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Rehabilitation strategies for Patients with Cardiovascular disease

Submitted by

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Abstract

Acronyms and Abbreviations

Acronyms and Abbreviations	Definition
ICT	Information and Communication Technology
GP	General Practitioner
CAD	Coronary Artery Disease
CR	Cardiac Rehabilitation

Table 1: Forkortelser & Definition

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1 Introduction

1.1 Background

1.1.1 Technology

The technology section will be based on the new ICT based virtual coaching solution 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 is a camera, microphones and 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. [1].

1.1.2 The Danish Healthcare System

The establishment of the Danish Healthcare System started in the eighteenth century. The first hospital was placed in Copenhagen and it opened in 1757. This hospital is still functioning and is today known as Rigshospitalet. Outside the capital small hospitals were built during the late eighteenth century. Even then the hospital was partly financed by taxes, patient payment and charity. In the late nineteenth century every thirteenth Dane was a member in a sick-benefit association which the Danish Government co-funded. The Danish Welfare State has it's root in 1933 where the Social reform was founded. With this reform for 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 to the Danish Healthcare System.
The sick-benefit associations were shut down in 1973 and replaced by public health insurance. The Danish public health insurance is paid by the Danes themselves within taxes. But the insurance provides free care for everyone regardless of income and residence. This public health insurance includes hospital stays, surgery, visits to a GP and specialist'. Furthermore, it provides partly funding for dentist, physiotherapist, chiropractor, podiatrist and contributes to medicine.

The structure og the Danish Healthcare System

Every healthcare system consists of users, healthcare institutions and the financial third part, besides the fundamental financial mechanism user fee, tax and budgets/rates. This is described with the tripartite model in figure 1.1. The A, B and C is the financial mechanism and 1, 2 and 3 is the consistence of the healthcare system. The model shows how a third part is pushed in between the users and the 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 the for these services [2].

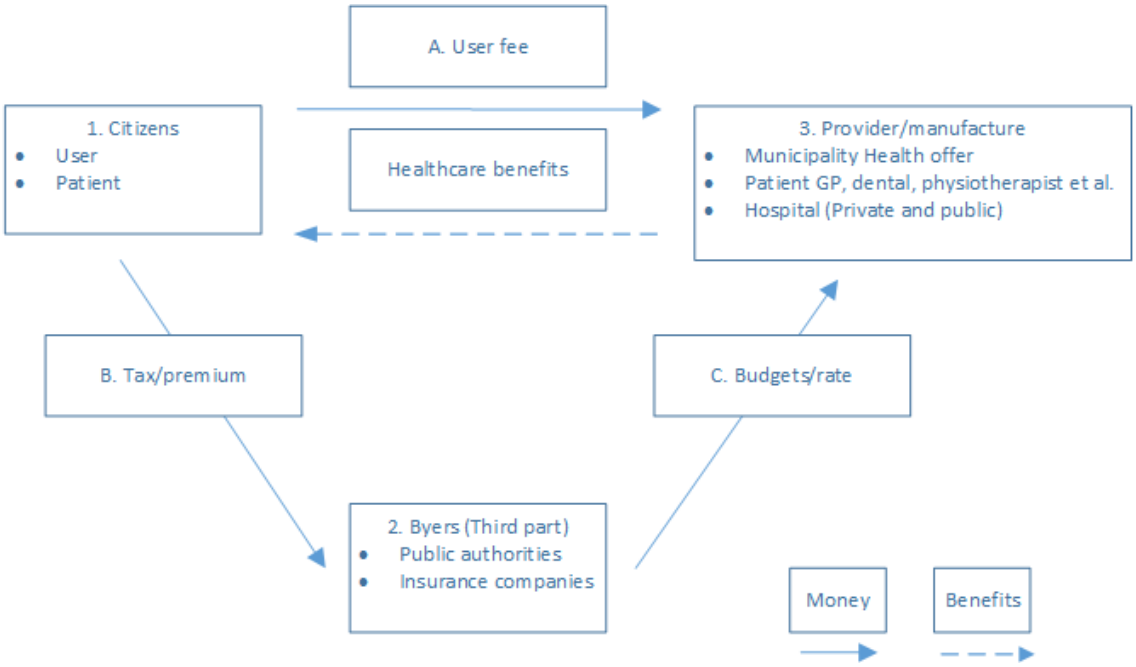

Figure 1.1: Tripartite model [2]

In 1927 there was a total of 160 somatic hospitals in Denmark. Today the Danish health authority is responsible for planing the distribution of specialized hospitals. The Danish healthcare authority made a decision to centralize hospitals to improve quality and efficient use of ressources. 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 is 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. The average length of the admission has decreased with 40%, which makes Denmark the country with the shortest length of stay in Scandinavia. The decline is due to more effective treatments and out patient 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 goals for the future 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[3, 4].

