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SCHOOL OF BUSINESS AND SOCIAL SCIENCES

TECHNOLOGY SPECIALISATION 1

Rehabilitation Strategies for Patients with Cardiovascular Disease

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Page count: 75

Word count: 19653

June 7, 2018

Abstract

Introduction

Cardiac rehabilitation is a common term for post treatment of patients suffer from chronic cardiac disease. It is currently recommended as a part of the overall treatment for cardiac patients. Advantages of cardiac rehabilitation are well known and it has been proven that cardiac rehabilitation has positive effects on morbidity and mortality in cardiac patients. Unfortunately, long-term sustainability of exercise effects and the key to continue a healthy lifestyle are unsolved issues and tele rehabilitation could have the potential to overcome this. Experience has shown that telemedicine can be used to enhance efficiency of the public healthcare service and hereby economic and financial aspects could benefit from telemedicine solutions.

Method

The purpose of this project was to look further into the Danish Healthcare System and how the system could be affected by a telemedicine solution within cardiac rehabilitation. More specific Herning Municipality has been used as the main area of interest. To gain knowledge a literature research has been performed. Literature upon this field is mainly based on telemedicine solutions within other disease areas or studies where cardiac telemedicine rehabilitation has been evaluated as a trial in other countries. To achieve information on cardiac rehabilitation in Denmark, some interviews have been conducted whereas healthcare professionals from Herning Municipality have participated. Furthermore, it was important to have a patient perspective on the solution and therefore a group discussion with cardiac patients has been held. To analyze cost and quality a cost-effectiveness analysis has been carried out.

Findings

The core findings in this project are with regard to the interviews that have been performed and the economy analysis that has been made. By the interviews it can be concluded that both healthcare professionals and cardiac patients are happy and satisfied with the way cardiac rehabilitation is being performed today. To replace center-based rehabilitation will not be seen as the best solution but to expand with telemedicine could possibly have a positive outcome. Due to the economy part of the project it has been evaluated that 488.383,33DKK will be saved per gained Quality Adjusted Life Year when exchanging center-based rehabilitation with telemedicine rehabilitation.

Conclusion

The outcome of this project has proven that telemedicine rehabilitation could be an effective and favorable expansion of the rehabilitation program that is being used today in Herning Municipality. With regard to a patient perspective it has been showed that telemedicine rehabilitation could result in a continuous maintenance of healthy lifestyle. Looking at the Danish Healthcare System it can be concluded that both the effectiveness of healthcare services and the financial part could benefit from the solution. When implementing a new healthcare technology, it is important to keep in mind that the legislation plays an important role and that the solution has to be evidence based to be an integrated part of the rehabilitation program.

Acronyms and Abbreviations

Abbreviations	Definition
CAD	Coronary Artery Disease
CAPEX	Capital Expenditure
CEA	Cost-Effective Analysis
CR	Cardiac Rehabilitation
FUT	Fælles Udbud om Telemedicin
GP	General Practitioner
HRQoL	Health Related Quality of Life
ICER	Incremental Cost-Effective Ratio
ICT	Information and Communication Technology
NDA	Non-disclosure agreement
OPEX	Operating Expenses
QALY	Quality Adjusted Life Year

Table 1: Abbreviations & Definitions

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1 | Introduction

1.1 Background

The background section will give a short introduction to the three main areas in this project; The technology that is used in vCare, the Danish Healthcare System and finally an introduction to the main target group who will be affected when introducing telemedicine in rehabilitation.

1.1.1 Digitalization within the Danish Healthcare System

Denmark is known for extensive digitization and electronic communication within the Healthcare System and the use of health data. Denmark made standards for electronic communication years ago and the result of this is an almost digitalized communication within the healthcare sector. Health records, laboratory test results and hospital referrals are all nearly collected as electronic data.

Multiple ICT and digital workflow are completely integrated, this marks Denmark as a frontrunner in deployment of e-health. Telemedicine is a big part of the digitalization plan in Denmark where five initiatives is to be the foundation of future telemedicine infrastructure in Denmark. "The goal is to have a digital infrastructure and IT architecture in place within the foreseeable future, so that relevant information can be exchanged across the healthcare system and other sectors" [1].

In 2011 Denmark started a project for telemedicine throughout the country. The five regions in Denmark made a strategy on how to develop telemedicine in a wider scale and combine it with effective shared knowledge. For this to happen a board has been chosen and is known as the National Board of E-Health [2].

1.1.2 Technology

The technology section will be based on the new ICT based virtual coaching solution vCare. This project will be centered on the concept of vCare.

The basic concept of vCare is carried out by a central eHealth platform that serves central infrastructure services. The platform obtains the information delivered by sensors or gained by the direct interaction between the patient and the virtual coach. The devices added to this platform consist of camera, microphones and a Kinect, which makes the platform able to track movements. The information from the devices are conducted by a real-time processor. Beside the platform the infrastructure delivers supporting services to improve the quality of life of patients. The service provides physical and cognitive exercises as well as education material within nutrition and life behaviour. This service will be extended with a care pathway and a knowledge layer that enables personalized exercises and material for the given patient. Based on algorithms the virtual coach is flexible regarding the patients'

needs and hereby able to make specific rehabilitation programs. The platform can be implemented on different devices, e.g., tablets, smartphones, TV screens etc. [3].

1.1.3 Target Group and Market Segment

By introducing telemedicine, the rehabilitation process is brought directly to patients' homes and mostly targets people with chronic conditions, which includes cardiac patients. Telemedicine rehabilitation is used to prevent hospitalization, to improve patients' feeling of safety and to empower patients to manage their own chronic condition and hereby improve patients' quality of life [4].

The need for cardiac rehabilitation is evaluated for all patients with heart disease. This includes both patients who have had a balloon dilation or by-pass surgery and patients with stable ischemic heart disease. Patients with heart failure, pacemaker or patients who have had heart-valve surgery or cardiac transplantation are also being evaluated for the purpose of cardiac rehabilitation [5]. By this statement it is seen, that this intervention will involve a large target group.

To teach cardiac patients about their illness and how they are able to influence the course of the disease, results in a reduced risk of dying. Furthermore, research shows that rehabilitation programs with physical exercises results in reduced cardiac mortality [6].

1.2 Problem Statement

More than half of the Danish citizens above the age of 55 suffer from a cardiovascular disease. Furthermore, cardiovascular diseases are one of the most common causes of death in Denmark. The total cost of treating cardiovascular patients at the Danish Healthcare System was 5.5 billion DKK in 2015. Every year approximately 55.700 Danes is diagnosed with cardiovascular disease.

Nearly 107.100 Danes are hospitalized every year for cardiovascular disease and almost 73.100 Danes are yearly at one or more consultations at the hospital. Approximately 23 percent of the cardiovascular patients are readmitted into the hospital within 30 days after being discharged. It has been proven, that cardiac rehabilitation results in a reduction in mortality caused by cardiovascular diseases as well as the need for readmissions [6].

All this indicates that cardiovascular patients constitute a large part of the Danish states economy. This leads to our problem statement which is:

- What impact would an ICT solution for rehabilitation have on both cardiovascular patients and the Danish Healthcare System?
- How can ICT help to prevent readmission of cardiac patients?
- Which barriers/challenges can such system meet in implementation?

1.2.1 Delimitation

This project is limited only to be focusing on healthcare in Denmark, mainly focusing on Herning Municipality, and how the technology within rehabilitation will have an essential impact on the Danish Healthcare System. However, the project will be compared to related ICT solutions in EU as scientific articles based on The Danish Healthcare System is limited in this research area.

Relevant data on how the Danish Healthcare System is establish will mainly be based on literature found in books and on websides where guidelines, statistics and the historical development is being published.

A trial has not been conducted in this project. Therefore, relevant and significant data to perform cost-effectiveness analysis has been obtained from similar studies in Europe. Furthermore, as vCare is an ongoing project some financial costs has been estimated to calculated the difference between centre-based rehabilitation to telemedicine rehabilitation.

2 | Methodology

This study is a combined multi-method qualitative case study divided into three phases. The study is combined between exploratory, descriptive and evaluative study. Each study type is represented as a research question. Furthermore, the study is a multi-method qualitative study due to two types of qualitative analyzing techniques.

2.1 Research design

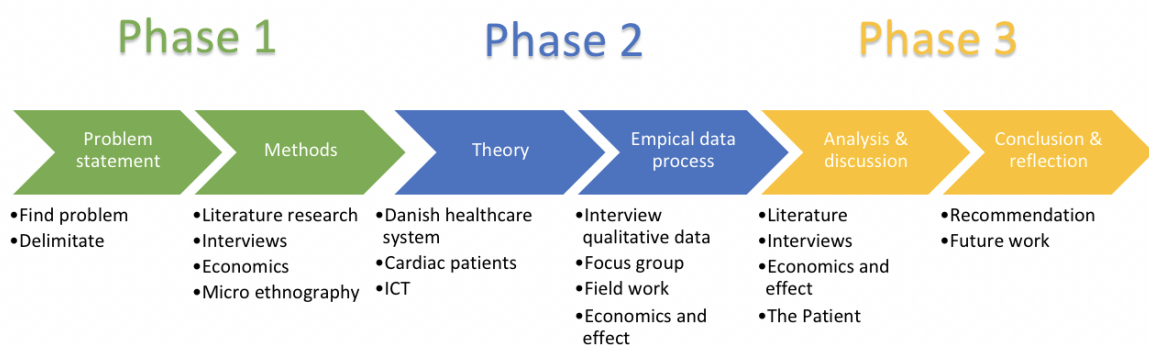


Figure 2.1: Research design

Figure 2.1 is an overview of the research design in this project. Phase 1 in the study is the initial process, phase 2 is knowledge/data process and phase 3 represents the analysis and outcome.

In phase 1 the topic was selected and translated into questions and hereby the problem statement. In this process the delimitation of the project was laid out. Furthermore, the methodology was chosen during this phase in the project. The methodology contains considerations in literature research, interview methods and data analyzing methods.

Phase 2 is the process to gain knowledge and collect the necessary data to analyze the problem. The knowledge is gathered through a literature search in the area. The method is described in Section 2.2. The data is collected throughout interviews with both healthcare professionals and cardiac patients. To read more about the interviews and the empirical process please see Section 2.3 and Chapter 4.

In phase 3 the collected data and knowledge is analyzed and evaluated. Furthermore the newly gathered information are discussed within the literature search. The closing statement in this study will be an overall conclusion of the studies findings. The last process in the project is to reflect and look into further investigation of the problem.

2.2 Literature research method

The literature was conducted with a thorough literature research. To find the right type of literature PICO (Population/Problem, Intervention, Comparison/Control, Outcome) was used as a framework, see Table 2.2 [7].

Following databases have been used for this project: PubMed, AULibrary, Embase and Google Scholar. The literature search started in february 2018, where the primary part of the literature was collected within two month, although literature has been collected through the whole period of the writing process. Search keywords was conducted in the problem statement and have been used for search words in the databases. Following words was chosen as key words: ICT, Healthcare, cardiovascular, rehabilitation, cost effectiveness.

The papers were chosen based on title and abstract. Furthermore, more literature was conducted through chain search found in relevant literature. Multiple papers was deselected due to irrelevance or mismatch of the subject. The national guidelines and national history was conducted on state webpages. The keywords were combined with an "AND" - and in related areas an "OR". The PICO blocks was as well combined with the "And" and "OR". Furthermore, a search criteria was compiled in relation to the publication year of the paper. Therefore, most of the literature used in this project is no more than 10 years old. This restriction was made as a lot of research has been made in the area of telemedicine, and to achieve the best result it is important to use the most recent knowledge within this area.

PICO	Search headings
Population/Problem:	Patients with cardiac illness
Intervention:	Patient in telerehabilitation
Comparison/Control:	Standard cardiac rehabilitation
Outcome:	Adherence to CR, readmission, mortality

Table 2.2: Search headings in PICO principles [7]

2.3 Research interviews

Research interviews are defined as a purposeful conversation between two or more people, whereas an interviewer ask concise and unambiguous questions and the interviewee will respond. To collect data for this study interviews with experts within rehabilitation of cardiac patients and cardiac patients themselves has been made [8].

There are many types of interviews, but for this study a semi-structured interview has primarily been used. The semi-structured interviews can be exploratory, explanatory and evaluative. Furthermore, this kind of interview is referred to as qualitative research interviews. This type of interview makes it possible to prepare the interview setup, but it

also allow the interviewee to expand the knowledge area and hereby expand the outcome of the interview.

Besides the expansion of the frame, this setup allows the interviewee to explain their opinions and reasons for attitude. Semi-structured interviews provide the opportunity to probe answers whereas the interviewee can explain their responses. The interview may also lead the discussion into unforeseen areas, which can collaborate to new knowledge. The different interview types gives a detailed set of data, but it can be viewed as biased due to the interviewers impact on the interviewee. By using semi-structured interviews allows to gain insight on the use of telerehabilitation in CR from different point of views which will benefit the analysis.

In this project the questions are formed as open ended and only as a frame, hence the semi-structured interview [8].

To prepare for the semi-structured interviews the "five p's" were used: Prior - Planning - Prevents - Poor and Performance. To withhold these p's following was taken into account. Level of knowledge, developing the interview themes, inform interviewee before interview and finding an appropriate location.

The group had gained a lot of prior knowledge about the rehabilitation process of cardiac patients in Denmark. This supports the capability to accurate response under the interview and the interviewers credibility. The knowledge was secured during the literature research fase [8].

For the interviews organized with healthcare professional within rehabilitation of cardiac patients, the interview questions were designed to make sure that every area wanted to be clarified was conducted. Ideas to make relevant questions came from literature and the problem statement. The prepared questions are presented in Appendix B. The frame made for these interviews was made as a guide in a logical order. The location of the interview should be convenient for the participant otherwise they might feel uncomfortable which could impact the data collection. For these interviews the participants chose the location to oblige convenience for the participant.

2.4 Focus group/open discussion with patients

A focus group is defined as an interview method that involves more than one but usually at least four participants. The interview takes place in a fairly unstructured setting. The person who runs the interview is the moderator or facilitator and is expected to guide the session without being intrusive. In this project the focus group session was held with patients who attends CR in Herning Municipality at that moment. The data collection from this focus group is qualitative and is used to collect the opinion on ICT used in rehabilitation of cardiac patients. This setup gives the researchers the possibility to understand the way people feel. The setup also gives opportunity for the attendees to probe each other [9].

The questions for the focus group was premade and pointed for the group of patients. The short focus group was held in continuation of the education and training class. Before the

open discussion took place the researchers introduced and told briefly about the project. This means that the participants had a knowledge of the project before the discussion.

Through the interview both premade and new questions were asked during the session. The interview was recorded and transcribed, the transcription can be seen in Appendix C. The session is further described in Section 4.4.

2.5 Micro ethnography

The method ethnography is used when an observer/ethnographer immerses in a group for an extended period. For this project it has not been possible to follow CR in Herning Municipality for an extended period. However, a micro ethnography has been carried out. The project group attended a training and education session for cardiac patients in Herning Municipality. The participant observer role is classified in four role types: *Complete participant*, *Participant-as-observer*, *Observer-as-participant* and *Complete observer*.

For the training and education session in Herning Municipality the researchers attended in the role as *Participant-as-observer*. The *Participant-as-observer* is a fully functioning member in the setting and the social setting is aware of the researchers status as a researcher [10]. The purpose of the participation is to connect with the patients before the focus group and to get a sense of the social setting within cardiac rehabilitation. During the session mental field notes were taken. The notes was taken as mental notes where as much as possible were remembered during the session and written down later on. This is a method that results in a low detail level, but it makes it possible to fully participate within the session without interfering with social setting [11]. This field work was prior to the focus group/open discussion with the patients and that might make the patients feel more comfortable of sharing their thoughts. The Field notes can be read in Appendix D.

2.6 Analyzing qualitative data

Qualitative research is depending on social interactions and therefore the qualitative data is analyzed in an interactive and iterative process. Qualitative data are likely to be more varied, elastic and complex than quantitate. An analyzing method is therefor a great tool to evaluate and use the data to answer the research questions.

To analyze the data from the semi-structured interviews an analyzing tool was necessary. The Narrative analysis method has been chosen to perform this process. The narrative analysis consist of a collection of different approaches to analyse qualitative data.

The study only have the narrative of a few individuals, but they are able to give another perspective within the healthcare system than what is stated in the literature. The interviews gave the opportunity to look into a small piece of the Danish Healthcare System, more likely region Midtjylland and specific Herning Municipality. By using the narrativ analysis of the qualitative data it was possible to analyze themes to compare the narrators opinion on the use of telerehabilitation in centre-based CR [8].

Various approaches are possible when evaluating and comparing a technology to the existing method. For this study one approach has been chosen to look into the cost and effect of telemedicine rehabilitation in Denmark.

2.7 Cost-effectiveness analysis

When implementing new technology and rehabilitation processes, it is important to look at the cost. Every region and municipality are on a budget which is provided by the state. Therefore, resource allocation is a big part of the Danish Healthcare System. In healthcare, cost is not the only value which is taken into account, the patients' health and well-being is an important part of the puzzle. When allocating money for one intervention, another intervention may be dismissed. This is why a decision tool is needed to evaluate interventions and pick the interventions that provides the most benefit with the available resources.

Cost-Effective Analysis (CEA) is an analysis of cost and effectiveness of a new service or technology. The benefit by using a CEA is that it does not only look into cost but also takes the patient into account. It is often used to evaluate effectiveness in healthcare. In this study the CEA is used to compare the traditional CR with the new setup where tele rehabilitation is used. Incremental Cost-Effectiveness Ratio (ICER) is a type of CEA and it is used to analyse healthcare interventions. Therefore, this analysis tool has been used in this study. In the analysis the CE ratio is calculated. The CE ratio is the cost associated divided with health outcome [12].

The data for the analysis is collected in corporation with Herning Hospital and Herning Municipality.

Following costs are taken into account:

Health related	Non-health related
Profession (Staff)	(Travel)
Rehospitalization	(Productivity loss)
Physical materials	(Presentism loss)
Training equipment	
Other cost	
(Medication)	
IT	

Table 2.3: Cost variables CEA

The different costs in this setup can vary at lot from municipality to municipality and furthermore in between countries. Moreover, the choice of the costs taken into account. The selected costs in this project is chosen due to research in similar trials and the costs that were possible to be collected [13, 14].

