Project Report Friska Group 1

DEL DH2465/KID DH2655

Adam Orre
Aleksandar Balicevac
Arvid Larsson
Axel Pers
Erhan Kayhan
Esra Kahraman
Leo Rönnbäck
Sam Hamra
Trolle von Sydow
Viktor Charpentier

EXECUTIVE SUMMARY

Age-dependent, lifestyle-related chronic diseases are increasingly affecting the daily life of ordinary people. Despite improving healthcare abilities, the progress trend is insufficient and a significant share of the population in developed countries experiences lifestyle-related health issues. Driven by the latest technology, new channels arise for health advisors to interact with patients and share their expertise and knowledge. This paper examines how traditional health expertise can be embedded into modern technology to improve the life quality of people with the relevant health concerns. Furthermore, the paper will investigate the opportunity to shape a profitable business by exploring the landscape of the Swedish public health sector.

1. Introduction

Metabolic syndrome, in Sweden referred to as multi-sickness, is characterized by a grouping of medical conditions such as abdominal obesity, high blood pressure, impaired glucose tolerance, elevated blood fats and more. The syndrome is thought to be caused by malfunctioning in the body's energy utilization and storage, but its complex mechanisms are still undergoing medical research. However, factors such as diet, genetics, age, sedentary behavior, low quality sleep and excessive alcohol consumption are thought to contribute.

Digitalization and IT in the healthcare industry has followed the same pattern as other industries, according to an article by McKinsey[1]. Adoption has been slow and gradually taking on new use-cases, with a majority of efforts being put into easing existing processes of the healthcare system. A McKinsey survey concluded that, even though healthcare could be a sensitive matter, 75 percent of respondents would indeed like to use digital health services, and that it is not only young people who drive this need. McKinsey concludes, in their 2014 article, that there has been limited efforts put into developing digital solutions that has the patient need as top priority, and one can already see in 2018 that solutions are being presented in a rapid pace. In 2017 digital health startups raised an all-time high of 11.5 billion dollars in 2017, increasing more than 40 percent from the year before[2].

Friska is a start-up focused on bridging the gap between metabolic diseases and digitalization. Their solution aims at significantly increasing its users' well being and empowering them with the tools needed for self-help. By enabling continuous measurements, first-class presentation and ease of use, Friska wants to bring knowledge and real time insight into the very specific metabolic processes happening in the body. By integrating intelligent technology as well as human coaching and guiding, Friska strives to offer a digital app suitable for tomorrow's healthcare system.

This project was carried out to investigate two main themes, one being how to commercially deploy such a value offering and the other being how to design the interface and identify desired functionality towards clients of the Friska platform.

[1] Biesdorf S, Niedermann F. Healthcare's digital future. McKinsey. 2014-07-14 [cited 2018-10-03]. Available from: https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/healthcares-digital-future
[2] Lovett L. Digital health startups raised record $11.5B in 2017, StartUp Health reports. Mobi Health News. 2018-01-03 [cited 2018-10-03]. Available from:
https://www.mobihealthnews.com/content/digital-health-startups-raised-record-115b-2017-startup-health-reports

2. Problem Statement and Delimitations

Friska's main problem statement can be formalized as below.

"How can we address the challenge of age-dependent, lifestyle-related chronic diseases with the help of technology and digital services?"

As touched upon in the Introduction, Friska had two main questions to be investigated by us.

a) *"How should Friska be positioned in the commercial ecosystem of the Swedish healthcare system?"*
b) *"How could a first iteration end-user interface look and what functions should be included?"*

For the first question, the aim for this project was to acquire knowledge about the market and industry in which Friska aims to operate in and identify their possible role in this ecosystem. More specifically it aimed at investigating how Friska can commercially fit into the system, identifying revenue set-up etc. The project had to delimit itself in regards to the number of investigated possible commercial setups. More concretely this resulted in leaving out the possibility to frame Friska's concept as directly B2C.

For the second question, problems to be solved by the digital platform were discovered iteratively during the design process, and involved input and discussions with Friska representatives, end users and within the development team. The problems to be solved can be seen as twofold. Firstly, the platform should provide a simple overview of measurements that relate to metabolic health. These measurements include blood pressure, blood sugar levels, ketone levels and weight. The importance of an easily understood overview became clear during interviews with end users. The end users highlighted the need for an aggregation of multiple measurement platforms to minimize the need for navigation between multiple platforms. Secondly, the platform should enable quick communication between end user and health advisor. This requirement is an effect of the business model of Friska - their idea of continuous guidance, encouragement and communication.

2.1 Delimitations

GDPR

The EU General Data Protection Regulation is a regulation on data protection and privacy, and affects all individuals within the EU and the European Economic Area. While it does not directly target entities outside of these areas, it does apply to all companies handling the data of an individual residing in these areas, regardless of the company location. The official website for GDPR lists the rights of an individual pertaining to her personal data, including but not limited to: Consent (the conditions for consent of personal data storage has to be given in an "intelligible and easily accessible form"), Breach Notification (the right to notification if the security of a database containing personal information is compromised), Right to access (the right to obtain all personal data related to you) and Data Portability (the right to transmit your personal data from one company to another).[3]

In order to develop a commercial platform that handles personal data, as our platform aims to, these laws have to be followed, and additional infrastructure has to be set in place in order to abide by these laws. Because this project is subject to time constraints and not yet commercially viable, we have elected to not develop the aforementioned infrastructure.

Journal, privacy and portability

In addition to the GDPR, which applies ubiquitously regardless of the company type or personal data type, there are specific laws and regulations in Sweden that target the usage of personal data within healthcare. The Swedish Data Protection Authority lists the responsibility of a company in the healthcare industry handling personal data. These responsibilities include, but are not limited to: Electronic health records (the ability for caregivers to give direct access to each other's patient records) and inner secrecy (patient data is obtained on a need-to-know basis)[4]. In order to abide by these laws, additional infrastructure would need to be developed and agreements would have to be made with City Councils.

Licenses for libraries used

In the development process of a digital platform, there are a lot of ready-made software written and available on code-sharing platforms such as GitHub and NPMjs. In order to leverage the existence of this resource and to cope with the project time requirements, we have elected to use code of this nature, regardless of whether we are authorized to use it in a commercial product. This is in accordance with the law, because the intent is not to release the platform in a commercially available format.

[3] The EU General Data Protection Regulation. GDPR Key Changes. 2017. Available from: https://eugdpr.org/the-regulation/ (accessed 2018-11-10)

[4] Datainspektionen. Patientdatalagen. 2008. Available from: https://www.datainspektionen.se/lagar--regler/patientdatalagen/ (accessed 2018-11-10)

3. Work process and organisation

Considering the scope of the work, project time limitations and the size of the work group, we divided our team in 2 smaller, equally sized sub-groups assigning one main workstream per group. Group members with a more technical background ('Tech Team') took responsibility for development of client application towards Friska's target user group, 'patients'. The other group ('Business Team') was business oriented, focusing primarily on research of the alternative go-to-market strategies suggested by Friska and the corresponding business models.

A project leader was assigned for each group. These two persons' main responsibility was to organize and lead the work forward within the groups, synchronize cross-group related work on a weekly basis and communicate with Friska on a weekly basis as well as with course leaders when necessary.

3.1 Business Team

Described in general terms, the work of the business team was divided in five 2-week iterations. At the end of every iteration, major decisions were made both within the group and with Friska. These decisions regarded the course of the project for the next period through (re)definition of the guiding objectives, and after some iterations redefinition of final deliverables as well. Every 2-week iteration started with a brainstorming session with all business team members present where research questions for week 1 of 2 of the iteration were generated. These questions were delegated to the team members for individual work. At the beginning of the second week of iteration, all business team members gathered to analyze and discuss the findings, and follow-up research questions for the second week were generated. The project manager had a weekly meeting with Friska the same day where the findings were discussed and Friska's input was added to the corresponding research questions for the upcoming week.

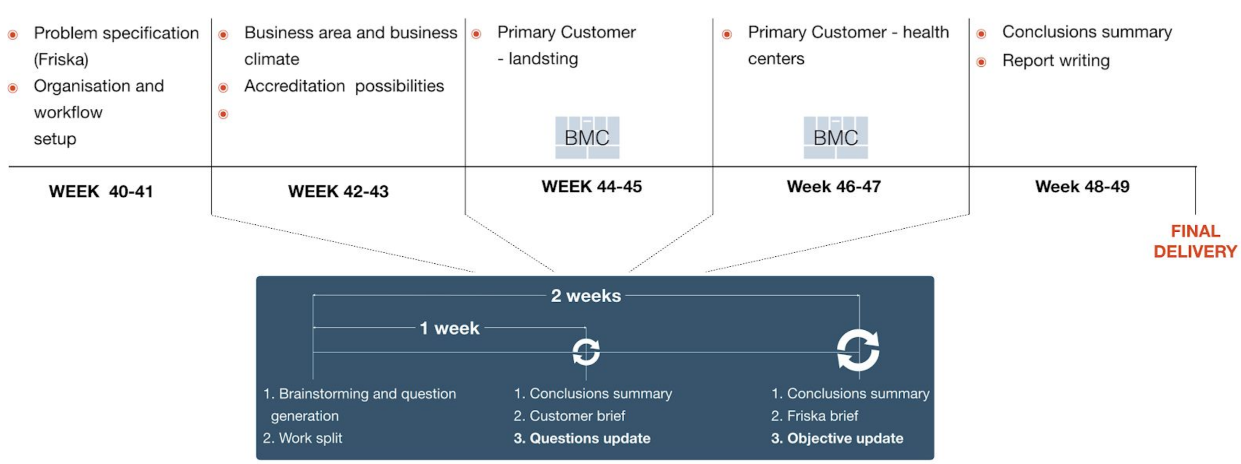

Figure 3.1, Business team workflow

During the first iteration, the whole workgroup (10 members, i.e. including the at the time future tech team) collectively tried to understand and map out Friska's needs and the desired approach to the problem they are trying to solve. The work was conducted through workshops with Friska and internal discussions within the group. After creation of initial specification that both parties agreed on, the above explained organisation (4.1 Organisation) within the group was created.

