who are responsible for the costs of healthcare, especially for diabetes. Also the European Union relates as a stakeholder, regarding different legislation and directives given to guide acquisitions and providing of healthcare services to EU population in ways that should be valuable to the common good.

On the other hand, there are patients' relatives and friends, who are concerned on the wellbeing of the patient and also might participate in the treatment in different ways. The healthcare professionals are another stakeholder section to be mentioned, who would like to get good knowledge of the patients' situation to be able to make correct decisions on their treatment, medication and guidance. Any of these human stakeholders mentioned might not be well versed in ICT-related or technical matters, so anything that is easy to use and quick to learn that can help in producing better health data and making it more conveniently available for each party, would be valuable.

Then there are the private sector enterprises that also have a stake in the big picture of the diabetes treatment. Medical and bioscience companies, producers of medical services and healthcare outsourcing, private hospitals, insurance companies, smaller startups matching different ICT inventions with healthcare and such players of the industry also need to be considered. Private sector considers their goals and needs differently than public sector. Companies consider return on investment (ROI), gained advantages and competitive price as major factors when considering business decisions. On the opposite, public sector considers fulfilling their duties first and then who is paying, who is saving and if it is same or some different administrative unit, because it matters much into which budget the costs go into.

Regarding home care or assisted living for diabetics, there are three main parties to consider: customers, care providers and care professionals. Care professionals can be divided into two main groups, which are home care staff working with social services and diabetes treatment professionals who are employed in healthcare services.

1.2.3 Scope and delimitation

The scope includes finding out methods to influence the healthcare officials to widen the perspective in the procurement of glucose measurement apparatus. Any possibilities to affect modification of the traditional procurement methods will be investigated. Suggestions on ways to package the product into a service are included. Discussion about new revenue generation models to replace the traditional ones is inside the scope, meaning research of possibilities to split the costs of the service model between different stakeholders, instead of only the city, municipality or state being the only one responsible for the healthcare costs.

The target group of the research is limited to diabetes home healthcare or assisted living and the devices and services offered to such customers. This is a target segment, which requires most healthcare professionals work and resources and as such, will allow for most prospective cost savings to be achieved. Real time measurement could provide invaluable information to healthcare staff to help guide the patient and possibly even prolong the necessity of insulin use initiation for type 2 diabetics.

Different diabetes types are not limited, although most elderly suffer from type 2 rather than type 1. The scope does not include discussion on the development of the products abilities. The role of authentication regarding systems containing medical health records is not being considered in this work.

1.2.4 Research questions

- 1) What are the current and future technological requirements from glucose measurement devices, services and diabetes home care solutions?

Which are the current technology trends in healthcare devices and glucose measurement in general? What is the meaning of a new technical solution such as Mendor Balance and Mendor Smart to the elderly diabetic customers and other stakeholders? Would new technologies and solutions bring an incentive for the customer to switch using private sector healthcare services? Would they be willing to participate to the costs and what would be the possible models of dividing the costs?

- 2) Which specific groups of customers or other stakeholders in assisted living or care of elderly people would be gaining the most advantage in using new generation of cloud connected glucose meters?

What would characterize such diabetic customers that would best be able to use these new solutions? How about the professionals, is there some certain groups that can be identified as being those who would see their work being improved the most by modernizing glucose measurement processes?

- 3) Who are the decision makers responsible of procurement of these products in Finland and what are the best means and arguments to positively influence purchasing of certain product or service?

Should it be mostly offered via public, private or third sector? How would it be possible or is it at all possible to participate in the current method of competitive offerings regarding similar products in the public sector? What are the centric roles of people that have saying in the acquisitions and how to influence them?

- 4) What type of effect do the recent and upcoming changes in legislation and operating environment have in the business?

Does the recent SOTE reform decision regarding citizens expanded right to select the producer of their healthcare services open new possibilities for new kind of service products / solutions such as those that Mendor offers? What are the prospects to enter the market via the private sector operators? How does the new Act on Public Contracts change the sales environment on the public sector?

Is it possible to widen the current financing structure, where only the public sector, cities, municipalities and the state are the only ones to pick up the costs? Would it be possible to get others, such as employers, insurance institutions or the customer users themselves participate to some parts of the costs?

2 Theoretical framework

In this main chapter, the subject theory is being observed from the medical, legislative and technical viewpoints. Goal is to gain adequate basic knowledge of the matter and most of the relating issues within the scope of this work.

2.1 Healthcare and diabetes

2.1.1 Diabetes types and certain special needs diabetic groups

There are quite many subtypes of diabetes that can be diagnosed. The most common ones are type 1, type 2 and gestational diabetes, but different combinations and variations also exist.

- Type 1 diabetes is most commonly found in children and young adults. It is an autoimmune disease, meaning that the body's immune system mistakes its own cells for invading pathogens that need to be destroyed.
- Type 2 diabetes is most common form in adults and elderly. Either person does not make enough insulin for the body's needs or the cells in the body do not use insulin properly. This is called insulin resistance.
- Gestational diabetes can occur specifically during pregnancy.
- Diabetes LADA A form of type 1 that can occur in adults.
- Diabetes MODY is very rare and caused by a known genetic mutation.
- Double diabetes or type 1.5, is when type 1 diabetics develop insulin resistance.
- Type 3 is closely linked with Alzheimer's disease.
- Steroid induced diabetes is a type 2 variant brought on by long term use of corticosteroids.
- Brittle diabetes is a form of type 1 that is very hard to control.
- Secondary diabetes occurs as a consequence of another medical condition.
- Diabetes Insipidus is a rare form of diabetes not related to diabetes mellitus.

(Diabetes Digital Media Ltd, 2016)

For each of the subtypes and use cases there are different needs for treatment and medical products. Also people in various age groups, such as children or elderly, require specific guidance and products that will serve them most suitably. However, as many of the diabetic subgroups other than the top three are so limited, it would probably not be reasonable to create marketing target groups out of these or develop specific products or services for them. As a business strategy, it would make sense to look into niches based on age groups or inside the top three subtypes of the diagnosis.

2.1.2 Home care, service living and assisted living

Kela (2016) informs in their statistics that it has subsidized various forms of diabetes-related medication to exactly 352054 persons during the year 2014. Approximately 100 million € worth of subsidies are given to insulin and insulin derivatives and additional 90 million € to other blood glucose lowering medications. Total of 300708 persons were entitled to special subsidiary rights for diabetes medication from Kela at the end of year 2014. Out of all the diagnosed diabetics, approximately 1/6 are type 1 and 5/6 are type 2 diabetics. It is estimated that about additional 150000 Finns also have type 2 diabetes, without knowing it. Increasing amount of diabetics are elderly people. Exactly 167378 persons aged 65 or more were entitled to special subsidiary rights for diabetes medication from Kela at the end of year 2014, which is more than the total of those aged 64 or less entitled to the same special subsidiary rights. (Suomen Diabetesliitto, 2016)

As stated in the THL (2016 c) statistics, 73278 people were customers of constant home care in Finland at the end of November 2015. Of these, only 6401 were under the age of 65 and 30907 over the age of 85. Approximately one third of the customers received a minimum of 60 visits per month. This group of intense home care patients have grown 7% since the year 2010. It is clearly seen from the statistics that densely populated areas, like Uusimaa, Pirkanmaa, and Varsinais-Suomi, seem to have more emphasis on the lower end of the monthly visit spectrum. Sparsely populated areas, such as Karjala, Savo, and Lappi, tend to have around double percentages of the more difficult cases requiring over 90 visits monthly.

Based on FINRISKI research, the rate of diabetes percentagewise begins to rapidly increase in the age group of 55-64, being 3-4 times as much as in the previous age group of 45-54. Viewing only the men, the rise begins already in the previous age group. In the elderly age group of 65-74, already 18,3% of men and 12,8% of women state that they have medically proven diabetes. (THL, 2013)

Kaikki alueet yhteensä (painottamaton)													
Ikäryhmä	Miehet					Yht.	Naiset					Yht.	
	25-34	35-44	45-54	55-64	65-74		25-34	35-44	45-54	55-64	65-74		
Ei	98,4	98,7	95,2	87,1	81,7	91,2	98,3	97,0	97,4	91,7	87,2	94,1	92,7
Kyllä	1,6	1,3	4,8	12,9	18,3	8,8	1,7	3,0	2,6	8,3	12,8	5,9	7,3
Yhteensä	%	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
	N	445	538	606	653	748	2990	590	639	686	724	710	3349
Puuttuvia (N)		5	11	3	15	17	51	4	5	7	5	13	34

Table 1. People having a doctor diagnosed and treated diabetes during the last year. (THL, 2013)

Assisted living is a term meaning care for people, for whom independent living is not appropriate but who do not need the 24-hour medical care provided by a nursing home and are too young to live in a retirement home. Assisted living is a philosophy of care and services promoting independence and dignity. It includes co-ordination of services by outside health care providers; and monitoring of resident activities to help to ensure their health, safety, and well-being. Assistance may include the administration or supervision of medication, or personal care services provided by a trained staff person. (Wikipedia, 2016 a) Most often in Finland assisted living as defined by the law on services for the intellectually disabled is meant for intellectually disabled or ill persons who need assistance in their daily lives continuously. Assisted living as can be provided as service living at city-owned group home units, specially contracted housing for this purpose or at the customers own home. (City of Helsinki, 2015) Assisted living could be considered an umbrella term for both home care and service living healthcare arrangements. In the home care variant, customers could be scattered throughout a larger area in a city requiring lengthier transit for the care staff, where in the service living variant there are entire buildings where the care staff would only move between apartments and have less amount of longer transits between locations.

In a research on home healthcare and service living expenses for basis on service coupon implementation (Leppänen, P., Servo, A. and Laakso, J., 2013) there are exact economic figures regarding the municipalities of Askola and Lapinjärvi as well as cities of Porvoo and Loviisa, where this research was conducted during the year 2011. The assisted living services are divided to six main cost segments:

- Nursing and care (basic healthcare and washing assistance, medications, errands and evaluation visits)
- Personal and facility care (preparing food, cleaning, clothes etc.)
- Treatment planning (all preparations at the office, planning, reporting, registering, evaluations and documentations)
- Travelling to customer locations
- Management (trainings, meetings, work organizing and breaks)
- Support services (separately and externally produced, invoicable services, such as meal services, security services, group activities etc.

According to the research, nursing and care takes 39% of the total time used in and travelling to customers takes 11% of the total time used for providing these services to the customers. These are very significant cost factors and therefore any improvement on either the efficiency of nursing and care as well as cutting down the need to travel physically to see the customers could have a major impact as cost savings. Often there are external

contractors or non-healthcare staff handling much of the non-nursing care activities, such as those belonging to the personal and facility care cost segment.

Kuusikkokunnat municipality co-operative produces yearly reports on social and healthcare costs in the top six largest cities in Finland. There are separate workgroups for different areas, such as the care for elderly, producing a wide variety of statistics. (Var-tiainen, A., 2015) These six cities calculated to have 17565 customers in home care and 8658 customers in living services at the end of year 2014. Home care costs totalled at 268 million € for these six cities and service living costs totalled at 394 million €, making total assisted living costs around 662 million €. Dividing the home care costs by the amount of customers gives an average cost of 15257 € / person / year. Per customer expenditure service living depends on the care level and age of the patient, ranging from 21828 € to 47804 €, where the amount of nursing staff required per customer affects mostly to the result and the figure generally being much bigger compared to the home care due to the fact that people in service living require much more attention and help. An average cost for a home care visit without support services was calculated to be 36 € and there were in total of 7156258 visits made during the year 2014 in the six largest cities. In a service living accommodation, one day totaling all costs was ranging from 44 € to 169 € depending on the care level and if it was produced internally or bought externally.

2.1.3 Diabetes care and blood glucose measurement in assisted living

There are plenty of specific issues relating to glucose measurement for elderly diabetics. Karoliina Oja (2015) reminds that an elderly person might have symptoms less noticeable or even regular diabetes symptoms might not appear at all. Usual symptoms such as thirst, increased urinating and losing weight might shift to more generic symptoms on an elderly person, such as tiredness, mouth drying or forgetting things. Non-diabetic glucose values are from 4 to 7 mmol/l , which is basically the level diabetics should strive to, but for elderly this strictness is not recommended. Under 4 mmol/l value is hypo and going even lower can cause severe symptoms, which might be fatal for an elderly person living alone. Most elderly people can conduct the measurements themselves, but might require more practice and guidance. Nursing staff will often make the measurements when available and make sure that the patient knows the process. The reliability of the results depends for example that the blood is applied from fingertips instead of arm, for example. Usually the patient should be able to adjust their diabetic medication and insulin intake portions according to the measurements made. This might not be as easy for elderly as it would be for younger people. Once an acceptable balance is being kept and the patient

can both do the measurements and handle the medication dosages, there will be much less need for healthcare staff assistance. In some cases also relatives of the patient might assist in the measurements.

Traditionally the measurements are registered in a notebook or similar with a pen, but more often today the results could either be typed into a mobile device for registration or drawn digitally from the measurement device via some sort of cable or wireless connection. There are some detailed descriptions on the general logic and process of the care - regarding healthcare professionals visits to customers, usage of time, travel distances and intervals - in the empirical part, especially in chapters 3.8, 3.9 and 3.11.

2.1.4 Challenges in elderly diabetic home healthcare

There are several challenges in elderly home care. The patient might have memory challenges, making them forget taking medicine, observing their blood glucose, eating on a regular basis or even sometimes wandering out of their home for no reason. It could be that much of the time of the healthcare professionals treating the patient will go into keeping up with the situation and making unnecessary check-up visits. (Gillie Consulting, 2016)

Mäkelä (2016) considered the possibility that healthcare staff does not necessarily have strong expertise in technology or IT, making it challenging to master usage of several different devices and software. Different people in certain healthcare roles might require different data or statistics. On the other hand there is the IT administration, which has their viewpoints in the matters regarding any devices or software being used. Scheduling in any organization is tight and hurrying is always present, especially in a home care unit where people need to travel around to see their patients. Any changes or improvements in the tools usually require some sort of adjustments to processes and time management, which might lead to basic resistance to change.

Different technical obstacles apply also. Getting alarms to professional staff from hypo measurements that require instant action is often not possible with current offline equipment and software. Meters are electronically powered, so they might not be charged or battery is out. (Mäkelä, P., 2016) Obviously one major challenge is that the professional nurse or doctor is not present most of the time to attend to the patient. Each patient requires different type of care and the frequency of home care visits varies highly, from one to over hundred visits monthly (THL, 2016 c). Group is highly heterogeneous in every way including age, medical condition as well as mental and physical capabilities.