Following costs has been left out of the analysis: Travel reimbursement, Productivity loss, Presentism loss and Medication. The mentioned costs are all a part of evaluating a health technology as this, but not possible to collect in this project. Travel reimbursement is left out because it is a cost for the patient and not for the municipality. Productivity loss is left out because the average cardiac patient is above or about the pension age. Medication is a big area and would definitely be an interesting element to include. Unfortunately, this is an area that is too big and would require a greater effort as to what is possible in this project. Therefore, it is not possible to collect the needed data within the medication area.

The measure of effect can be done in various scale methods. For this project Quality-Adjusted Life Year (QALY) has been chosen. "The QALY is able to combine 'the effects of health interventions on mortality and morbidity into a single index', thereby providing a 'common currency' to enable comparisons across different disease areas" [15]. This evaluation method combines survival with health-related quality of life (HRQoL). QALY is an index between 1 and 0 and the higher the QALY index is, the better is the effect of the intervention. The QALY methods makes it easier to look at both the patients personal experience and medical factors [15]. To obtain the data from the patient an EQ-5D questionnaire can be used [13]. This project will not perform any actions to obtain a QALY index, but the data will be obtained from literature with similar studies where the QALY index haven been measured and calculated with the EQ-5D questionnaire.

3 | Theory

This section will consider the Danish Healthcare System history and structure. Denmark is a welfare state and therefore a bit different from other western countries. Moreover this chapter will provide a view on the rehabilitation process of cardiac patient and the use of ICT in telemedicine.

3.1 The Danish Healthcare System

The establishment of the Danish Healthcare System started in the eighteenth century. The first hospital was placed in Copenhagen and opened in 1757. This hospital is still running and today it is known as "Rigshospitalet". Outside of the capital small hospitals were built during the late eighteenth century. At that time the hospitals were partly financed by taxes, patient payment and charity. In the late nineteenth century every thirteenth Dane was a member of a sick-benefit association which the Danish Government co-funded. The Danish Welfare State has roots in 1933 where The Social Reform was founded. By this reform, to all Danes with a low income it became a demand that they were members of a sick-benefit association. During the thirties taxes gradually became the dominant finance source at the Danish Healthcare System [16].

The sick-benefit associations were shut down in 1973 and replaced by a public health insurance. The Danish public health insurance is paid by Danes themselves from taxes. The insurance provides free care for everyone regardless of income and residence. This public health insurance includes hospital stays, surgery, visits to a General Practitioner (GP) and specialist¹. Furthermore, it provides partly funding for dentist, physiotherapist, chiropractor, podiatrist and contributes to medicine [1, 17].

Structure of the Danish Healthcare System

Every healthcare system consists of users, healthcare institutions and the financial third part. Apart from that there are three fundamental financial mechanisms; user fee, tax and budgets/rates. These three financial mechanisms links together the Danish Healthcare System. This is described with the tripartite model in figure 3.1. A, B and C is the financial mechanism and 1, 2 and 3 are the components within the healthcare system. The model shows how a third part is pushed in between users and healthcare institutions. This third part creates equality between users as much as possible. The constellation of finances differs from country to country. Denmark is mostly funded by the Government through taxes whereas US citizen needs health insurance to pay for these services [16].

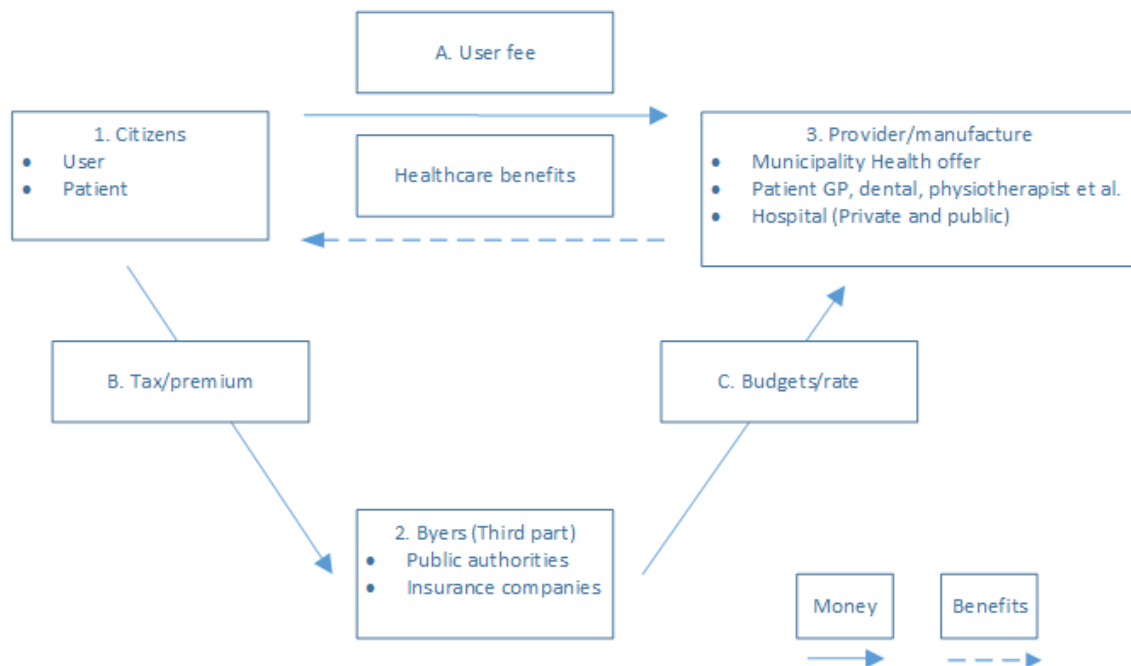


Figure 3.1: Tripartite model [16]

In 1927 there was a total of 160 somatic hospitals in Denmark. Today the Danish Health Authority is responsible for planning the distribution of specialized hospitals. The Danish Healthcare Authority made a decision to centralize hospitals to improve quality and efficient use of resources. This concerns both acute, long-term and psychiatric care sectors. The centralization leads to a structural change within the hospitals. Small hospitals got shut down and big hospitals have been modernized. Besides these alterations seven new greenfield projects are under construction. These projects are specialized hospitals. The new hospital construction requires modernized technology and new solutions to ensure cost effective care and shorter admission time [1].

The average length of the admission has decreased with 40%, which makes Denmark the country with shortest length of hospital stay in Scandinavia. The decline is due to more effective treatments and outpatient treatments. The Ministry of Health is constantly seeking to improve the sector both in quality and efficiency at a minimum cost. Hereby the ministry set up some future goals and one of them is to minimize bed days. "As a result of the modernisation process, the number of bed days is expected to be reduced by 20 percent, and outpatient treatment to be expanded by 50 percent from 2007 to 2020". To manage greater distance between both hospitals and patients, ICT solutions will be a major factor in the development of communication within the new hospital construction[1, 2].

In 2007 the Danish State made big structural changes throughout the healthcare organisation. Municipalities were combined which meant a change from 275 municipalities down to 98. The 14 counties were replaced by five regions. The Danish Healthcare System was thereby organized in three levels: State (national level), region (regional level) and municipalities (local level) [1, 18].

The municipalities have multiple tasks but in the health area they administrate GP's,

home nursing, public healthcare, school health service, child dental treatment, prevention and rehabilitation[19].

The five regions are responsible for the secondary sector which is mainly focusing on the hospital sector. Each region is able to organize their services accordingly to their regional needs. They may adjust within the national legal limits, but the region will be responsible of procurement of staff and equipment.

The states task is to initiate, coordinate, and advise. Furthermore, the job is to establish goals for the national health policy [19]. In Denmark a ministry takes care of this job. The ministry changes over time but in 2015 the name of the ministry became Ministry of Health [20]. This ministry is responsible for establishing the overall framework for the provision of health and elderly care.

Finances

The region is financed by four subsidies: Block grant from the state (75%), state activity-related subsidy (5%), local contribution (10%) and local activity-related contribution (10%). The block grant from the state is distributed with the consideration of differences inside the regions which will give the regions equal prospect of providing healthcare services. The rest of the subsidies are divided in three different types of distribution, this is partly to encourage the regions and municipalities to increase activity and efficiency [19].

The municipalities are financed with a block grant from the state but also council taxes which differs in the municipalities. The regions receive activity-based subsidy from the municipality which means that the municipality pays the region money depending on the number of hospitalisations and treatments performed at the hospital. Due to this constellation the municipality has incitement to reduce demands for hospitalization and other regional healthcare services [1].

The finance structure in the Danish Healthcare System aims to strengthen health clinical production and responsiveness with free choice of hospital in combination with the activity-based financing. Throughout the structure plan in 2007 the municipalities were given a financial incentive to keep their citizens healthy [2].

Preventive healthcare

As a part of the local government reform in 2007 preventive healthcare became an important part of the Danish Healthcare System. The vision was to improve quality of life and impact the lifestyle related diseases like cancer and cardiovascular diseases which are the dominant cause of mortality today in Denmark. Furthermore, it included focus on risk factors as tobacco, alcohol and lack of exercise. The municipalities were given the primary responsibility for preventive health [19].

Rehabilitation

Rehabilitation, including both physical and mental training programmes, are offered to all citizens by the municipalities. Training and rehabilitation of a patient may be initiated at the hospital and continued within the municipality when the patient is discharged. This means that the municipality will be responsible for the rehabilitation after discharge. Rehabilitation helps the patient to regain functional abilities and helps them to become self-sufficient. Some patients will receive rehabilitation free of charge whereas others may pay partly by themselves. This depends on type of illness [1, 21, 22].

Treatment of Cardiac patients

In 2010 treatment packages for non-acute heart disease were introduced in Denmark. This package included a process consisting of investigation, diagnosis, treatment and rehabilitation. The Danish Health Authority decided to phase out the package deal in 2017. With the new alteration the patient will achieve a more simple and coherent treatment with better quality. The progress for the patient is divided in five steps and will be described in the next section.

Step 1 Preliminary assessment and referral: When a patient feels ill they contact their GP, unless it is acute. It is the GP's job to carry out preliminary examination and to give the patient the right kind of treatment if necessary. The GP should include the patient in choice of treatment plan and decide if the patient needs to be admitted to the hospital or an outpatient treatment is necessary.

Step 2 Investigation and treatment: The investigation and treatment of cardiovascular patients differs from different diagnoses. Common is, that the knowledge of comorbidity is important due to stabilization and treatment of the concurrent disease throughout the treatment of the cardiovascular disease. The health facility will form a treatment plan in corporation with the patient.

Step 3 Planning follow-up on treatment, rehabilitation and palliation: At the end of treatment the cardiology department/specialist practice performs a systematic assessment of needs. The needs assessment is carried out in collaboration with the patient and perhaps relatives.

Step 4 Follow-up: When the patient has been discharged from the hospital the treatment will pursue as outpatient visits while others will pursue follow-up at their GP's.

Step 5 Rehabilitation and palliation: Patients with heart disease should systematically perform a need assessment in order to offer rehabilitation and palliative action based on patient needs and heart disease. Rehabilitation with cardiac patients is mainly performed with focus on disease coping, nutrition, physical training, tobacco cessation and work retention. Furthermore, it aims to improve the individuals physical and mental state of health. The rehabilitation is primarily placed in the municipalities. The effort of rehabilitation planning should origin in the patients functioning, preferences and resources.

Motivation, participation and adherence of achieved change of behaviour are important elements in the rehabilitation process. After a heart disease the patient is at great risk of developing anxiety and depression and it is therefore important that physicians related to the rehabilitation process are observant.

Patients with heart disease experience varying periods of worsening of the disease along with more calm periods. In connection with impairments and possible subsequent hospitalization, there will often be uncertainty as to whether the patient survives. This is always a burden for both the patient and the relatives. In this regard, it is important for health professionals to pay attention and to assess the patient's and their dependents' palliative needs and problems associated with heart disease. It is important that the need is assessed on a regular basis to prevent efforts from initiating too late [23].

3.2 ICT in telemedicine

The first use of telemedicine was in 1877. A group of doctors made a communication network towards the drug store by using telephones. The first video consultation between a doctor and a patient took place in 1927. In the 1950s a two way television group therapy took place in Alaska. In the 1970s NASA built *Space Technology Applied to Rural Papago Advanced Health Care (STARPAHC)*. By this system they were able to communicate with a two-way radio and to deliver and send data. It was not until the eighties where the technology had renewed interest, due to high cost, lack of suitable technologies and unacceptance. At this point the military picked up the idea of the usage of telemedicine in combat. The use of technology in military has extended to hospitals throughout the world.

Telemedicine is a generic term that covers different types of healthcare which is provided digitally and in distance. Telemedicine range from tele consultations to telesurgery. Telemedicine has made it possible to give specialized care and diagnostic medicine for people in rural and remote areas. The introduction of telemedicine has changed the traditional doctor-patient relationship.

ICT is an information and communication technology which allow people to interact in the digital world. Telemedicine uses ICT as the digital communication method. ICT has drastically changed the way the world in general communicates, work, learn and live. The use of ICT in telemedicine has made cost-effective treatment options available due to reduced traveling expenses, decreasing hospital readmission rates, and maximization of consultations. It is important to keep in mind, that providing medical care with the use of telemedicine opens important medical, ethical and legal issues, which must be addressed and considered [24].

4 | Empirical data

The empirical data is collected from interviews both with a perspective from Herning Hospital, Herning Municipality and the involved patients. The outcome of the interviews will be presented in the following sections.

4.1 Interview with Vibeke Lynggaard, post.doc, Cardiovascular Clinic, Herning Hospital

The interview was held as a semi-structured interview and was a conversation based two-way communication. The questions was premade, but the interview was open for clarifying questions. The interview was audio-recorded and afterwords the record was transcribed, Appendix E for the transcription.

Vibeke Lynggaard is working as a project nurse at the clinic for cardiovascular research. The interview was also held at the cardiovascular clinic at Herning Hospital. The interview was conducted in order to gain information on telemedicine rehabilitation from a healthcare professionals point of view. Through this interview it was possible to obtain information on how telemedicine rehabilitation can be used to support the already existing rehabilitation process. By the interview it was also possible to obtain an opinion on which limitations and disadvantages a telemedicine solution gives. By the information based on this interview it was possible to give an idea on how telemedicine rehabilitation can be used in the Danish Healthcare System.

4.1.1 Outcome of the interview

Cardiac rehabilitation has been a subject to the municipalities since the 1th of January 2017. Before that it was the regions responsibility to offer rehabilitation for cardiac patients. Only one team of 12 patients are directly connected to the hospital. These patients are severely ill and therefore in need to be in contact with the hospital throughout their rehabilitation progress. Cardiac rehabilitation consists of exercise, education and social aspects and it is important that all three collaborates. Both at the hospital and in the municipalities the patients do cardiac rehabilitation 2 times a week in 12 weeks. Furthermore, they are being educated about their illness and healthy lifestyle habits once a week. These 12 weeks of rehabilitation is described as phase 2 rehabilitation. Afterword patients are offered phase 3 rehabilitation. At the beginning of phase 2 rehabilitation the patients makes a maximal symptom-based stress test. This gives a starting point for the rehabilitation progress. Furthermore, they measure weight, height, waistline, blood pressure and heart rate. After 12 weeks they will do the test and measurements again and hereby the healthcare professionals are able to see how the patients have developed through the progress. The physiotherapist coaches the patients through a program where both cardio stress and muscle stretching are included. There are some national guidelines which indicates how much intensity and how many repetitions the patients are able to do.

It is necessary to keep in mind that cardiac patients struggles from different illnesses, such as reduced pump function, heart valve replacement and those who have got a pacemaker. Therefore, cardiac patients got different needs and have to do different exercises.

How could telemedicine be included in rehabilitation?

Phase 2 rehabilitation is mandatory to offer cardiac patients. This rehabilitation program is a class 1 recommendation from the American and European heart institutes and there is strong evidence that it is working. Therefore, it would be a hard process to replace phase 2 rehabilitation with telemedicine rehabilitation. All patients are being offered phase 3 rehabilitation, but most patients refuse to undergo this program. Mostly they refuse phase 3 as they want to get back to the labor market and a normal life. Unfortunately, most patients stops with common care and does not continue their healthy lifestyle after the rehabilitation program. Therefore, it would be highly relevant to introduce a telemedicine solution after phase 2 rehabilitation. Furthermore, phase 3 rehabilitation is about continuing and maintaining decent exercises and dietary habits and for example continue a smoking cessation.

Moreover, patients are being screened for depression at the beginning of their illness. They complete the questionnaire HADS – The Hospital Anxiety and Depression Scale. There is an algorithm behind the scale which indicates if the patient need to contact the doctor. It could be beneficial to perform a depression score once a month and hereby catch patients who are in risk of getting a depression. This questionnaire could potentially be a part of phase 3 and could easily be included in a telemedicine rehabilitation program.

Is it possible to do all measurements at home?

Waistline can be hard to do by the patients themselves. Usually healthcare professionals do this measurement to make sure there is no bias. The objectivity disappears if the patient has to do that kind of personal measurements themselves. Furthermore, Vibeke Lynggaard mentioned that it could be relevant to connect a sensor to the telemedicine platform. This could for example be used as a reminder to take medicine. Hereby the patient need to interact with the platform to let the system know that they have taken the medicine, otherwise an alarm will start. Another score that is used today is a score to indicate how nicotine dependent the patient is. The score will let the patient know whether they need to use a nicotine plaster or chewing gum. This could easily take place at the patients home and hereby be integrated in a telemedicine solution.

How could telemedicine be used in rehabilitation?

It would be beneficial to track how the patients complies with healthy lifestyle and behavior. Moreover, if the patient could interact with healthcare professional through the platform it would be very useful. By this communication platform it would be possible for the patient to ask questions about the illness and how to maintain a healthy lifestyle. For healthcare professionals it would be possible to keep an eye on the patient and keep track on their behavior.

The rehabilitation program that is used today includes former patients to communicate experienced knowledge. This could also be included in telemedicine rehabilitation where former patients could be connected to the platform and hereby it is possible for former patients and current patients to be in contact when needed.