In 2007 the Danish State made big structural changes throughout the healthcare organisation. Municipalities were combined which meant a change from 275 municipalities 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) [4, 5].
The municipalities have multiple tasks but in the health area they administrate general practitioners, home nursing, public healthcare, school health service, child dental treatment, prevention and rehabilitation[6].
The five regions are responsible for the secondary sector which is mainly 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[6]. 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 [7]. 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 [6].

The municipalities are financed with a block grant from the state but also council taxes which differs in 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 by the hospital of the municipalities citizens. Due to this constellation the municipality has incitement to reduce demands for hospitalization and other regional healthcare services [4]. The finance structure in the Danish Health care 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 where given a financial incentive to keep their citizens healthy [3].

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 death 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 [6].

Rehabilitation

Rehabilitation, including physical and mental training, programmes are offered for all citizens by the municipalities. The training and the rehabilitation of a patient may be initiated at the hospital and carried on 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 will receive rehabilitation free of charge whereas others may pay partly from their own pocket. This depends of the type illness [4, 8, 9].

Digitilization in the healthcare system

Denmark is known for extensive digitization and electronic communication in the Healthcare Systems 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" [4]. In 2011 Denmark started a project for telemedicine throughout the country. The five regions jointed forces to make an strategy how to develop telemedicine in an wider scale and combine it with effective shared knowledge. For this to happen a board has been chosen and it is the National Board og E-Health [3].

Treatment of Cardiac patients

In 2010 treatment packages for non-acute heart disease was introduced in Denmark. This package included a process consisting of investigation, diagnosis, treatment and rehabilitation. The Danish Health Authority decided to offer the package deal in 2010. With this alteration the patient will achieve a more simple and coherent treatment with better

quality. The progress for the patient will be described in the next section.

Step 1 Preliminary assessment and referral: when a patient feels ill they contact their general practitioner (GP), unless it is acute. It is the GP's job to carry out preliminary examination and give the patient to 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 visit to the hospital.

Step 2 Investigation and treatment: the investigation and treatment of cardiovascular patients differs from diagnosis to diagnosis. 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 in the outpatient visit 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 heart 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 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 to and assess the patient's and their dependents' palliative needs and problems associated with heart disease, and that the need is assessed on a regular basis to prevent efforts from initiating too late [10].

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, to empower patients to manage their own chronic condition and hereby improve patients' quality of life [11].

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 [12]. By this statement it is seen, that this invention 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 exercise reduce cardiac mortality [13].

1.2 Problem Statement

More than half of the danish citizens over the age of 55 suffer from a cardiovascular disease. Furthermore, cardiovascular diseases are one of the most common causes to 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 deaths caused by cardiovascular diseases and the need for readmissions [13].

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 be used to shorten hospital stay for cardiovascular 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 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 were guidelines, statistics and the historical development is being published.

2 | Method

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

2.1 Research design

Fase 1 in the study is the initial process, fase 2 is knowledge/data and fase 3 is analysis/outcome. In fase 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 fase in the project. The methodology contains considerations in literature search, interview method and data analyzing methods. Fase 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 cardiac patients and a research nurse. To learn more about the interview and the empirical process read section 2.3 and **??**. In fase 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 search 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. Following databases have been used for this project: PubMed, AUlibrary, Embase, 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 hole period of writing the project. 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, cardio-vascular, rehabilitation, cost effectiveness. The papers were chosen from title and abstract. Furthermore other literature was conducted through a chained search 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 as "OR". The PICO blocks was as well combined with the "And" and "OR".

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

Table 2.2: Search headings in PICO principles

2.3 Research interviews

Research interview is 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 in rehabilitation of cardiac patients and cardiac patients themselves have been made. There is many types of interview but for this study Semi-structured interview has its purpose. The semi-structured interviews is exploratory, explanatory and evaluative. Furthermore this kind og interview is referred to as qualitative research interview. This type of interview makes it possible to make a frame of the interview but it also allow the interviewee to expand the knowledge area end hereby expand the frame of the interview. Besides the expansion of the frame this setup allows the interviewee to explain the opinions and reason for attitude. Semi-structured interview provides the opportunity to probe answers whereas the interviewee can explain their responses. The interview may also lead the discussion in to unforeseen areas, which can collaborate to new knowledge. The interview types gives a detailed set of data but it can be viewed as biased due to the interviewers impact on the interviewee. In this project the questions are formed as open ended and only as a frame hence the semi-structured interview.

To prepare for the semi-structured interview we used the "five p's": Prior planning prevents poor performance. To withhold these p's following was taken in to count. 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 of the rehabilitation of cardiac patient in Denmark before the interview which supports the capability to accurate respons in the interview and the interviewers credibility. The knowledge was secured during the literature research fase.