2.2 Legislative and state organizational changes

2.2.1 The Act on Public Contracts

Ministry of Employment and the Economy in Finland (2015) has prepared new legislation on public procurement and concession contracts, called the Act on Public Contracts (abbreviated here as APC). Changes in legislation are based on three directives given by the European Commission for on public procurement and concession contracts that were approved on 18 April 2014 (2014/23/EU, 2014/24/EU and 2014/25/EU). Purpose is to simplify procedure of national procurement, make the use of public funds more effective, improve the possibilities of small and medium-sized enterprises to take part in competing for contracts, improve the possibility to observe environmental and social viewpoints, and to ensure equal and non-discriminatory treatment of all who compete for contracts in public procurements.. The new act is said to contain at least following: "...municipalities' possibilities to make direct awards are increased, and so that factors related to employment and health care policy, social aspects and quality, and innovation and environment policy can be better taken into account in public procurement. National threshold levels will be raised closer to EU directive levels.", as presented by Ukkola (2015).

PTC Services (2015) has picked some key points from the legislation package, stating that the monetary threshold minimums that will make procurement offering competitions mandatory will be raised. Also the requirement for the vendor turnover can be maximum two times the prospected value of the contract. Innovation partnership is a completely new procurement method. Quality emphasis on the procurement, instead of only the pricing, is being advocated. This legislation is expected to be verified and put to function during the spring of 2016.

2.2.2 SOTE reform

Ministry of Social Affairs and Health & Ministry of Finance (2015) lists the goals of the SOTE reform package as follows:

- Responsibility for providing public healthcare and social services will be assigned to autonomous regions that are larger than municipalities. Healthcare and social services will be brought together at all levels to form customer-oriented entities, and basic public services will be strengthened.
- The existing multisource financing will be simplified and customers will have more freedom of choice in the services.

- The objective is to reduce inequities in wellbeing and health between people, and to manage costs.
- The reform will help to bridge a large part of the sustainability gap in general government finances. The Government's aim is to save € 10 billion, of which approximately € 3 billion should be covered through the reforms in the branch of government of the Ministry of Social Affairs and Health.
- Besides structural reforms, the steering and operating models in healthcare and social welfare will be thoroughly modernised. The aim is to achieve better services that are not only more customer-oriented, effective and cost-efficient than before but also better coordinated.

The country will be divided into new governing areas that take responsibility for the public healthcare in the municipalities and cities they consist of. As a part of the reform, there will be new legislation in freedom of choice for healthcare services. This apparently means that a citizen will be allowed possibility to select a public, private or third sector producer of the services, but still be allowed to have same government subsidies or financing to that selected service producer as they would get with current public healthcare. Purpose of this is to enforce the basic level health services and to ensure faster admission to care than currently. (MoSAaH & MoF, 2015) Finnish government has agreed on the basic principles of the reform and the definition of the SOTE areas and governing areas on November 2015. The new legislation and organizational structure is being prepared in its initial stages, so most of the specifics are at the moment still unclear. However, it is most likely that such a reform will open new possibilities for new services and products to enter the healthcare market in Finland, when the old organizational structures and financing models are being revolutionized entirely.

2.3 Technologies

2.3.1 Healthcare IT systems in Finland, generally and home care

Most commonly used healthcare patient data systems in Finland were compared by a professional research group for the medical journal Suomen Lääkärilehti and the result was that all of them have major flaws and shortcomings. All systems were averaging their given grades around 6 to 7,5 on a scale of 4-10. Even the ones that had high percentages of excellent grades were also getting high percentages of very low grades to even out the score. Most used health care center systems include Efficca, Finstar, Mediatri and Pegas-

os. Hospitals are using systems, such as Effica, ESKO, Mediatri, Miranda-Oberon and Pegasos. (Winblad, I. et al, 2010)

Potilaskertomusjärjestelmä	Vastaajia n	Keskiarvo	95 %:n LV	Kiitettävien ja heikkojen arvosanojen %-osuudet	
				9-10	4-5
Terveyskeskusten järjestelmät					
Effica	274	7,1	6,9-7,2	6	8
Graafinen Finstar	31	6,9	6,4-7,4	3	13
Mediatri	34	6,9	6,4-7,5	21	21
Pegasos	231	6,2	6,1-6,4	<1	25
Muu	15	6,7	5,9-7,4	7	13
Kaikki	585	6,7	6,6-6,8	4	16
Sairaaloiden järjestelmät					
Effica	289	6,7	6,5-6,8	1	15
ESKO	148	7,2	7,0-7,4	13	10
Mediatri	51	5,6	5,2-5,9	0	53
Miranda-Oberon	580	6,1	6,0-6,2	1	30
Pegasos	60	6,1	5,8-6,4	1,7	28
Muu	90	6,4	6,1-8,7	8	24
Kaikki	1 218	6,4	6,3-6,5	3	25

Table 2. Comparison of patient data systems in Finland. (Winblad, I. et al, 2010)

Mäkelä (2016) points out some factors regarding some of the major systems. Effica by Tieto and Pegasos by CGI, both have home care mobile solutions included and integrated into their systems. But there might be some challenges on displaying the data in a proper format in the correct place. FastROI produces FastROI RTC, a mobile ERP -solution for the healthcare and social services, which has a home care module. Another company with similar products and services is Invian Oy with its DomaCare product line. Each vendor has their own separate solutions for mobility, of which some are still in piloting stages and most challenge is presented by them not always being compatible with each other.

2.3.2 Glucose measurement

Official Finnish recommended treatment guidance states that self-conducted measurements are essential for diabetics to assess blood plasma glucose variations. The need for self-conducted measurements varies for example the form of treatment, diabetic balance, daily rhythm and patients' own abilities. Specifics are being defined together with each patient. Usual goal is to produce meal pair measurements, meaning previous to a meal and approximately 2 hours afterwards. Also measurements are done prior to sleeping and immediately after waking up. These are being combined for glucose profiling as a generic view on the variation of the plasma glucose values during a regular day. If the patient uses medication that subjects them to hypoglycaemia, additional checking measurements

should always be made when suspecting hypo, prior to driving a vehicle, prior to attending to a dangerous or high responsibility task and also whenever there is exceptional physical strain. The need for measurements should be re-evaluated if any medication is being changed, during acute illness or medical operations, during and after pregnancy and when there is a major transition in daily life. (Suomalainen Lääkäriseura Duodecim, 2013) Type 1 diabetic might require even approximately 56 test strips weekly for measurements as in measuring from 4 up to 8 times per day, while a type 2 diabetic with a treatment not subjecting to hypo might require only 10 weekly as in measuring usually once in the morning.

Understanding blood glucose level ranges is a key part of diabetes self-management and the recommended levels have a degree of interpretation for every individual. Measuring, monitoring and keeping a log of the blood glucose values is the basis for any diabetes treatment. There is a wide variety of different meters available to do the job and usually it is a matter of discussion between the patient and doctor to determine the most suitable devices to use in each case.

Target Levels by Type	Upon waking	Before meals (pre prandial)	At least 90 minutes after meals (post prandial)
Non-diabetic*		4.0 to 5.9 mmol/L	under 7.8 mmol/L
Type 2 diabetes		4 to 7 mmol/L	under 8.5 mmol/L
Type 1 diabetes	5 to 7 mmol/L	4 to 7 mmol/L	5 to 9 mmol/L
Children w/ type 1 diabetes	4 to 7 mmol/L	4 to 7 mmol/L	5 to 9 mmol/L

Table 3. UK National Institute for Clinical Excellence (NICE) recommended target blood glucose level ranges. (Diabetes Digital Media Ltd, 2016)

Diabetes Digital Media (2016) offers some easily readable and understandable tables on the target glucose levels on different diabetics and non-diabetics as well as screening values for glucose testing when diagnosing diabetes on people. It is essential to know when the person has had their latest meal when judging the results of glucose measurements.

Plasma glucose test	Normal	Prediabetes	Diabetes
Random	Below 11.1 mmol/l Below 200 mg/dl	N/A	11.1 mmol/l or more 200 mg/dl or more
Fasting	Below 6.1 mmol/l Below 108 mg/dl	6.1 to 6.9 mmol/l 108 to 125 mg/dl	7.0 mmol/l or more 126 mg/dl or more
2 hour post-prandial	Below 7.8 mmol/l Below 140 mg/dl	7.8 to 11.0 mmol/l 140 to 199 mg/dl	11.1 mmol/l or more 200 mg/dl or more

Table 4. Blood sugar levels in diagnosing diabetes. (Diabetes Digital Media Ltd, 2016)

2.3.3 Internet of Things, mHealth/eHealth, ambient assisted living and big data

In a Finnish medical journal called *Potilaan Lääkärelehti*, Lehtovirta (2013) states the challenges of entering a saturated market with an entirely new mHealth product or service, complementing similar statements by Mäkelä (2015). Mobile health innovations are countered by different stakeholders in healthcare in various ways, but most often with somewhat negative or non-encouraging feedback. Private sector companies are stuck to how a new gadget could be priced and who will pay for it. For diabetes care, they will often point out that the public side will always handle it during the current legislation and system, so they are not interested in such products. Public side decision makers are saying they might be interested in two years, if they will be presented with scientific and economic proof by then. Current procurement legislation makes the public healthcare organizations rigid and too concentrated on the pricing of the products, instead of searching for innovation and quality. Healthcare professionals might counter the offering with change resistance, by saying that new methods or products will only mess up their old ways of working and scheduling. For a regular middle-aged nurse, it might need some additional persuasion to adapt to using new technologies, devices and services, even though in the end it would make their work more efficient. To get to see the result in the end, will require letting go of the old habits and methods at first.

Lehtovirta (2013) also points out that there are questions in where a startup company with mHealth products need to look into. Most importantly what sort of new ways of working and thinking this allows and requires and how will it effect in the current structures? Successful implementation of a new mHealth application will always require active and result-oriented co-operation of the startup companies, clinical operators and basic researchers, which will end up moulding each of the participating parties.

In a presentation of a research regarding eHealth in Finland and globally, Holopainen (2015) concludes that when queried on the importance of the results of having electronical healthcare transactions, among other things the following issues are strongly considered important. 71% think that it is important to avoid any mistakes in medication, 73% look into it making easier or faster to get into treatment and 76% make a point that it will give a more wholesome image of the persons' status of health and even so avoid possible unnecessary medical examinations. These are definitely some of the main issues a diabetic patient would find positive and also the healthcare personnel could see as advantages in customer service, when applying new mHealth service into the healthcare system.

IoT –based applications for glucose measurement have been researched and available already for some years now. (Jara, A. et al, 2010.) The smart home segment “Ambient Assisted Living“ includes products and services for networked emergency alarms, accident detection (e.g. pressure mats), activity monitoring (by means of sensors) and comparable connected products that are aimed to support independent living for the elderly. Fitness trackers and wearables that are not directly connected to the household are not included in this segment. Revenue on this business segment is divided between hardware and services, services taking a larger portion at the moment, but projected to be more equalized between hardware in the near future. Revenue in the segment amounts to approximately 2 million € in 2016, but projected to grow annually at average 54.83% resulting in a market volume of around 11 million € in 2020. Household penetration is at 0.14% in 2016 and is expected to hit 0.76% in 2020.

The average revenue per smart home currently amounts to USD 606.74. (Statista, 2015)

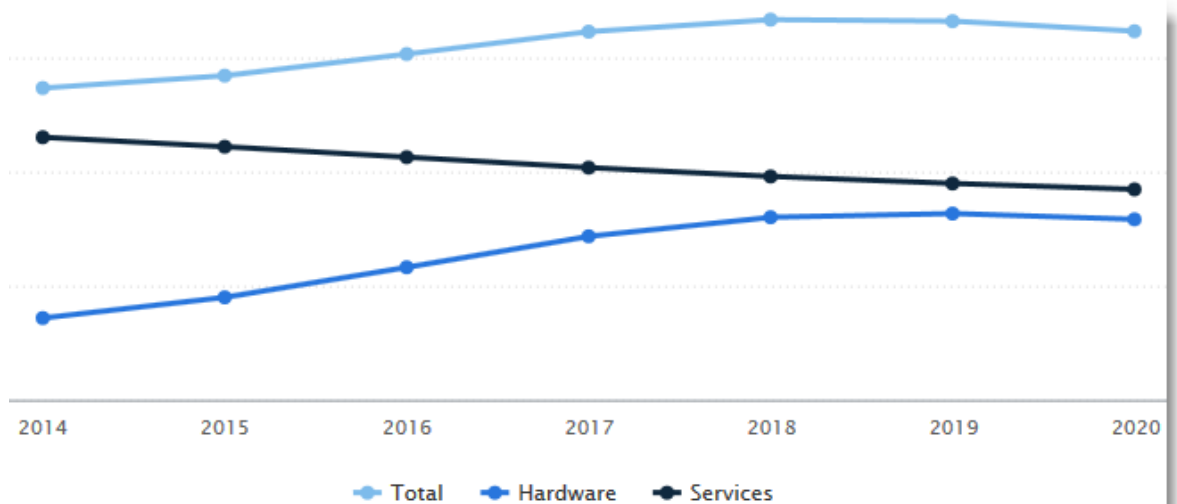


Figure 1. Average revenue per smart home in ambient assisted living. (Statista, 2015)

There are several examples of IoT and big data efforts by both multinational companies and small startups to bring devices and services into market for diabetes healthcare. Google is developing a glucose measuring biometric contact lens with pharmaceutical giant Sanofi and Joslin Diabetes Center (Bresnick, J., 2015). In Germany, Insulin Angel, a Berlin-based startup, has created a IoT sensor chip set that can be attached to diabetic utensils, like insulin pens and glucose meters. Devices are reporting to an app with alerts that can tell the recipient if their medication is at risk of being compromised due to excess heat or cold, power failure, or if the user’s device has moved beyond a certain pre-set range of their medication. Invention is using relayr’s WunderBar technology, which is a chocolate bar-shaped array of six wireless IoT sensors. (Scroxtton, A., 2015)

Big data mining can be very valuable in diabetes treatment, for creating better advice and treatment models, by researching the mass of measured values of patients' blood glucose and any other additional information that can be attached to the measured values. However, it will require first the mass of the data to be existent in a database. Using biometric IoT devices to collect the data into a big data storage, would eventually make this research possible.