Furthermore, at the current rehabilitation program, patients are offered a program at a dietitian. Usually the program is within two days and concludes a presentation and some practical exercises. Not all patients accept this offer and therefore it would be preferable to include meal plans, diet diaries or television chefs at the platform. By this platform the patient does not need to go to the dietitian, but they will be able to obtain the information through the platform. This would possibly seem easier and hopefully more patients would continue a healthy lifestyle.

By introducing telemedicine in rehabilitation both the patient and healthcare professionals would experience time savings as they do not have to spend time on transportation. If telemedicine could be used to keep a healthy lifestyle for more patients, and hereby reduce readmission, a health economic reduction will also be a positive outcome.

Participants in rehabilitation program in Regional Hospital West Jutland

Vibeke Lynggaard has taken part in a trial which was carried out in collaboration with Regional Hospital West Jutland. In the recruitment period of the trial 1642 cardiac patients were hospitalized and only 50% participated in the rehabilitation program. The reason that only 50% participated was that some patients did not meet the inclusion criteria, some were not referred to cardiac rehabilitation, some declined to participate and some were rehabilitated in Primary Health Care. Furthermore, the trial showed that 20% did not complete the rehabilitation program [25]. By this trial it can be concluded that a very large group of patients do not undergo the rehabilitation program that is being offered. Hopefully by introducing telemedicine, and hereby a more technological and easy access rehabilitation program, this large number of patients could be reduced.

Limitations and disadvantages

The social aspect with other patients can be hard to obtain by using telemedicine instead of cardiac classes. To most patients it gives motivation if the teamwork and dynamic between the patients is good. There has been made some qualitative research interviews which indicates that the social aspect is highly important. Furthermore, there are some ethical challenges that have to be taken into account. For example, patients must be offered the best-known rehabilitation program and as there is highly evidence that the rehabilitation program that is used today is the best this one must be the one that is being offered.

4.2 Interview with Hanne Voldgaard Nielsen, Professional leader, Health, Training and Assistive Technology, Herning Municipality and Eva Klose Jensen, Leader, Rehabilitation and Health, Herning Municipality

The interview was held as a semi-structured interview and was conversation based between the interviewer and the two interviewees. The interview was held to give a perspective on how rehabilitation is working in Herning Municipality and to achieve information for cost-effectiveness analysis. The questions were pre-made and were based on previous and comparable cost-effectiveness analysis from other similar studies [13, 14]. Notes were taken during the interview and can be seen in Appendix F.

Hanne Voldgaard Nielsen and Eva Klose Jensen are both working with cardiac rehabilitation in Herning Municipality. The interview was held at Holing Sport Center in Herning which is normally used for rehabilitation. The main purpose for this interview was to obtain cost-effectiveness data. By the interview it was almost possible to achieve all the cost data that was sought. The only data that was not possible to get was the number of readmissions. Unfortunately, it was not possible to get any effectiveness information as the rehabilitation team does not use and calculate on that specific data. Furthermore, the interviewees gave a subjective opinion on how cardiac rehabilitation is working in Herning Municipality.

4.2.1 Outcome of the interview

In Herning Municipality 200 patients are being offered the rehabilitation program. Table 4.2 shows patients who did not want to participate on cardiac rehabilitation. As seen on the table the percentage of participants is very high, and only five patients turned down the offer.

Date	Ends before test	Ends after test	Reason
17.01.18	X		Fails to appear
06.02.18	X		Dementia – tried to start the program. Does wish to continue
18.04.18	X		Regretted that he said yes
30.04.18	X		Called for start test - announces cancellation. Ends via non-disclosure letter
23.04.18		X	Depression

Table 4.2: Registration cardiac rehabilitation 2018

In Herning Municipality, the rehabilitation program is offered in Sport Center Holing which is very centrally located for patients in Herning Municipality. It is known from other municipalities that patients who live in rural areas seem to turn down the offer as the rehabilitation program is being offered too far away from their homes.

In Herning Municipality, the rehabilitation department agreed on making the best possible solution where the desire was to achieve the best possible result for cardiac patients. Therefore, the solution is not the cheapest as the main focus is not on the financial part. The primary focus is on the patient and how to get them through a rehabilitation process in the best possible way with the best possible outcome. The nurses used within the rehabilitation program are hired from the cardiac department at the hospital. It is important that the nurses have the right competences to work with cardiac patients and therefore they are more experienced and on a higher salary step. The same applies

for the physiotherapists. When the rehabilitation department became a subject to the municipalities the rehabilitation department had to find the right place to perform and offer the rehabilitation program. In Herning they did not have access to a health center and therefore they were required to invest all equipment necessary to open up a rehabilitation center. Therefore, it is important to keep in mind that the prices seen in Table 5.4 and Table 5.6 are implementation rates and hereby a lump sum payment.

Beside nurses and physiotherapists, a dietitian is available through the rehabilitation process. The dietitian participates four times a year for three hours. Furthermore, cardiac patients are being offered smoking cessation during and after the rehabilitation program. Most patients do not have the time and energy to undergo a smoking cessation while they participate in the rehabilitation program. Therefore, it is possible to do a smoking cessation after the 12 weeks of rehabilitation and it will still be paid by the municipality.

An important part in the rehabilitation program is that a previous patient participates in the program. By this concept patients are able to share experiences and to get knowledge on how to deal with a chronic disease. This is a very important factor to many of the patients, as it is very trustworthy to hear personal disease and health experiences.

By the interview it was mentioned that patients are being pressed hard physically to obtain the best result. A few times it has been experienced that some patients feel ill and are in need for personal help and assistance. As this patient group suffer from heart diseases it is important to keep in mind that they are in risk of getting a heart attack while they are doing their exercises. This is an important information to be aware of if telemedicine is introduced in rehabilitation. If patients are doing their exercise via telemedicine at home instead of participating at a team at the rehabilitation center, they are not able to receive the same urgent help if a heart attack or another emergency health situation appears.

4.3 Economy and effect

The economy aspects of this study is conducted in collaboration with Herning Municipality. The primary data for the economic analysis was gathered at Sportscenter Herning, which is the location of cardiac rehabilitation in the municipality. The data was collected as an open semi-structured interview with Eva Klose Jensen, Rehabilitation and health promotion manager in Herning Municipality and Hanne Volsgaard Nielsen, Professional leader at Herning Municipality. The data from this interview will be used for the control group resources of the standard CR treatment. The outcome of this interview can be seen in Section 4.2. Hanne Volsgaard Nielsen and Eva Klose Jensen were not aware of the expenses for the database HjerteKomMidt. To collect the cost of the database they referred to the region, whereas the cost of the database can be enlightened [26].

The economy for the intervention group is based on estimations because a trial is not conducted in this project. vCare for cardiac patients is not yet developed and there is not any guidelines to what elements the ICT solution should include for CR. Due to the lack of rules in this area the project group made three possible packages including professions, materials, medical equipment, IT, and other costs. The three packages is produced based on knowledge gained from the meeting with Herning Municipality, providers of similar

products, former studies and estimations [13, 14, 27, 28]. Out of the three produced packages one is chosen for comparison between treatment of the control- and intervention group.

The packages are divided in Bronze, Silver and Gold. With all packages the patient will be provided with a tablet and a license for the program and proper interaction with health professionals.

The Bronze package is the minimum possible set up, where the patient will carry out the training in a fitness center such as Fitness World. In this way no training equipment will be needed in the patient's home.

The Silver packages includes training equipment to achieve home training otherwise the set-up of the Bronze and Silver package is somewhat similar.

In the Gold package sensors are included to monitor the patients during training and to keep an eye on their state of health. Furthermore, the combination of professions needed for this task is slightly different. The solution is a store and forward solution where data will be collected and afterwards delivered to healthcare professionals.

To compare the control group with the intervention group in the cost-effectiveness analysis, the Silver package is the most suitable package hence the Silver package is the most comparable to the equipment used in the control group. The Bronze and Gold package will not be further described in the report, but the economic setups are included in Appendix G.

This project is not a trial so there is a need of data from a former conducted trial to look closer into the effect of implementing an ICT solution in rehabilitation of cardiac patients. To do so, a study from 2015 in Belgium was chosen [13]. The set up for the trial is comparable to the Danish setup, see Section 5.6. It is a randomized controlled trial which is looking into the cost-effectiveness of tele rehabilitation with the ICER method. The study uses the same methodology and setup as wanted in this project, but with focus on the Belgian Healthcare System. In this paper they measure effect in QALY. The result of the papers QALY is comparable to this project as Belgium and Denmark are following the same guidelines provided by the European Union for cardiac patients. To collect the QALY the EQ-5D questionnaire was used before, after and under the trial. Therefore, it was chosen to use the collected QALY of the intervention group from this paper. Herning Municipality do not collect effectiveness data on their patients and due to the lack of data for the control group the QALY of the control group is used from the Belgium project [13].

4.4 Open discussion with cardiac patients, Sportscenter Holing, Herning

The interview took place at Sportscenter Holing and was conducted both as a micro ethnography and an open group discussion. 12 patients participated, and the interview was held as a part of the rehabilitation program that the patients are following. The researchers participated in the physical rehabilitation program followed by the education program within knowledge on risk factors to develop heart disease. During both the physical rehabilitation program and the education program, field notes were taken and got

written down after the session. After the education program the facilitators had time to ask questions. The questions were premade and were focusing on the subjective perspective to how telemedicine could be used in rehabilitation. The interview was audio-recorded, and afterward transcribed, see Appendix C for the transcription.

The patients were mostly elderly retired citizens who suffer from heart disease, only a few were still on the labor market. One of the patients has not had a heart disease but was in higher risk of becoming a cardiac patient. Therefore, the rehabilitation program in Herning Municipality is both offered to cardiac patients but also to citizens in high risk of getting a heart disease. By offering a rehabilitation program to citizens in high risk of getting a heart disease, these citizens could possibly get the right help and information about heart disease and hereby avoid becoming a cardiac patient. By this open group discussion, it was possible to obtain opinions on the use of telemedicine rehabilitation by the patients themselves. It was also possible to get an impression on how the rehabilitation program works in Herning Municipality and how the patients find the program.

Outcome of the interview

This group of patients could not imagine home based rehabilitation as a replacement to the 12-week rehabilitation program that they follow at the sportscenter. They do not think they would be able to do the exercises at home as they had to do it by themselves instead of doing it together on a team. To them, the social aspect is very important. A patient states, "We have a great relationship to each other. It means a lot that it is not just workout but also social. We meet in good time before we start and speak a little afterwards as well: "To do rehabilitation by themselves is not as motivating as being on a team. It is too impersonal and to talk with other patients will be missed.

Another important factor is the safety by participating at the sportscenter compared to home rehabilitation. The patients feel safe at the center as there is a nurse and a physiotherapist while they are doing the exercises. That would not be the same if rehabilitation took place at the patient's home. If a patient feels ill during home rehabilitation it would take some time before they get the right help. The patients are being pushed very hard during training and sometimes patients feel a bit dizzy after an exercise.

Telemedicine rehabilitation could possibly be used after the 12 weeks of center-based rehabilitation. A patient mentions: "That would definitely be a motivation to continue". The patients could see an idea in developing an app where different training programs and nutritional advices were regularly uploaded. It was also discussed how measurements, e.g. blood pressure could be measured at home and sent directly to doctors at the hospital. To these patients that was seen as a positive monitoring and would give a sense of security.

Overall, this patient group would prefer to keep the 12 weeks of center-based rehabilitation. At the center they learn what exercises to do and they learn to do them the right way. An important information was mentioned by one of the nurses who pointed out that unfortunately after three years most patients are back at the same state of health as they were before they started rehabilitation. Therefore, to do some kind of rehabilitation program after the 12 weeks could possibly have a positive effect. One patient mentioned that it would be beneficial to have a process after the 12 weeks of center-based

rehabilitation. “It would be helpful if it could be tracked that the citizen followed the training program. Of course, it is beneficial to my own health, but it gives motivation that someone is looking after me”. Even though, patients learn training exercises and get healthy nutrition advises it can be hard to stay motivated and continue the new healthy lifestyle. Therefore, some kind of telemedicine solution after the 12 weeks of center-based rehabilitation is seen as a possible and positive solution, both to patients and healthcare professionals.

5 | Analysis

5.1 Impact of ICT in homecare

Existing studies describing the use of ICT in homecare are predominated by positive responses from both chronically ill patients and healthcare professional. As an example, healthcare professional's opinion is that their work has been facilitated by introducing ICT in homecare. Most studies show that communication between patients and healthcare professional was improved by using ICT. Furthermore, the use of ICT showed cost savings. However, it is important to keep in mind that the use of ICT cannot replace face to face consultations but is an ideal complement [29]. It is important to keep in mind that telemedicine supporting already integrated care is associated with the development of new roles within the healthcare system. Ideally, new structures of care delivery at an operational level needs to be supported by corresponding changes at institutional level [30]. Therefore, by introducing telemedicine both patients and healthcare professional has to be openminded to this new technology and adaptable to change already known working methods. Hence, the development of ICT in homecare should be seen as a learning process and will constantly be evolving and improved based on the ongoing use.

Another important impact of ICT is the information flow between healthcare professionals. Effective interprofessional communication is highly important within the healthcare system but is seen to be critical when teams are not co-located. For this reason, healthcare professionals who have been in use of an ICT solution pointed out how information via ICT potentially could have a positive effect on patient care and collaboration [31].

Furthermore, exchanging information with patients, follow up and motivating them to keep working out and keep having a healthy lifestyle is seen to be easier with ICT. Patients are able to log information, send documents and ask questions more frequently which increases the communication and contact between patient and healthcare professionals. Having more regular discussions with the patient will facilitate more comprehensive and effective collaboration to the patient [31].

5.2 Implementation of telemedicine in Denmark

By the European Society of Cardiology, it is a Class I recommendation to follow a cardiac rehabilitation program. This recommendation also includes cardiac patients in Denmark. The effects of a clinical rehabilitation program is clinical approved and there is very strong evidence that it is working. This statement was also mentioned in the interview with Vibeke Lynggaard. Although cardiac rehabilitation is strongly recommended it is seen that long term benefits are often disappointing due to low cardiac rehabilitation uptake and adherence rates. Several studies has been made to indicate the feasibility, safety and effectiveness of cardiac telemedicine rehabilitation. Looking from a cost-effectiveness point of view it has been shown that telemedicine rehabilitation is more effective and efficient. Furthermore, it has been concluded that the total cost of an ambulant telemedicine

rehabilitation is lower than hospital rehabilitation. A follow up study has shown a reduced number of days lost due to rehospitalization and an increase in days alive and days out of hospital [13, 28].

5.2.1 Rehabilitation offered in Herning Municipality

Herning municipality offers free rehabilitation programs for all cardiac patients. The rehabilitation program is known as phase two rehabilitation and consists of a 12-week team progress with 12 patients on every team. The program includes an individual conversation, physical exercises, education and social networking. The team meets twice a week for about two hours and both physiotherapist, nurse and a professional dietary consultant are responsible for the course. At the beginning of the progress the patients are being asked to fill a questionnaire. After respectively 3 and 12 month the patients are being asked to fill the same questionnaire to follow up how the progress is going.

The purpose of this rehabilitation program is to achieve greater knowledge and understanding of the factors that affect life with a chronic disease. It is important that the patients learn to live life with a chronic disease and how to deal with everyday challenges. Furthermore, it is essential that patients improve physical health, mental fitness and well-being and hereby share experiences with other patients.

The education will be focusing on better habits within diet, smoking, alcohol and exercise. The physical exercises will consist of different types of training. Both cardio and strength will be included. In corporation with the physiotherapist the right exercise program will be matched to the specific patient in order to physical level and situation [32]. After participating in phase two rehabilitation patients are offered phase three rehabilitation. This rehabilitation program is based on follow-up and maintenance of treatment, exercise and a healthy lifestyle [5].

5.2.2 Position on ICT in Herning Municipality

It is important to keep in mind that cardiac rehabilitation is a Class I recommendation as has been approved international. Patients are entitled to be offered the best-known rehabilitation program and so far, the center-based rehabilitation is the best rehabilitation program to offer. At the interview with Vibeke Lynggaard she mentioned, that center-based rehabilitation will be hard to replace as it is the best to offer at the moment. An important note from the interview was how telemedicine could be used in phase three rehabilitation. Vibeke Lynggaard mentioned, that all patients are being offered phase three rehabilitation but most of them decides not to participate in the program. This statement indicates, that telemedicine rehabilitation could possibly have an influence and great effect in phase three rehabilitation. This, of course, rely on the fact that patients decide to participate in the telemedicine solution instead of not participating at all. If more patients agree to participate in phase three rehabilitation where telemedicine is being used, this might have an positive influence on readmission and in the end an cost reducing outcome.

5.3 Relative's Experiences of cardiac Patient's telemedicine rehabilitation

It is known that it can be stressful to be a relative to cardiac patients. Most often relatives help with home exercises, medicine dosage and transportation to and from the hospital. They participate in discussions about the patient's illness and they do housekeeping and practical activities at home, which the patient is not capable of doing. Research has shown that relatives are in risk of being a patient themselves as a consequence of the stressful job it is to take care of the patient [33, 34]. Therefore, telemedicine rehabilitation is being offered to reduce relative's homecare. By introducing telemedicine rehabilitation relatives feel more comfortable and secure as the patient is being monitored and healthcare staff react if the patient's measurements are to be concerned about. By an interview of 13 cardiac patients who participated in telemedicine rehabilitation the results indicated that relatives find telemedicine equipment easy to use and the use of telemedicine motivates the patient to be more active in their own treatment [35].

A research has taken place in Denmark where the patients did weekly blood pressure- and weight measurements. A heart rate monitor was used three times a week under physical conditions. Data were shown on an application via smartphone and hereby the patient, relatives and healthcare professionals were able to follow the patient's state of health. For the patients it was a relief that they were able to do exercises and health measurements at home and hereby they were able to do so according to work schedule as well as motivation and mental energy. Furthermore, less hospital visits removes focus on the disease and makes the patient feel more normal and less ill. Hereby patients experience higher quality of life as they feel more healthy. [36].

Relatives experienced that everyday life were more normal by using telemedicine rehabilitation as they were able to continue everyday routines and spent less time taking care of the patient. They experienced more freedom as they did not have to take the patient to rehabilitation classes, regulate diet and take care of medicine. It indicates that relatives to patients using telemedicine rehabilitation gain more freedom and less concern and responsibility [37].