The second 2-week work iteration conducted by the business team was an introductory, less structured research led by a few questions defined by Friska. At the end of the iteration, business model canvas was accepted as a common framework to guide our further work in iterations 3 and 4. During the final (iteration 5) 2-weeks phase, both tech and business teams' work results were discussed, summarized and further recommendations to the Friska were generated collectively.

3.2 Tech Design Process

The platform development process was iterative in nature, involving both the tech team, the end users and the project owner (Friska). Because of this, the process could be adequately categorized as an agile software development process[5], although some of the agile principles[6] were not properly adopted. For instance, the principle of welcoming requirement changes late in development was not adopted due to time constraints.

To give an overview of the design process it is illustrated in Figure 3.1.1. Each blue arrow represents an activity crucial to the development of the application. The iterative principles were mainly used in two parts of the design process, the requirement specification and in the development of the Lo- and Hi-Fi prototypes, as is shown by the circling arrows in the illustration. Furthermore, the red arrows separating some of the activities illustrate a more formal gate where a certain requirement was needed before entering the next activity. The following sections aims at describing each of these activities more in-depth.

Figure 3.2, The design process

1. Target group interviews

[5] Agile Aliance. What is Agile Software Development? 2001. Available from: https://www.agilealliance.org/agile101/ (accessed 2018-11-15)
[6] Beck et al. Principles behind the Agile Manifesto. 2001. Available from: https://agilemanifesto.org/principles.html (accessed 2018-11-15)

Before the project was specified, interviews were conducted with people in three different categories: Friska's target group (i.e. people suffering from prediabetes, diabetes type 2, etc.), subject experts and competitors. The three categories were selected to gain a holistic perspective on the problem that Friska is trying to solve. By reason of having different types of stakeholders taking part in the interviews, the interview questions differed between the categories. Because the interviews were conducted early in the process it was possible to later better specify the needs and possibilities of what was going to be developed. By doing the interviews directly with people involved with the diseases that Friska is trying to treat, first hand information could be collected directly from the sources.

2. Project presentation

The development process had its inception during a presentation held by Friska, where Friska described their vision and business model. Furthermore, they described their need for a digital platform, in which context it would operate and how it would relate to other parts of their internal infrastructure. In a subsequent meeting with Björn Wiqvist, CTO at Friska, Björn specified Friska's initial ideas regarding the nature of the digital platform. This included a customer journey mapping, a more detailed description of the context in which the platform would operate and an initial idea of the platform design and functionality.

3. Focus Group

A focus group session was conducted together with people in Friska's target group. The goal of the session was to generate ideas for our future development of the application through insights from potential future users of the application. According to Kontio et al., the focus group method is a quick and cost-effective method to obtain insights and feedback from the end user.[7]

The focus group was structured in three parts: introduction, association cards and application-specific questions. The association cards were used to facilitate idea generation by showing a collection of words and asking the participants for general thoughts or ideas regarding these keywords. The shown words were generally related to healthcare, but not specifically to the digital platform. The application-specific questions were used to evaluate specific design choices regarding the application, specifically asking questions about how a digital platform might be constituted.

4. Requirement Specification

The requirements specification was developed together with Friska representatives to ensure that all project stakeholders, both project owners and designers, had the same expectations of what would be delivered. Even though the requirement specification used in this project was not near as extensive as the international standard for requirements specifications[8] it still aimed at the same objectives as the standard, namely to help both customers and suppliers understand each others expectations.[9] The specification in this project focused on the screens and the functions of the app.

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[7] Kontio, J., Lehtola, L., & Bragge, J. Using the focus group method in software engineering: obtaining practitioner and user experiences. Proceedings. 2004. International Symposium on Empirical Software Engineering, 2004. ISESE '04. doi:10.1109/isese.2004.1334914

[8] IEEE standards association. ISO/IEC/IEEE International Standard Available through: https://standards.ieee.org/standard/29148-2011.html (accessed 2018-11-15)

[9] University of Ottawa Requirements Specification with the IEEE 830 and IEEE 29148 Standards

The process of developing the requirement specification followed the same iterative nature as the rest of the design process. A suggested specification was sent to Friska, who subsequently gave feedback, with which we updated the specification. This was done three times until everyone was satisfied with the specification. The final specification stated that there would be four main screens and one screen, More, that would link to further, less important screens. The functionality was focused mainly on reading and writing the patient's health readings and how the feed should function.

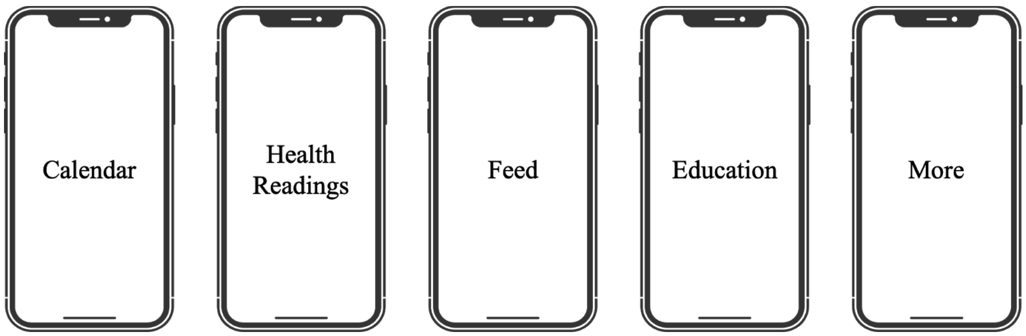

Figure 3.3, The five main screens

Functionality	
Write from app to database	● Manually enter and write health readings ● Write diary entries and write them to the database
Read from database and display in app	● Read health readings and illustrate in graph ● Attach health readings and graphs to certain events in the feed ● Read diary entries and show in feed ● Read chat conversations and show in feed

Table 3.1, The functionality of the application

5. Lo-fi sketch

An obstacle when development started was that ours and Friska's ideas regarding both the application's functionality and its graphical user interface diverged. To get an overview of what was possible for us to accomplish we had to start outlining our ideas. Sketches were drawn from our own ideas and perspectives to visualize what we had envisioned for the app amongst ourselves. This was also used as a brainstorming exercise to gain ideas from each other's sketches. These were then merged into a combined sketch that the high fidelity sketch could build further on.

Before committing to the merging of the sketches, the customer journey document, provided by the company, was analyzed to see how well it compared to the created possible outcome. Through the brainstorming, the creation of an own customer journey and the sketching, all the pain points in the given document had already been addressed. The next step included creating a high fidelity sketch, or prototype, visualising the results from the low fidelity sketch.

6. Hi-fi sketch

From the low fidelity paper sketches, the high fidelity sketches (or prototype) were created using Adobe XD CC, a free prototyping application, to create clickable wireframes. The hi-fi sketch was the basis for the model which was implemented later on. At this stage, the focus was on creating a prototype as similar to the end product as possible. Adobe XD made it possible to add interactions when pages and elements were to behave a certain way. For example, if they were to slide right or left. Developing a prototype similar to the end product also enabled getting feedback from end users, therefore facilitating identification of errors or uncertainties before final implementation. This was done in several iterations as new information was added along the way and problems were identified.

7. Application development

Going from a prototype or model to something real can be time consuming and potentially error-prone. Therefore, it is important to have a well-defined plan and structure to realize the prototype by developing a working application. This means discussing and agreeing upon a technology stack to be used during development, splitting the workload in precisely defined areas by atomizing each part of the application, like routing, layout, database management, graph views and more. We decided on writing a mobile application in React Native using the real-time database of Firebase for the management of health data.

To achieve the best possible development process, we put a lot of effort into setting up the developer environments and agreeing on how to format our code. An editor extension called Prettier, more precisely a code formatter, was used to facilitate this process. Furthermore, GitHub is essential when working in a team larger than one person. For our git processes, we chose to work with a locked master branch and work in feature branches so that we could easily see progress and keep the project structured and effortlessly assign smaller assignments for everyone.

Throughout the development of the final app we kept working on the hi-fi prototype as our final goal, and worked iteratively on which features could be included. The app never quite reached the level of refinement that the hi-fi prototype suggests, but the prototype works as a pointer for further development.