2.3.4 Medical information exchange systems and standards

In Finland, the first edition of the law on electronic handling of healthcare records is younger than 10 years old - issued on 9.2.2007 – and has had several additions later including this year. Law 10 § directs that information exchange between service providers is possible by specific customer consent only. 14 § of the law states that Kansaneläkelaitos (KELA) is responsible for keeping archives of patient records, where also additional other healthcare related information can be stored. (Finlex, 2016)

Kanta –services, including Electronic recipe, Medical database, Patient data archive and information service, and Omakanta are services provided at the kanta.fi internet portal. These data platforms have been created and implemented during years 2010-2016 and are still in some final stages of development. (Kanta, 2016 b) There is still a transitional period up to year 2020 when all of the healthcare service providers should use all the functions of the Kanta services. (Kanta, 2016 a) Kanta is generally the Finnish system and standard for healthcare information exchange.

Technical standards are mostly developed in the United States. These include such as file format and communications standard DICOM and electronic health records terminology database standard LOINC. There is also a major organization developing standards to the healthcare industry. (Wikipedia, 2016 c) “Health Level-7 or HL7 refers to a set of international standards for transfer of clinical and administrative data between software applications used by various healthcare providers. These standards focus on the application layer, which is ‘layer 7’ in the OSI model. The HL7 standards are produced by the Health Level Seven International, an international standards organization.” (Health Level Seven International, 2016)

One of the most modern draft standards of the HL7 is FHIR, pronounced “fire”. (Wikipedia, 2016 b) FHIR is an attempt to give healthcare interoperability the same sort of toolset that the HTML brought to the internet. It is based on clinical modeling by experts but does not

require implementers to understand those details. The specification is free for use with no restrictions. It is meant to be fast and easy to implement with proven results of multiple developers having had simple interfaces working in a single day. It has foundation in Web standards like XML, JSON, HTTP, Atom, and OAuth. FHIR has API support for RESTful architectures and also seamless exchange of information using messages or documents. (Forbes, 2014) FHIR is already being used as a basis for new healthcare application platforms and information exchange channels. Finnish Kanta also provides FHIR connectivity to its services and offers a sandbox and guides to developers for it. (Kanta, 2016 c)

2.4 Case variations of healthcare in Finnish municipalities

Finland has several municipalities, where the whole healthcare or some major parts of it have been outsourced to private sector companies. Pihlajalinna Oy has a complete social and healthcare outsourcing contract with municipality of Mänttä-Vilppula. (Mänttä-Vilppula, 2015) They also have similar contracts with some other municipalities. Espoo has outsourced some of its local healthcare centres in Puolarmetsä and Espoontori to the medical giant Mehiläinen Oy. (Helsingin Sanomat, 2016) Outsourcing appears to be trending and it seems likely that quite many new outsourcing contracts will be made more throughout the nation. (MTV, 2014) There is not much research or statistical data to be found on larger scale of the effectiveness of the outsourcings nationally, but THL research concluded in 2015 that the annual social- and healthcare costs at Mänttä-Vilppula municipality have been cut down by 8 per cent, although there were staff increases during the evaluation period and queuing had been cut down to minimum. (Tekes, 2015)

There are many cases of co-operative organizations of several municipalities founded to split the costs and create larger functional units to handle social- and healthcare in major local areas. For example Oulunkaari healthcare co-operative organization organizes the social and healthcare services of its member municipalities. The members are Ii, Pudasjärvi, Simo, Utajärvi and Vaala. (Suomen Kuntaliitto, 2016 b) Etelä-Karjalan sosiaali- ja terveystieteiden keskuslaitos Eksote, with head offices in the city of Lappeenranta is in the front line developing the new digital services for the customers in assisted living. Pohjois-Savon sairaanhoitopiiri PSSHP is centered in the city of Kuopio. In Kuopio, there are 700 persons with wellbeing technology in use currently. The city divides the elderly services customers into three segments: active pensioners, those who need support in their daily living and those in constant care. (Theme interview 1, 2016)

In Tampere, there is a single diabetes care unit, where all type-1 diabetics go to meet their healthcare personnel. With concentrated knowhow and treatment, it is possible to provide better treatment and advise. They are experimenting on making more automatized adjustment suggestions to diabetic behaviour based on real time measurement data. One goal is to widen the frequency of the necessary visits to the healthcare unit. (Mäkelä, P. 2016) Sairaanhoitaja magazine described a pilot project initiated in Tampere in 2015, where the effectivity of electronic diabetes services compared to the current traditional working model is being investigated and how the customers and professionals experience the usability of the new products and services. Pilot project includes 200 diabetics, who are given Mendor Smart glucose meters and the usage of Mendor Balance service is being used to in co-operation with the healthcare personnel. Positive results already in the middle of the project have been quicker reaction to problems and applying the messaging possibilities of the service, less visits and phone calls, customer being able to self-control their care goals, no need for the notebooks or data transfer cables as well as having the data available at the doctors appointment, even though the meter would have been forgotten. The diabetics in the project receive the diabetic supplies delivered to home, instead of having to go to the distribution center and the amount of test strips sent is defined based on the amount of measurements actually made. To meet the needs for the growing number of diabetic patients in opposite of the professional staff size being static, this has been deemed as a useful method of operation. (Härmä-Rodriquez, S. et al, 2016)

2.5 Qualitative research and semi-structured interview

“The researcher should select quotes that are poignant and/or most representative of the research findings. Including large portions of an interview in a research paper is not necessary and often tedious for the reader. The setting and speakers should be established in the text at the end of the quote.” ...”Qualitative research necessitates having a small sample because of the detailed and intensive work required for the study. So sample sizes are not calculated using mathematical rules and probability statistics are not applied. Instead qualitative researchers should describe their sample in terms of characteristics and relevance to the wider population. Purposive sampling is common in qualitative research. Particular individuals are chosen with characteristics relevant to the study who are thought will be most informative. Purposive sampling also may be used to produce maximum variation within a sample. Participants being chosen based for example, on year of study, gender, place of work, etc.” (Anderson, C., 2011)

“While a structured interview has a rigorous set of questions which does not allow one to divert, a semi-structured interview is open, allowing new ideas to be brought up during the interview as a result of what the interviewee says. The interviewer in a semi-structured interview generally has a framework of themes to be explored. However, the specific topic or topics that the interviewer wants to explore during the interview should usually be thought about well in advance (especially during interviews for research projects). It is generally beneficial for interviewers to have an interview guide prepared, which is an informal grouping of topics and questions that the interviewer can ask in different ways for different participants. Interview guides help researchers to focus an interview on the topics at hand without constraining them to a particular format. This freedom can help interviewers to tailor their questions to the interview context/situation, and to the people they are interviewing. Semi-structured interviews are widely used in qualitative research.” (Wikipedia, 2016 f)

“Semi-structured interviews are often preceded by observation, informal and unstructured interviewing in order to allow the researchers to develop a keen understanding of the topic of interest necessary for developing relevant and meaningful semi-structured questions. Typically, the interviewer has a paper-based interview guide that he or she follows. Since semi-structured interviews often contain open-ended questions and discussions may diverge from the interview guide, it is generally best to tape-record interviews and later transcribe these tapes for analysis. While it is possible to try to jot notes to capture respondents' answers, it is difficult to focus on conducting an interview and jotting notes. This approach will result in poor notes and also detract for the development of rapport between interviewer and interviewee. Development of rapport and dialogue is essential in unstructured interviews. Semi-structured interviews also allow informants the freedom to express their views in their own terms. Semi-structure interviews can provide reliable, comparable qualitative data.” (Cohen D., Crabtree B. 2006)

This method for the research was an obvious choice, because any answers to the research questions are mostly not describable by plain numeric data. The area of this research is much more detailed and obscure, so the usage of qualitative research with semi-structured interview method will likely produce most likely the desired results if there are exact answers and conclusions to be drawn altogether. In some aspects, the issues under observation are opinions and perceptions of people working in the industry, so thorough discussion with open word given to the interviewees is the only way to produce the nuances searched in this work. Numeric and statistical data will act in a supporting role throughout the research with means to initiate further discussion and relate to concrete evidence on the issues.

3 Empirical part

First it is necessary to get acquainted with the usage of the devices and services of the Mendor products, from a general viewpoint as well as the patient viewpoint. Then the theme interviews are being done with selected people, to get better understanding of the challenges, changes, business aspects and other essential issues regarding the topic area. The term “customer” is a preferred more neutral synonym to the term “patient”, so these two concepts go hand in hand and mean the same throughout the empirical part.

3.1 Mendor service and device usage

Mendor service includes two main technical components: Mendor Smart blood glucose meter (Pictures 1, 2 and 4) and Mendor Balance online cloud service (Pictures 3 and 5-7), which acts as the logbook, glucose profiling and statistics dashboard. To initialize the service, the user first goes to create a profile into Balance at <https://balance.mendor.com/personal>. Then the Smart meter needs to be integrated to the Balance account (Picture 2). A six digit authentication code is given by the Smart meter, which is then typed into the Balance website to integrate the meter. There are also few other base settings to choose from for the Balance service as well as the Smart meter. On a typical situation the meter integration to the web service is done by the healthcare staff, who issues the meter to the patient.



Picture 1. Mendor Smart meter with a test strip attached



Picture 2. Integrating and synchronizing Mendor Smart meter with Balance service.



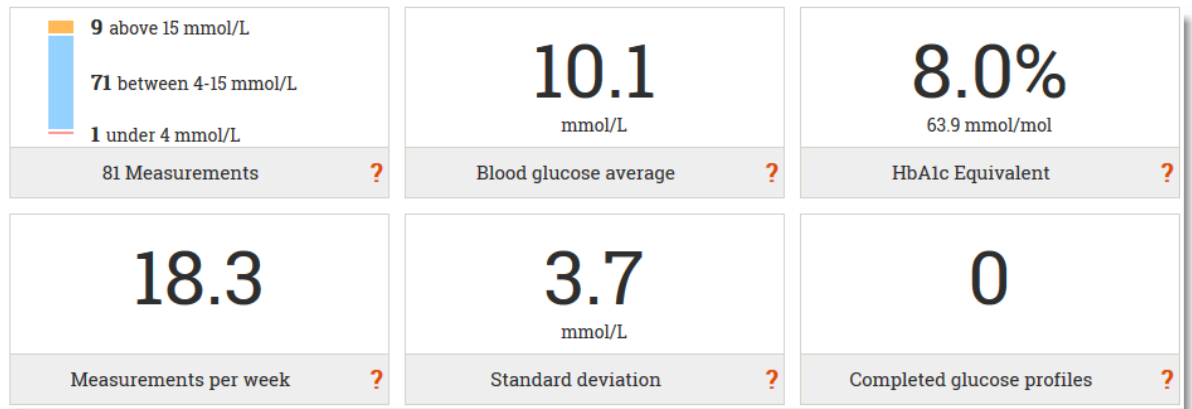
Picture 3. Balance service menu items.

After the integration process has been completed and other base settings, such as the meal time schedules and user country, have been selected, the user is able to do measurements, which are then automatically uploaded to the Balance service. Inserting a test strip into the meter, sets the power on and waits for a blood drop to be applied. User lances a tiny wound usually to fingertip with a purpose built lancer and applies blood to test strip. After five seconds, blood glucose value result is displayed for about 10 seconds, then the results are being uploaded in another 10 seconds or so. (Picture 4) Test strips are single use only, so each measurement requires a new test strip. Measurement process for most diabetics is typically done by the patient themselves, but for home care elderly people it could also be anyone else from family, relatives or friends to nursing staff or other caretaking persons available to do the task in case the patient is not able or might forget the task.



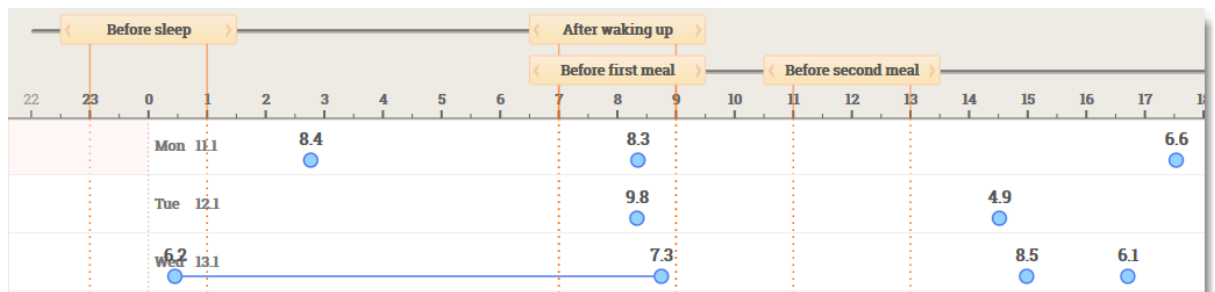
Picture 4. Glucose measurement and results automatic upload with Mendor Smart.

As the data is being gathered, a measurement profile is being constructed. Together with the settings made and measurements done, the meter will soon begin instructing the user to do measurements at certain times. Mendor Smart begins to beep at the hours it will assume the patient would be waking up or having meals, suggesting the user to do a measurement. There is a message log also in the device, which for example notifies when a successful measurement pair has been captured and what is the progress of creating the measurement profile.



Picture 5. Statistics dashboard in Balance service.

Patient, or someone caring for them, can log on into Balance service using email address and supplied password. Results are displayed in a matrix view logbook (Picture 6) and some basic statistics calculated from the measurements can be observed in the dashboard and extended blood glucose analysis views (Picture 5). Results can be printed out. Obviously many elderly people would not use the cloud-based web service themselves or it might not be used at all on the patient side.



Picture 6. Setup scroll bars for meal time schedules and measurement result matrix.

Healthcare professionals can use Mendor Balance Pro to access to their patients' blood glucose data in real time (Picture 7). A doctor or a nurse can monitor patient lists and focus on individuals needing the most care and support, such as those having most low and high glucose level measurements registered. Patients requiring more assistance or guidance can be focused on better than without having this information available constantly.

balance

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List of Patients >

Search Search here Add a new patient Data shown is from the last 12 weeks ?

Health system ID:	Last name:	First name:	Latest Upload	Latest Value	Valid	Invalid	< 4 mmol/L	> 15 mmol/L
G-6588412385	Koskela	Sara	10/10/2014	10/10/2014	60	1	43	11
G-6588112380	Ferguson	Mia	01/09/2014	01/09/2014	109	8	2	97
T2-6588112370	Griffin S.	Michael	30/08/2014	30/08/2014	85	-	-	-
T1-6588412363	Hahm P.	Jenny	28/08/2014	28/08/2014	232	7	71	45
T1-6588112343	Hall	Edward	28/08/2014	28/08/2014	177	9	90	75
T2-6588512373	Heisenberg P.	Wilson	26/08/2014	26/08/2014	88	-	-	35
G-6588112381	Jokinen	Maria	25/08/2014	25/08/2014	63	-	-	-
T1-6588612362	Foreman	Michael	22/08/2014	22/08/2014	18	47	5	11
T2-6588112371	Neilson S.	April	20/08/2014	20/08/2014	56	34	6	4
T2-6588612372	Philips S.	Leonard	18/08/2014	18/08/2014	145	-	104	2
T1-6588112351	Ross	Megan	16/08/2014	16/08/2014	12	-	-	-
G-6588512383	Sanders	Lois	11/08/2014	11/08/2014	32	-	-	-
G-6588612382	Swanson	Jane	10/08/2014	10/08/2014	54	-	-	-
T1-6588512368	Winston	Mark	09/08/2014	09/08/2014	254	-	-	-

Picture 7. Balance service for healthcare professionals listing patients and their data.