5.4 Comparison with telemedicine solution for COPD patients

Telemedicine solutions have been tested in pilot projects in different cities in Denmark. The projects have shown that telemedicine can provide financial benefits as well as better and more consistent patient progress and more self-reliant patients [38]. In 2016 the government, *Kommunernes Landsforening* and Danish Regions did an agreement to offer telemedicine home monitoring to citizens with Chronic Obstructive Pulmonary Disease (COPD) throughout the country by the end of 2019 [39].

In 2014 a pilot project took place in Skanderborg Municipality where 15 COPD patients were included. After participating in the project, the patients were interviewed to give their perspective on the telemedicine solution. Overall, the patients were very satisfied

for the solution and especially as they had the freedom to do measurements and exercises whenever they wanted and did not depend on a specific time schedule at the hospital. The only disadvantage the patients were aware of was the connection, which sometimes was a bit unstable. To the patients it was very important that picture and sound on the platform was clear and was working optimal at all time, otherwise they easily lost motivation. An important observation at this interview was how the patients experienced the social aspect. The patients were used to do exercises at the gym in classes with other patients. Now they had to do exercises at home where they were able to see and talk to each other through the screen. One of the patient's mentioned that it was a good solution but only for a short time. To him the social aspect was very important, and he did not experience the social interaction the same way as he did at the gym.

Another important observation was one of the patients who was too ill to get to the hospital and therefore he was not capable of participate at the exercise classes. But, by the telemedicine solution he was able to do exercise at home and in the end of the project his physical condition had increased so much that he was able to do his normal routines at home and also to leave home and go to the hospital. Therefore, this telemedicine solution definitely was an important help to make him feel and get better, Appendix H.

5.5 Challenges within telemedicine rehabilitation

5.5.1 Personal aspect

The telemedicine solution collides with the GPs' individual approach, where knowledge on patients' reaction patterns and personal relationship to the patient is important when assessing the patient and deciding the right intervention. By the use of telemedicine, GPs' are not able to look at the patient's overall condition and use knowledge about the patient's normal reactions. By using telemedicine GPs' will be looking at measurements measured by the patients themselves and that will not give the same overall understanding on the patients' physical condition [4].

Furthermore, communication through ICT is seen to be more impersonal and to build up trust to the patient is much more difficult compared to face to face meetings. Visual information such as body language, person interaction and empathy are very important for the therapeutic relationship and this is seen to be a barrier to the effective collaboration between healthcare professional and the patient [31].

5.5.2 Funding

In several countries medical help is funded by health insurance and therefore an ICT solution for cardiac patients would be financed primarily from the insurance company. This limits the possibility to implement such solutions in foreign countries, as the health insurance do not want to cover the cost [24]. Denmark in the other hand is primarily funded by the state as explained in Section 3.1. This gives Denmark an unique opportunity to offer the patient the best treatment. In Denmark the municipality takes care of the rehabilitation of cardiac patients. The municipalities receives a fixed amount of money

which should be distributed in different areas. If vCare is a cheaper and more sufficient solution it would be worth investing for the municipality.

An important consideration in funding is the public tendering rules both in Denmark and EU. If a provided service expense, provided by an private company to a public unit, is more than 1.489.820 DKK the service is ordered to go into public tendering. This process can be expensive for both the company and the public unit. The rules of public tendering is made to secure transparency, equality of treatment, non-discrimination and openness [40]. If the ICT service that the municipality wants is less expensive than 1.489.820 DKK the municipality may be free to buy the service without going into public tendering, if no other obligations is crossed.

5.5.3 Technological skills

There are certain technological skills necessary for operating ICT. The majority of cardiac patients are older adults and may not be familiar or comfortable using ICT. Some patients might not be used to use technology on a daily basis and therefore the ICT solution can be a difficult solution to that specific patient group. Additionally, some patients might live in rural areas where adequate internet access is not available. This is seen to be a barrier which has to be considered when introducing ICT [31].

5.5.4 Ethics

During the implementation process ethical implications of telemedicine has to be considered to ensure privacy and confidentiality. It is an universal understanding that all patients have rights and healthcare professionals are obliged to respect those rights. When handling patient data, it is important that healthcare professional keep personal information protected. An ethical concern when using telemedicine, it that confidentiality may be more difficult to ensure. To break confidentiality can be seen as breaches of security or inappropriate disclosure of patient data. This kind of inappropriate disclosure applies both videoconferences and viewing electronic medical patient journals [41]. This big ethical issue is related to the patient's autonomy. It is the patients free right to choose if they want treatment and what treatment they want if multiple treatments are providable. Furthermore, it is the patients right to refuse consent on distributing data or to deny acces on medical records.

Edward Chen explains in an article some of the considerations of implementing telemedicine. One of the big concerns is the lack of face-to-face interaction. Telemedicine has a lot of positive effects such as easy patient access, cost reduction, continuative care and a potentially more active patient which can improve compliance, patient satisfaction and anxiety, but it can potentially depersonalize the relationship between healthcare professional and the patient [24].

Another ethical concern is that every patient should be treated fairly and equitable. People in rural areas should have the same opportunities as people who lives in the city or near

the hospitals. The only concern that collides with the use of telemedicine is that the internet connection can be slow in some rural areas and therefore this patient group might experience bad internet access. This might create some issues though telemedicine mostly gives the patients the same equality hence it will be provided in the patients home [24].

The Danish Healthcare Authority must ensure that patients are offered the best possible treatment. This requires many and high demands to fulfill. Both prevention, diagnostics, treatment and rehabilitation must be carried out with high academic quality and effective utilization of resources. Moreover, it is a requirement that expertise, research, development and education should be continuously expanded and maintained [42]. With that said it is important to keep in mind that all patients must be offered the best known and evidence based rehabilitation program to ensure that patients are being treated in the best possible way. Therefore, if Herning Municipality decides to introduce telemedicine in rehabilitation it has to be proven that telemedicine rehabilitation is a better and more effective solution than center-based rehabilitation which is used today. Evidence based clinical decisions includes four components: clinical expertise, research evidence, patients' preferences and resources. Clinical expertise and patients preferences may override the two other components as the patients preference will dominate in the treatment decision, although research evidence indicates that another treatment is more preferable for the patient. By using evidence in patient treatment it ensures that the patient are being offered the best treatment based on the best research-based knowledge [43].

5.6 Cost and effectiveness analysis

The cost part of this analysis will be the implementation cost of standard or telerehabilitation with vCare as the ICT provider. It is important to distinguish between Capital Expenditure (CAPEX) and Operating Expenses (OPEX). For this project the CAPEX to implement standard CR and vCare is collected and the OPEX for running the rehabilitation for the first year.

Comparable basis to randomised controlled trial conducted in Belgium

As it was not possible to collect data on cost-effectiveness analysis using QALY and rehospitalization rates, it has been chosen to use data from a previous study. The study that has been used was done in 2015 and carried out in Belgium. The study was made to investigate in the effect of cardiac telerehabilitation in patients with a personalised patient-centred web application. 140 patients suffering from a cardiac disease were randomly allocated to telemedicine rehabilitation (intervention group) or centre-based rehabilitation (control group). Belgium is following the same European CR guidelines as seen in Denmark. Therefore, the rehabilitation program used in the control group is seen to be the same as the one used in Herning Municipality. The study period for the control group was three months and the group participated in group-based training sessions at the rehabilitation centre. The group size varied from 8-12 patients per session and they were under supervision of physical therapist and exercise specialist, both specialised in CR. The rehabilitation program started with an individual physical test on an electromagnetically braked cycle ergometer. In the end of the program the patient's physical health were evaluated by a nurse.

Furthermore, the CR programme consisted of an information / education module, smoking cessation and dietician guidelines [13].

As seen in the above section the study conducted in Belgium can be compared to the 12-weeks rehabilitation program used in Herning. Therefore, QALY and rehospitalization rates are evaluated as useful data to be used in this project.

The Economic analysis in this project does not include a detailed analyse of phase 1 which is the period of hospitalization of the patient. This is dismissed because the cost of the control group and intervention group is the same in this phase of rehabilitation. Furthermore, the introduction of tele rehabilitation will not affect this phase of rehabilitation. Moreover, phase three will not be included in this analysis due to lack of knowledge on cost in this specific phase. However, telemedicine could possibly have a great effect on phase three rehabilitation.

Phase 2 is the phase after the patient has been discharged and this is the phase that will be included in this analysis.

5.6.1 Control group

The control group in this cost-effectiveness analysis is as before mentioned the standard CR in Herning Municipality. The patients in the control group participates in a 12-week session within the municipalities training facility. 200 patients are on average following the program yearly.

Economics

Almost all costs for the control group were collected during the semi-structured interview with Eva Klose Jensen and Hanne Voldgaard Nielsen described in Section 4.2. If a cost has been collected elsewhere it will be described throughout this section.

The cost of profession is the first cost that is taken into account. The salary and working hours of the professions needed in the control group is based on the cost in Herning Municipality. This means that the cost on this element will differ from municipality too municipality as the salary may vary. The collected data will be described further in this section where cost per patient will be the outcome of the calculations.

The salary of the nurses needed in the standard CR is 308DKK per hour and they have two nurses who works 21 hours, 48 weeks a year. The cost per patient will therefore be as follows:

Total hours of working nurses a year:

$$42hours \cdot 48weeks = 2016hours$$

Total cost per year:

$$2016hours \cdot 308DKK = 620.928DKK$$

Cost per patient:

$$\frac{620.928DKK}{200patients} = 3104,64DKK$$

The cost per year for the physiotherapist is 600.000DKK hence the calculations for the physiotherapist is backwards. The physiotherapist works 54 hours a week in 48 weeks a year. The cost of the physiotherapist is therefore as follows:

Total hours of working physiotherapist a year:

$$54hours \cdot 48weeks = 2592hours$$

Physiotherapist hourly cost:

$$\frac{600.000DKK}{2592hours} = 231,50DKK$$

Cost per patient:

$$\frac{600.000DKK}{200patients} = 3000DKK$$

The salary of the dietician needed in the standard CR is 225DKK per hour. The dietician is scheduled to participate four times a year for three hours. Furthermore, the dietician gets paid for two hours of preparation per class. Therefore, the cost of the dietician is as follows:

Total hours of working dietician a year:

$$5hours \cdot 4 = 20hours$$

Total cost per year:

$$20hours \cdot 225DKK = 4500DKK$$

Cost per patient:

$$\frac{4500DKK}{200patients} = 22,5DKK$$

Profession	Average hourly Cost	Total cost a year	Cost per patient
Nurse	308 DKK	620.928DKK	3104,64DKK
Physiotherapist	231,50DKK	600.000DKK	3000DKK
Dietician	225DKK	4500 DKK	22.5DKK
Technician	200DKK	0DKK	0DKK
Total		1.225.428DKK	6127,14DKK

Table 5.2: Profession control group cost

The next cost that is considered is the implementation cost of materials such as training equipment and office supplies at the training facility. It is important to notice that these costs is an one-time cost and therefore it will be a significant minor cost in the future. The data is collected from a spreadsheet handed out from Herning Municipality. To see the spreadsheet with exact prices on all materials please see Appendix I.

Materials implementation	Unit	Total Cost	Cost per patient
Training equipment	97	29.711DKK	149DKK
Training bikes	12	118.200DKK	591DKK
Test bike	1	76.750DKK	382.75DKK
Office supplies	39	34.545DKK	173DKK
Other material	8	18.161DKK	91DKK
Total	157	277.367DKK	1386,75DKK

Table 5.4: Materials control group cost

To provide the right and most effective care for the patient and to follow up on their medical condition, some medical equipment is needed. These are described in Table 5.6. This data is based on the spreadsheet as before mentioned and is to be seen in Appendix I.

Medical equipment	Unit	Total Cost	Cost per patient
Model of heart	1	350DKK	1,75DKK
Sphygmomanometer	1	1599DKK	8DKK
Pulse Oximeter	1	599DKK	3DKK
Cuff	2	498DKK	2,5DKK
Ventilation mask	1	1637DKK	8DKK
Total	6	4683DKK	23,25DKK

Table 5.6: Medical equipment control group cost

Herning municipality do not use any IT solutions for the centre-based CR hence Table 5.8 is without any cost.

IT	Unit/ hourly cost	Total Cost	Cost per patient
IT license	0	0DKK	0DKK
IT training	0	0DKK	0DKK
Total			

Table 5.8: IT equipment control group cost

The rest of the costs in Herning Municipality is collected in Table 5.10. The cost for renting the facility is not given in the table. This is due to a non-disclosure agreement with Herning Municipality. The project group is aware that this specific value is a big part of the overall cost. Unfortunately, is it not possible to publish the number in this project.

The cost of HjerteKomMidt database is based on the population in the municipalities and is something every municipality in Region Midtjylland is obligated to contribute too [26].

The number of re hospitalized patients in Region Midtjylland was 4658 in 2015 out of 20289 admissions, hence the percentage of rehospitalization per patient is 23% in the Region. Keep in mind that some patients are re hospitalized twice and therefore the total number of readmissions is 6339, which means a total percentage of 31% readmissions [44]. It is not possible to collect the exact data from Herning Municipality. The total cost is calculated as it is expected that 23% of all patients in CR treatment in Herning Municipality are re hospitalized. The average cost of rehospitalization was 100.875DKK in 2004 [17]. This is the newest number that has been collected, but the cost is higher today, but unknown. The calculation of cost in Herning Municipality is as followed.

Estimated number of readmissions to Herning Hospital:

$$31\%200 = 62readmission$$

Total cost:

$$62 \cdot 100.875DKK = 6.254.250DKK$$

Total cost spread out as a cost on all patients:

$$\frac{6.254.250DKK}{200} = 31.271,25DKK$$

Other Cost	Total Cost a year	Cost per patient
Location	(NDA)	(NDA)
Employee education	10.000DKK	50DKK
HjerteKomMidt (database)	34.346 DKK	171,75DKK
Brochure	0DKK	0DKK
Rehospitalization	6.254.250DKK	31.271,25DKK
Total	6.298.596DKK	31.493DKK

Table 5.10: Other cost control group

From these collected costs from Herning Municipality it is possible to calculate the total cost and total cost per patient after the first year of implementation. This total cost includes both CAPEX and OPEX.

Total cost for implementation and first operational year:

$$1.225.428 + 277.367 + 4683 + 6.298.596 = 7.806.074DKK$$

Total cost per patient for implementation and first operational year:

$$6127,14 + 1386,75 + 23,25 + 31.493 = 39.030DKK$$

Effectiveness

The adjusted mean QALY in the control group is 0.36 and this is the number that will be used in the cost-effectiveness analysis in this project [13].

5.6.2 Intervention group

The intervention group are following a 12-week rehabilitation program as the control group. Based on the number of 200 patients in the standard CR in Herning Municipality the calculation in this section is based on a maximum of 50 patients attending a program at the same time. This will give a maximum of 200 patients following the program on a yearly basis.

The Silver package

The composition of the Silver package is based on the knowledge of the existing CR equipment and minimized hours of health professionals. Both CAPEX and OPEX is a part of the setup which makes it comparable to the control group.

The patients using the Silver package will be tested before starting the treatment and in the end of the treatment and for this test some tools are needed. In this case the same equipment is taken into account as what is used in the standard CR in Herning Municipality. Added to this is the IT-equipment which in this case is a tablet and a license for using the rehabilitation program. The program will consist of a virtual trainer, dieting advises, materials focusing on the illness and other knowledge on health risk. The training equipment in this package is the minimum amount of equipment used in a training setup, it is estimated that the combination of weights, yoga mats, step benches and a training bike is suitable constitution. By this few training components it has been estimated that it is possible to perform an exercise program similar to the one that is being used in the centre-based rehabilitation program in Herning Municipality.

The composition of health professionals is an estimation based on a minimum need. First of all, the need of testing patients medical condition before and after the program is still important. Furthermore, it is important to create an individual program for each patient hence three hours of nurse and physiotherapist are provided to take care of both the testing and creation of the individual program. Moreover, one hour of providing suitable diets for the patient made by a dietician is set in the program.

Throughout the program it is possible to be checked up on by a nurse for this matter one-hour per patient is provided.

There is a need of a technician to set up the IT and perhaps the training equipment in the patients home. Furthermore, if there is some trouble with the technology during the program a technician is available for IT support. For this matter two hours of help from a technician is provided. Last but not least the patient is in need of some training on how to use the application and to do so one hour of instruction is provided.

The other costs in the intervention group is quite similar to the control group because most of the expenses is mandatory for the municipality. The only cost that changes is the rehospitalization as this number is based on the study in Belgium [13] which will be further described in the section of the table, Table 5.20.

Economics

The nurse hours are calculated as one, even though some hours are used for testing the patient before and after the cardiac tele rehabilitation and other hours will be spend during the 12-week training period. Three hours have been included on testing the patient and creating the best fitted solution for the individual patient.

Total hours of working nurse per patient:

$$1hour + 3hours = 4hours$$

Total hours of working nurses per 200 patients:

$$4hours + 200patients = 800hours$$

Total cost per year for 200 patients:

$$800hours \cdot 308DKK = 246.400DKK$$

Cost per patient:

$$4hours \cdot 308DKK = 1232DKK$$

The physiotherapist is in the same setup as the nurse and the calculations are as followed.

Total hours of physiotherapist per patient:

$$1hour + 3hours = 4hours$$

Total hours of working nurses per 200 patients:

$$4hours + 200patients = 800hours$$

Total cost per year for 200 patients:

$$800hours \cdot 231,50DKK = 185.000DKK$$

Cost per patient:

$$4hours \cdot 231,50DKK = 926DKK$$

The dietician is included to personalize a diet for the patient, the hours is mostly in the start of the program but it will be possible to reevaluate the diet during the rehabilitation period.

Total hours of working dietician per 200 patients:

$$1hours \cdot 200patients = 200hours$$

Total cost per year:

$$200hours \cdot 225DKK = 45.000DKK$$

Cost per patient:

$$\frac{45.000DKK}{200patients} = 225DKK$$

The technician is working two hours per patient and is provided with a wage of 200DKK.

Total cost per year:

$$400hours \cdot 200DKK = 40.000DKK$$

Cost per patient:

$$\frac{40.000DKK}{200patients} = 400DKK$$

Table 5.12 shows the estimated cost of professions when implementing the Silver package and the operation cost for the first year.