8. Task-based evaluation

When designing a task-based evaluation, the first step is understanding what the user needs to be able to do. This information was gained earlier in the design process, mainly from the contextual inquiry and focus group. Then, when the evaluation is conducted, the evaluator is simply asked to perform the task corresponding to the activity and the performance is observed.[10]

When conducting the evaluation, some of the conditions that are usually expected had to be relaxed. The limitations causing this were the number of people participating, that the evaluation was conducted over video call, and lastly that the evaluation was performed on the final hi-fi prototype, not the actual application. These limitations, and the implications following them, will be discussed further in the

[10] Nielsen Norman Group. Task Scenarios for Usability Testing. Available through: https://www.nngroup.com/articles/task-scenarios-usability-testing/ (accessed 2018-12-02)

discussion section. Due to these limitations, the focus of the evaluation was not centered on the user experience, but rather on the functions of the application.

4. Findings

4.1 Competitor mapping

There are a number of applications that aim at supplying a similar service to what Friska are intending to. Most notable of these are Virta Health and Livongo, both currently serving the U.S. market. Virta Health is an app designed to improve its patients metabolic health by providing continuous feedback and coaching through the patient's dedicated health coach. When signing up for the treatment the patient will receive the tools which will enable him/her to track the relevant health values. Virta are mainly targeting the B2C market.[11] Livongo provides a similar service but differs in the sense that they are focusing more on the B2C market, mainly targeting companies and their employees. Furthermore, Livongo also focuses more on the analysis of the data that they receive from their users.[12]

Further examples of other actors trying to digitize healthcare are Swedish start-up Linkura and Apple (more specifically the Apple Watch). These actors provide technical appliances that enable the end user to track certain health factors such as heart rate, physical activity, body weight and ECG measurements. In Apple's case, the measurements are focused on pulse and physical activity, but the service does not provide any direct coaching through human interaction, but rather coaches through data driven advice that are not individualized. Linkura's appliances measure the user through ECG and does provide direct, individualized coaching. Linkura focuses mainly on health issues related to stress and sedentary working environments[13][14] and results in reduced sick leave when implemented in a working environment.[15] Neither of these services are specifically marketed as a solution for age-dependent, lifestyle-related diseases such as type 2 diabetes, but could be utilized in a preventive capacity. Both services can be considered a part of the wearable electronics-market, a rapidly growing market where the biggest actors have seen major growth in the latest year.[16] Apple have the end user as their target group, offering guidance to lead a healthier life, as well as third party developers developing software to the Apple-provided hardware. Although Linkura targets the end user secondarily, Linkura's primary target group is the employers,

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[11] Virta Health. The virta treatment https://www.virtahealth.com/thevirtatreatment (accessed 2018-11-20)
[12] Livongo. Applied health signals https://www.livongo.com/applied-health-signals/ (accessed 2018-11-20)
[13] Åkerberg A, Koshmak G, Johansson A, Lindén M. Heart rate measurement as a tool to quantify sedentary behavior. Studies in health technology and informatics. 2015;211:105-110. Available from: http://ebooks.iospress.nl/publication/39243 (accessed 2018-11-20)
[14] Andersson D. Real-time ECG for objective stress level measurement. Linköping: Linköpings Universitet; 2017. Available from: https://s3-eu-west-1.amazonaws.com/linkura/filer/Real-time+ECG+for+objective+stress+level+measurement.pdf (accessed 2018-11-20)
[15] Linkura. Linkuraprogrammet. Linköping: Linkura AB. Available from: https://www.linkura.se/linkuraprogrammet (accessed 2018-11-25)
[16] Phelan D. Apple Watch Sales Soar to 8 Million In Last Quarter, Apple Owned 2017 Wearables Market. Forbes. 2018. Available from: https://www.forbes.com/sites/davidphelan/2018/03/01/apple-watch-sales-soar-to-8-million-in-last-quarter-company-owned-2017-fitbit-huawei-garmin/#7376a5c37e91 (accessed 2018-11-30)

offering benefits such as reduced sick leave, improved performance, improved employee retention and reduced costs. Linkura harvests revenue from corporate health plans.

4.2 Business model definition

The iterative research process led us to develop a business model canvas from assessing three different options, each having the Swedish counties (landsting) as the ultimate buyer/payer. The key finding from the research is that Friska's best short-term option is to act as a supplier to an existing health care center, despite that option having some complications. In the long run, however, there could exist an opportunity to act directly towards the counties by lobbying towards a new type of accreditation/procurement.

4.2.1 'Accreditation' by counties

Accreditation typically refers to a company or an organization getting an approval (similar but not equal to certification) from an unbiased entity, e.g. related to possessing a certain competence.[17] In Sweden, Swedac is the legal entity responsible for this process. Through online research however and through an interview with a Swedac representative, it seems like accreditation in the standard sense is no way forward for Friska in the short-run due to an already populated market and limited opportunities. It should however be noted that since 2017 Swedacs' responsibility to certify medtech products has been entrusted to Läkemedelsverket[18]. The digital healthcare actor Kry has its app certified by Läkemedelsverket and medtech apps should generally also be CE-marked. In this sense the Friska teams' hints regarding accreditation led us to finding something of value in the end, even though accreditation as such is no established way of providing healthcare to counties. We have however decided to stick with the title 'accreditation by counties' for the sake of structure.

A thorough interview with Lars Kolmodin[19], working at SKL (the Swedish Association of Local Authorities and Regions) with an expertise in alternative ways of working, followed a similar tone; it highlighted the difficulty in getting a deal directly with the Swedish counties. He mentioned that there are examples of specialized healthcare providers getting a deal with the counties, but that it might be tricky in Friska's situation since they are proposing a solution that, in a way, already is a part of the Swedish 'primärvård' (e.g. curing diabetes type 2). For it to work, the counties would first need to realize that they have a need for such as a treatment and subsequently conduct a public procurement (sv. offentlig upphandling). This should be considered quite a tedious process and for that reason, Lars suggested two alternative options: (1) to create a healthcare center under the Act on System of Choice in the Public Sector (sv. LOV, Lagen om Valfrihetssystem) or (2) to act as a supplier to an existing health care center.

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[17] Swedac. Ackreditering eller certifiering? Available at: https://www.swedac.se/swedac_magasin/ackreditering-eller-certifiering/ (accessed 2018-12-05)
[18] Swedac. Swedac lämnar ansvarsområde till läkemedelsverket. 2017. Available at: https://www.swedac.se/swedac-lamnar-ansvarsomrade-till-lakemedelsverket/ (accessed 2018-12-05)
[19] Interview with Lars Kolmodin, SKL (conducted 2018-10-18)

Even though the opportunity for Friska to get accredited (procured directly) by Swedish counties seems to be a long and resource-heavy process, this alternative could indeed be possible. Following multiple conversations with Asghar Farahani, who works as 'hälsovalschef' in Södermanland and a central stakeholder in such a procurement, it seems like the county has the full mandate to procure products and services if they see so fit. Typically they do follow recommendations and directives from Socialstyrelsen and similar institutions too a large extent. However, the responsibility and mandate to provide healthcare to a counties inhabitants is solely theirs. Following a conversation with Mina Abassi, in charge of national guidelines for the treatment of diabetics, it is crucial to follow their recommendations, and a diet recommendation based on low carbohydrate-intake will currently not conform with today's guidelines. [20] This being said, Friska indeed has a possibility to frame their offering directly towards counties, but there's an array of questions to be answered before this can be done. And if such pathway was to be pursued, Friska would need to court every single county (20 of them). On-boarding of patients may require an initial meeting, why the healthcare center approach may indeed be favourable in the short-term.

4.2.2 Own healthcare center

The contemporary approach in providing healthcare is fully visit-centered and focused around Vårdcentraler (healthcare centers). Creating a healthcare center could be an alternative for Friska but it would depend on them fulfilling each requirement to fit under a certain 'vårdval'.[21] This would require Friska to provide the full range of services part of the primary treatment system, or to find a vårdval more similar to their solution. There are a few vårdval that might touch upon their solution, but currently no vårdval that seems to be fitting the 'Friska treatment'.

After a thorough review of the existing vårdvals in Stockholms Läns Landsting (SLL), the vårdval 'Primärvårdsrehabilitering' was identified as a possible candidate to operate within, with certain adjustments and adaptation from Friska. Today, this is the vårdval that Stockholm's diabetes centers, with diet counseling, are established in. In theory, Friska could offer the same 'rehabilitation service' that diabetes clinics offer through a digital encounter. Operating within this vårdval entails that Friska could treat patients and be entitled to compensation by SLL. However, there are strict requirements that Friska need to fulfill in order to be accepted as a care provide within the vårdval.

According to Asghar Farahani in Södermanland, the whole healthcare center approach is centered around the physical clinic. At a quick glance, digital healthcare in Sweden might look disrupted and progressive, but the underlying framework and mindset of the procurers (counties) is still conventional. If Friska was to procure within choice of service (sv: hälsoval) 'Primärvårdsrehabilitering' in SLL, they would need a physical center. And again the issue of addressing patients across different counties arises.