The main differences between the old traditional and the new action model in glucose measurement relating diabetes treatment can be observed in appendixes 2 and 3. New model presented by Mendor ONE is much more efficient, reliable and provides a much more simple and contemporary way to handle the process similarly in each possible situation. Whether the measurement is done by the patient themselves, their friends or relatives, home care staff or anyone, the measurements are always automatically logged. Healthcare staff who are authorized to view the results have constant 24/7 visibility to the situation and can direct the treatment accordingly. Potential benefits would include efficiency in registering the measurements with less possibility of errors. Time would be saved during care staff visits to patient and even more importantly if some visits might not be necessary due to measurement results being available automatically.

3.2 Semi-structured theme interviews

Theme interviews will be constructed on five themes. Theme interview structure and some leading basic questions and ideas to the topics are presented in appendix 4. More leading questions were improvised during each interview based on specific interests and knowledge of the interviewee. Some of the questions were asked as is, some were reformulated and some were not asked at all, depending on the specialty field of the interviewees.

The interviewees were selected with the basis of being from a possible wide range of different organizations, roles and professions from public, private and third sectors. This was due to having the themes looked from more different angles and likely to produce a variety of important points to the discussion. The amount of interviewees was limited to ten, although there were many others suggested, that could have been also interviewed. With this variation of interviewees, it was decided that enough different viewpoints and stakeholders has been included. Each interview advanced in different paths with questions and topics discussed in large variance and order.

3.3 Theme interview 1 – CEO of a medical ICT integrator startup

The company that the interviewee represents is a small startup company that has created an integration platform called for combining data from different IoT devices used in assisted living or home care. Their goal is in short to refine the devices usability by integration. Integration offers advantages to healthcare providers and other stakeholders in the care of the patient, when they can access a multitude of information in a single comprehensive IT solution that can relay the significant data forward to other systems where it is valuable or required. Interviewee uses the term “wellbeing technology platform”, apparently coined by Finnish Kuntaliitto - union of municipalities - on its KODA project, where three healthcare provision districts and eight cities are developing such integration platform, where different devices would be integrated to commonly used healthcare IT systems to produce a more comprehensive analysis on the health of a person. There are also other similar integration projects and integration platform acquisition competitions being initiated on the public sector currently, which are discussed in other interviews.

Interviewee states that usually all vendors of different devices and solutions have their own web portals and methods of data collection and reporting. This is not convenient in public sector healthcare, as they are mainly only using the generic healthcare IT tools and usage of a wide variety of device specific tools would not be convenient or efficient. Sepa-

rate devices and non-integrated solutions will not easily become part of healthcare processes, because the healthcare people are usually not IT enthusiasts and they are always too busy to handle issues outside of the generic process. Any new devices and solutions must become part effortless part of the generic processes and tools to gain the acceptance from the healthcare professionals. Mäkelä (2016) has noted the majorly used healthcare IT tools in Finland to be Pegasos by CGI and Effica by Tieto, which are being used in almost all municipalities and healthcare organizations throughout the country.

One aspect, which came up in the interview was different self-monitoring portals, such as Mavel in northern Finland, which the platform of the interviewee company is already integrated into, allowing relaying of Mendor Smart data into Mavel portal. Generally these portals are already integrated into the main healthcare platforms, such as Effica in this case, so the information is then relayed forward from there. In eastern Finland, similar platform is called Medinet, which they also have integration with. Often getting the data into these portals, which are already linked into the main systems is the key need for the public healthcare organization. Then there is already partly in use the new Finnish national health archive or Kanta, which already has interfaces with the mostly used healthcare IT platforms. In the near future, this will be the main database containing all patient medical records nationally integrating all healthcare providers mandatory by law. It also includes electronic prescriptions and a portal for citizens to access their own medical data using strong authentication, such as bank credentials. Since mid-2015 this database has been up and running with more municipalities and private sector companies joining. It doesn't contain any historical data, but eventually all new healthcare data will be integrated into it. The updated schedule describes the phases of the deployment during 2016-2018 with separate deadlines for all healthcare industry organisations to join certain functions during 2016-2020. (Kanta, 2016a)

Interviewee says that in the public sector there are two main ambitions regarding the topic area: for people to have a dignified old age at home and to achieve cost savings on providing healthcare services to people. Costs for assisted living consist much on the frequency of the visits and unit costs. Currently the level is between 20-40 euros in an urban area and possibly even more in a rural area. The advantage that a new product or service might bring to this, if it could be shown that usage of the product could for example cut the necessity one visit monthly out of usual four the business case would be there. The main sales points regarding Mendor Smart would be to have the information that measurements have been made and the possibility to react on certain findings in the measurements if needed. For type 2 diabetics it is also essential to know if the glucose values are fluctuating because the medication has not been taken or even though the medication has

been taken, which is something that could be concluded combining data from several devices.

Discussing about the effects of the SOTE reform legislation, the interviewee sees that there will be less healthcare providers or organizers, but several healthcare producers. In the current situation, some of the municipalities are not handling their social and healthcare matters cost efficiently with good quality, so the purpose of the new legislation is to guide the public sector more commonly towards that way. Considering the effect of the SOTE reform possibly directing people more to use private sector healthcare services he notes that some of the cities and municipalities have already for several years been attempting to push customers towards private sector with different means. In Vantaa there has been a home care service coupon in use for six years, but it has not had a huge impact. The case seems to be so, that for the customer it doesn't matter that much who the provider is, when the service is quite much the same and the purchasing is much easier from the public sector. Elderly people especially would often find it difficult to tender out private sector companies in such matters.

In regards to the new APC legislation, he says that the current law in itself does not block using quality criteria in the acquisitions. For example it would be possible to have a purchase requirement that it is mandatory for the glucose meter device to have possibility to relay the measurement data into a certain portal, such as Mavel or Medinet. But the problem often is that the understanding of the specific area inside the purchasing units is limited. The people in the purchasing are not the decision makers, but they will get a mandate from some internal party with directions on what are the base requirements for the product they should acquire. Often the most important person affecting the decisions could be the medical director handling diabetes affairs in the organization or similar person having high medical responsibility. Influencing such principal mandators could turn out to be key factor in getting new products accepted into or winning the acquisition process.

The interviewee points out that in home healthcare the safety bracelets are widely used, but other helper devices are quite rare. There is plenty of interest on these, but there are lots of challenges regarding the processes and different stakeholders. Some further examples on their integrated products are water leak IoT sensors that could alert a plumbing company that would contact the customer and offer to come over to check and fix the situation in case of a dishwasher malfunction, or an automated medication dosage timer and supply. As some of the elderly are prone to forgetting things and need reminders, he also noted that in some research it has been shown that some elderly people would rather react to a human voice than just a sensory beep, which is quite common notification method

in many devices, like the Mendor Smart. Finally, there was some discussion on future ideas, such as a speaking IoT bracelet with integrated warnings and guidance for home care devices or a possibility to open a video connection from the nursing staff to the patient homes to help them.

3.4 Theme interview 2 – Project manager of municipalities assisted living IoT device integration project

Second theme interview brought more insight into some current public projects regarding healthcare. Discussion covered some of the challenges in assisted living as well as current and future trends and the recent juridical developments in the operational environment. In the organization the interviewee works in, an hour of home care service costs around 80 euros, including all work done. There are approximately 2400 annual customers coming and going, with some 1600 at all times.

One of the projects discussed is “KODA-KOtona Digitaalisesti ja Asiakasläheisesti -uusi kotihoidon palvelukokonaisuus”, which is a project by Eksote, Pohjois-Pohjanmaa, Tampere and Kainuu social and healthcare districts as a part of the national social and healthcare forum AKUSTI project portfolio. It is initiated with one of the current government spearhead agendas “Kehitetään ikäihmisten kotihoitoa ja vahvistetaan kaikenikäisen omaishoitoa (2016-2018)” with the intention of developing better coordinated, cost effective and more equal services for elderly, their relatives and nurses who care for them. (AKUSTI, 2016) This Tekes funded project is meant to create tools and methods to combine data from different sources and use it to construct even better customer serving products and services. Important role is with experience data from the users. (Tekes, 2016) Interviewee describes this as an assisted living safety device project ongoing with municipalities union and six municipalities. Goal is to provide a digital services integration platform that would combine several different devices data, on the contrary to the current situation, where each device has their own connectivity methods and portals. Project strives to produce a generic API, where all device and application manufacturers could easily connect to.

Challenges currently as described by the interviewee include that there are multiple solutions to the same things, as in several devices by several manufacturers with the same purpose. The patient data systems do not have places for all of the necessary information, meaning that there is a data field for blood glucose, but not for several other measurable factors. Also the patient data systems are often different, so that every service provider –

hospitals, social welfare, open healthcare and private organizations - have their own and there is no information exchange between them. Approximately 80% of the assisted living customers in home care have memory issues, causing forgetting of glucose measurements. Double registration – first on site and second to the patient data system afterwards - of the measurements takes excess time. Patients can rarely make the measurements themselves, so often it is a nurse or a relative who does them, as happens in some cases with the injection of insulin also. For the professional staff point of view, a challenge is that there is not enough time or willingness to bring in a new device, password or an application to the mix of the ongoing busy work.

Current trend is towards remote healthcare, including monitoring and any doctors or nurses services that can be provided remotely. The monitoring of the patient - or in home care more preferably referred to as the customer - remotely will make it much more efficient to do decisions on the care as well as ease the distribution of the information to the relatives of the customer. Things that could be monitored alongside blood glucose values include blood pressure, movement and sleep. Combining the data to one system allows to make conclusions and to produce more readily valuable information to the professional staff. It is difficult to say when the generally available health records would contain automatic measurement data. Also trending is to put emphasis on the quality in the acquisition processes compared to pricing, due to the fact that in the long run quality also produces economic advantages. If the public sector would go into giving out more advanced and expensive meters is not easy to see, but it would be more likely that those would be lent to people with worse glucose balances, to improve the results in their diabetes care.

Regarding the SOTE reform, it will not have a major effect on the selection of the care provider, on the interviewees' opinion. Based on current research, people do not travel that much - for example to neighbouring municipalities - to receive treatment, even though they could get instant appointment without queuing. Service coupons have not been effective, probably due to the service providers in the system being scarce as well as the selection of services included inside the coupon system. As positive aspects, most likely the reform would improve the exchange of information between basic healthcare and special healthcare organizations, which is currently a weak point. Even the new Kanta database will not bring all the patient data visible. Different SOTE areas have various solution to information retrieval from different patient databases, meaning that there are viewing accesses being given, but not write access.

There was also discussion about a new experimental law on social and healthcare service planning. With the current laws, combining information of the social and healthcare data is

prohibited. This is often not good when professionals are trying to construct a full medical profile of a customer and to take all aspects into consideration. This new law is meant to improve the exchange of information, to define what information would be in the customers best interest to be available on both sides and both customer and professionals would have visibility to the plan.

Discussing on the sales points of new products, interviewee mentioned first having references, scientific data and doctors testimonies. Any calculations on potential savings and cost advantage analysis would be very important. For the application, it would be beneficial for it to produce alarms, notifications and have well thought ways of displaying the data and reports. Important technical aspects as described by the interviewee include integratability, ease of use, smoothness of implementation and fitting to the existing work methods. Discussing about organizing meetings to promote products, interviewee pointed out that suppliers should strive to set up combined presentations to gather up representation from several different stakeholders in a single organization at the same time. First meeting would focus on the management to get a green light in general and then possibly a second round for more specialist staff with more detailed views. Bringing the stakeholders together would produce often much needed internal organizational information sharing and possibly result in better general acceptance for the new product. Well prepared and concise presentation including proper knowledge of the potential customer environment and correct terms on things will bring the best results. Possibly also some events, where multiple companies and organizations might be able to get acquainted with the product at once, could be organized.

The main ideas and points taken from the interview are firstly that diabetes is not the centric challenge in the assisted living field, but instead it might be valuable to consider the group of people, who are not yet home care customers, but have a risk of being such in the near future. Secondly, assisted living customers are mainly in such bad shape that fully automated solutions that do not require patient action are the ones that are most sought after. Thirdly, possibility of loaning more expensive meters by the people who have the worst glucose balances is an idea to consider. Lastly, a list of good sales tips was brought up, including the idea to bring together several stakeholders at the product presentations.

3.5 Theme interview 3 – Statistics specialist at municipalities union

The third interview mostly concentrated on discussing statistical data and possible references for that data as well as some of the legal aspects regarding the SOTE reform and law of acquisitions. The suggested sources included Sotkanet (THL, 2016 a), which contains some of the general statistics based for example on the AvoHILMO open healthcare notification system of THL. However, it does not offer much statistical data on diabetes care specifically and only a bit more on assisted living. There are municipality specific percentages on diabetics of selected age groups available as well as similar data on customers of assisted living. THL does have much more data than the statistics generally presented in Sotkanet, such as social care nationwide person registers. Such data is available to research use only with specific application and permission, but these would likely not have much added value to this work. Interviewee points out that it is a line in the water if the diabetes is a primary or a secondary diagnosis or a combination of issues, which makes statistics creation somewhat complex.

Interviewee was presented with previously found statistics based on research of a few municipalities that an average cost of home care, would be 36 euros per visit and that 39% of home care total costs consists of the care itself and 11% of the trips to customer locations. Thus, half of the costs are due to the care and visits, other half due to other expenses, such as administrative and office work, devices and accessories etc. (Leppänen, P. et al, 2013) On the question of similar statistics being available nationwide, the interviewee concluded that there is no definite nationwide statistical data source on these matters. Suggestion was to combine data from different sources and presenting specific cases from a certain municipality or service provider.

On other good statistical sources interviewee said that FINRISKI research (THL, 2013) could provide some further information on the generality of diabetes in Finland. Kuusikkokunnat statistics (Vartiainen, A., 2015) the interviewee deems as being very good material. Some other statistical sources brought up to discussion were THL Sosiaali ja terveydenhuollon yksikkökustannukset (Kapiainen, S. et al, 2014.), the annual THL Perusterveydenhuolto study (THL, 2016 b) and Kotihoidon asiakkaat marraskuussa 2014 (THL, 2015). On the last one interviewee remarked that the study contains planned visits, which doesn't entirely tell the actual truth, because in reality there are a bit less visits.