Profession	Average hourly Cost	Total cost a year	Cost per patient
Nurse	308 DKK	246.400DKK	1232DKK
Physiotherapist	231,50DKK	185.200DKK	926DKK
Dietician	225DKK	45.000 DKK	225DKK
Technician	200DKK	80.000DKK	400DKK
Total		556.600DKK	2.783DKK

Table 5.12: Profession Intervention group cost

In Table 5.14 the materials and medical equipment expenses is shown for implementing rehabilitation in a patients home and test facility in the municipality. The units vary depending on whether it should be in every patients home or only used in the test of the patient. The prices on the training materials is the same provider as Herning Municipality used when they implemented their rehabilitation unit in 2017.

Materials implementation	Unit	Cost per unit	Total Cost	Cost per patient
Training weights	4 · 50	200DKK	40.000DKK	200DKK
Test bike	1	76.750DKK	76.750DKK	384DKK
Training bike	50	9850KK	492.500DKK	2462,50DKK
Yoga mat	50	99DKK	4950DKK	24,75DKK
Step bench	50	399DKK	19.950DKK	99,75DKK
Tablets	50	2790DKK	139.500DKK	697,50DKK
Total	401		773.650DKK	3868,50DKK

Table 5.14: Materials intervention group cost

Medical equipment	Unit	Total Cost	Cost per patient
Sphygmomanometer	1	1599DKK	8DKK
Pulse Oximeter	1	599DKK	3DKK
Cuff	2	498DKK	2,5DKK
Ventilation mask	1	1637DKK	8DKK
Total	5	4333DKK	21,50DKK

Table 5.16: Medical equipment Intervention group cost

The IT license is based on an expert estimation of the monthly price for such ICT solution [27]. The unit of the IT license is three because it will be provided for three months. The expenses related to IT is shown in table 5.18.

IT	Unit/ hourly cost	Total Cost	Cost per patient
IT license	3	27.000DKK	135DKK
IT training	200DKK	40.000DKK	200DKK
Total		67.000DKK	335DKK

Table 5.18: IT equipment Intervention group cost

The costs of rehospitalization are based on the same numbers as used for the control group [17, 44]. The percentages of rehospitalization are quite hard to estimate and therefore the results from the study in Belgium is included in this calculation. The percentage of rehospitalization in the intervention group in Belgium was 17% [13].

Estimated number of readmissions in Herning Hospital:

$$17\%200 = 34readmission$$

Total cost:

$$34 \cdot 100.875DKK = 3.429.750DKK$$

Total cost spread out as a cost on all patients:

$$\frac{3.429.750DKK}{200} = 17.3505DKK$$

Other Cost	Total Cost	Cost per patient
Location	0	0
Employee education	10.000DKK	50DKK
HjerteKomMidt (database)	34.346 DKK	171,75DKK
Brochure	0DKK	0DKK
Rehospitalization	3.429.750	17.148,75DKK
Total	3.474.096DKK	17.370,50DKK

Table 5.20: Other cost Intervention group

From these self-estimated and collected costs from Herning Municipality it is possible to calculate the total cost and total cost per patient after the first year of implementing the Silver package in Herning Municipality. This total cost includes both CAPEX and OPEX cost.

Total cost for implementation and first operational year:

$$556.600 + 773.650 + 4333 + 67.000 + 3.474.096 = 4.875.676DKK$$

Total cost per patient for implementation and first operational year:

$$2.783 + 3868,50 + 21,50 + 335 + 17.370,50 = 24.378,50DKK$$

Effectiveness

The adjusted mean QALY in the intervention group is 0.39 and this is the number that will be used in the cost-effectiveness analysis in this project [13].

5.6.3 Results

The cost and effectiveness obtained in the previous sections is used to calculate the ICER which will elaborate on whether the solution is cheaper or more expensive due to effectiveness compared to the center-based rehabilitation program.

$$ICER = \frac{Cost\ I - Cost\ C(DKK)}{Effectiveness\ I - Effectiveness\ C(QALY)}$$

$$\frac{24.378,50 - 39.030(DKK)}{0.39 - 0.36(QALYs)} = -488.383,33(DKK/QALY)$$

This incremental cost-effectiveness ratio indicates that 488.383,33DKK would be saved per gained QALY when exchanging standard CR with telemedicine.

A scatterplot can be used to visualize the cost effectiveness. Figure 5.1 is the scatterplot from the study in Belgium [13]. The results in this analysis will be placed in the fourth quadrant as well as the results from Belgium. The scatter plots tell that QALY is increased and the cost is declining when introducing an ICT solution in CR.

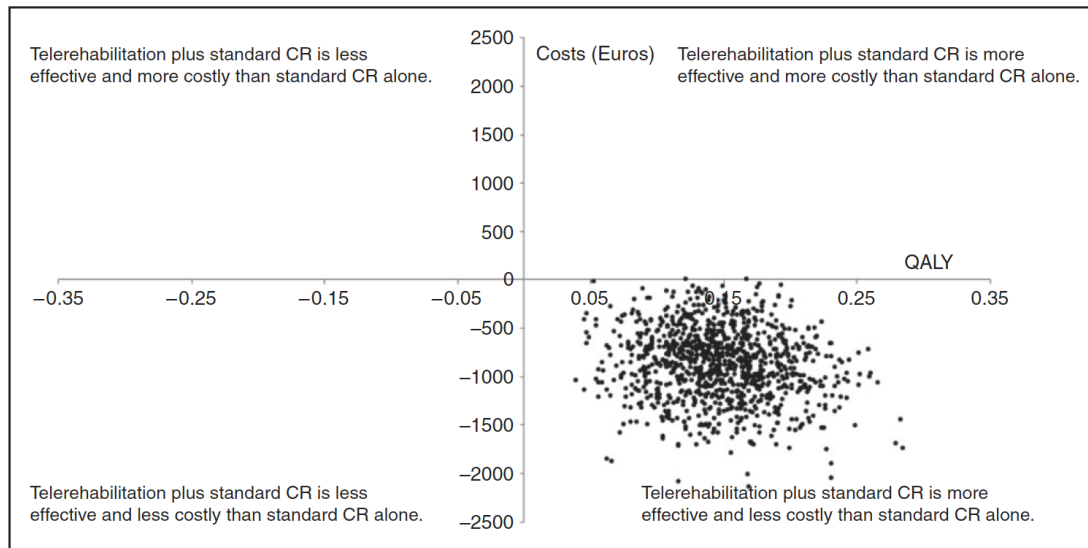


Figure 5.1: Scatterplot from comparable study [13]

6 | Discussion

Throughout this chapter the findings in this project will be discussed and argued. The chapter contains thoughts on the selection on methodology and a critical view of the data collected. Furthermore, a discussion of the barriers in implementing telemedicine in Denmark are included.

6.1 Choice of methodology

When conducting empiricism based on qualitative data from semi-structured interviews and focus groups it is important to be aware of the data reliability. There are three types of bias related to this. These are as follows: Interviewer bias, response bias and participation bias. Through the conducted interviews in this project it is believed that no interviewer- or response bias has occurred. The participation bias in the other hand might be seen in the use of semi-structured interviews in this project. This type of bias is related to whom is participating in the interviews. Some of the patients who participated in the open group discussion did not take part in the debate. Therefore, the interview did not give a personal perspective from all patients in the group. This might create a wrongfully picture of the group as a whole picture. Furthermore, cultural differences might create a bridge between the interviewer and the participants. As a part of collecting data from a patient perspective a micro ethnography was conducted, this field study was intended to create a relation between the researchers and the participants before the interview. This were done in order to minimize bias. This *participant-as-observer* role in the micro ethnographic methodology might help to equalize cultural differences and prejudices [8].

It can be argued that the qualitative data collected in this project is a bit sparsely, it would benefit the investigation to collect further data on health professionals and patients. If more data were to be collected, it might elaborate on other opinions on the matter of telemedicine in cardiac rehabilitation. A greater amount of data would potentially give improved validity of the data.

To evaluate an implementation of a new technology in Herning, Denmark, the CEA methods were used. CEA is a validated and acknowledged method of evaluating cost and effect as one unit. Though CEA and ICER are well approved, it is possible to use other methods such as Cost-Benefit-, Cost-Utility- and Cost-Consequence analysis. The choice of method was based on accessible data. Other methods might have a better fit to appraise this sort of implementation, but it was not possible to collect effectiveness data in another index than QALY, hence Herning Municipality does not collect any data based on effect. The best choice of data is to use similar studies.

The literature research in this project could have been more thorough and could possible been made as a literature review. A complete literature review focusing on the topic within the use of telemedicine and ICT is a great deal of work and out of scope for the time that was available for this project.

6.2 A critical perspective on the empirical data

The empirical data that has been collected in this study has been obtained mostly by interviews with both healthcare professionals and patients who are involved in the center-based rehabilitation program in Herning Municipality.

Firstly, looking at the interview with Hanne Voldgaard Nielsen and Eva Klose Jensen, they both represent the center-based rehabilitation program in Herning Municipality and has been a part of this project since the very start. As they are both advocates for the center-based solution the outcome of the interview is clearly affected by their positive opinion. In the interview they pointed out that in one year only five patients did not participate in the rehabilitation program in Herning Municipality. This state is contradictory to the statement which was mentioned in the interview with Vibeke Lynggard. Vibeke Lynggard mentioned that 50% did not participated in the rehabilitation program. It is important to keep in mind that the trial Vibeke Lynggard refers to has been conducted in Regional Hospital West Jutland and therefore more Municipalities are included in this trial. The reason that more patients participate in the rehabilitation program in Herning Municipality compared to an overall attendance number in Regional Hospital West Jutland could be that the patients in Herning Municipality live closer to the rehabilitation center in Herning. This differs from other Municipality where more patients' lives in rural areas and therefore geographical aspects could be the reason for not participating. This was mentioned in the interview with Hanne Voldgaard Nielsen and Eva Klose Jensen, see Section 4.2.

In the interview held with cardiac patients in Herning Municipality the interview took place at the rehabilitation center. Therefore, the patient perspective in this project only includes patients who have agreed to participate in rehabilitation and patients who do not participate in rehabilitation is not included. This does not give the project the full perspective from a patient point of view. The patients who participated in the interview were all very happy and had a positive perspective on the center-based rehabilitation program. Furthermore, most of the patients who participated were elderly retired patients and is therefore a limited group of all cardiac patients who have been offered the rehabilitation program.

6.3 The digitally native

The new generations are digital born so to say. Younger generations have grown up with internet and endless possibilities for digital areas. They experience an expectation to be constantly online and consider a digital presence as important as analogue. Technological devices, such as smartphones and tablets, are constantly within reach. The physical company is not as important, as the technological devices make it possible to be connected and be in contact at all time. Furthermore, the digital generation has grown up in a technological world where smartphones, tablets and laptops can be and are being used for almost everything [45].

The patients interviewed in this project was not born with a smartphone in hand and did not grow up in a digital world. Therefore, this technology take over is something they

have to get used to and must learn to live with. The use of smartphones, tablets and laptops is not an integrated part of their normal lifestyle and everyday life and therefore it is an upheaval that has to be taken into account when implementing a new IT system. The next generations will possibly be more change ready, more accommodating to new technology and most importantly, they are used to live a life where technology is an important and essential part in everyday life. With that said, introducing telemedicine in cardiac rehabilitation may possibly be easier with time, due to a more and more digital and technological influenced world.

6.4 A rehabilitation solution with respect to the patients needs

Cardiac rehabilitation has proven beneficial effects on morbidity and mortality and is highly recommended by international guidelines within the European Society of Cardiology [46]. These guidelines contain evidence exists for selected items to be offered in cardiac rehabilitation and therefore it can be a difficult task to replace the centre-based rehabilitation program which is used internationally today. Unfortunately, CR is underutilised due to patient related factors such as traveling distance, personal aspects and/or work schedule. As reported in a randomized controlled trial in Regional Hospital West Jutland [25], only 50% of the patients who are being offered to follow a rehabilitation program accepts the offer. Furthermore, it is seen that improvements on lifestyle behaviour, such as physical condition and nutrition, are often not maintained over time [47]. This statement was also concluded in the patient interview, Section 4.4, where a nurse mentioned that three years after participating in the rehabilitation program most patients are back to the same state of health as they were before participating in the rehabilitation program. With these aspects in mind, telemedicine rehabilitation can possibly be a beneficial solution to be offered as part of the centre-based rehabilitation program. To accommodate the patients' needs a telemedicine solution would be beneficial after the 12-weeks of centre-based rehabilitation. By this solution patients could possibly continue on both exercises and nutrition programs made by physiotherapist and dietitian. This solution could possibly be implemented as an application that can be downloaded to both smartphones and tablets. The application could consist of exercise programs with different levels to accommodate patients with different physical shape. Also, nutrition programs made with regard to cardiac patients could be included. Furthermore, information and knowledge within heart disease, risk factors, medicine, etc. could be a part of the application. This solution would not be used to reduce exact costs on the rehabilitation program that is being used today. It could possibly help patients to stay in good physical shape after the rehabilitation program and hereby it may result in a cost reduction for the municipality.

6.5 Implementation

The literature research and interviews in this project provided a general knowledge of barriers and challenges when implementing ICT in the Danish Healthcare System and how other societies have experienced their implementation issues.

Studies implies contradictory opinion on whether implementation of ICT in healthcare is beneficial toward the patient [24, 29, 30]. The patients who were interviewed in this project implied that they could not imagine to exchange the social network at the center-based CR with a ICT solution as vCare. Whereas the study conducted on COPD patients in Denmark showed a general positive experience in the use of telemedicine. In general, implementation of telemedicine with COPD has been successful in the last couple of years [48]. Studies from other countries proves that the quality of life improves when patients self-managing rate increases [24]. When patients are given the opportunity to take responsibility of improvement in to their own hands it may motivate them more than following a planned schedule. Overall barriers for the patients includes lack of technical skills, adaptability, safety, self-reliance and lack of social interference. These barriers should all be considered before implementing telemedicine. Cardiac patients are a fragile patient group who is not only in the need of training but also a change in their lifestyle. The challenges for the state facility implementing tele-health in the other hand is mostly to prove that it would be both beneficial in the view of cost and effect. Furthermore to reinsure that patients are given the best treatment and to follow the given legislation.

Legislation

Due to the new EU Legislation *The General Data Protection Regulation* (GDPR), which will take effect on the 25 of May 2018, protection of personal data is at high relevance at the moment. A new regulation was necessary to take into account and the changes was mostly triggered by an increased use of internet in healthcare and new technologies such as telemedicine [49]. Telemedicine generates huge amounts of data, including both health data but also location- and movement data is identified. GDPR will provide a secure use of telemedicine services both with respect to collection, processing and storage of personal data. New provisions around anonymisation of personal data and the right to be forgotten are intended to drive trust and hopefully break down some barriers, due til secure data management, in the implementation process of telemedicine. Furthermore, the regulation will provide a more harmonized regulatory framework for all telemedicine service providers.

6.6 Cost-effectiveness analysis

The CEA and ICER is a general used and acknowledged model in evaluation healthcare interventions. In this project the model can be flawed due to uncertainty in the use of data. Following will elaborate on the concerns of the analysis conducted in this project.

The price on the re hospitalization and amount of readmission used in this project is quite uncertain hence the price is from 2004 and the unit of readmissions is from another study conducted in Belgium [13, 17]. This constitutes that the result of the cost part of the analysis might be slightly different from the real-world numbers. The cost of a readmission definitely increased since 2004, but there is no data accessible to the public. The index of re hospitalization may be different or about the same, but this is not provable unless a trial is carried out.

If re hospitalization is taken out of the equation it is seen that the ICT solution is still somewhat less expensive than the standard CR treatment. The total cost of the CR excluding re hospitalization is 1.551.824DKK and for the use of the Silver package in the intervention group it is 1.445.929DKK which is a margin of -105.895DKK. The difference of the two groups is mostly seen in the allocation of human resources. The hourly wage of an health professional is expensive, and it is proven that digital interaction can replace the human contact. Even though the numbers of readmissions is not included in the equation it is still uncertain how much the total price of implementation an ICT solution such as vCare would be. The solution has not been introduced to the market yet which means that the numerous cost included in the analysis is based on estimations.

In Table 6.1 the cost of both the control group and intervention group is included.

Description of resources	Control group		Intervention group	
	Total cost	Cost per Patient	Total cost	Cost per patient
Professions				
Nurse	620.928	3104,64	246.400	1232
Physiotherapist	600.00	3000	185.200	926
Dietician	4500	22,5	45.000	225
Technician	0	0	80.000	400
Materials				
Training equipment	29.711	149	141.650	708,25
Training bikes	118.200	591	492.500	2462,50
Test bike	76.750	382,75	76.750	382,75
Office supplies	35.545	173	0	0
Other material	18.161	91	0	0
Tablets	0	0	139.500	697,50
Medical equipment				
Model of heart	350	1,75		
Sphygmomanometer	15599	8	15599	8
Pulse Oximeter	599	3	599	3
Cuff	498	2,5	498	2,5
Ventilation mask	1637	8	1637	8
IT				
IT license	0	0	27.000	135
IT training	0	0	40.000	200
Other Cost				
Location	NDA	NDA	0	0
Employee education	10.000	50	10.000	50
HjerteKomMidt	34.346	171,75	34.346	171,75
Brochure	0	0	0	0
Rehospitalization	6.254.250	31.271,25	3.429.096	17.148,75
Total	7.806.074	39.030	4.875.676	24.378,50

Table 6.1: Overview of cost in DKK

The cost of location in the center-based CR was not included in the analysis due to an NDA with Herning Municipality on this matter. The exclusion of this cost is definitely a lack in the cost analysis as this type of operational cost is one of those that matter

when comparing the two solutions. The intervention group will be doing the rehabilitation in the home and there will not be any cost related to location whereas the center-based CR are in the need of a location to perform the rehabilitation program. This indicates that the margin between the two groups are even greater than illustrated in this project. Though some unknown costs to implement vCare in the municipality might appear as well to equalize the margin.