Earlier this year Doktor.se acquired Vingåkers VC in Södermanland, enabling them to offer completely free digital healthcare visits and getting the 650 SEK per 'out-of-county'-visit in accordance with the

[20] Interview with Mina Abassi, Social Styrelsen (conducted 2018-10-16)
[21] Interview with Lars Kolmodin, SKL (conducted 2018-10-18)

guidelines from SKL[22]. The Södermanland county has a current policy of not charging anything for primary care, thus pushing through the full 650 SEK to the digitally visiting patients home-county. Whilst in Kry's situation (see further below) the Jönköping county deducts the patients payment and pushes the remainder to the home-county. It should also be said, in connection to this, that doktor.se is currently targeting a niche offering in triaging healthcare needs in order to make current healthcare centers more productive. Acquiring a healthcare center could indeed be a pathway for Friska which would instantly provide the medical breadth required to supply the county and a platform for invoicing. But the mindset and payment model is still centered around visits (either physical or digital), something that doesn't instantly cohere with what Friska is aiming to offer.

Furthermore, should Friska decide to start their own healthcare center they need to ensure that their treatment is aligned with the rigid requirements of the vårdval they operate within. According to Pontus Bergqvist, administrator at the healthcare contracting unit, there are currently no exceptions to offering alternative treatments within a vårdval for any supplier. The introduction of new treatment methods is done when a vårdval is revised. A political decision is needed for a revision of a vårdval to take place. In a revision, 'hälso- och sjukvårdsförvaltningen' will take a stand to whether new measures or treatment methods should be introduced in the vårdval.[23]

4.2.3 Supplier to existing healthcare center

The last option investigated in detail was to act as a supplier to existing health care centers, similar to what commonly known actors such as KRY and Min Doktor are doing. The best option would probably be to partner up with a private actor instead of a public one.[24] An interview with a current KRY employee revealed that the company gets paid for non-county residents, conducting a digital meeting with KRY. The total payment is regulated to SEK 650 per meeting in KRY's situation, of which the patient pays SEK 250 and the home-county SEK 400 (the split differs depending on county). The healthcare center to which KRY acts as a supplier keeps an admin fee (royalty if you will) equivalent to a transaction cost and the remainder goes as revenues to KRY.[25]

A major difference between KRYs model and Friska's proposed one is that KRY provide traditional 30 min meetings whereas Friska aims to provide more continuous and ad-hoc meetings, e.g. by chat or calls. This complicates using the same model as is typically used by today's digital healthcare providers. Also, the same problem highlighted in (4.2.2) persists if Friska decides to become a supplier to an existing healthcare center that is entitled to compensation from the county. They need to offer a treatment that is aligned with, and permitted by, the underlying vårdval agreement that the healthcare center has. However, if Friska can show financial and/or significant quality benefits, such as increased customer acquisition numbers and reduced churn, they might be able to partner up with a private health care center that can be utilized as a platform for invoicing and joint marketing.

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[22] Sveriges Kommuner och Landsting. Patientavgifter vid digitala vårdmöten. 2018. Available at: https://skl.se/download/18.2819ed29162193bf8f26137e/1521195006266/05-2018-WEBB-Patientavgifter-vid-digitala-vardmoten.pdf (accessed 2018-10-22)

[23] Interview with Pontus Bergqvist, SLL (conducted 2018-10-22)

[24] Interview with Lars Kolmodin, SKL (conducted 2018-10-18)

[25] Interviews with Jakob Snihs, KRY (conducted 2018-11-11 & 2018-11-21)

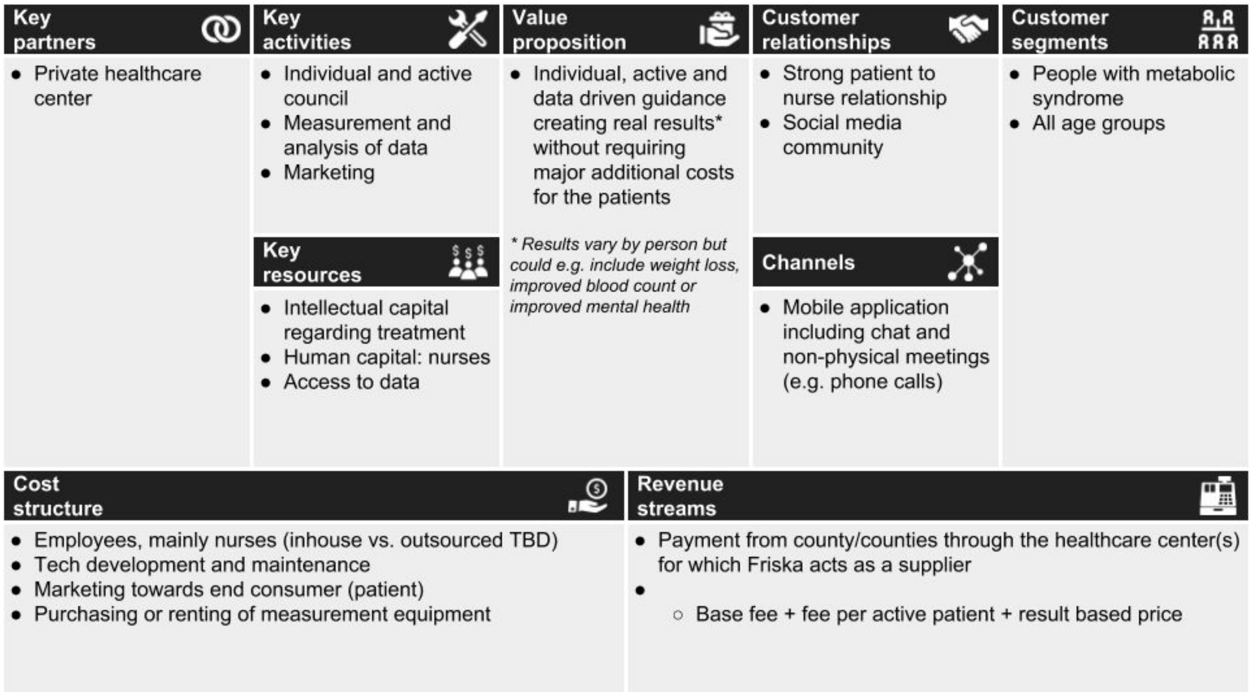

Figure 4.1, Business Model Canvas

4.3 Cost assessment

Diseases do not only affect our health and mental condition, they also drive great amount of financial costs for society and essentially the people. To understand the magnitude of this, we tried to quantify the total financial impact of the main medical conditions that are known by the name metabolic syndrome. Our belief is that such information can be leveraged in commercial discussions with the public sector to (1) highlight how much money is being spent currently, (2) what the trend looks like over time, and when possible (3) what is driving the costs among different cost types such as productivity-loss and medication. However, it is important to emphasize that the medical conditions are both causing and correlating with each other and due to the complex nature of the human body, understanding and isolating the primary cost driver was not part of the scope.

The figures we have prepared describe the total costs for society caused by the following three diseases: diabetes type-2, obesity and heart diseases.

Diabetes type-2

According to a study by The Swedish Institute for Health Economics (IHE), it was estimated that in 2013, there were 421,000 people suffering from diabetes type-2 and that the medical condition was causing in total of 16 SEKbn in direct and indirect financial costs to society. That means an average cost of 38,000

SEK per year per person suffering from diabetes type-2. Furthermore, the study estimated that the total costs would increase to 21 SEKbn in 2030 with number of patients reaching 560,000. In 2030, the average yearly cost per patient would reach 37,500 SEK[26].

A study conducted as part of the DAISY-project (The Diabetes Auto-Immunity Study in the Young) by AstraZeneca and scientists from leading Swedish institutions concludes that the total costs (excluding primary care and productivity loss) caused by diabetes type-2 has increased from 5.5 SEKbn in 2006 to 11.6 SEKbn in 2014. It was estimated that 206,000 people suffered from the medical condition in 2006, a figure that increased to 366,000 people in 2014. On a cost per patient-basis per year, this would mean that the cost has increased from 26,700 SEK to approximately 31,700 SEK during the 8 year period. However, if the study adds adds primary care and productivity loss to the equation, then for 2014 the total costs rise to 17.5 SEKb, meaning 47,000 SEK per patient per year[27].

Having two different sources indicating figures in the approximately same magnitude is a positive contribution to the accuracy of the findings.

Obesity

Another study by IHE concludes that in 2016 there were approximately 1.1 million obese people and that this figure would grow to 1.6 million by 2030. Furthermore, the total direct and indirect costs are expected to grow from 25 SEKb to 35 SEKb during the same time period. However, the average cost per patient and year is expected to remain at 22,000 SEK. An interesting add-on to the figures is an attempt to divide the costs between different cost types. In 2016, the total costs are believed to be distributed as 18% healthcare, 80% loss of productivity and 2% informal healthcare and this split is expected to be 19% healthcare, 78% loss of productivity and 2% informal healthcare[28].

Heart diseases

Regarding heart diseases, an extensive study by IHE concludes that the total cost for society was 61.5 SEKb in 2010 with an estimated cost split of 41% in healthcare, 29% loss of productivity and 30% informal healthcare. This study was based on calculations on the population in Östergötland which was thereafter scaled up to represent the Swedish population. In total, the study estimates that 440,000 people were suffering from heart diseases in different degrees[29].

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[26] Lundqvist A., Andersson E. and Steen Carlsson K. The costs of diabetes in 2020 and 2030 - A model analysis comparing innovative glucose lowering treatments in second line following European and American guidelines compared to current standard of care. IHE Report 2016:9, IEE: Lund.