When discussed about the subvented costs or complete free availability of the diabetic devices and accessories provided to the diabetic customers, the interviewee mentioned that the current situation is subject to change in the near future. There are plans to renew the payments of the diabetics and there will be rises in costs to the customers to be ex-

pected. Any services, apparatus or accessories that are currently free of charge, will be re-evaluated.

Regarding the SOTE reform and the integration that is planned in it, the main point is that diabetes care and diabetic accessories distribution is in healthcare domain, while home care is in social services domain. Traditionally mixing these domains, information traversal in between them and such, is prohibited by law, but the reform intends to open this. Still, even currently the diabetic medical accessories can also be delivered by the home care personnel. Another point where SOTE reform might have an effect is incorporation of the services. Would the customer have possibility to choose both of these integrated services from a certain service provider, which would ease the service relationship from the customer point of view.

In the law of acquisitions, as the interviewee points out, there is a rule of indiscrimination, which disallows any unreasonable prerequisites to be set so that a certain supplier would be unable to offer. It can be challenging to evaluate this in a situation, when the acquisition documents might state some prerequisites that could favour some or certain suppliers.

3.6 Theme interview 4 – Chairperson of a diabetic association

The fourth interviewee is a type 1 diabetic who is very active in the affairs of diabetics and elderly, leading a diabetic association in a major city and also participating to the city steering group for diabetes care. Interviewee was expected to bring out the needs and views of the patients and immediately emphasized that the home care nursing staff often don't have required experience and training to handle the type 1 diabetic patients requiring multiple injection insulin care. For example, they do not have the rights to modify the dosages, although these modifications are often required. Dosage needed for each meal depends on the amount of carbohydrates and physical activity. Sometimes patients might have infections or such that would require even doubling the insulin amounts. Infection susceptibility and vulnerability gets much lower, when the glucose balance gets better. To get better results and make the treatment more effective, remotely reporting measurement devices might be very valuable and could provide data for on duty diabetes care professionals, who have the required skills to guide the care and possibly give advice and manage the home care nurses work on the diabetes care issues. The instructions would need to be quick and precise, because nurses might need to go to 12 different locations during one working day, so there is no time to waste. Immediate follow up and alarm notifications

are important when making the measurements and getting them uploaded to the cloud service.

Interviewee describes typical assisted living customers needing help in both measuring as well as injecting insulin. Some do take care of themselves fine, but the older people get, obviously they need more external care. Of the most elderly over 80 year old patients, even 30% might have diabetes, which is 3-4 as much as the general population. Interviewee uses term “revolving door customers” on such home care patients that need emergency room clinic immediately when they get in worse shape than usual.

Discussing on the SOTE reform, interviewee states that the basic structure will not likely change much. Services will anyway need to be produced locally, but the organizational units will grow bigger. For a diabetic home care patient it is essential to have both the healthcare and social services produced by the same service provider organization to receive the complete care package for all their needs.

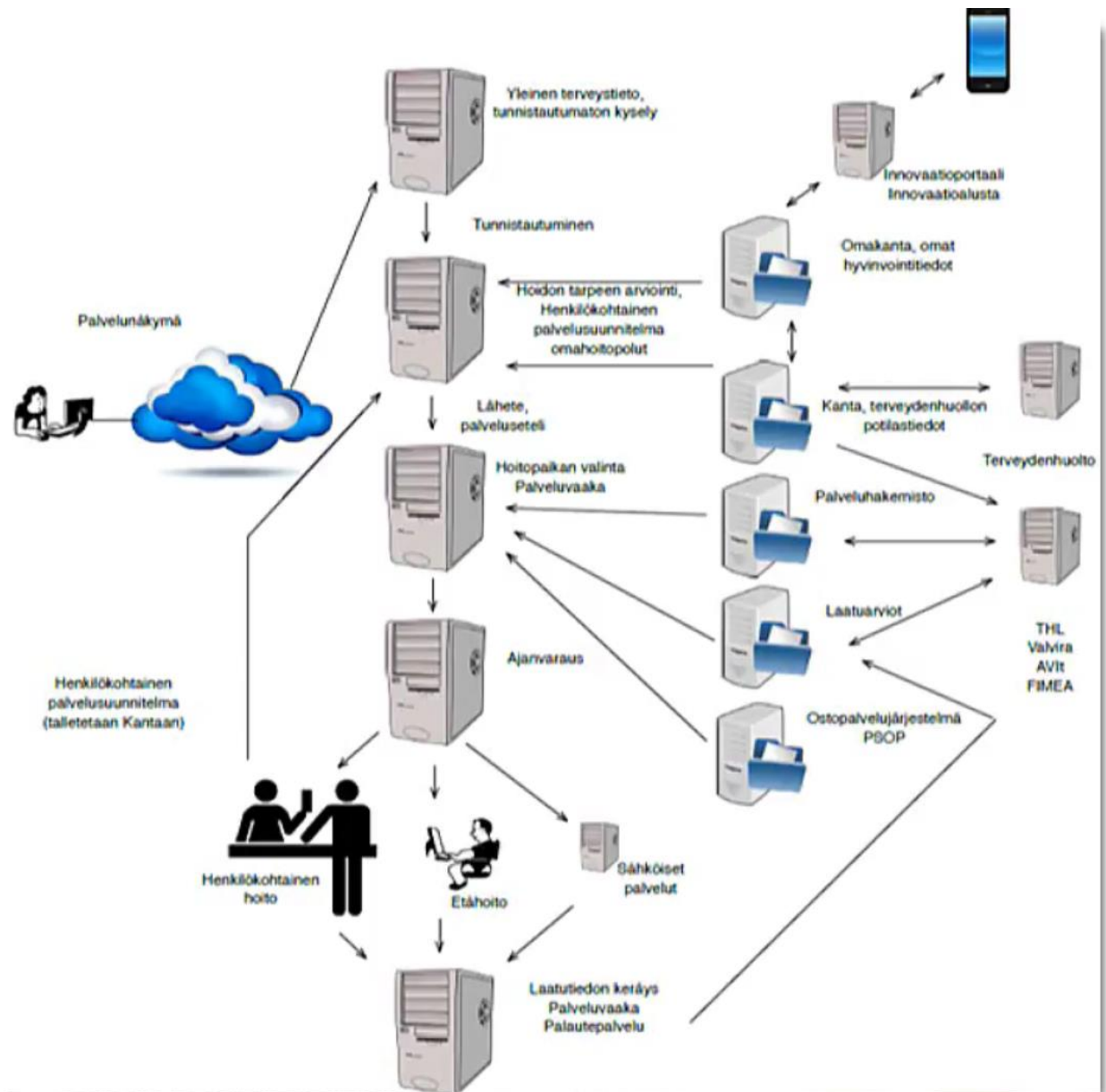
Main points of the interview were that any devices taken into the care need to be very reliable and it would be highly appreciated if they integrate into other existing parts of the current care system. Also, for someone to follow up on the measurement results all the time and taking the necessary actions based on the data.

3.7 Theme interview 5 – Program manager at a healthcare ICT supplier

Fifth theme interview was conducted with two persons in program manager and project manager roles at a healthcare ICT software supplier company. They had insight on the technical viewpoints regarding the healthcare ICT, upcoming trends and public sector customer needs. The company provides a complete solution information system for handling healthcare and social services patients from scheduling to reporting with integration to national Kanta. Customers include municipalities healthcare co-operatives, healthcare centers and private companies operating in the healthcare sector.

They have a self-care portal with strong authentication. Users can register their glucose measurements manually and get graphical reports. They have a mobile application for the data input also and a demo stage experiment for direct transferring of the measurement data from the meter device. In this case there is Bluetooth connectivity to a mobile device and FHIR interface support also. Currently there are no such solutions in production, which would contain APIs to bring in data from third party systems or devices. The big

challenge regarding integrations is the lacking common standards for different devices, which FHIR is a good example of, but all of these are still in developing stages.



Picture 8. Kanta related services, data storages and interfaces (Teemupekka Virtanen/STM, 2016)

The FHIR would currently seem to be one of the important standards, which most of upcoming healthcare integrations should probably support. There was recently an STM seminar on the implementation of the SOTE reform strategies (STM, 2016), where FHIR interface was discussed relating to the ODA project. Information from the ministry was that this could be the centric API strategy for the data collection towards Kanta archive, which will be the basis for all healthcare and social services data nationwide. OmaKanta archive, which is a Kanta extension to contain the personally collected data, is apparently meant to use the FHIR interface to bring in data from multiple different devices and applications.

Patient can then give access to certain healthcare professionals to this information and it can be transferred to other integrated systems for further analysis. Also, all of this relates to a virtual hospital that would allow remote doctor appointments, which could partially revolutionize healthcare and be very helpful to customers in assisted living. (Picture 8)

Some views on the public sector customers were discussed in the interview. The general feel is that the customers have centralized acquisition and offering competitions. The interviewees claim that the public sector is not really yet at such maturity state, where much more than a cheap price would be expected from glucose measurement devices. They think that devices that would directly send data to cloud might work in a short timeframe for measurements made at healthcare centers, but not likely among devices given to customers for home use, unless the customers would pay for the more expensive device option themselves. Having notification alarms was brought up as a mandatory functionality on a measurement system. For reporting purposes, such things like comparison of measurements to medication, in graphic form on last 12 or 24 hour timeline would be valuable for professionals to adjust the care balance.

3.8 Theme interview 6 – Project manager at a municipality assisted living services

The sixth interviewee is developing new assisted living work methods at a major Finnish municipality, having a wide experience as a nurse and team leader with lots of field experience and implementation projects participation. The discussion concentrated much on the professional side challenges and procedures in diabetes care regarding assisted living, different projects and new portals on the field and technologies as well as the legal side change effects.

For nurses and care staff point of view, it is a challenge that you are not present at all times to observe what the customer is eating or taking what medicines if anything at all. Glucose values reveal something, which makes it important to get the measurements to patient data system immediately for analysis. Many of the home care customers require some sort of assistance or support doing the measurements. Some make them, some don't care or remember. In this municipality, the home care personnel register the measurements with their mobile device to Hilikka system, which should transfer them to Pegasos patient data system, but there have been problems with the integration. In practice, there are also traditional pen and paper notebooks in use with the patients and process

regarding the measurements registration with several steps until the results are where they need to be, is as not as smooth as it could be.

Presenting the new action model (Appendix 3) compared to the old (Appendix 2), interviewee commented on the advantages of the new model. There would be possibility to make less visits and the credibility of the results would be better. In fact, it is known that sometimes customers have forged measurement results on paper. When the customer benefits with better glucose balance, it will minimize the occurrence of any side diseases, minimize the need for diabetes medication as it can be taken partially down, fewer unnecessary hospital visits and so on. All of this results in significant cost savings that would make the new action model using more expensive modern devices and services still pay itself back in a reasonable timeframe. Tablet medicated diabetics do not require as much measurements, but for customers requiring insulin injections several times daily, if it would be possible to have even one less visit per day each day, the savings would be four digits per customer each month. For the more self-sufficient and active customers any alert beeps, notifications and guidance for and from the device will work fine, but the amount of such home care customers are decreasing. People are hard of hearing and they often have other media devices on to mix the noisescap. In case the professionals could receive directions via the device it would be valuable. Also, with virtual treatment, it would be useful to get the measurement results from the customer directly from the device with proper validation.

In this municipality the hourly cost for home care personnel is 48 euros per hour and the nurses make on average 14 visits during a working day. If you include all the costs, like electronic locks and resource planning, the cost can be up to 60 euros per hour. Interviewee points out that the statistical figures vary by municipality often depending on how they calculate the total cost as in what is included. They are also using a remote home care solution VideoVisit eCare in use, where customers are given 10" tablet computers. If the customer has pre-approved forced opening of the remote connection it can be fully initiated by the care staff, but otherwise the customer accepts the connection each time. For some patients, this is being used to guide them to take insulin injections on a daily basis. Virtual nurses make 28-30 visits daily with approximately 8 euros per visit cost, making it twice more than traditional local visit model and much cheaper with no need to travel distances.

Discussing on the SOTE reform, interviewee figures that the acquisitions will be more done on bigger scales for larger areas. Quality will be in a significant role as well as properly functional service and price will be less of a decisive factor. Municipalities will co-

operate much more and their representatives, and nurses and doctors, will be more involved in the decision making than in the current model. Currently money makes the decisions and those who lead the acquisitions need to prioritize a lot so that different unrelated matters compete for the money.

On the diabetes technology in general the interviewee concludes that future trends will be devices that connect via mobile phones or other such mobile devices that everyone already has, devices that guide customers towards the correct actions and that deliver the data directly to the patient data systems. ODA and KODA services, all types of online guidance, tests and notifications need to be implemented to customer usage. Future will bring more automatic care guidance to the customer so they can take more control of the care by themselves and not only by the professionals. A common database is needed to contain the device produced data, which also shows a real need for the integrators striving to relay and combine the data. Separately build APIs are very costly and future systems will need to offer integration solutions as a default.

One example idea from the interviewee was to use an existing widely used system as a customer portal. Hyvis.fi is an electronic customer portal with over two million Finns user base that provides strong authentication with bank account logins. This could act as a gateway with single sign-on to other systems, like Kanta and Gillie.io so it would be possible to view and build reports on the data in those systems via Hyvis.fi login. The interviewee stated that it is somewhat of an issue that if a professional does not validate or sign some text that is produced in a customer care event in a certain way, it is not transferred to Kanta.

To draw one main point from the discussion, the interviewee mentioned that glucose meters, as well as any other medical devices, already now need to have some digital intelligence included. When any new purchases are made, it is vital that the choice is not towards the cheapest end of the devices, because this might prevent the implementation of future advanced methods, techniques and solutions to be used with the devices. Another important fact was that data from any personal measurement devices would need to be integrated and brought into the platform that is being constructed in the KODA project, which will be the centric home care data collection system.

3.9 Theme interview 7 – An experienced nurse working with diabetics and elderly

More hands-on nursing point of view was discussed in this interview, with emphasis on daily work processes and reflecting on the challenges and possible solutions regarding certain subtypes of diabetic customers. As in some of the other interviews, the change resistance in taking new software applications such as Mendor Balance into usage was mentioned. The nurses don't specialize in computer or software usage, so it would be most beneficial if new devices would interact with current software already being used. Interviewee rises as the main challenge to be motivating the nurses to understand the benefits and to want to use more modern devices and applications to help in their work. Nurses need to use all of their time to the basic treatment so any assisting tools should not demand more time or effort as they have no extra time for it.