The calculation of QALY is the most uncertain factor in the analysis. It was not possible to obtain any measure of effect in Herning Municipality and as the project does not include a trial on the intervention group, a QALY for this is not possible to collect. This is why the data from the study in Belgium was selected [13]. Using data from another study is not a fertile soil to base a conclusion on. Instead the results of this analysis is used as an assumption of an outcome by introducing the solution in Herning Municipality.

From the obtained cost-effectiveness analysis, it is possible to indicate that an implementation of an ICT solution as vCare can reduce the amount of readmissions in the Danish Healthcare System based on the similar study from Belgium [13].

The choice of package for comparison

The difference between the three packages; Bronze, Silver and Gold is not significant. The total cost of the Bronze package is 4.413.679DKK, the Silver package is 4.875.679DKK and the Gold package is 4.927.979DKK. These numbers shows that the Bronze package is the cheapest solution. That the Bronze package is the cheapest solution is due to the training sessions, which will take place in a fitness center and therefore investment in training equipment will not be necessary. This can both be a positive setup and a negative setup. Some patients might enjoy going to a fitness center where it is possible to meet up with acquaintances to execute the training session together. Others might prefer to do their exercises at home without anyone watching. The Bronze package is with no doubt the cheapest and the most stripped-down ICT solution. The Silver package is used as the model for comparison in this project because of the similarity towards the standard CR treatment. The solution is quite simple and do not include the possibility to monitor the patient. The Gold package in the other hand makes it possible to monitor the patient's blood pressure, weight and pulse. The measurement might be able to indicate if the patient are to have a relapse or whether the patient is following the rehabilitation plan or not. When monitoring the patient, it might be possible to predict a difference in the patient's state of health and then prevent a readmission. Furthermore, studies shows that the self-monitoring and self-management makes a successful outcome. It has to be taken into account that the equipment and the use of it has to be accurate to assure quality of the data [24, 50]. This might indicate that the Gold package will contribute to the most value if it is possible to foresee readmissions and qualm the patient.

After developing the three types of packages and it has been identified that patients might be in need of different solutions, it could possibly be effective to give the patient the opportunity to choose the type of package that fits and match their personal and medical preferences as best as possible. This, of course, should be in collaboration with healthcare professionals. For more detailed view of the Bronze and Gold packages, please see Appendix G.

7 | Perspectivation

The use of ICT and telemedicine is by no means a new phenomenon. However, a successful implementation of the solution remains difficult and it can be a challenging task to complete. Telemedicine is a newer area of healthcare and due to stringent legislation within development and implementation, it is important that the procedure is being performed correctly and within the proper legislation. Multiple trials have been carried out to prove the effectiveness and advantage of the use of telemedicine. At the moment a trial in the Netherlands is investigating the use of ICT in rehabilitation of cardiac patients.

7.1 Ongoing project in the Netherlands

A project in the Netherlands is looking into the impact of ICT solution for a group of cardiac patients. The patient group has been diagnosed with coronary artery disease (CAD). The result of the trial is not yet submitted as the trial is ongoing. The study is looking into 300 patients whereas 150 are restricted as a control group. The control group will receive normal CR treatment and the intervention group will receive home-based telemedicine rehabilitation [47].

The control group will be doing the same centre-based rehabilitation program as the one that is being performed in Herning Municipality. The telemedicine CR program will consist of the following treatment modules: exercise training, information about the disease, a relaxation program, smoking cessation, psycho education prevention and individual treatment by a physiologist or dietician. The core component of the solution is a patient-centered web application which can be installed on the patients' personal computer. The platform enables patients to register and adjust both rehabilitation goals and training goals, upload data such as exercise training data and physical activity data and perform video consultations with physical therapist and caregivers. Furthermore, patients will receive a heart rate monitor and an accelerometer [47].

The Netherlands uses the same standards and European guidelines for cardiac patients as what is being used in Denmark, and therefore it could be an interesting study to follow up on. The result of this study could have a great impact on this project and the outcome of the trial might enlighten the use of telemedicine with cardiac patients.

7.2 Future work

FUT is an ongoing national tendering in Denmark. FUT stands for *Fælles Udbud om Telemedicin* and is the organization that is responsible for implementing the joint offer of telemedicine solutions on behalf of all 98 municipalities and five regions in Denmark. This public tendering might influence the possibilities of introducing and implementing a telemedicine product like vCare on the Danish market in the future. FUT was a part of the economy agreement in 2018 between the state, municipalities and regions. It is the

first time in the history that all 98 municipalities and five regions collaborate on a national solution on telemedicine.

FUT contains of two tendering. One tender of a common telemedicine infrastructure and one comprehensive tender for telemedicine solutions with respect to employees and citizen respectively. The common infrastructure consists of a number of common building blocks so that all telemedicine solutions can utilize across sectors of health professionals between regions, municipalities and GP's. This infrastructure is made to secure that the different types of solutions are compliant, and that the data is secure. The new infrastructure will not collide with already existing solutions if the supplier integrates the solution as a part of the infrastructure. This also indicates that future telemedicine solutions are in the need to be able to integrate on the joint platform in Denmark.

The second tendering which includes the telemedicine solution itself might be won by nine different suppliers to prevent monopoly. After the tendering period it would then be up to the different municipalities and regions to select the solution they want within the nine different suppliers in the framework agreement.

The tendering is divided in two parts to ensure dynamic and competition. The joint solution on telemedicine is developed to include COPD patients at first but the aim is to include other illnesses over time. Therefore, it is important as an ICT provider for the Danish Healthcare System to be aware of the motion in the area of FUT [48, 51]. The outcome of the tendering is expected to be settled in the fall 2018.

With this in mind it will be recommended to withhold implementing of vCare in Denmark until the effect of telemedicine rehabilitation of cardiac patients have been proven. Moreover, it would be preferable to wait for the outcome of the public tendering of FUT to determine the correct setup of a telemedicine solution in Denmark. The new standard might influence the general employment of telemedicine in Denmark and therefore some elements in implementing a telemedicine solution is still uncertain.

8 | Conclusion

The aim of this project was to elaborate on how an ICT solution for cardiac patients can effect both the Danish Healthcare System as well as cardiac patients. Furthermore, the purpose was to investigate what challenges and barriers such solution encounter when deployed in Denmark and other countries.

To investigate this area, multiple methodologies have been applied. Primarily interviews have been carried out to investigate the opinion of both healthcare professionals and cardiac patient, who would be effected by the implementation of the ICT solution.

From the literature research and the conducted interviews, relevant findings regarding this area has been shown. Cardiac patients and healthcare professionals who were interviewed in this project are doubtful that an ICT solution is able to replace the centre-based rehabilitation but they are convinced that a combination of both telemedicine and standard CR could improve quality of life. Both healthcare professionals and cardiac patients implies that an ICT solution at home could motivate the patients to keep up the healthy lifestyle and exercise training after the 12-week rehabilitation program at the centre. On the other hand, studies shows that a complete transition from standard cardiac rehabilitation to telemedicine solution will improve the quality of adjusted life years and the patients self-management.

To analyse the financial and effectiveness impact of implementing an ICT solution as vCare in Herning Municipality the Cost-Effectiveness Analysis was chosen. To examine this the Incremental Cost-Effectiveness Ratio was calculated. To do so, a control group and intervention group is needed to compare the existing method with the intervention technology. The control group was the centre-based CR treatment in Herning Municipality. For the intervention group three different technology setup was obtained and the Silver package was chosen as the comparable setup with the control group.

The analysis indicated that 488.383,33DKK would be saved per gained QALY when exchanging standard CR with telemedicine. Basically this suggest that QALY is increased and the cost is declining when introducing an ICT solution in cardiac rehabilitation. The data for the analysis was conducted in collaboration with Herning Municipality, comparable studies and interviews with healthcare professionals.

Re hospitalization was included in the Cost-Effectiveness Analysis as several cardiac patients is readmitted after being discharged. A study conducted in Belgium investigated this matter and showed that the readmission rate decreased from 0.37 to 0.17. In Herning Municipality the readmission rate is approximately 31% for standard cardiac rehabilitation and it is estimated to decrease to 17% with the implementation of telemedicine. By this analysis it is seen that ICT might help to prevent readmission of cardiac patients.

When implementing telemedicine solutions in Denmark it is important to consider the structure of the Danish Healthcare System. The municipalities in Denmark are in charge of the rehabilitation of patients and they are the ones to choose the acknowledged method of rehabilitation. The municipalities are to follow the European and Danish legislation which include the regulation on public tendering.

The research throughout this project indicates that an ICT solution for cardiac patients would have a positive effect on the Healthcare System through lower cost and reduced readmissions. The danish cardiac patients are sceptical, but studies shows that patients will gain quality of life when replacing standard rehabilitation with telemedicine rehabilitation.

References

- [1] Health Care in Denmark - an overview. Healthcare Denmark and Ministry of Health. 2017
.
- [2] Martin Strandberg-Larsen, Mikkel Bernt Nielsen, Signild Vallgård, Allan Krasnik, Karsten Vrangbæk, Elias Mossialos, World Health Organization, et al. Health systems in transition: Denmark: health system review. 2007. : .
- [3] Virtual Coaching Activities for Rehabilitation in Elderly (vCare). Technical annex
.
- [4] Jannie Christensen. The Emergence and Unfolding of Telemonitoring Practices in Different Healthcare Organizations. *International Journal of Environmental Research and Public Health*. 2018. 15 (1): p. 61.
- [5] Sundhedsstyrelsen. Vejledning om hjerterehabilitering på sygehuse. Center for Forebyggelse og Enhed for Planlægning. 2004. : .
- [6] Hjerte Foreningen. Fakta om hjerte-kar-sygdom i Danmark. [Last checked: 28/02/2018]. 2018. URL: <https://hjertereforeningen.dk/alt-om-dit-hjerte/noegletal/>.
- [7] Videnscentret. [Last checked: 03/03/2018]. URL: <http://videncentret.dk/forskerservice/vaerktoej/>.
- [8] Saunders Mark, Lewis Philip, Thornhill Adrian. Research methods for business students. 2009.
- [9] Alan Bryman, Emma Bell. Business research methods. Oxford University Press, USA, 2015
.
- [10] Raymond L Gold. Roles in sociological field observations. *Social forces*. 1958. : pp. 217–223.
- [11] John Lofland, Lyn H Lofland. Analyzing social settings: A guide to qualitative research and analysis. Belmont, CA: Wadsworth. 1995. : .
- [12] Heejung Bang, Hongwei Zhao. Median-based incremental cost-effectiveness ratio (ICER). *Journal of statistical theory and practice*. 2012. 6 (3): pp. 428–442.
- [13] Ines Frederix, Dominique Hansen, Karin Coninx, Pieter Vandervoort, Dominique Vandijck, Niel Hens, Emeline Van Craenenbroeck, Niels Van Driessche, Paul Dendale. Effect of comprehensive cardiac telerehabilitation on one-year cardiovascular rehospitalization rate, medical costs and quality of life: A cost-effectiveness analysis. *European journal of preventive cardiology*. 2016. 23 (7): pp. 674–682.
- [14] Claire Hulme. Using cost effectiveness analysis; a Beginners guide. *Evidence Based Library and Information Practice*. 2006. 1 (4): pp. 17–29.
- [15] Sarah J Whitehead, Shehzad Ali. Health outcomes in economic evaluation: the QALY and utilities. *British medical bulletin*. 2010. 96 (1): pp. 5–21.
- [16] Bjarne Rose Hjortbak et al. Sundhedsvæsenet på tværs - opgaver, organisation og regulering. 2nd ed. munksgaard, 2013

- .
- [17] Susanne Reindahl Rasmussen, Dansk Sundhedsinstitut. Hjerterehabilitering i Danmark. 2011. : .
 - [18] The local government reform. The Ministry of the Interior and Health. 2005
 - .
 - [19] Health Care in Denmark. Ministry of Health and Prevention. 2008
 - .
 - [20] Sundheds og ældre ministeriet. Ministeriet historie. [Last checked: 21/03/2018]. 2016. URL: <http://www.sum.dk/Om-ministeriet/Ministeriets-historie.aspx>.
 - [21] National klinisk retningslinje for hjerterehabilitering. 1.1. Sundhedsstyrrelsen. 2015
 - .
 - [22] World report on disability. World Health Organization. 2011
 - .
 - [23] Anbefalinger for tværsektorielle forløb for mennesker med hjertesygdom. 1st ed. Danish Health Authority. 2018
 - .
 - [24] Edward T Chen. Considerations of Telemedicine in the Delivery of Modern Healthcare. American Journal of Management. 2017. 17 (3): pp. 20–28.
 - [25] Vibeke Lynggaard. LC-REHAB: Effect of the patient education. Learning and Coping Strategies in cardiac REHABilitation - a randomised controlled trial. MA thesis. Aarhus University, 2018.
 - [26] Mads Venø Jessen. Note: Expenses HjerterKomMidt database. 2018.
 - [27] Sofoklis Kyriazakos. Lector at Aarhus university.
 - [28] Anael Barberan-Garcia, Ioannis Vogiatzis, HS Solberg, Jordi Vilaró, DA Rodriguez, HM Garåsen, Thierry Troosters, Judith Garcia-Aymerich, Josep Roca. Effects and barriers to deployment of telehealth wellness programs for chronic patients across 3 European countries. Respiratory medicine. 2014. 108 (4): pp. 628–637.
 - [29] Birgitta Lindberg, Carina Nilsson, Daniel Zotterman, Siv Söderberg, Lisa Skär. Using Information and Communication Technology in Home Care for Communication between Patients, Family Members, and Healthcare Professionals: A Systematic Review. International Journal of Telemedicine and Applications. 2013. : .
 - [30] Maria Lluch, Fabienne Abadie. Exploring the role of ICT in the provision of integrated care—Evidence from eight countries. ScienceDirect. 2013. : .
 - [31] Monica Graves, Shelley Doucet, Anik Dube, Michel Johnson. Health professionals’ and patients’ perceived barriers and facilitators to collaborating when communicating through the use of information and communication technologies. ScienceDirect. 2017. : .
 - [32] [Last checked: 05/05/2018]. URL: <http://sundhed.herning.dk/lev-aktivt-med-sygdom/hjerte>.
 - [33] Alexander M. Clark, Kathryn M. King-Shier, David R. Thompson, Melisa A. Spaling, Amanda S. Duncan, James A. Stone, Susan B. Jaglal, Jan E. Angus. A qualitative systematic review of influences on attendance at cardiac rehabilitation programs. American Heart Journal. 2012. : .

- [34] Jacqueline M. Bailey, Paula M. Wye, John H. Wiggers, Kate M. Bartlem, Jennifer A. Bowman. Family carers: A role in addressing chronic disease risk behaviours for people with a mental illness? Preventive Medicine Reports. 2017. : .
- [35] Louise M. LaFramboise, Jenna Woster, Amy Yager, Bernice C. Yates. A Technological Life Buoy Patient Perceptions of the Health Buddy. Journal of Cardiovascular Nursing. 2009. : .
- [36] Ann Wolff Bregendahl, Sussie Laustsen. Pårørendes oplevelse af hjertepatientens telemedicinske rehabiliteringsforløb - Relatives' Experiences of Patients' Telemonitored Cardiac Rehabilitation. Klinisk Sygepleje. 2016. 43 (02): pp. 129–142.
- [37] G. Pare, M. Jaana, C. Sicotte. Systematic Review of Home Telemonitoring for Chronic Diseases: The Evidence Base. Journal of the American Medical Informatics Association. 2007. 14 (3): pp. 269–277.
- [38] [Last checked: 22/03/2018]. URL: http://www.sum.dk/Aktuelt/Nyheder/Digitalisering/2012/August/~media/Filer\%20-\%20Publikationer_i_pdf/2012/Telemedicin/Telemedicinsk-handlingsplan.ashx.
- [39] [Last checked: 22/03/2018]. URL: <http://www.rn.dk/sundhed/til-sundhedsfaglige-og-samarbejdspartnere/telecare-nord/national-udbredelse>.
- [40] Udbudsportalen. Kend reglerne for udbud. [Last checked: 15/05/2018]. URL: <http://tilbud.udbudsportalen.dk/artikler/kend-reglerne-for-udbud/>.
- [41] David A. Fleming, Karen E. Edison, Hon Pak. Telehealth Ethics. Telemedicine and e-Health. 2009. 15 (8): pp. 797–803.
- [42] Enhed for Planlægning. Patienter skal sikres den bedst mulige behandling. Sundhedsstyrelsen. 2007. : .
- [43] Alba DiCenso, Nicky Cullum, Donna Ciliska. Implementing evidence-based nursing: some misconceptions. Implementation forum. 1998. : .
- [44] Hjertetal.dk. [Last checked: 06/04/2018]. 2015. URL: <https://hjertereforeningen.dk/alt-om-dit-hjerte/hjertetal/hjertetaldk/>.
- [45] Undervisnings ministeriet. Generation Z og de digitalt indøedte. [Last checked: 06/06/2018]. URL: <https://www.emu.dk/modul/generation-z-og-de-digitalt-indf{\oe}dte>.
- [46] European Society of Cardiology. Cardiac Rehabilitation and exercise training recommendations. [Last checked: 01/05/2018]. 2017. URL: <https://www.escardio.org/Education/ESC-Prevention-of-CVD-Programme/Rehabilitation>.
- [47] Rutger WM Brouwers, Jos J Kraal, Simone CJ Traa, Ruud F Spee, Laurence MLC Oostveen, Hareld MC Kemps. Effects of cardiac telerehabilitation in patients with coronary artery disease using a personalised patient-centred web application: protocol for the SmartCare-CAD randomised controlled trial. BMC cardiovascular disorders. 2017. 17 (1): p. 46.
- [48] Foreningen af Kommunale it chefer. Fælles Udbud af telemedicin (FUT) får ni leverandoerer. [Last checked: 30/05/2018]. 2018. URL: <https://www.itchefer.dk/kit-magasinet/artikel/faelles-udbud-af-telemedicin-fut-faar-ni-leverandoerer>.

- [49] A guide for patients, patients' organisations. The new EU Regulation on the protection of personal data: what does it mean for patients?The new EU Regulation on the protection of personal data: what does it mean for patients? European Patients Forum. 2015. : .
- [50] Chronic Conditions - Patient, Healthcare and Community. National Board of Health. 2006
.
- [51] Digitaliserings styrelsen. FAQ om Fælles Udbud af Telemedicin (FUT). [Last checked: 30/05/2018]. 2018. URL: <https://digst.dk/media/16304/faq-om-faelles-udbud-af-telemedicin-feb-2018.pdf>.