For the interview with the expert in rehabilitation of cardiac patients some interview questions were designed to make sure that the every area wanted was conducted although the nurse was able to walk outside the framework. The question ideas came from read literature and the problem statement. The prepared questions is present in app XXX. If the interview do not have some focus the interview might lack a sense of purpose. The frame made for this intervies was made like a guide in a perhaps logical order. The

location of the interview should be convenient for the partipant otherwise they might feel uncomfortable which could impact the data collection. For this interview the participant chose the location to oblige convenience for the participant.

interview patienter

2.4 Analyzing qualitative data

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

To analyze the interview with the research nurse an analyzing tool is necessary. The Narrative analysis method has been chosen to this. The narrative analysis consist of a collection of different approaches to analyse qualitative data. The study only have the narrative of one individual but the nurse will give another perspective into the healthcare system than state literature can. She gives the opportunity to look into a small peace of the danish healthcare system, more likely region Midtjylland and specific Herning hospital. Due to the interview only being collected on one individual coding has been deselected in this analysis.

2.5 Economy

cost-benefit...

3 | Theory

3.1 What is telemedicine and ICT

Considerations of Telemedicine in the delivery of modern healthcare

The first use of Telemedicine was in 1877. A group of doctors made a communication network towards the drug store by using the 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)*. This system was able to communicate with a two-way radio, audio and data. It wasn't 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 the technology in the 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 teleconsultations 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 a information and communication technology which allow people to interact in the digital world. Telemedicine use this technology as there digital communaction method. ICT has drastically changed the way the world in general communicates, work, learn and live. The usage of ICT in telemedicine have made cost-effective treatment options available due to reduced traveling expenses, decreasing hospital readmission rates, and maximization of consultations. Though providing medical care with the usage of telemedicine opens important medical, ethical and legal issues that must be addressed[14].

4 | Empirical data

The empirical data is collected from interviews both with Vibeke Lynggaard, post.doc at the Cardiovascular Clinic, Herning Hospital and PATIENT?!?!??! The data has been analyzed in section 5.

4.0.1 Interview with Vibeke Lynggard, post.doc, Cardiovascular Clinic, Herning Hospital

The interview was held as a semistructured interview as was a conversation based two-way communication. Vibeke Lynggaard is .... and the interview was held at the .... 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 used rehabilitation process. By the interview it was also possible to obtain an opinion on which limitations and disadvantages a telemedicine solutions gives.

4.0.2 Interview with patient

The interview was made to give a personal and subjective aspect on how the patient experience telemedicine rehabilitation.

5 | Analysis

5.0.1 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 isn't 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 [15, 16]. 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 [17].

A research has taken place in Denmark where the patient 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 staff 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 healthier [18].

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 didn't 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 [19].

5.0.2 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 [20]. 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 [21]. 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 has been in use of an ICT solution pointed out how information via ICT potentially could have and positive effect on patient care and collaboration [22].

Furthermore, exchanging information with patients, follow up and motive 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 [22].

5.0.3 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 patients progress and more self-reliant patients [23]. 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 [24].

In 2014 a pilot project took place in the municipality of Skanderborg were 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. For the patients it was very important that picture and sound on the platform was clear and was working optimal at all time, otherwise they lost the motivation. An important observation at this interview was how the patients experiences the social aspect. The patients were used to do exercises at the gym in classes with other patients. Now they had to do exercise 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 didn't 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 wasn't capable

of participate at the exercise classes. But by this telemedicine solution he was able to do exercise at home and in the end of the project his physical condition was so good 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 1.

5.0.4 Challenges within telemedicine rehabilitation

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, the GPs' are not able to look at the patient's overall condition and use knowledge about the patient's normal reaction. By using telemedicine GPs' will be looking at measurements measured by the patients themselves and that won't give the same overall understanding on the patients' physical condition [11].

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 [22].

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 for 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 [22].

5.0.5 Effects and barriers in implementation of telemedicine solutions for chronic patients across 3 European countries

Deployment of ICT solutions can be tough. Some barriers is "workforce preparation and organizational aspects; regulatory and ethical issues; business model and reimbursement modalities; and, technological factors. During the deployment process, appropriateness of the organizational dimension of the project constitutes, with no doubt, a major priority to ensure positive outcomes"[25]. Throughout their studies in Barcelona, Athens and Trondheim they found two factors that must be satisfied when deploying ICT in healthcare. Firstly the intervention of ICT should take the patients characteristics in to account. Secondly the businessmodel, in particular the reimbursement modalities, incentives and shared risk among the involved people in the process[25].

What impact would an ICT solution for rehabilitation have on both cardiovascular patients and the Danish Healthcare System? [26].

How can ICT be used to shorten hospital stay for cardiovascular patients?

Which barriers/challenges can such system meet in implementation?

"Studies have shown that telemental health has proven to reduce both healthcare costs and patient costs. Break-even analysis of multiple studies, however, showed that in order to be cost-effective, a certain number of consultations must take place per year to justify the capital investment costs of implementing such programs (Hilty, et al., 2013)". [14]

6 | Discussion

7 | Perspectivation

7.0.1 Ongoing project in Netherlands

A project in 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 it 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 Cardiac Rehabilitation (CR) treatment and the intervention group will receive home-based telemedicine rehabilitation[27]. The result of this study could have a great impact on this project.

8 | Conclusion

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Appendix

Appendix Number

1. Interview - Borgere fra Skanderborg Kommune

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