Interviewee positioned as the most beneficial group from Mendor ONE system to be type 1 diabetics that are in centralized care covering the wider municipality area with 3-6 month control visits. Limited amount of doctors taking care of these patients could see the glucose balance from the computer and it would often be possible to skip a single visit. However, people with memory problems could not do the measurements and injections themselves. For the type 2 diabetics, generally people on pension in home care, would not be the correct target group because then all of the teams and staff would need to start using the Balance software, which would cause too much change resistance. Generally, people who are customers of home care are often patients restricted much to their beds, with 4-5 visits daily, who would rarely be able to make any glucose measurements on their own.

Interviewee described a regular assisted living visit in their municipality home care services. A work organizer programs the visits of each day to a mobile phone with the addresses and work instructions. Nurse goes to a visit, registers time of entry from a QR code at the door, makes notes to the phone, measures glucose and other values and does the tasks assigned and leaves with another QR code timestamping. The glucose value is only marked up in the text description, not to any numeric field to draw any statistics from. The markup is in home care own care planning section of the patient data system. Nurse does not have time to check the history on other visits. Diabetes doctors do not follow up on these notes and there are no responsible doctors on the home care side that would. It might make a significant difference if the nurse would have a link to measurement history data on the visit work assignment, to be able to see if there are high or low measurements for determining possible need for adjusting the insulin dosage at the same time.

Pegasos patient data system that is used in this municipality does have a measurements section for some other figures like blood pressure, pulse and weight, producing graphic history data. But for now, there is no such place for glucose measurements. This is where Mendor software would come in handy, being described by the interviewee as “poor mans glucose sensing solution”.

Main points of the interview were that in current patient data systems, there are no proper places for home care glucose measurement registrations or tools to handle those. For procurement of more advanced glucose measurement solutions, it would require the responsible doctor to be enthusiastic about the device or service and thus market the solution for the rest of the team. Pricing has a great meaning in the acquisitions, so added value for more expensive solutions will need to be justified.

3.10 Theme interview 8 – Solution designer of an ICT service provider for a healthcare district

Eighth interviewee is an engineer with also medical studies, working in development project renewing home care safety services in a major municipality. Measurement devices regarding personal health as well as diabetes care and medications are familiar being part of the project. Discussion varied from device and service specifications in acquisitions to all sorts of challenges, processes and solutions in healthcare organizations.

The interviewee stated that in practice it seems to be big variation on where do the professionals register measurement results. Describing an example from a previous project, it was noted that several patients had higher than optimal glucose values. Patient data system had a place for registering the values, but there was no proper historical data in existence for the patients. Doctors make their decisions based on laboratory results, which means they mostly rely on HbA1c (glycated haemoglobin) values. Glucose balance varies highly in these cases. There would be lots of potential using the latest devices and software applications to put further focus on results follow-up and optimizing measurements. Technology is there and many of the challenges are solvable, but existing processes rely heavily on the patient data systems. Taking advantage of the Kanta service is still only beginning. Key role to bringing the modern solutions into use is with the management of the organizations to strategically decide to drive them, change the action model, take advantage of Kanta and make decisions based on data produced by the customers themselves.

There are still plenty of aspects to consider with the usage of remote access meters. Where will the data be stored and who owns the data? Who owns the devices and who pays for them? Interviewee concluded that it should be so that the patient owns the data and the best place to store it would likely be OmaKanta, where the professionals could be given access. Municipality could cover the expenses up to a certain amount and the customer or some third party would pay for the rest. Integrations from the vendors own cloud services towards OmaKanta or direct connectivity to it is highly necessary. Adding even one new software or vendor cloud platform to the current mix is questionable, because the processes rely heavily on the existing patient data system and home care system.

In comparison to the official measurements made by the laboratories of the healthcare organizations that are registered directly to the patient data systems, the interviewee presented question if it is problematic to do such measurements outside the laboratory with varying equipment? Are these accepted to the patient data as is? Are the devices calibrated and how is it possible to verify the data? Regarding these questions the interviewee expressed that it might be unnecessary or obsolete to drive the self-measurement data there, but instead keep it elsewhere, with possibility to retrieve if wanted. Still, it would be highly advantageous to have historical glucose values data available from a person that ends up in emergency care. In certain situations it might not be good to start rapidly decreasing a high glucose level, so to have the trend data accessible to support decision making would be highly valuable.

One aspect the interviewee pointed out was that currently every small organization looks to their own budget and own functions while nobody really tries to figure out the big picture. Basic healthcare, special healthcare, social services and Kela with the other financing organizations all drive their internal agenda and fight internally for resources. The whole field suffers from too much partial optimization. SOTE reform will hopefully tear down some of the barriers between these organizational boundaries when it comes to resourcing. The competition opened by the SOTE reform might drive the more traditional organizations in the healthcare field to more freely try out newer solutions and services to meet the customer demands. The reform will require much better visibility of the patient data and smoother transferring of that data from one service provider to another, so that continuity and wholesomeness of the treatment history is preserved intact.

The new law on acquisitions doesn't by itself bring more quality aspects into the buying processes, but it does point out towards that direction by setting the borders of the field. On the interviewee opinion, currently the biggest issue is lack of experience and

knowledge on procurement. Tight schedules are always bent. Several stakeholders are being attempted to get to participate, but usually the process of gathering opinions and needs from everyone and making compromises based on it is time consuming. Human resourcing is always too low. This work and expertise how to handle the procurement processes should be concentrated to a team that has juridical knowledge and procurement technical process knowhow. Team should be reinforced with topic or substance specific knowhow that could be added per project from outside as well as bringing in some end user expertise.

Some challenges or considerations the interviewee listed regarding a healthcare device purchasing are:

- Balancing the price and quality
- Assessing the total cost of ownership during the product or service lifespan
- Defining quality requirements is difficult, because they need to be unequivocal and not such undetailed expressions as “easy to use” or “simple”
- Creating such a request that produces similarly comparable offers

Offering processes are expensive and complex compared to the limit which is set that an acquisition needs to be set for competition. If the buyer organization would be able to properly argue and document the reasons for acquisition of a certain product or service, direct buying should be allowed to be used in much more expensive acquisitions than currently. As the interviewee said, this would in many cases most likely prove to be overall more effective than using a huge amount of time and resources to buy something that is not so expensive.

3.11 Theme interview 9 – Service manager of assisted living in a municipalities healthcare organization

Further knowledge on hands-on nursing work was given in this interview by a very experienced nurse currently leading a section of teams of assisted living at a smaller municipalities co-operative healthcare organization. Interviewee stated that although the society pays for the healthcare itself, it is the citizens who are the experts in their own health and preventers of their diseases. The elderly part of the population is highly increasing and better solutions are needed for the municipalities to uphold proper services for them. Sometimes it is just small things that might help people live at their own homes for longer.

Interviewee states the main challenges for the nurses being maintaining good glucose balance on patients, memory issues of the patients and other defects and bodily changes due to aging, such as kidney hypofunction. For many patients in home care it is not possible to teach them to do measurements themselves, even if the meter was easy to use. For the patients that get visited less, it is difficult to get a wholesome understanding of the glucose balance and health status. Such patients would be the most recommendable to be offered Mendor Smart type glucose meter. Customers of the elderly policlinic having temporary need for assisted living home care, for example once in the morning and once in the evening. Requirement would be to now have serious memory problems and preferably even customers who have already before learned to follow the glucose levels themselves. With such customers, it would most likely work fine and give much better possibility to follow up on their health status by having the meter beep for reminders and register the measurements automatically for the professionals to check on.

In this healthcare organization, the calculated hourly price for a home care visit total cost is roughly 70€ per hour as in the service being provided with that cost. What the customer pays depends on income, spouse or temporariness of the care. A home care professional varies from around 8 to 10 visits daily on rural areas and more than 10 in urban areas.

The process of the measurement registration was described by the interviewee. Mainly it is the home care nurses that do the measurements, but some customers do it themselves. Results are registered manually with mobile Hilikka app, which transfers them to Effica patient data system. However, the results go to home care pages or section in the patient data system and nurses will be required to afterwards manually transfer them to diabetes care pages or section. Diabetes specific things, such as medication is not currently possible to be registered with the mobile application. Only a text explanation on the visit with information on wellbeing, actions and measurements is possible to be registered to the home care section.

Also this interviewee, like many others, had the opinion that out of all customers in assisted living, a Mendor Smart type of meter solution would work only with a minor percentage. Similarly also to other interviewees, it was mentioned that it would be most suitable if the results would be registered directly to their Omahoito healthcare service portal, where the doctor could follow up on them. As a novel idea, the interviewee suggested the possibility of having the more expensive Smart meters available for temporary loans at the utilities borrowing facility, which they have at the organization. After a testing period, customers who prefer to use it rather than the basic devices, would be able to purchase them, possibly with partly subsidized pricing.

3.12 Theme interview 10 – Wellbeing technology expert of a municipality social and healthcare services department

Final interview was conducted with a healthcare technology expert of a major municipality and covered discussion on some of the projects and events running in the social and healthcare services of that municipality. There was discussion on different technologies used in assisted living and challenges related to them.

Interviewee explained that there is a law in Finland (Laki terveydenhuollon laitteista ja tarvikkeista 629/2010) that requires healthcare devices and equipment to be maintained, calibrated and serviced in defined methods. Devices need to be registered and followed. Although the law has been mandated since 2010, these matters are still not handled too well in almost any municipality in Finland. In the future, Valvira will conduct inspections on the application of this law in municipalities. This means it will be mandatory to have such documentations and guides concerning any new devices that the law necessitates for them to be accepted in an offering.

Interviewee described the basic process of glucose value registration in a regular home care visit, which matched some of the other interviewees descriptions. Mobile device with Hilikka application is being used to make notes of the visit and these are transferred to Effica. As the customer has been identified from the door tag, interviewee determines that it would be most useful if the measurements would be registered to the patient data of that customer via the same connection. As other discussions have brought up, it is illegal to mix the markups or notes of social (home care) and healthcare (diabetes). As such, the information to either party is being limited.

A technical viewpoint the interviewee pointed out was that Bluetooth connectivity is highly trending in healthcare devices. In to a centre for the elderly in this municipality, they will be constructing a Bluetooth network with location services that would allow also connectivity for different meters. Another example was that in the same facility they have Ascom Miratel internal service call phones, which include bar code scanning for patient recognition, and it is planned that some of the patients own meters and devices could be connected to those. The centre has nurses present in the upper floors, assisted living customers in the middle floors and an open service centre in the bottom floor, where those in worse condition may benefit from the presence of those in better condition. This seniors' centre would be a perfectly suitable place for any other similar piloting and testing of new solutions in a controlled environment. The municipality is also planning their own customer web portal, which would include connectivity for select meters that would allow bringing personal

measurements to professionals to view. The results would be transferred automatically, but the device should have an approval step if the measurement was correct.

Interviewee encourages piloting and organizing such smaller scale proof-of-concept style experiments as a good method for marketing and promoting new devices and solutions. It is highly important to be able to test the devices hands on in a functional environment. A key point for any new products is also to integrate better into existing systems. Interviewee has been informed that there is an upcoming EU regulation that would better allow the direct purchasing of piloted services that have been deemed useful. This is to fix the previous situation where after a successful pilot it has been mandatory to organize an offering competition, which has resulted in acquisition of another product that has not been as good as the piloted one. Also, interviewee determines that a suitable forum for promoting new products is a “digital agenda” conference that should be held annually by the municipality as an event where many of the stakeholders would be present to state their needs and suppliers to demo and showcase their solutions.

Discussing on the challenges related to the measurement and meters the interviewee mentioned that often nursing personnel in assisted living might not even know if the meters need to be calibrated. There are several types of different meters and controlling all the aspects of them could be quite challenging. Manually registering measurement results and identifying the customer are some technical challenges that came up.

The interviewee lists thoughts, requirements and advantages relating to the new generation of glucose meters:

- Supplier quality, such as defined response times in maintenances etc.
- Notifications and alerts, with emphasis on abnormal results so that professionals can act accordingly
- Verifying of the fact that measurements are made
- Possibility to include registrations on digested foods and drinks by the customer
- Simplicity of usage
- Device to give guidance and directions to the customer
- Data security concerns of cloud services
- Widely compatible APIs
- “If you purchase a device, but the installation or implementation of it is half of the price, then you are actually purchasing a service”

On the notifications, the interviewee described a solution in use in Great Britain, where the service sends an SMS message instructing the customer to measure. Then the customer is required to send a uniform message with the result. Something like this might turn out valuable in establishing a care contact for newly diagnosed diabetics.

SOTE reform discussion brought up the fact that the general direction is already towards buying from the private sector more and more of the services offered to the public. There will be more competitiveness between other SOTE regions and private sector organizations. Different comparison websites and services will emerge that will allow customers to find the best suitable, closest located and lowest priced service providers for them. With the service coupons already being used, the future trend would likely be that such can be used as partial payment in case the customer wants to select a more expensive service than the basic public one. The operating environment is in the middle of a revolution, with insurance companies coming in to healthcare business and merging of smaller companies to the big players in the market.

4 Discussion and conclusions

The elderly part of the population is highly increasing and better solutions are needed for the municipalities to uphold proper services for them. Sometimes it is just small things that might help people live in their own homes for longer. There doesn't seem to be really many clear major solutions to the research questions presented, but more of nuances to be considered.

4.1 Requirements for technology and integrations

Judging from the discussions with the professionals in the industry, there are several trends that can be seen. First of all, the need for integrations, which are constantly advancing on many different frontiers. There are plenty of national and local projects with attempts to bring the data together for the professionals to work with more conveniently. Currently the challenge is that the measurements are not by default brought to the correct places in the patient data systems, where they would be readily available for the doctors and care staff to observe. Another aspect is that they might be registered inside text explanations and not into specific numeric fields, where they could be used for reporting and proactive purposes. Multitude of products and services with little standardization and integration makes it challenging to implement good solutions that would help and ease the current working processes. On the other hand, there is the issue of trustworthiness of the data if it was directly delivered from the customer meters to the patient data systems, which currently often mostly contain laboratory-verified results done with calibrated equipment. Although an external observer must ponder what is the difference between measurements done by a nurse with the same customer meter if they are good enough to be applied to the patient data, but still there is a definite point that must be considered.