[27] Kalkan, A., Bodegard, J., & Eriksson, J. Doubled healthcare costs of type 2 diabetes mellitus during years 2006-2014: a nationwide cost-of-illness study in Sweden. 2016. In *European Association for the Study of Diabetes (EASD) Annual Meeting. Munich* (pp. 12-16).

[28] Andersson E., Welin K-O, Steen Carlsson K. Kostnader för fetma i Sverige idag och år 2030. IHE Rapport 2018:3, IHE: Lund.

[29] Steen Carlsson K., Persson U. Kostnader för hjärt-kärlsjukdom. 2010. IHE Rapport 2012:1, IHE: Lund.

4.4 Design process findings

The key takeaways from the interviews with the target group were that (1) lifestyle adaptation is difficult and that (2) there exist sufficient information about the diseases they are suffering from, but there is a lack of continuity in the flow of information. The subject experts, one researcher at EXODIAD (Excellence in Diabetes Research in Sweden) and one dietist, believed that there will be a shift in the way many patients' diseases are treated, from today's universal treatments to a more personalized approach. The competitor, a company using both hardware and software to screen companies' employees for stress related diseases, had chosen to focus on the B2B market due to the fact that it is costly to penetrate the B2C market.

Based on the results from the interviews it was evident that there exists an opportunity in the market for treating people with diabetes type 2 and similar diseases using new technology and by using a more personalized approach.[30]

The key takeaways from the focus group was that the end users wanted a way to connect their health readings with their everyday activities, for example to see how their blood sugar graph is affected by what they ate for lunch, and to be able to view an aggregated timeline containing all measurements regarding metabolic syndrome.

The overall result from the task-based evaluation suggested that the functions that are provided in the application are what the persons taking part in the contextual inquiry and the focus group had asked for. The evaluator specifically enjoyed the fact that it is possible to see graphs responding to health readings in connection with certain events in the feed. But, due to the low number of participants in this evaluation, the results should not be taken for granted, they should rather be used as a base for further evaluation.

4.5 Final Hi-Fi prototype

This section describes the hi-fi prototype that was developed in Adobe XD. The reason for presenting this as a result of the project and not merely as a step in the design process on the way to the final application is because this prototype will be handed over to Friska as well. The idea is that the hi-fi prototype can be used in Friska's further development of the design.

The user will presumably log into the platform with help of BankID which is a way to confirm that someone is who they say they are.. As a first time user they will write about themselves (see Appendix A, picture 1); their name, email, address, doctor, clinic, illnesses, medication and goal. This to give the nurse a short review of who they are. After saving this information they will be directed to the Friska app where information is given about the app and its services.

The Friska app consists of five main tabs; Calendar, Measurements, Feed, Education & More. The main tab is the *Feed* (Appendix A, picture 2). This is where everything is documented and kept track of and

[30] Focus group interview, KTH (conducted 2018-10-04)

also where data entries are added (Appendix A, picture 3). From individual diary posts to writing measurements, chatting with nurses to notes, everything is either in this feed or created in this feed. The diary posts are for the user to add whenever they feel like it is significant to their condition. Chatting with nurses are for when you need to ask a question and the notes from this session are subsequently documented in the feed. In the feed you also have the ability to filter, to easier find what it is that you are looking for.

The *Calendar* (Appendix A, picture 4) is where you can keep track of the different appointments the patient might have. Whether it be phone appointments with your health representative (these are different from the aforementioned chat) or classes to keep track of. The *Measurements* tab (Appendix A, picture 5) however is connected to the feed. While one of the functions of the feed is to make it possible to insert different measurements (Appendix A, picture 6), the measurements tab is a more advanced option to analyze your blood sugar, blood pressure, weight and ketones. For instance, by choosing the blood pressure measurement, you will be able to select a timespan and be presented with an overview of how the measurement has changed (Appendix A, picture 7). This gives both a broader view and the opportunity to single out individual instances to explore why your blood pressure might have been especially high that day by connecting it to the posts in the feed.

The two remaining tabs are the *Education* (Appendix A, picture 8) tab and *More* (Appendix A, picture 9) tab. Friska wants to educate people about their conditions, hence the education tab. The latter however includes the option of continuing to the profile (Appendix A, picture 10), recipes (Appendix A, picture 11), forum, settings and logging out. The forum and settings screens were not implemented due to time constraints.

4.6 Final application

The goal was to implement the prototype as a working mobile application in react-native. According to the specification presented in section 3.2.4, some parts of the application are not functional, and thus only display the concept using stub data. The more central functionalities are implemented and made functional using the Firebase real-time database and internal application logic. This strategy is used to present the functionality in the proper user interface context, giving the impression of an application rich in functionality. The application serves as an entry point for further development of a fully-functional application based on the prototype explained in the previous section.

The final application was developed trying to resemble the hi-fi prototype as much as possible, and most tabs and screens looks and functions in the same way as described in the section above. This section will therefore mostly highlight the functionalities that have been implemented in the application that are not in the hi-fi prototype.

After being greeted with a mock login page simulating the BankID login sequence, the user gets access to the main tabs: Calendar, Measurements, Feed, Education, and More. The Measurement screen was made fully functional, and the application supports uploading health data to the database that is later used to draw data-over-time graphs. The purpose of the graphs is to visualize the patients health status, and it is possible to view the data over variable-sized intervals. The end goal is to be able to connect events like exercise and dinner to changes in health-data. There is also the Feed that collects the latest inserted data from the database and presents it in an intuitive manner, this includes chat messages, diary posts and health data. The Calendar and Education tabs are both mock screens that mostly serve as a pointer for future development. The More tab is functional as it redirects the user to another screen where more options are available such as to view the Profile, Recipes and Settings screens. Screen captures of all screens can be found in appendix B. These screens are only serving as mock images to get an idea of how the design could look.

5. Discussion and future work

5.1 Alternative commercial setups

The scope of this project was to investigate whether Friska could generate revenues from the public healthcare system, via the counties. In this section we will try to map an array of alternative setups.

Insurance
In its broadest sense, insurance companies could reduce claims being paid out by making people more healthy. Therefore, we've identified insurance companies as a possible final sponsor of the Friska project and possible sub-setups within an insurance centered approach are multiple. If Friska can prove efficacy, insurance companies could offer reduced premiums to their clients if they were to enter the Friska program, with Friska taking a cut of the premium reductions. The Friska program could also be mandatory for people with a certain insurance plan (high-risk individuals etc) and Friska could take a fee from insurance companies in providing the proactive risk-reducing care. Even though we believe this pathway can be complex and hard to initialize, it could be a serious option for the Friska team and therefore recommend them to keep this in mind and possibly study further.

Direct to consumer
Friska could try to frame their offering directly to consumers/patients. Virta Health is on track towards a B2C offering, and Livingo announced in 2017 that they launched a similar offering at a monthly subscription price of 49.99 USD. However, it is possible that such a setup would require extensive marketing capabilities and the payors purchasing power and willingness to engage might be lower than necessary to carry the business. It should be noted that a B2C offering in Sweden might be less viable compared to in the US, because of the Swedish welfare state approach. This is well illustrated in the startup Linkuras choice of not going B2C by the simple reasoning that people would not spend money on it because healthcare is supposed to be covered by the public through taxes etc.

Employers/Companies
Private companies in Sweden invest a great amount of money in their employees but despite that, we are seeing increasing cases of burnt-out employees, decreasing well-being and increase in perceived stress. There are several factors driving the current situation and we believe that Friska could create substantial value for clients and for themselves, financial value, by targeting one of the main factors: employee health.

Friska could use wellness grants (sv: *friskvårdsbidrag*) as a starting point to build a bridge into corporate clients. Today, a number of similar services are eligible for wellness grants, e.g. diet counselling and weight loss programs. To initially create these relationships, Friska could try bundling their services with corporate events and corporate discounts. This could possibly lead to a first client base that can go two ways, (1) Friska keeps corporate clients as their target group and uses that as a channel to help thousands of patients or (2) employees realize Friska's value-add and Friska recruits these patients into an external

B2C model. A hypothetical add-on to this business proposal is to convince employers to take personal health into account when evaluating performance of employees that are believed to be in a risk zone because it can lower the risk for a future sick leave. Pointing out people in the risk zone can be politically difficult, but instead they could initiate talks with people they have identified to be in the risk zone and tell them it would mostly be for their own health benefit. Such a scenario would create further incentives for these employees to engage in Friska's programmes.

An interesting case example to understand the potential for this business model is Linkura, a Swedish B2B provider of services and training to improve employee health. Linkura measures health- and stress levels in organizations to improve employees' health and essentially to increase productivity, decrease sick leave and reduce employee turnover. In the end, they create a win-win situation for employers, employees and themselves.

5.2 Tech problems/Discussion

In this section aspects of the design process will be discussed. First, motivation for why some findings from the focus group were incorporated in the application, while others were disregarded will be brought up. Secondly, the effects on the results of the evaluation phase caused by the time limitations will be discussed and explained.

The two main takeaways from the focus group was that the end users wanted to be able to follow their health readings actively when they are doing specific activities, for example eating, resting, being active etc. and to be able to view an aggregated timeline containing all four different measurement data streams. The first takeaway has been incorporated in the app, while the second takeaway has not. Both of them were desired functions from the end users, but it was judged that only the first one would actually be of benefit for the end user. The reason for this was that no suitable way of representing four different kinds of data in one single graph was available without making the graph too cluttered.