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B | Interview questions

Interview 24/04 2018 med Vibeke Lynggaard, Herning Sygehus

- Hvad er din rolle og hvordan du er linket til telemedicinsk rehabilitering?
- Hvilke generelle processer (målinger, behandlinger, samtaler) kan rykkes hjem til hjemmet og hvilke kan ikke (begrænsninger)?
- Hvilke data er relevant at opsamle for hjertepatienter?
- Hvilke devices skal tilkobles enheden?
- Hvilke træningsplaner er relevante / materiale om eksempelvis ernæring og om sygdommen?
- Er der et specifikt device som vil være oplagt at benytte (telefon, TV)?
- Hvad er din holdning til at erstatte almindelig rehabilitering med tele rehabilitering?
- Vil det være muligt at udføre rehabilitering (træning) i hjemmet via telemedicin?
- Tror du man vil opnå samme resultat med den pågældende patient (sygehus vs. hjemmet)?
- Kunne det være en kombination eller vil de erstatte 100%?
- Vil du se tidsmæssige besparelser ved at udføre rehabilitering?
- Ser du begrænsninger / ulemper ved at indføre telemedicin i rehabilitering?

Interview 15/05 2018 med Hanne Voldgaard Nielsen og Eva Klose Jensen, Sport Center Holing, Herning

What is the cost of following elements in the cardiac rehabilitation in Herning?

- Standard CR
- Nurse
- Physiotherapist
- Dietician
- Education
- Technician
- Physical equipment
- Brochure

- Measurement equipment
- IT
- Location
- Travel reimbursement
- Rehospitalization
- Other cost related to hospital after first admission

Effectiveness

- How do you measure quality of life?
- Do you have any measurement in QUALY?

Interview 17/05 2018 med hjertepatienter, Sport Center Holing, Herning

- Kunne I forestille jer at man flytter rehabilitering hjem i hjemme?
- Kunne man eventuelt flytte noget af rehabiliteringen hjem i hjemmet? Evt. bare undervisningen?
- Ville det være angstprovokerende at åbne op for eget hjem?
- I forhold til det sociale aspekt - vil man savne at mødes to gange i ugen med resten af holdet?
- Når i er færdige med det 12 ugers forløb kunne i så forstille jer at i fortsatte med at træne selv eller ville det være nemmere hvis man havde en platform, evt. app hvor trænings programmer samt madprogrammer fra diætist er indskrevet?
- Ville i have problemer med at have en monitor påsat som måler data 24 timer i døgnet?

C | Transcription: Open discussion with cardiac patients

Interview 17/05 2018 med hjertepatienter, Sport Center Holing, Herning

- Kunne I forestille jer at man flytter rehabilitering hjem i hjemme?

Nej det kunne jeg ikke forestille mig fordi, jeg tror langt de fleste får ikke gjort det derhjemme, men at man gør noget i fællesskab fremfor at gøre det selv så er der mange som ikke går det gjort.

Enighed blandt af patienter.

Bruger man det ikke allerede nu eller er det forsøgsbasis? Har set noget om det i TV får man brugte telemedicin hos KOL patienter.

En anden ting er sikkerheden i at komme herud fordi der er en sygeplejerske og en fysioterapeut så de kan helt principielt samle en op hvis man falder af cyklen. Det vil de ikke kunne hvis man sidder derhjemme. Der vil gå flere minutter inden der kommer hjælp.

Man hører tit at nu skal vi til at gøre noget ved vores krop og køber en motion cykel hjem til. Den motionscykel får man brugt tre gange og så bliver den stillet væk igen og det er fordi man gør det alene, jeg tror det er derfor.

- Kunne man eventuelt flytte noget af rehabiliteringen hjem i hjemmet? Evt. bare undervisningen? Ville det være angstprovokerende at åbne op for eget hjem?

Nej det tror jeg ikke. Så tror jeg de forskellige ville gøre mere ud af det.

Hvordan skulle man rent praksis gøre det i hjemmet i forhold til trænings udstyr? Line: man skal sætte cykel ud til borger eller også skal træningen i hjemmet være baseret på øvelser som ikke kræver udstyr. Matilde: Det man har gjort med KOL projektet er at man får en KOL kuffert hvori man har det udstyr der skal bruges.

- I forhold til det sociale aspekt Vil man savne at mødes to gange i ugen med resten af holdet?

Ja det ville man, jeg tror det bliver det største problem. Det bliver for upersonligt, man vil komme til at savne at få en snak om alt muligt andet end lige sygdommen.

Jeg kan sammenligne det med en vandregruppen som jeg er med i hver tirsdag. Om det stormer, regner eller sner kommer vi altid afsted. Hvis jeg ikke var med i sådan en klub havde man ventet til vejret var bedre. Så tror jeg også at hvis man skal træne hjemme har man ikke lyst og udsætter det til i morgen.

Her på holdet er man mere eller mindre tvangs indlagt. Der skal være en god til at melde pas.

- Når i er færdige med det 12 ugers forløb kunne i så forstille jer at i fortsatte med at træne selv eller ville det være nemmere hvis man havde en platform, evt. app hvor trænings programmer samt madprogrammer fra diætist er indskrevet

Det ville helt klart være en opstrammer til at man fortsætter. Herning kommune har nogle trænings timer for osteoporose patienter hvor jeg har været med de sidste par år. Det er en gang om ugen i et fitnesscenter, det er rigtig godt. Regner med at skulle fortsætte der når jeg er færdig her. Det er der ikke nogen tvivl om for der har vi også et godt sammenhold. Det trækker når der er andre. Det betyder meget at det ikke bare er træning men også det sociale. Vi mødes i god tid og snakker også lidt bagefter.

Eksempel fra Canada: målinger bliver foretaget i hjemmet og sendt direkte til egen læge og sygehus som opdatere 24 timer i døgnet. Hvis man bliver forværret sender de en ambulance og kører ham på sygehuset. Mange folk bliver redet på den måde.

Tidligere blev det nævnt at nogle borgere måler blodtryk. Hvis der er nogle svingninger i de målinger ville det opdages i tide og man kan på den måde fange patienten inden de blive forværret alvorligt.

- Ville i have problemer med at have en monitor påsat som måler data 24 timer i døgnet?

Nej det ville jeg ikke have et problem med. Man ville blive positivt overvåget. Det ville give en tryghed hvis man var bange.

Jeg har for år tilbage haft en døgnmåler på. De er nok blive mindre nu end de var for 10 år siden. Det er 12-15 år siden jeg har haft det.

Jeg havde og sådan en og kan godt huske den nattesøvn jeg fik. Man sov næsten ikke. Den strammer jo op hver halve time, men det var heldigvis bare et døgn.

D | Field notes: Observation doing rehabilitation program

Observationer under træning:

- Vil gerne bibeholde 12 ugers forløb da det er her man lærer øvelserne
- Ville være optimalt at indsætte som forløb efterfølgende – gavnligt hvis man kunne tjekke op / sikre sig at borgeren har trænet ("det er selvfølgelig for min egen skyld, vi er voksne mennesker så brude bare hanke op i sig selv")
- Ses af efter 3 år er borger tilbage på samme stadie fordi de ikke følger op på træningen
- Bliver også tilbudt borgere som ikke er ramt af hjertesygdom men er i risiko for at udvikle hjertesygdom
- 8 borgere til første træning

Observationer under undervisning:

- Undervisning i risikofaktorer
- 13 deltagere til undervisning
- Afsluttende cykel test, samtale og afsluttende kontrol i hjerteklinikken (1-2) uger efter træning. Tjekker kolestol, blodtryk og andre målinger – kan tilrette medicin herefter

E | Transcription: Interview with Vibeke Lynggaard

Interview 24/04 2018 med Vibeke Lynggaard, Herning Sygehus

- Hvad er din rolle og hvordan er du linket til telemedicinsk rehabilitering?

Jeg arbejder som projekt sygeplejerske, men er lige blevet færdig med ph.d., så er lidt in between positions. Når man er på hjerteafdeling får man ekg'er som er blevet taget i ambulancen. Dem får man ind og skal se på en skærm, det er så primært den læge som tager imod i forhold til om patienten skal til en direkte ballon udvidelse eller skal ind omkring Herning sygehus først eller kører patienten til Århus. Telemedicin i det man går ind og kigger på en skærm.

- Er du linket til patienternes rehabilitering efter indlæggelse?

Ja, men det er projekter som patienter kan vælge at deltage i. Det har ikke noget med rehabilitering at gøre. Men vi kommer alligevel til at lave rehabiliterende tiltag. Mit arbejde går ud på at vi har projekter med medicinalindustrien og så har vi patienter inde som afprøver ny medicin. Så kommer de til os en gang i måneden i muligvis 5 år. I og med vi er projekt sygeplejersker så kommer man til at lave rehabiliterende tiltag i form af vejledning og pleje af en måske mulig stress tilstand.

- Hvilken rehabilitering udfører man for patienter i dag?

Det er pr. 1/1 2017 blevet lagt ud til kommunerne i stedet for regionerne, så det er ikke herinde på hospitalerne længere. Der kører dog et hold kontinuerligt med 12 patienter med de sværest syge, dem der har problemer med pumpefunktioner af hjertet og nogle hvor man ikke kunne åbne alle kransåre. Det er altså de dårligste patienter som bliver rehabiliteret på hospitalerne. Eller er det lagt ud i kommunerne og har været der det sidste 1,5 år hvor de træner patienterne i 12 uger 2 gange i ugen og bliver undervist en gang om ugen i et ønske om at lægge det ud der hvor borgeren er geografisk. Eks regions Vestjylland er meget spredt.

- Hvad gennemgår de 12 patienter, som kommer ind på sygehuset til rehabilitering?

De får lavet en maksimal symptom betinget stress test på en kondicykel hvor man beder dem cykle så meget de kan. Her øger man loads i watt. Så har man et udgangspunkt, efter de 12 uger laver man testen igen og ser om de har forbedret sig. Fysioterapeuten har et program – dette gælder på samme vis i kommunerne. De laver både cardio stress for at få pulsen op og så laver de muskel stretching. Der er nogle nationale retningslinjer for hvor

meget intensitet man skal træne med og hvor mange repetitioner man skal lave. Der er både dem som har blodpropper i hjertet, dem som har nedsat pumpefunktion, dem som har fået en ny hjerteklap og dem som har fået en pacemaker. De har meget forskellige behov og skal derfor træne forskelligt.

- Hvilke målinger bliver der lavet?

Man måler vægt, højde og taljemål, blodtryk og puls. Det er lovpligtigt at patienten skal igennem dette forløb, så det er noget man skal sætte ind efter. Kunne være muligt at sætte telemedicinsk forløb ind efter de 12 uger – de 12 uger er fase 2 rehabilitering. Patienter skal tilbydes fase 3 men rigtig mange vælger det fra fordi de skal tilbage på arbejdsmarkedet. Rigtig mange stopper med vanlig care og der er et kæmpe frafald i at fastholde sunde livstilsvaner. Her kunne det virkelig være relevant at indføre. Passe på med at tænke de ind som erstatning for de 12 ugers forløb da det er lovpligtigt og meget evidens baseret. Det er på klasse 1 rekomendaion fra de amerikanske og europiske hjerte institut, så det er ikke noget man bare erstatter. Fase 3 handler om at fortsætte og vedligeholde gode motions- og kostvaner, fastholde et rygestop. Screener også patienter for depression. De udfylder et spørgeskema som hedder HADS – hospital and society depression score. Det vel også en form man kan udfylde i hjemmet. Der ligger en algoritme bag og så kommer der en score ud. Den kan sige om man skal kontakte egen læge.

- Er der nogle af målingerne som kan tages i hjemmet i stedet for på sygehuset?

Det er svært at lave et taljemål selv, da det i forvejen er et meget usikkert mål. Det plejer derfor at skulle være en sundhedsplejerske som tager dette. Der er også meget bias hvis patienten selv skal måle taljen. Så forsvinder objektiviteten. Spørgeskema kunne derimod sagtens tages i hjemmet. Blodtryk kunne også. Ved ekg får man kun tre afledninger hvis det måles i hjemmet. Ved ekg vil man gerne se om der er tegn på iltmangel og det kan man ikke ret godt på tre afledninger, der skal man helst have 12 afledninger. Hvis der var en form for en censor eller så man husker at tage sin medicin – man skal trykke på en knap når man har taget sin medicin eller kommer der en advarsel. Der findes også scoringstest hvis man tobaks ryger hvormed man kan se hvor nikotin afhængig man er. Der kommer også en score fra algoritme som siger om det er plaster eller tyggegummi.

- Hjertesygdomme er ofte afledt af livsstil sygdomme. Er rehabilitering ligeså meget at man skal af med sine dårlige vaner?

Hjerterehabilitering består exercise, education og social, at man også forholder sig deres sociale. Der er altså trepinde og der er meget stærk evidens for at det virker. Så det ene kan ikke stå alene. En hjertepatient bliver pludselig syg og exercise er derfor vigtig, men det går meget på at få pulsen op og lære dem nogle sunde motionsvaner. Motion fylder derfor ligeså meget som uddannelse og risikofaktorer.

- Hvilke data er relevant er opsamle i hjemmet – skal der sætte devises til?

Rehabilitering går meget på at man kan tracke at de overholde deres sunde livsstil og adfærd. For en patient med hjertesvigt kunne man benytte en vægt. Hvis man via tablet kunne interagere med sundhedsfaglig ville dette være meget relevant. Herved kunne genindlæggelser undgås. Puls, blodtryk og iltmætning er ikke det som er vigtig i rehabilitering af en hjertepatient. Det er vigtigt at patienten lærer at mestre livet og komme tilbage til livet og arbejdsmarkedet. Den gennemsnitlige hjertepatient er omkring 60 år så det er ikke de ældre ældre. Depression score screeninger en gang i måneden kunne godt være en anbefaling, herved kan patienten fanges før de ryger ud i en depression. Det trækker en handling. Det er et spørgeskema som også hører ind under de nationale kliniske retningslinjer. Nogle patienter er meget deprimeret og det opdages for sent fordi de kun tilses på sygehus hver tredje måned. Hvis kufferten fortæller at spørgeskemaet ikke er udfyldt og det skal gøres i morgen, så der kommer en påmindelse. Mange af dem som har haft blodpropper i hjertet er i risiko for at udvikle en depression. Spørgeskema udfyldes 6 uger efter udskrivelse. Så det er en engangsting som både laves i kommuner og hospital afhængig af hvor de træner henne. I de 12 ugers forløb er der både fysioterapeut og sygeplejerske tilstede og så kører de et forløb som hedder læring og mestring hvor der også er en tidligere patient med som medundeviser ud fra den tanke at de selv har levet med en hjertesygdom. Så formidler man erfaringsviden sammen med professionel viden. Man skal være meget opmærksom på lovgivning hvis det skal erstatte fase 2.

- Hvad er vigtig i forhold til ernæring hos hjertepatienter?

Hjertepatienter bliver tilbudt forløb hos diætist. Det har man valgt i region Midtjylland. Ernæringsenheden ligger i Holstebro. Det er ikke alle som møder op. Der er oplæg en dag og nogle praktiske øvelse, det er ofte 2 dage man er afsted. Det ville være oplagt at ligge madplaner ind på appen. Og også systemer hvor man på en eller anden måde kan logge en kostdagbog. Sådanne nogle ting virker godt for nogle for andre kan det være en belastning. Denne type apps findes allerede og man kunne så linke til tv køkken hvor nogle kokke laver det.

- Er der nogle platforme / deviser der vil være oplagt til telemedicin?

Tablet og telefon ville være oplagt til telemedicin. Jævnfør alder, de er forholdsvis ungdommelige og ville godt kunne håndtere en tablet.

- Hvad er din holdning til at erstatte almindelig rehabilitering med telerehabilitering?

Det kunne sættes i stedet fase 3. Hvis der er evidens for det kunne man så forkorte de 12 uger hvormed de sidste 6 foretaget i hjemme ved telemedicin? Fællesskab med de andre på holdet tabes lidt, hvis der er god dynamik på holdet fungerer det rigtig godt. Der er lavet kvalitativ interview hvor det ses at det vægtige er de andre patienter, den erfarende patient. Det skal derfor afdækkes. Det skal testes op imod hinanden. Vil også give etiske udfordringer, det plejer man at holde på fire niveauer. Man må ikke give patienten noget der måske kunne være dårligere, når vi ved at dette er det bedste kan det ikke tages væk. Kunne godt følge tanken, da det for mange på arbejdsmarkedet er nemmere at tænde for

tablet og koble sig på holdet om aftenen. De fleste kommuner har både formiddags og eftermiddagshold, rigtig mange kan blive godt gjort af arbejdsgiver, så mange er ikke på fuld tid fordi det er en del af behandlingen. Så de dage de træner har de fri til det. Fase 3 kunne sagtens være en god ide. 20% gennemføre ikke fase 2 og det er kun 50% som møder op til fase 2, så allerede her er det en ret stor gruppe. De patienter som ikke møder op til fase 2 har formentlig en hel del konkurrerende sygdomme fordi der er nogle kendte barrierer. Kvinder har tendens til ikke at møde op og det er fordi når de bliver hjertesyg er de ofte lidt ældre og har ofte konkurrerende sygdomme. Derudover kan der være geografi og noget med at køre. Bare hvis man skal køre 15 min kan det være svært for nogle. I sådanne situationer kunne det være en mulighed for at tage med hjem, men vil aldrig supportere at de springer fra. Det her er det tilbud som vi ved der virker og hvis det eksempelvis er en som har KOL samtidig er man meget udfordret. Træner er altid meget individualiseret. Man ved også at lav sosu økonomisk status er en barriere til at møde op så der kunne også være noget. Helt sikkert, der er et kæmpe behov. Især hvis alternativet er at de ikke får noget. Dog hvis det er vildt dyrt har vi igen en skævhed i hvem er det som vælger det til – hvis det er en app som koster penge. Det er et kæmpe område. Kunne også være dem som er henvist men ikke dukker op, men hvem skal finde dem? Det er den sygdom med størst dødelighed og lige nu lever 300.000 mennesker med sygdommen i Danmark. Prævalensen er stigende fordi vi bliver bedre og bedre til at behandle selvom mortalitet er faldende. Egentlig også incidensen fordi man bliver bedre til at spise sundere og så videre. Den er svagt faldende eller stabiliserende, men selv prævalens (forekomsten) er stigende.