It would seem that the most suitable and desirable would be to integrate measurement devices into delivering the results to the already widely used self-care platforms containing personal patient data already, such as Hyvis or OmaKanta and such commonly available portals. From there it is then possible for the patient to allow visibility to the data to their healthcare personnel along with any other information that they already retrieve from there as part of the current processes and the integration with the patient data systems is usually already there or being developed. One additional technical viewpoint with the self-operated measurement devices producing data to professional healthcare staff for basis of decision making is to enable a step of approval to validate a measurement before it is being included in the reportable data mass. Whether approver is the person making the

measurement or a professional discussing with the measurer about the results or both, is up to further discussion on the pros and cons of such a step.

Another trend is connectivity and notifications. For the meters to be more generally connective, it would need to be considered for them to be Bluetooth pairable to mobile phones and tablets to deliver results. Bluetooth would be quite a generic connectivity method available in most devices, where different types of cable solutions might or might not be compatible. Also it seems a good idea that integration APIs for meters should be programmed to meet FHIR specifications as it has implication to become a centric standard. This would make possible better connectivity with third party applications and systems in the future. On the notifications, all types of channels should be considered, from SMS messages to video/audio contacting. Not only the customers will need to be notified to make measurements, but also the professionals need to be alerted of major fluctuations in the measurement results relating to historical data.

People working with the digital agenda in the municipality healthcare organizations stress that that the choices of devices and services should not limit the implementation of future advanced methods, techniques and solutions to be used with the devices. Any new purchases must already have means of connectivity and programmability. Some concern must also be put to maturity of the public sector regarding their ability to accept and implement highly modern digital solutions within their daily processes. The digital revolution is definitely ongoing, but some of the public organizations might not be that agile in embracing these concepts and in certain cases might still hang on to the old and traditional just for the feeling of safety and resistance for change.

Future possibilities for improvement on the technical side would include also automatic registration of consumed carbohydrates and exercise, which both have obviously major effect on glucose values and thus would provide even more usable data towards the healthcare professionals for evaluating and improving of the care balance. With the current differentiation of the newer innovative products compared to traditional, there is not yet so much incentive for people to switch service providers based on just the product features, but perhaps with some more added value the adequate boost would be there.

Mendor Smart as a glucose meter is not so technically unique compared to some other devices on the market. Only when combined with the Mendor Balance service, the combination becomes more technically advanced. As the Balance service is also compatible with most or all of the glucose meters in Finnish market that allow for the digital extraction of the results, it is quite versatile especially for professional use. Additional integration

capabilities through Gillie.io or other means makes the Mendor package a very frontline competitor on the market. But definitely the best advantage is to be gained by using both the device and the service combined. Results from pilot projects are promising, but further integration towards OmaKanta should be made possible and included in the marketing. For the elderly patients in home care, the Mendor package could be the primary solution for just a minor part of the segment, although could prove to be very efficient for improving on the care balance of those few. For the professional staff there is much more potential on the improvement of the processes demanding manual labour, which might justify the deployment of Mendor devices and services more throughout the patient spectrum. Concluding from the technical aspect, I would emphasize the possibilities for improving the professional side working processes.

4.2 Targeting the correct customers and stakeholders

Finding the correct target group, or “sweet spot” of people inside the segment of diabetic customers defined in this work is quite challenging. There seems to be a wide consensus with the interviewees that actually most of the people that are already customers of assisted living, those who require constant home care services, are actually already very much past the time where they would be benefiting from modern glucose measurement equipment at their home. No matter how easy to use the devices might be, or how loud and obvious the notifications could be set, the great mass of these people would not be able to do the measurements themselves.

For sure, there is an advantage to be drawn from the possibility that the daily nurse making the measurements would not need to register the results manually to a different device and then in many cases still transfer the values from text markups to a different numeric fields inside the patient data system. This will leave some manual steps out from the equation, thus making the results registration somewhat more reliable.

As a conclusion, there is probably not a good enough one single target group to be found here that would create a sufficient mass for business purposes for the modern glucose meters. But there are many groups that would benefit in various ways that can be identified and these are listed as follows in random order.

When a home care customer or their relative has a bigger role in doing the measurements, the advantage is good. Results are created without the presence of a professional. An on duty doctor could make care adjustment decisions remotely based on the data and

possible alerts or a nurse can seek for consultation if suspecting that changes are needed.

Elderly people in general who are not receiving home care services yet, but have a risk of their condition worsening due to complications of diabetes. As preventive action, to improve these customers glucose balance with constant remote follow-up, possibly in cooperation with a virtual hospital or such service. There are significant cost savings to be had if the health of these people could be improved for years to come and their quality of life would be better.

Customers receiving assisted living services temporarily, who are more accustomed to making measurements themselves already and in sharper mental condition to learn the usage processes of devices that are not so familiar. These customers could be loaned equipment and their follow-up could be concentrated to fewer professional staff and local visits could be significantly reduced, making the care much more effective.

Care organization units with certain types of diabetic patients of a municipality or area concentrated there. Judging if type 1 or type 2 diabetics would benefit the most seems to have dependence to the care organization structure. Some organization could have a distributed model where type 2 patients are receiving care in smaller local units would likely not have the adequate resources to follow-up on remote measurement results. On the contrary, in another example type 1 diabetics are concentrated to a bigger area centric care unit with more dedicated personnel resources could benefit by being able to check up on the patients current status via the remotely registered measurement results and thus there would be possibility to find cost savings by lengthening the periods of their visits to the doctor or nurse.

4.3 Costs, sales arguments, sales methods and decision making

Towards the near future it will still be the public sector covering the bigger part of the costs for diabetes patients, no matter which sector or organization will provide the services and the treatment. There is definite visibility to the fact in the current economic climate that the burden for the costs will be pushed more towards the patients themselves and thus there might open up some new sources for financing via private insurance companies or employer side provided insurances.

Cost savings, being probably the most valuable sales argument, is actually quite difficult one to define exactly. There is research data available on the numbers of the visits to customers and what does a single visit cost, but this varies highly depending on the severity of the patient condition and the city or municipality providing the service. It is clear that the savings would best be extracted in the least severe part of the patient spectrum, among those who are able to do the measurements themselves and would best benefit from remote guidance to their treatment. I would see the best marketing stance to be the pre-emptive positioning of the product for the customers in better physical and mental condition to improve their chances in keeping up that condition as long as possible and the resulting cost savings to the system from their wellbeing. In this context it is most plausible that home care visits could be made fewer, immediately for some customers and definitely foreseeably in the future for many others.

Also, for the professional staff, anything that would ease their tasks and make processes faster and more automatic, is always welcome and a good sales point. But the challenge there is to integrate the products and services into the existing work processes in a way that using them would not require significant extra effort and they could be implemented with limited amount of training. The discussions show that many organizations are looking for improved methods and solutions to serve a growing number of customers with even more limited staff and this will only be possible when remote data collection of the health metrics of the customers is made possible. E-recipes, virtual hospitals, and health records made available in the web are all part of the digitalization of the healthcare industry and online health metrics is one vital part of this. It would be recommendable sales argument to position Mendor Smart and Balance as essential building blocks in this digital versatile healthcare environment of today and the future.

Most important people to affect the decisions regarding the diabetes devices and accessories purchases would appear to be the leading doctors who define the requirements towards the purchasing departments and who have influence on and listen to their professional team members. For best impact on the decision making, the offered product or service should attempt to answer the needs of the financial side as well as the working process side.

Proof-of-concept style pilot projects on implementation and usage is most likely the most suitable sales method of promoting entirely new products and services. It is highly important to be able to test the devices hands on in a functional environment. Public side organizations are keen to initiate such experiments in confined circumstances like in a certain facility or in a certain team. On success, such pilot projects can radiate goodwill

towards the vendor throughout the organization and flatten the path for larger purchases of the products and services that have already been deemed suitable and functional in an actual working environment. Loaning the meters to patients could also be included in such a pilot with the possibility for a later purchase with partial subsidy from the municipality. EU legislation is leaning positively towards favoring piloting and mutually beneficial innovation partnerships between buyers and vendors that also favor this type of marketing strategy.

4.4 Changes in the operational environment and legislation

Main breakthrough expected from the SOTE reform appears to be breaking the old legal and functional barrier between social services and healthcare that has been limiting the flow of information and making the structures too inflexible. Traditionally these organizations have had separate agendas and resources to fight for internally and externally. The reform will require much better visibility of the patient data and smoother transferring of that data from one service provider to another, so that continuity and wholesomeness of the treatment history is preserved intact. Competitiveness between SOTE regions and private sector organizations on the efficiency will remodel the operating environment. Internet with its limitless possibilities will offer consumers comparison websites to find the best suitable, closest located and lowest priced service providers.

The operating environment is in massive revolution. Insurance companies and other entirely new entities are entering the healthcare business and mergers are being planned and made. Outsourcing is already trending in Finnish municipalities and it is highly likely that SOTE reform will put in another gear to it. Major healthcare companies on the private sector will compete fiercely to get the outsourcing contracts and a bigger share of the market cake. It is very likely that the competition will also include offering and implementing of more modern devices and services to make the healthcare more efficient and to shine the image of the competing service providers for the customers. The elderly might not be the ones to jump around for different providers, but everyone else will definitely be evaluating for the best options available.

The Act on Public Contracts seems to be a bit controversial if it will have much effect. It could be that it is more of a result for the need and direction that the public healthcare industry is already heading to with learnings from recent years of operation along the EU legislation and mandatory competitive offerings system. Cheap pricing is going to make some way for quality for sure, but still the constantly scarce resources will set the space to

move within. Pricing has a great meaning in the purchasing, so added value for more expensive solutions will need to be justified. However, when new products can be presented with cost and personnel resource saving opportunities, reasonable price difference will not be an issue if quality can be delivered.

In addition to the other legislation discussed, Article 31 of Directive 2014/24/EU sets the stage for innovation partnerships “Where a contracting authority wishes to purchase goods or services, which are not currently available on the market, it may establish an innovation partnership with one or more partners. This allows for the research and development (R&D), piloting and subsequent purchase of a new product, service or work, by establishing a structured partnership.” (European Commission, 2016). This and probably also other EU legislation would better allow the direct purchasing of piloted products and services that have been found suitable and useful to the piloting organization.

As a conclusion on this part, I would state that on the short term there will not be huge changes seen at the customer level, but on a bit longer run three things will surely happen. Public sector will be able to take less responsibility of the costs and customer needs to put more money on the healthcare costs themselves or with the assistance of insurances or employer. Healthcare data will be more ambulatory and much better available for everyone required, although data security is a concern. Possibilities for customers to cherry pick service providers and healthcare products will be much convenient, but is something that younger generations will anyway embrace more than those who would now be elderly and using assisted living services.

4.5 Validity, reliability and relevance of the research

To the question of how many qualitative interviews in a research paper is enough, Harry Wolcott answered in a research done specifically on this topic, quite openly but very well put: “That is, of course, a perennial question if not a great one. The answer, as with all things qualitative, is ‘it depends.’ It depends on your resources, how important the question is to the research, and even to how many respondents are enough to satisfy committee members for a dissertation. For many qualitative studies one respondent is all you need – your person of interest. But in general the old rule seems to hold that you keep asking as long as you are getting different answers, and that is a reminder that with our little samples we can’t establish frequencies but we should be able to find the range of responses. Whatever the way the question is handled, the best answer is to report fully how it was resolved.” (Baker, S.E., Edwards, R., 2012) During the process of the inter-

views it was clearly noticeable that on some questions there seemed to be quite a good consensus with most of the people. As the amount of interviews increased, the feeling of having most essential viewpoints being already brought out was emerging. The ten interviewees in this paper represent already much of the stakeholders imaginable. There were a few more interviews scheduled that were cancelled or failed due to different reasons. Out of these, one interview with a managing doctor failed due to a calendar mishap, which I find that could have been the most additionally productive for this paper and have a bit of regret for it not being included. Personally, I believe that the interviews conducted were such that lead to discovery of the most essential aspects regarding this work and not too much more of significant findings could have been extracted with more interviews.

Certainly, all of the interviewees had extensive knowledge on the issues discussed. Sometimes it can be difficult to produce answers to qualitative questions in a semi-structured interview with not much information given beforehand of what will be asked or discussed. It could be a good idea to let the interviewees ponder and prepare on some of the topics already in advance, but then again the flow of the interview sometimes presses the interviewee to give some vital pieces of information that might not have been included if they had more time to think on their answers. It could be that a discussion would degrade to reading of a paper with readily thought out cleansed replies. I think that the method used has produced valid answers to the research questions on the table. Topic is quite complex and has many considerations and the limitation to the home care segment I would say made it actually harder to find answers than it would have been if the segment would have been something else.

Studying and considering all potential digital disruptors that might have effect on existing traditional industries, products, and services that have not yet fully embraced the digital era of this century with constant connectivity, wide and clear transparency, mining of data, global positioning, and handing out of the keys to information to the small consumer, is most certainly relevant to be researched upon. The example of traditional industries from transportation, accommodation and communication with completely revolutionized business models is bound to absorb all other industries as well. That is a matter of time only when and where the change begins. Where ever one can find a customer need that can be better satisfied with digitally enhanced products compared to traditional ones, presents a useful business opportunity as well as potential to even minimally improve on the lives of millions of people using those products.

Some listed strengths of qualitative research that I find especially relate to this work include: "Interviews are not restricted to specific questions and can be guided/redirected by

the researcher in real time.”, “The research framework and direction can be quickly revised as new information emerges.”, “The data based on human experience that is obtained is powerful and sometimes more compelling than quantitative data.”, “Subtleties and complexities about the research subjects and/or topic are discovered that are often missed by more positivistic enquiries.”, and “Data usually are collected from a few cases or individuals so findings cannot be generalized to a larger population. Findings can however be transferable to another setting.” (Anderson, C., 2011)

Likewise, some of the listed limitations of qualitative research have been clear during this study, such as: “The volume of data makes analysis and interpretation time consuming.”, “Issues of anonymity and confidentiality can present problems when presenting findings.”, and “Findings can be more difficult and time consuming to characterize in a visual way.” (Anderson, C., 2011)

Ethically, I think it is quite acceptable and normal – even preferred – that any company trying to market their products goes through the necessary means of extracting information on the most suitable sales strategies as well as further development ideas for the future. Open discussion on all levels is an excellent way to pursue these, which is the effort done during the creation of this paper.

4.6 Summary and suggestions

Finally, I can shortly summarize the learnings of this thesis after a little bit over a year of slowly progressing process that lead to the results presented here. As for the actual research results, based on the discussions with Mendor during the thesis process, I think we all have come to much similar conclusions on the issues with some minor adjustments and divergence of opinions. The work for finding out the most suitable target segments is an ongoing process and this work raises some good points regarding the elderly people in home care and around that segment. That specific segment might not be the most lucrative for the marketing of the products and services in question as such, but as the numbers and percentages of our population who can be counted in to it now or soon are growing rapidly, it is one of the main segments that should be taken into consideration. With some product development and pinpointed tactical marketing drawing some tips from the interviews done in this work, I am confident good advancements in market share can be won. All the changes in the operational environment are happening still and need to be considered as there are some good opportunities there to be capitalized on and not many threats concerning these types of products.