Regarding the task-based evaluation there are three factors, all resulting from the time limitations, that affected its success: the number of people participating, the lack of access to technologies enabling good remote evaluation practice, and lastly that the evaluation was not performed on the final application but on the final Hi-Fi prototype. When doing any type of evaluation, the number of participants is important as it harmonizes outliers and extremes in the result. The fact that only one person participated in the task-based evaluation, makes it difficult to draw any real conclusions from the evaluation. When the evaluation was conducted it had to be done over video call. This should not be considered a problem on its own as remote evaluations effectively can be used when time is sparse or the persons participating are in different geographical locations. In this case, the problem occurred because no suitable program with which conducting the evaluation remotely was available. It was for example not possible to see the screen of the evaluator so the person conducting the evaluation had to rely solely on the descriptive comments the evaluator gave. This made it difficult to follow the how the tasks were carried out. Lastly, that the evaluation was conducted on the Hi-Fi prototype made it difficult to gain any insights regarding the feel of the application and its user experience.

In addition to the user-centered approach a heuristic evaluation with subject experts should have been conducted. But again, due to time limitations it was not possible. Involving only end users in the evaluation does not always provide sufficient information as they do not know what good usability is.

5.3 Future work

For the application to be considered deployment-ready, some adjustments need to be done, because some parts of the application only use static data and don't actually function in the way the users expect, like actually reading user-input dynamically. Figure 5.3.1 illustrates the priority of implementation, where the activities in the bottom right should be implemented first, top right second and top left last. Firstly an authentication mechanism needs to be in place, either using traditional username/password authentication or something more sophisticated like BankID. Secondly, the communication platform should be set up to allow the patient to communicate with the Friska representative. This should be the chat format that is shown in the prototype but also a video call function, as was suggested in section 4.2.

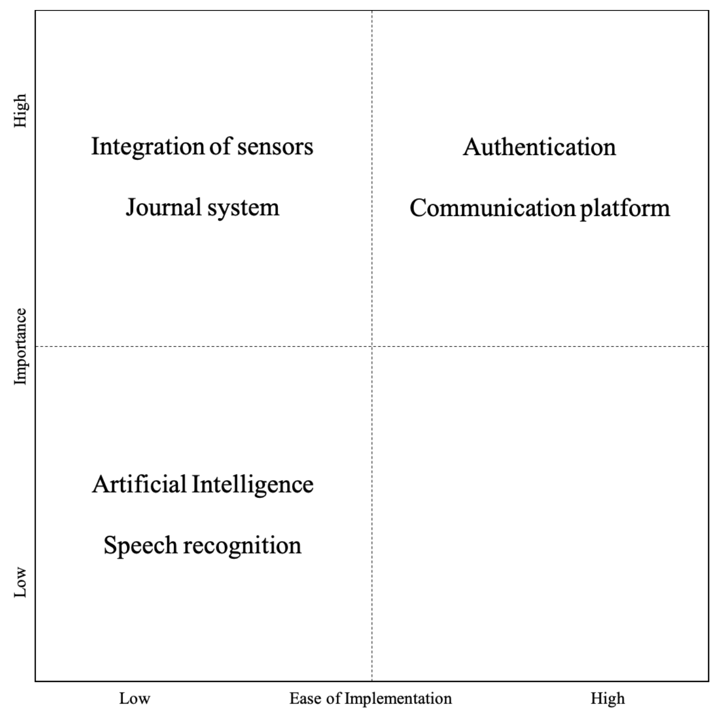

Figure 5.1, Matrix showing importance vs. ease of implementation of future activities

Another big part of the application that is currently missing is the integration of a Journal system into the application, this can of course be very time consuming and is outside of the scope of this course. One subject that needs to be reassessed is the topic of security, especially when dealing with delicate data like personal health information. This could influence the approach taken for persistent storage. As of right now Firebase real-time database is being used for persistent storage of health data, but it should be of no trouble to replace the database with any other, and still be able to reuse much of the structure already present.

For this whole concept of an app to flow smoother it is recommended for future researchers in this area to look into how one could integrate measuring devices into the app, so the users can automatically enter data into the application by using the measuring device. This can be done in many ways, either by integrating the measuring device into the application, or providing the measuring device with an API to send health data. This second approach is of course less realistic, to have a measuring device with internet capabilities, programmed to send data to a specific endpoint. The simpler approach would be a measuring device that can output results either by wire or wirelessly to any endpoint, which could then be configured to work for the Friska application.

Looking at technology such as speech recognition enabling the patients to enter their diary notes simply by speaking into a microphone should not be the focus in the near future. Even though that also would make the user experience much smoother, there are more important functions to focus on first. This also applies to implementing any machine learning algorithms that has been suggested during the project to for example detect anomalies in the health data. This could very well be an important function in the future, but Friska must first focus on attracting customers from whom they then can collect the necessary data.

Overall, the source code of the applications that has been built could have great value for Friska. It is considered consensus that react-native is one of the most scalable and easy frameworks to use and build applications in. Because of the code structure built around the application, further development will be made simple and intuitive. If Friska decides on not continuing the development of the code, parts of the code could nevertheless be used, as navigation for example probably will remain the same. If the code is completely discarded it can still be used as pointer for the new development iteration.

6. Conclusion

For the commercial part, this project has identified that there are substantial challenges in realizing what Friska wants to offer in the short to medium term. The current government-sponsored healthcare system is robust and very open not as fundamentally disrupted and open for innovation as it might look like at a first glance. Providing alternative, almost experimental, value offerings to patients is something that the current revenue model and organizational structure will struggle to accept. The visit-centered approach and double digit number of counties will act as roadblocks for the current Friska-envisioned path.

The system is indeed conscious about the need for change, opening up for private initiatives and innovative setups, but it will take time. Potential investors and other key resources, e.g. employees, might not appreciate this. In the long term we agree that Friska can provide a new and innovative way of offering long term tools and treatment of metabolic syndrome patients. However, we do stress that it is important that Friska's value offering gets improved by end-user feedback to reach proof-of-concept. This will allow Friska to refine its functionality which will increase the likelihood of being accepted in a future semi-reformed healthcare system. For the long term we recommend that Friska tries to find key persons and driving spirits within the counties (and SKL), and try to appeal to them that Friska will be one of the key players once, and if, the system catches up with private initiatives and does change.

We therefore recommend that Friska accepts the current well-established revenue model and tweaks its offering into a hybrid sort of 'telemedicine'. The somewhat self-administered data collection functionality and user-centered approach should still be there, but we suggest to include digital doctor appointment as a supplement to enable short term revenues. The 'telemedicine' offering can be easily provided by cooperating with an existing healthcare center and enables Friska to harvest the 650 SEK/visit[31] (300 SEK for nurses) as recommended by SKL and instantly reach all Swedish nationals as compared to reaching out to all 20 counties separately. We suggest that the Friska team looks into cooperating with a healthcare center located in Södermanland as the Friska patient would not need to pay anything additional for the, say monthly, meeting with a registered metabolic doctor. This setup could enable Friska to charge the patient a one time startup cost aimed at covering the hardware expenses. The digital appointments could also act as a great platform for harvesting invaluable feedback on the core Friska app functionality.

Challenges with such a setup could include reaching potential patients. However, we do believe Friska should be able to attract clients through for example interest groups (such as Diabetikerförbundet) and also direct marketing. It is possible that it could be beneficial for Friska to team up with one of the large 'telemedicine' players such as Kry in order to attract capital necessary to develop software and hardware. In such a setup we believe Friska can shoulder the role of providing long term treatment of metabolic syndrome patients, in parallel symbiotic relationship with Krys other broad offering of primary health care.