- Skal det være en kombination eller erstatte den almindelig rehabilitering?

Dem vi ikke når ville det her være et bedre tilbud end ingenting hvis telemedicin handler om at man kan koble sig på forskellige trænings sessioner, koble sig på forskellige undervisning og viden om mad. Det der er evidens for er at det andet som virker. Det er internationalt anerkendt. Kan godt se muligheder.

- Vil du kunne se tidsmæssige besparelser ved at indføre telemedicinsk rehabilitering?

Ja bestemt, da patienten ikke skal fragte sig og selvfølgelig også for sundhedspersonale. Og hvis det er ligeså godt til at forhindre genindlæggelser som man ved hjerterehabilitering er så er det også sundhedsøkonomisk.

- Hvilke begrænsninger og ulemper ser du ved at indføre telemedicin i rehabilitering?

Jeg ser ingen begrænsninger. Hvis man tænker at de her sker efter vil der ikke ses nogle begrænsninger. Hvis det ses som en erstatning er der selvfølgelig det sociale da patienter hygger sig, drikker kaffe, snakker med hinanden. Men det er aldrig vist i projekter at det er det som der som sådan har en betydning for genindlæggelser. Men som sagt hvis du spørger patienterne selv vil de sige det har en stor betydning, men det er svært at skære alle over en kam fordi nogle vil mene det er rart ikke at skulle forholde sig til andre. Måske skal man screene patienter så man finder det rette, dette kan gøres ud fra læringsstile, ud fra risiko behov.

F | Interview: Hanne Voldgaard Nielsen and Eva Klose Jensen

Interview 15/05 2018 med Hanne Voldgaard Nielsen og Eva Klose Jensen, Sport Center Holing, Herning

Risiko: nogle der bliver dårlige og akut hjertestop – risiko i af være i hjemme og kan derfor ikke få som hjælp hvis man er derhjemme.

Primært de patienter som bor længere væk fra kommunen takker nej til tilbuddet fordi der er for langt til behandlings stedet. Dette ses ikke i Herning kommunen. Yderområder er flest af dem som takker nej til kommunerne. De 10% dårligste skal blive på sygehusene for at få træning. De fleste som bor tæt på kommunen tager imod tilbuddet.

Grunde til at takke nej: Depression ikke magtede det, syg ægtefælle, dement. Stoppet undervejs – dårligt knæ.

200 om året hvor kun 5 har sagt nej. Mail sendt.

Hjerterehabilitering har fået penge af kommunen. Det som koster mest er lønninger. Sygeplejersker timer køber de fra regionen: 2*21 timer, 48 uger om året. Lidt dyrere fordi de får løntillæg. Ca. 308 kr. i timen – pga. tillæg fordi de kommer fra hjerteafdelingen. To fysioterapeuter: 26 og 28 timer om ugen, 48 uger om året (130.000 pr. kvartal i fys timer). Omkring 600.000 om året (pensionstillæg osv. Indgår). Erfarne og på højere løntrin, får derfor højere løn. Derudover diætist: fire gange om året af 3 timer + forberedelse (2 timer) ca. 20 timer om året. Altid fire hold i gang. Cirka 200 patienter om året. Rygestop vejleder: tilbyder til alle borger som har brug for det. Udfordring til hjertepatienter er at de ikke kan overskue rygestop og træning på samme tid - en ting af gangen. Kunne tage det efterfølgende og vil fortsat være betalt af kommunen. Løsningen er ikke den billigste.

1 gang om ugen med undervisning, kost, livsstil, motion, sygt og rask hjerte, psykisk, fremtid, leve med sygdom. Først afklarende samtale og test - træning - slutter af med test. Sygeplejerske har alt samtale med hjerteklinikken og følger op på medicin.

Engangsinvestering – havde ikke et sundhedscenter og skulle derfor købe det hele fra nyt. 280.413 kr. undervisning materiale, kontormiljø, sikkerhedsudstyr, roll ups, test cykel (76750), blodtryksmåler - implementeringsprisen. Sendt på mail.

Bestiller materiale gennem hjerteforeningen som de får udleveret. Patienter får en bog fra hjerteforeningen hvor mange informationer.

Ikke noget separat kommunikation system – foregår på mail, e-boks osv.

140.000 om året for leje af lokale (dette må ikke blive publiceret)

Rejseudgifter: hvis de har over 50 km eller er ude af stand til at rejse – men ingen udgifter hertil.

HjertekomMidt database – database til alle kommuner i region Midtjylland som man skal

oprettes i.

Udgifter til kurser og uddannelse – 10.000 om året. Læringsmestring konceptet, erfarings deling hvor tidligere patient deltager. Deres historier og erfaringer gør patienter i stor grad brug af.

G | Economy: Different packages

Standard Cardiac Rehabilitation

	Unit	Cost per unit	Total Cost	Cost per patient
CAPEX				
Spygonanometer	1	1599	1599	8
Pulse oximeter	1	599	599	3
Cuff	2	249	498	2,5
Ventilation mask	1	1637	1637	8
Model of heart	1	350	350	1,75
Training equipment	97	306	29711	149
Training bikes	12	9850	118200	591
Test bike	1	76750	76750	384
Office invironment	39	886	34545	173
Other material	8	2270	18161	91
Profession				
Nurse	2016	308	620928	3104,64
Dietician	20	225	4500	22,5
Physiotherapist	2592	231,5	600000	3000
Other Cost				
HjerteKomMidt	1	34346	34346	171,73
Employee education	1	10000	10000	50
Location				
Brochure	0	0	0	0
Rehospitalisation	62	100875	6254250	31271,25
Total	163	240481,6932 kr.	7.806.074,00 kr.	39.030,21

Figure G.1: Costs relevant to Standard Cardiac Rehabilitation

Bronze package

	Unit	Cost per unit	Total Cost (DKK)	Cost per patient (DKK)
CAPEX				
Tablet	50	2790	139500	697,5
Spygonanometer	1	1599	1599	8
Pulse oximeter	1	599	599	3
Cuff	2	249	498	2,5
Ventilation mask	1	1637	1637	8
Test bike	1	76750	76750	384
OPEX				
IT License	3	45	27000	135
Fitness	3	159	95400	477
Profession				
Nurse	1	308	61600	308
Check up nurse	3	308	184800	924
Chech up physiotherapist	3	231,5	138900	694,5
Dietician	1	225	45000	225
Physiotherapist	1	231,5	46300	231,5
IT training	1	200	40000	200
Technician	2	200	80000	400
HjerteKomMidt	1	34346	34346	171,73
Employee education	1	10000	10000	50
Location	0	0	0	0
Brochure	0	0	0	0
Rehospitalisation	34	100875	3429750	17148,75
Total	110	230753 kr.	4.413.679,00 kr.	22.068,23

Figure G.2: Costs relevant to Bronze package

Silver package

	Unit	Cost per unit	Total Cost (DKK)	Cost per patient (DKK)
CAPEX				
Tablet	50	2790	139500	697,5
Spygonanometer	1	1599	1599	8
Pulse oximeter	1	599	599	3
Cuff	2	249	498	2,5
Ventilation mask	1	1637	1637	8
Test bike	1	76750	76750	384
Traning equipment				
Weigth	200	200	40000	200
Yoga mat	50	99	4950	24,75
Stepbænk	50	399	19950	99,75
Traning bike	50	9850	492500	2462,5
OPEX				
IT Licens	3	45	27000	135
Profession				
Nurse	1	308	61600	308
Check up nurse	3	308	184800	924
Check up physiotherapist	3	231,5	138900	694,5
Dietician	1	225	45000	225
Physiotherapist	1	231,5	46300	231,5
IT training	1	200	40000	200
Technician	2	200	80000	400
Other cost				
HjerteKomMidt	1	34346	34346	171,73
Employee education	1	10000	10000	50
Location	0	0	0	0
Brochure	0	0	0	0
Rehospitalisation	34	100875	3429750	17148,75
Total	457	241142 kr.	4.875.679,00 kr.	24.378,22

Figure G.3: Costs relevant to Silver package

Gold package

	Unit	Cost per unit	Total Cost (DKK)	Cost per patient(DKK)
CAPEX				
Tablet	50	2790	139500	697,5
Spygonanometer	1	1599	1599	8
Pulse oximeter	1	599	599	3
Cuff	2	249	498	2,5
Ventilation mask	1	1637	1637	8
Test bike	1	76750	76750	384
Traning equipment				
Weighth	200	200	40000	200
Yoga mat	50	99	4950	24,75
Traning bike	50	9850	492500	2462,5
Stepbænk	50	399	19950	99,75
IT equipment /med				
weight - Garmin Index	50	997	49850	249,25
Pulse sensor	50	159	7950	39,75
Control center	50	268	13400	67
Beurer BM 77 BT	50	980	49000	245
Server				
OPEX				
IT Licens	3	45	27000	135
Profession				
Nurse	1	308	61600	308
Check up nurse	2	308	123200	616
Check up physiotherapist	2	231,5	92600	463
Dietician	1	225	45000	225
Physiotherapist	1	231,5	46300	231,5
IT training	1	200	40000	200
Technician	3	200	120000	600
Other cost				
HjerteKomMidt	1	34346	34346	171,73
Employee education	1	10000	10000	50
Location	0	0	0	0
Brochure	0	0	0	0
Rehospitalisation	34	100875	3.429.750	17.148,75
Total	656	243546	kr. 4.927.979,00	kr. 24.639,73

Figure G.4: Costs relevant to Gold package

H | COPD Project

Interview 23/05 2016 med Borgere fra Skanderborg Kommune

- Evidens og indledning

Patientafsnittet for Skanderborg løsningen er primært baseret på interviews med borgere og en fysioterapeut, som arbejder med løsningen. Dertil er der dog også brugt en smule evidensbaseret artikler af lavere kvalitet (bl.a. fordi de ikke er randomiserede og der var få forsøgspersoner). Artikler er også udenlandske, hvilket også har betydet, at det har været nødvendigt at overveje om det kan overføres til Danmark. Afsnittet er bygget op omkring en samtale med to borgere over Skanderborg løsningen efter de havde trænet. Senariet, som var blevet sat op var 8:8 – alle kunne høre og se hinanden.

Patientafsnittet for digital monitorering er primært baseret på videnskabelige artikler. Artiklerne er af svingende kvalitet i forhold til, hvor mange forsøgspersoner der er, og hvor evidensbaseret de er. Flere af artiklerne er desuden ikke randomiserede, mangler kontrolgrupper og er bygget på andre artikler, hvor opbygning af studiet er ukendt. Disse ting gør, at deres indhold til kan tages som den altafgørende sandhed, men på grund af kvantiteten af artikler, som siger det samme, bruges de forskellige dele, som de har tilfreds samt patientudtalelser.

- Etiske forhold

Når man kikker på de etiske forhold, det vigtigt at kikke på det ud fra idealer, konsekvenser og pligter i forhold til det etiske hjul (Henvis til tidligere). Dette er blevet gjort ved at kikke på nogle af de overvejende ud fra samtale med borger, som bruger løsningen og egne overvejelser i forhold til løsningen. Efter samtale med borgere blev det gjort klart, at de ikke selv har overvejet nogle etiske problemstillinger ved løsningen. De så det f.eks. ikke som grænseoverskridende at åbne deres hjem over skærmen. En borger udtalte at løsningen ”absolut ikke er grænseoverskridende. Jeg har ikke noget at skjule.”. Så borgeren så det ikke som et overgreb. Dog er det vigtig at påpege, at det er individuelt, hvordan man har det med det, og bør være med i tankerne, når det skal implementeres ved andre. Derudover kan løsningen også komme til at virke stigmatiserende og forstyrrende i hjemmet for borgeren. Udtalelse fra Mette Hammer, fysioterapeut ”Jeg har haft en borger, som synes, at fjernsynet virkede stor og var grimt, så hun dækkede det til med en dug.”. Så særligt konsekvenser individuelle og skal overvejes ved implementering af denne teknologi. Teknologien: lyden ved den ene deltager hakker en del, Mettes billeder hakker, kommer i ryk når hun bevæger sig og fryser af og til. Mette siger at der har været problemer med Kurts lyd gennem træningen.

- Kommunikative forhold

Patient - Hvordan oplever du telemedicinsk træning i forhold til traditionel træning? Svar: Robert: Synes det er godt og virker rigtig fint. Fri for at skulle ud og køre. Fruen har bilen, derfor skulle han have en taxi hvis han skulle nogle steder hen. Går lige så meget op i det som hvis han skulle til traditionel træning. Kurt: rigtig godt, slipper for at komme ud i regnvejr. Kan gøre det når det passer. Dårlig forbindelse ind i mellem ellers er det ikke så sjovt.

- Kan du se ulemper ved den telemedicinske træningsform? Svar: Kurt: hvis forbindelsen er i orden, er der ingen ulemper. Billede og lyd skal være i orden. Lyden er særligt et problem. Når man ikke kan høre noget, kan man ikke være ordentlig med. Robert: vigtig at billede og lyd er i orden. Roberts går godt igennem. Generelt: billedet er godt ved begge, men lyden er dårlig ved Kurt. Robert prøver at hjælpe Kurt.

- Ville du hellere træne på et center frem for telemedicinsk træning? Svar: Robert: Ville hellere være til træning med nogle personer i stedet for over fjernsynet. Oplever ikke det sociale samvær på samme måde. En god løsning men en nødløsning. Ikke socialt på samme måde som når man er tilstede (sammenligner det med en kæreste). Programmet kører rigtig godt og Mette er god til at illustrer og rette på dem – et rigtig godt alternativ.

- Kan du mærke, at det hjælper at træne? Får du mere overskud og hvis ja, hvordan kan det mærkes? Svar: Robert: Hjælper bestemt, kan mærke det i musklerne når man udfører øvelserne så godt som man kan. Man skal gøre det så godt man kan og give sig lidt mere for at få noget ud af det. Ved ikke om han får mere overskud og energi i hverdagen. Men nyder at være med hver onsdag. Kurt: godt at de kan vælge nogle forskellige træningsprogrammer som passer til dem.

- Hvordan oplever du den sociale kontakt med de andre deltagere, når I anvender telemedicinsk træning? Er det grænseoverskridende at åbne sit hjem gennem en skærm? Etisk? Svar: Robert: absolut ikke grænseoverskridende. Har ikke noget at skjule.

- Teknologi

- Hvordan oplever du den tekniske del? Fungerer det som forventet? Svar: Robert: lyden og billede går godt igennem. Har trådløs forbindelse. Ingen problemer med at åbne op og logge ind: trykker bare så er jeg inde med det samme. Har ikke fået noget undervisning i at bruge det.

- Har du haft problemer med teknologien? Svar: Mette: Lyd problem og dobbelt klang er afhængig af internetforbindelse. Normalt er Kurts forbindelse ikke dårlig. Der er fundet visse områder i kommunen hvor forbindelsen går ikke igennem – dette giver udfordringer.

- Økonomi

- Har du haft nogle udgifter ved den telemedicinske løsning? Teknologien, hardware? Svar: Robert: ingen udgifter

- Har du haft nogle besparelser i form af tid/penge ved den telemedicinske løsning? Herunder kørsel? Svar: Robert. Betaler ikke selv hvis han skulle med taxi, det gør kommunen. Det er bare let at kunne sætte sig hen til sin PC. Mere tidsbesparende, men ikke det man mangler når man er pensionist.

- Evt

- Savner du at fysioterapeuten er hjemme ved dig? Tryghed? (professionalisme) Svar: Robert: Sygeplejerske og fysioterapeut kommer stadig på besøg ligesom de gjorde før. Har haft det dårligt rent fysisk. Træner hver onsdag over telemedicin. Har været alvorlig syg med lunger og har derfor ikke været oppe i centeret. Skal fremover træne på centeret hver tirsdag og fredag og med tele hver onsdag. Professionel vejleder oppe på centeret. Synes det er godt at vi får oplysninger og informationer fra brugerne. Normalt har man en lille egen betaling på 30 kroner frem og tilbage, svarer til busbillet pris. Denne har Robert ikke haft pga. sygdom. Da sygeplejersker satte systemet op instruerede hun i hvordan man bruger det.

I | Exercise equipment used in Herning Municipality

	Antal	Pris	I alt
Testcykel	1	76750	76750
kondicykler	12		118200
Stepbænke	12	399	4788
Sjippetov	12	49	588
Hockeystave	1	999	999
			0
battlerope	2	500	1000
Stor blød måtte	1	3699	3699
2 kg håndvægte	1	129	129
3 kg. Håndvægte	1	169	169
4 kg. Håndvægte	2	199	398
5 kg. Håndvægte	2	229	458
6 kg. Håndvægte	4	199	796
8 kg. Håndvægte	4	269	1076
10 kg. Kettlebells	4	149	596
12 kg. Kettlebells	4	169	676
14 kg. Kettlebells	4	179	716
16 kg. Kettlebells	2	189	378
18 kg. Kettlebells	2	199	398
20 kg. Kettlebells	2	449	898
TRX	2	279	558
træningsmætter	1	1199	1199
ribber	4	899	3596
kegler	1	99	99
vippebræt	4	79	316
ocean balance måtte	2	399	798
Bosu	2	479	958
træningsbold 55 cm	5	89	445
træningsbold 65 cm	5	109	545
Pilatesbolde 25 cm	1	199	199
Pilatesbolde 20 cm	1	99	99
hulahop 1,2 kg	1	149	149
hulahop 1,5 kg	1	179	179
skumbolde	4	129	516
stativ til måtter	1	2195	2195
boldnet	2	49	98
Kontorudstyr mm			
Skriveborde	2	2549	5098
Montage pr. bord	2	299	598
Kontorstole	4	1499	5996
montage pr. stol	4	99	396
Samtaleborde	2	0	0
skillevægge	2	3212	6424
fødder til skillevægge	4	679	2716
Montage skillevægge	2	99	198
Aflåseligt skab	2	4510	9020
Reol til vægte	1	999	999
montage			499
skab til træningsudstyr	1		1

Figure I.1: Exercise equipment

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