Personally, I have had a good journey in researching some of the latest technologies in the diabetes treatment field, where I have a strong personal stake due to my illness. I have opened my eyes to many possibilities and examined my own health metrics more closely and digitally. It is great to know that many new doors are opening towards improved treatment and cure of diabetes, through innovation and application of modern technologies. I am happy to see that also Finland as a society is putting adequate effort in embracing the possibilities available, although sometimes it seems that the change is still too slow, while the direction being correct. There is wide knowledge and wisdom in the industry that I am sure will take us forward, make every generation healthier and more aware of their personal health metrics and optimal treatment.

For further research, one might consider looking into other potential customer segments requiring glucose measurement in Finland with this same detail. Also, examining the world of integrations between different software and devices related to this field is definitely somewhat uncharted territory with still further innovation potential. What might turn out to be very interesting area of investigation, would be the most advanced diabetes technologies still in the beginning parts of the hype cycle, such as bionic pancreas and different methods of measuring glucose – such as contact lenses - and applying insulin – such as with a patch similar to applying nicotine. I will definitely keep my eye on those anyway.

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Appendix 1. Abbreviations

APC - The Act on Public Contracts, a new legislation to be passed in Finland during 2016

API – Application Programming Interface, a set of functions and procedures that allow the creation of applications which access the features or data of an operating system, application, or other service.

Basal - Referred to as the slow acting insulin used to cover your bodies own glucose stores

Beta cells - Pancreatic cells responsible for the production of insulin, amylin and C-peptide

Bolus - Referred to as the fast acting insulin used to cover food, typically carbohydrates, some cover for protein as well.

DICOM - Digital Imaging and Communications in Medicine - a standard for handling, storing, printing, and transmitting information in medical imaging. It includes a file format definition and a network communications protocol.

LOINC - Logical Observation Identifiers Names and Codes - a database and universal standard for identifying medical laboratory observations. ... has expanded to include not just medical laboratory code names but also nursing diagnosis, nursing interventions, outcomes classification, and patient care data sets. LOINC applies universal code names and identifiers to medical terminology related to electronic health records.

eHealth – Usage of information and communications technology in healthcare (much relation to the term mHealth)

FHIR - Fast Healthcare Interoperability Resources, a standard describing data formats and elements and an Application Programming Interface (API) for exchanging Electronic health records.

Glucose / Glycogen – Blood sugar / The storage form of glucose in animals and humans

HBA1C - HbA1c is the scientific shorthand for glycated haemoglobin. It develops when haemoglobin, a protein within red blood cells that carries oxygen throughout your body, joins with glucose in the blood, becoming 'glycated'. By measuring glycated haemoglobin, clinicians are able to get an overall picture of what the average blood sugar levels have been over a period of weeks/months.

HL7 – Health Level 7 International, a not-for-profit, ANSI-accredited standards developing organization dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information that supports clinical practice and the management, delivery and evaluation of health services. Developer of the FHIR standard.

Hypo – Hypoglycaemia (this means blood sugar level is too low)

ICT - Information and Communications Technologies

Insulin - A hormone which causes most of the body's cells to take up glucose from the blood

IoT – Internet of Things - the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data

KODA - KOtona Digitaalisesti ja Asiakasläheisesti -uusi kotihoidon palvelukokonaisuus, a project by Eksote, Pohjois-Pohjanmaa, Tampere and Kainuu social and healthcare districts for developing a new service concept for assisted living

Käypä hoito – Recommended treatment guidances for different diseases, created by the Finnish Medical Association Duodecim and other specialist doctor associations combined workgroups

mHealth - -Mobile health, a term used for the practice of medicine and public health supported by mobile devices (much relation to the term eHealth)

MoF - Ministry of Finance (Finland)

MoSAaH - Ministry of Social Affairs and Health (Finland)

ODA - Omahoito- ja Digitaaliset Arvopalvelut, a project of the Finnish municipalities union

SOTE – SOsiaali- ja Terveysterveystieteiden tutkimuskeskus = Healthcare and social welfare services

SOTE reform – SOsiaali- ja Terveysterveystieteiden tutkimuskeskus = Healthcare, social welfare and regional government reform package in Finland

STM – Sosiaali- ja Terveysterveystieteiden tutkimuskeskus, the Ministry of Social Affairs and Health.

THL – Terveysterveystieteiden tutkimuskeskus ja Hyvinvoinnin Laitos, The National Institute of Health and Wellbeing – a bureau on the administrative sector of the Ministry of Social Affairs and Health

Type 1 (autoimmune) - The most common form of type 1 diabetes

Type 1 (idiopathic) - All forms of type 1 which occur without a known cause

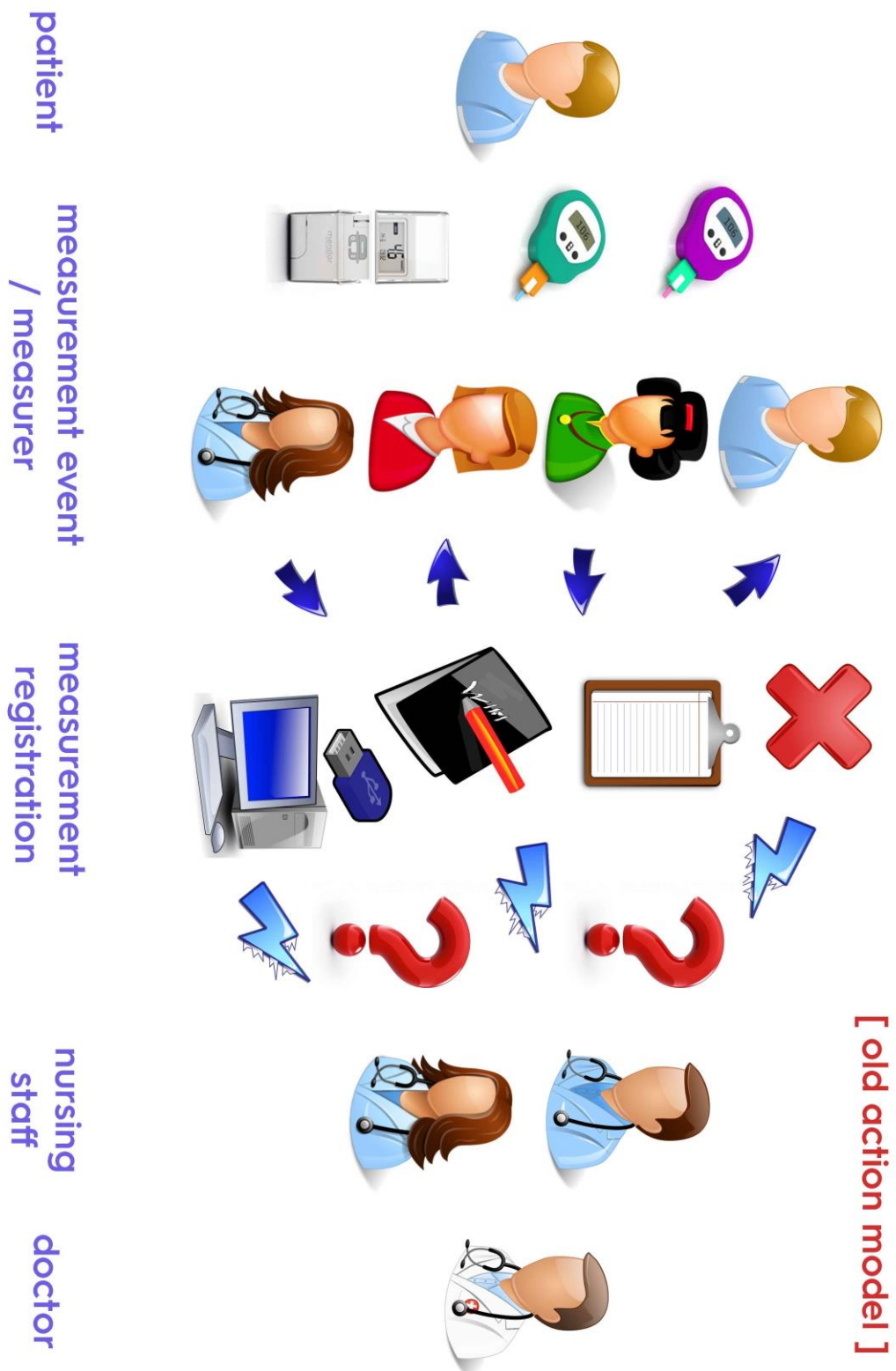
Type 1 (surgical) - Diabetes caused by partial or complete removal of the pancreas

Type 1.5 - Latent Autoimmune Diabetes in Adults (LADA), also known as slow onset type 1

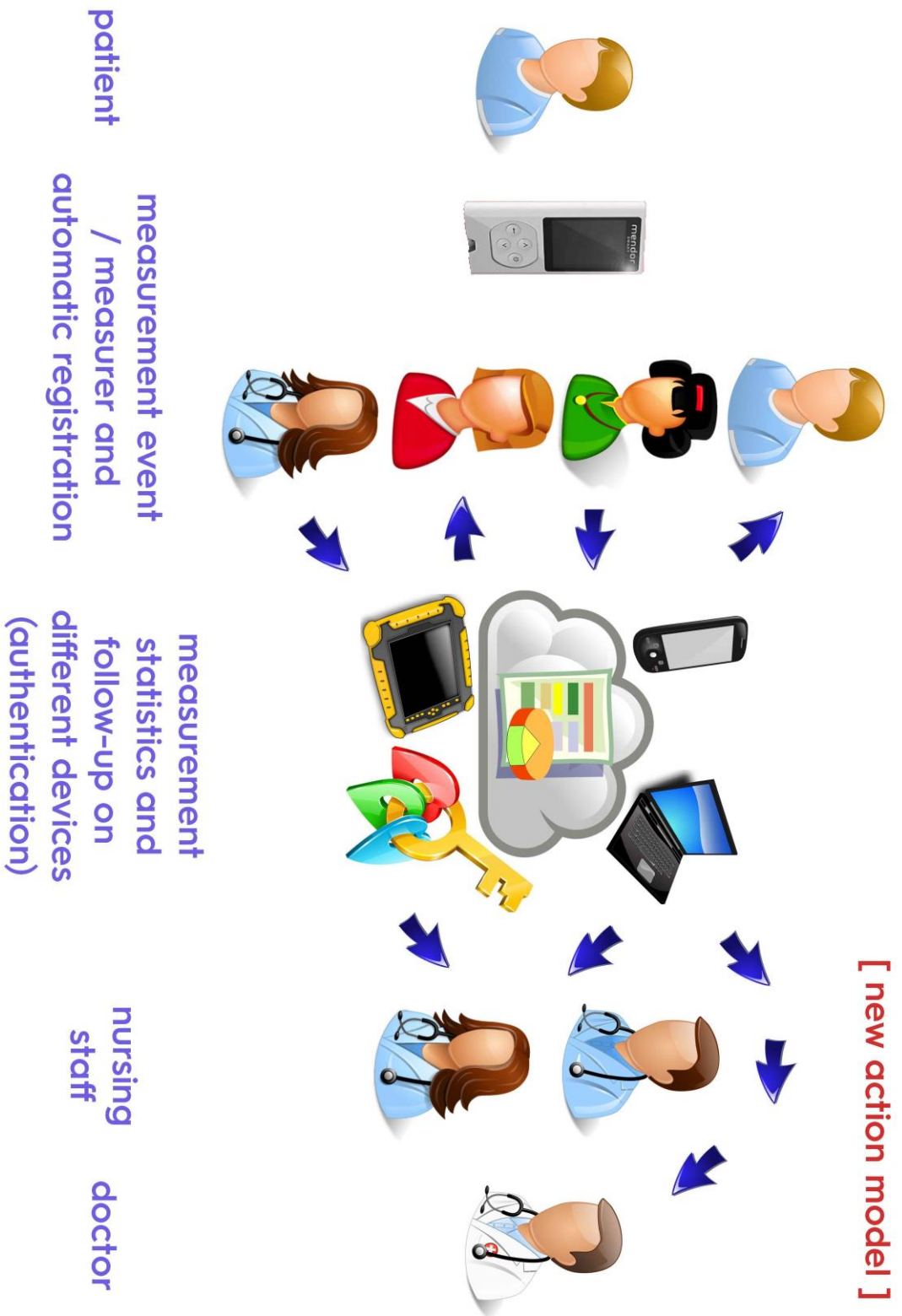
Type 2 - Diabetes mellitus type 2 is most often attributed to insulin resistance and relative

Valvira – National Supervisory Authority for Welfare and Health (in Finland)

Appendix 2. Glucose measurement old action model



Appendix 3. Glucose measurement new action model



Appendix 4. Theme interview structure

Theme 1: Basic information of the interviewee

What is your profession?

What kind of experience do you have in the field of diabetes care?

What is your employer and its role in diabetes care?

Theme 2: Challenges and possibilities to improve on diabetes home healthcare

Present the old and new action models to interviewee. Ask for comments and ideas.

Is there anything that should be added to or changed in the pictures?

What are the current obstacles in diabetic home healthcare?

How large portion of the home care patients would you estimate being able to do glucose measurements themselves?

Do you see any changes in glucose measurement and diabetes care products selection in the public/private sector being offered to customers?

Theme 3: Changes in legislation and their effects

How does the recent SOTE reform decision regarding citizens expanded right to select the producer of their healthcare services affect the diabetes healthcare?

How do you see the public/private sector reacting to it?

What effects do you see emerging from the upcoming new legislation Act on Public Contracts to the diabetes procurement practices?

Are there any other legislative changes in sight that would also have consequence?

Theme 4: Business aspect and decision making

How would a newly thought product need to be presented to public sector buyers? What are the most important things to consider when product abilities are the main competitive aspect instead of the pricing?

What sort of approach would you suggest for a new product/service to maximize possibility to be taken into consideration in an offering?

Can you provide any fiscal numbers on the current assisted living healthcare in different Finnish cities or municipalities or in general, what sort of costs are there and do you have specific statistics or numbers that you could give?

Theme 5: General discussion and additions

Do you have any other information, comments or ideas you would like to share regarding the topic?

If there is any new area or angle that has been opened in the discussion, attempt to draw more information of that.

Do you have any contacts that you could suggest, share or recommend to that might be interested in sharing their views in a similar discussion/interview?