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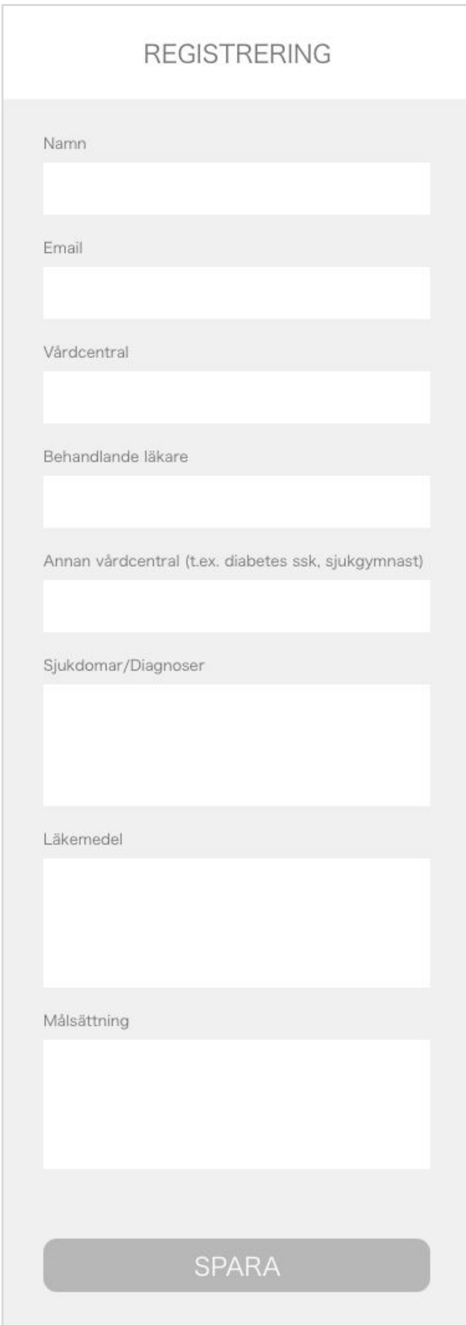
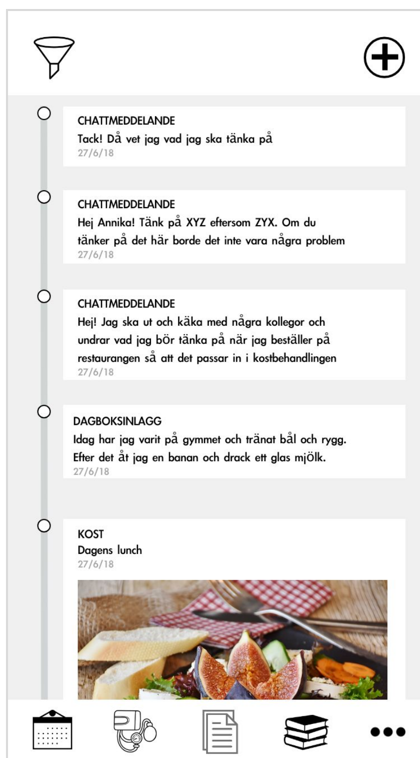
[31] (Note that this is the revenue for doctors appointment. A digital meeting with a nurse yields a revenue of 300 SEK.) Sveriges Kommuner och Landsting. Patientavgifter vid digitala vårdmöten. 2018. Available at: https://skl.se/download/18.2819ed29162193bf8f26137e/1521195006266/05-2018-WEBB-Patientavgifter-vid-digitala-vardmoten.pdf (accessed 2018-12-02)

Appendix A - Hi-Fi prototype screen captures

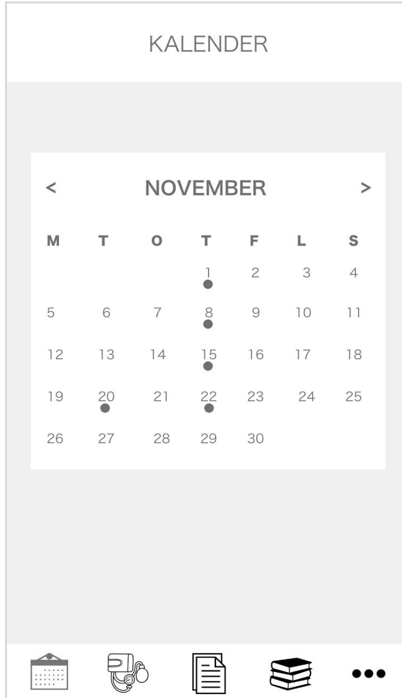


Picture 1: Registration

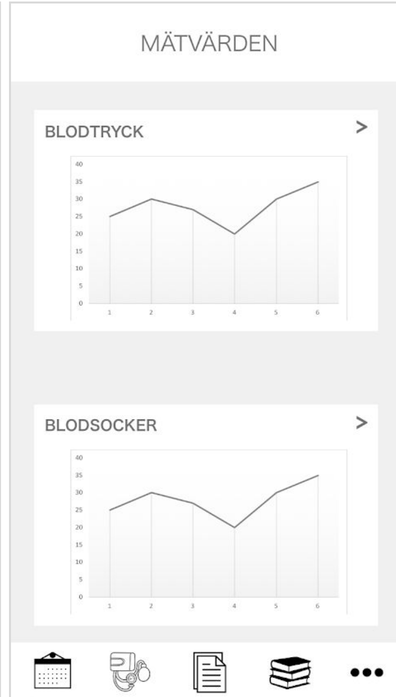


Picture 2: Feed

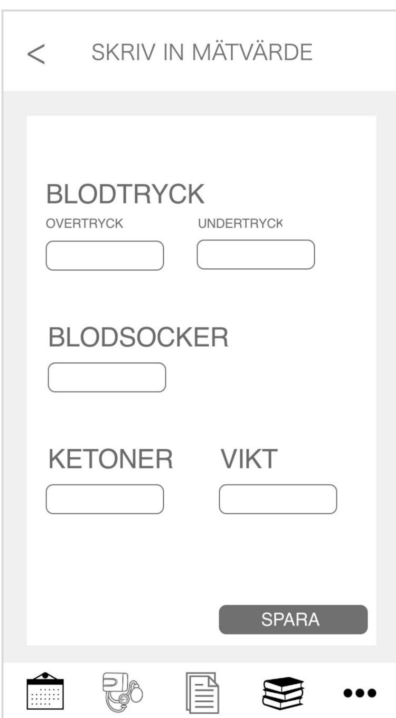
Picture 3: Add to feed



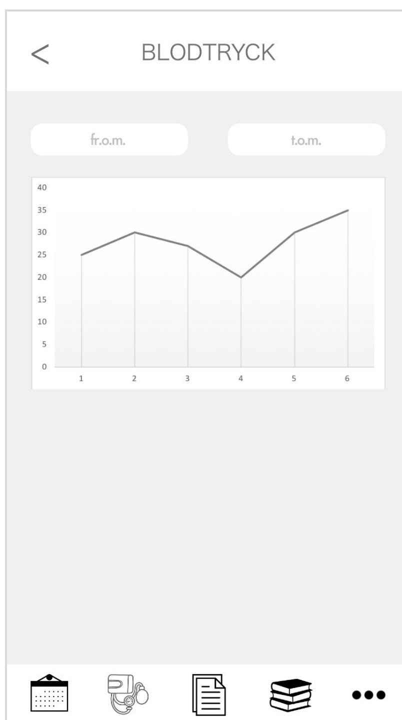
Picture 4: Calendar



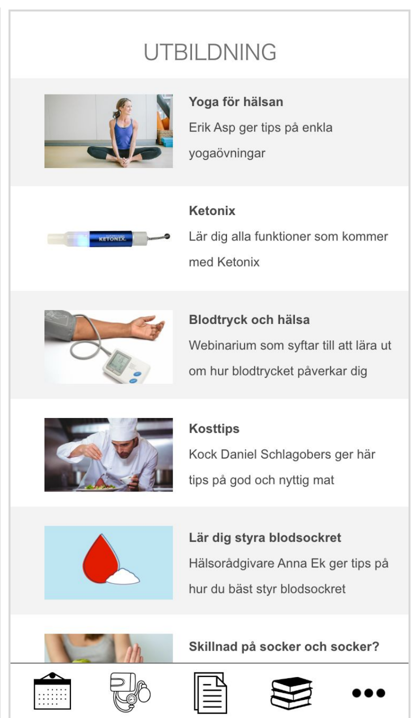
Picture 5: Measurement



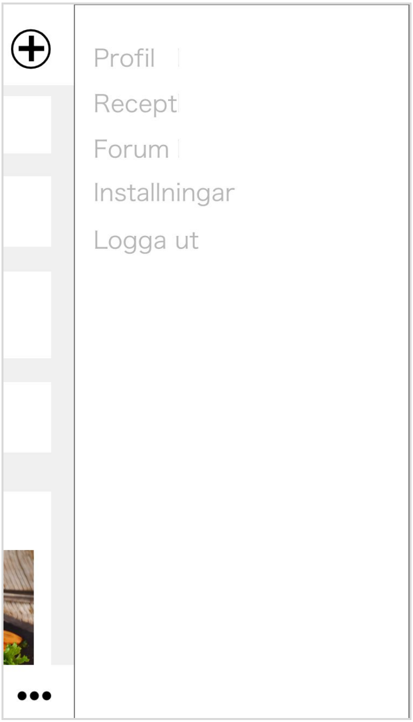
Picture 6: Add measurement



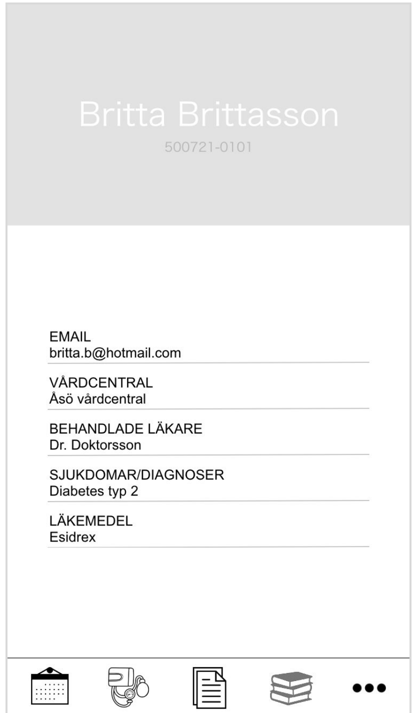
Picture 7: Blood pressure statistics



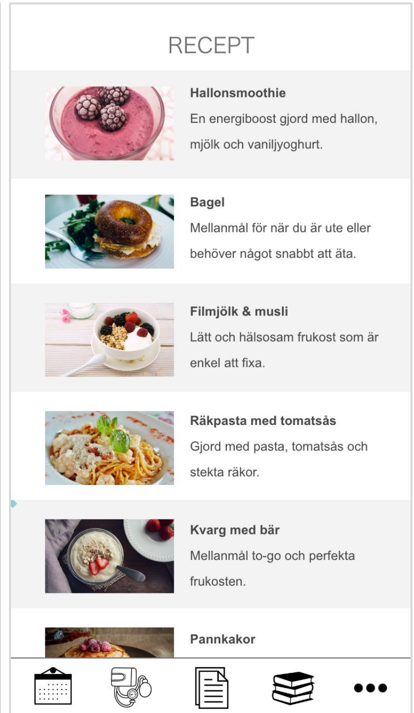
Picture 8: Education



Picture 9: More aka Sidebar

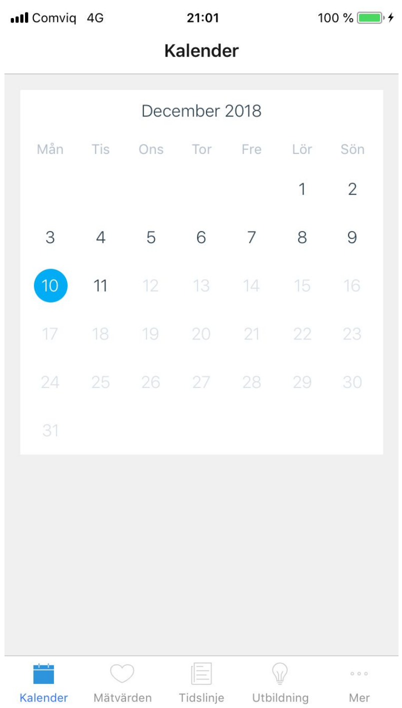


Picture 10: Profile

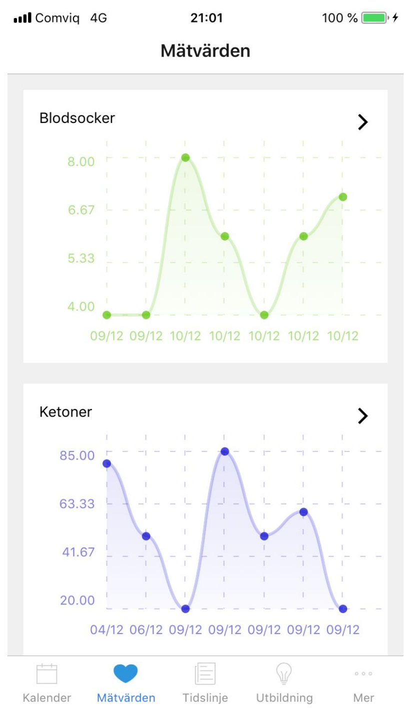


Picture 11: Recipes

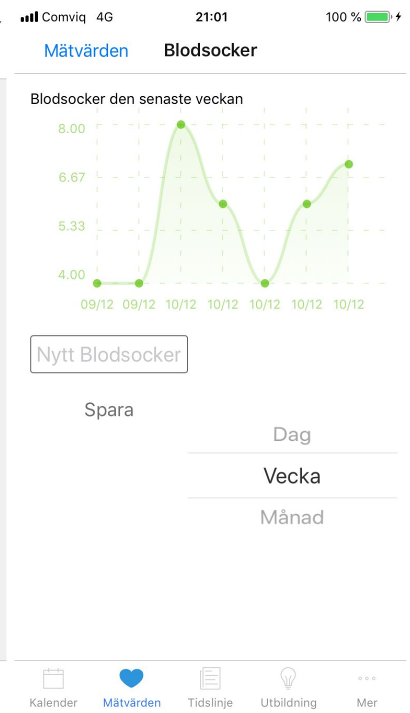
Appendix B - Final application screen captures



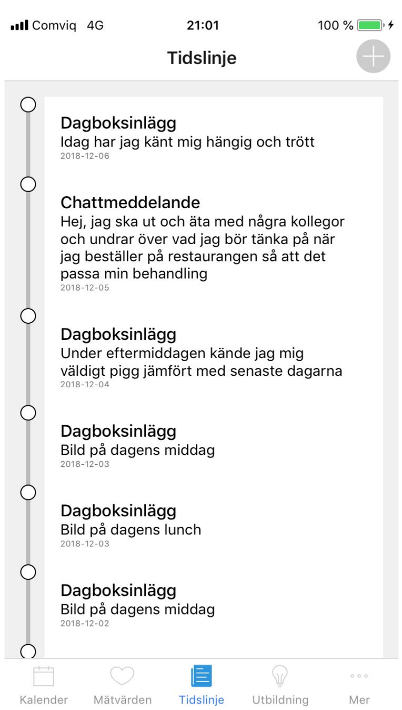
Picture 1. Calendar



Picture 2. Measurements

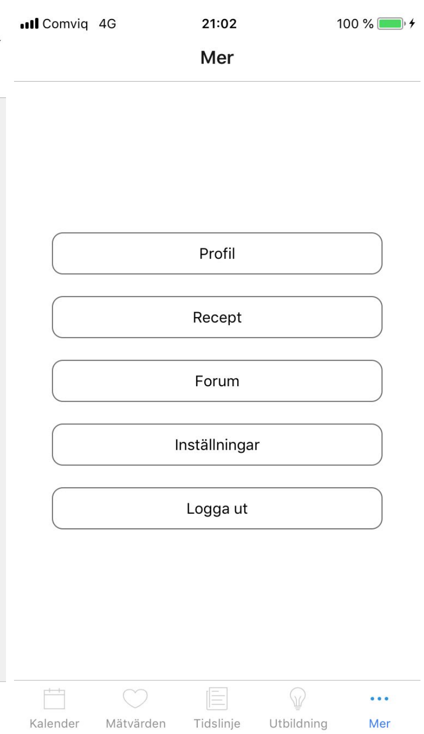


Picture 3. Blood sugar measurement



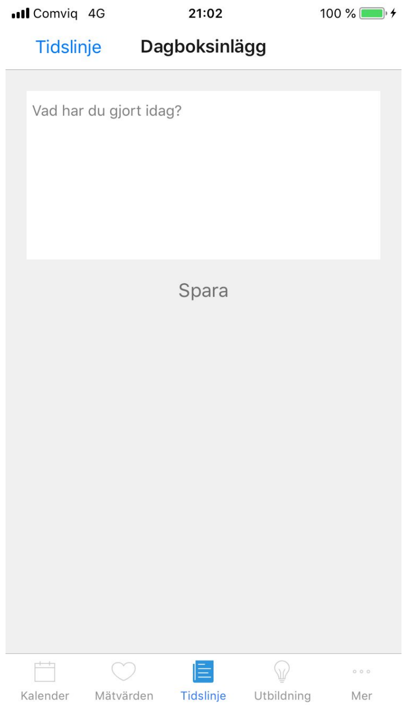
Picture 4. Activity feed

Picture 4. Activity feed(expanded)

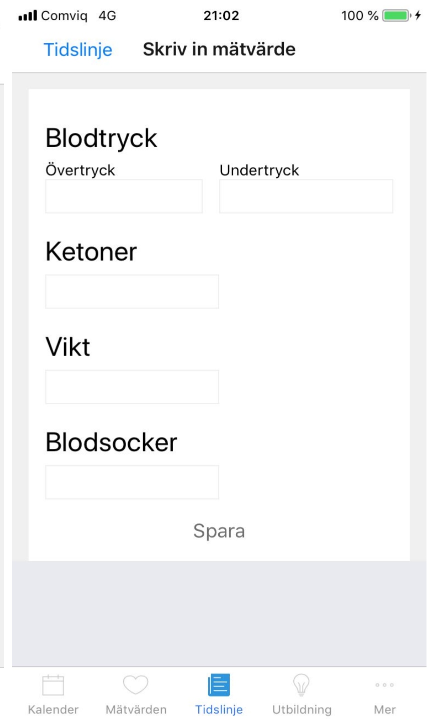


Picture 5. More

Picture 6. Instant messaging

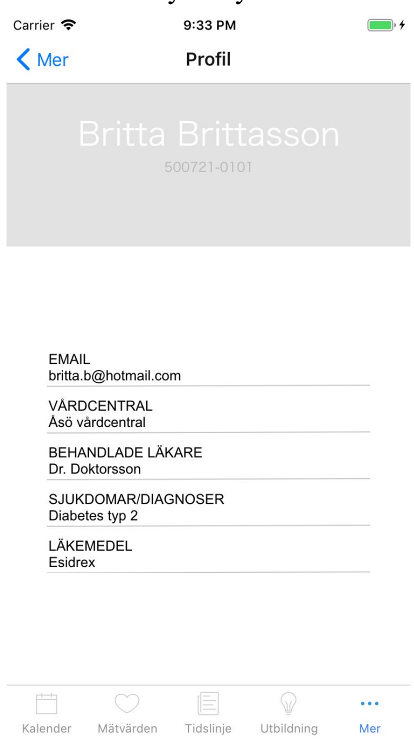


Picture 7. Diary entry



Picture 8. Measurement entry

Picture 9. Education



Picture 10. Profile