Monitoring Telemedicine Implementation in Denmark

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Abstract

According to the literature, Denmark has a leading position in the dissemination and use of health informatics. However, there is a lack of systematically collected and documented experience of telemedicine solutions in Denmark. This evidence is being established with a new project, which maps out all telemedicine initiatives in Denmark. Data on all the initiatives is collected in a single database and some of the data is analyzed in this paper. It is shown that there are a very large number of telemedicine initiatives in Denmark and that the elements from the national strategy for telemedicine are clearly visible in the telemedicine map. The very large number of projects could, however, also indicate a lack of national coordination of initiatives and a need for evaluation activities to systematically collect and communicate the learning outcomes from all the new projects.

Keywords:

Telemedicine; dissemination; monitoring; evaluation.

Introduction

Denmark is among the world leaders in digitization of the health care sector [1, 2]. The small size of the country (5.5 mill. inhabitants), the relatively well-organized health sector, which is almost entirely publicly financed by tax money and the fact that every citizen has had a unique personal identifier since 1968 has enabled an efficient and penetrating implementation of computer systems. The systems were in the beginning mainly used for administrative purposes, but during the last decades also for clinical applications. All hospitals have EHR systems, including clinical notes, medication, all kinds of laboratory data, and imaging RIS/PACS. All general practice physicians are fully digitized, and citizens can all view their medical record online including lab tests and medication, renew prescriptions and in many cases book consultation with their GP. Because of the unique personal identifier and a pioneering work with the development of a national health data network, communication of health data has also been possible for a long time, which means that clinicians use it routinely. Of course the development of the many different health information systems and their integration has not been a walk in the park, many problems have had to be overcome and many conflicts have been resolved – it rather means that there exists a huge amount of experience.

Due to the pioneering efforts in health informatics, huge efforts have also been exercised in telemedicine, where Denmark also has been mentioned as the world leader by several sources [3, 4]. The Danish Government, Local Government Denmark, and the Danish Regions launched a national action plan for dissemination of telemedicine in August 2012 [5]. The plan outlines a number of new possibilities with telemedicine:

- Improved and more coherent patient care
- More individually planned treatment and self-reliant patients
- Increased professional competences across sectors
- Financial gains in municipalities and regions

To realize these potentials, a stronger framework must be established which includes reference architectures and standards, common assessment models, and overview of telemedicine solutions.

The national action plan for telemedicine notes that there is a lack of systematically collected and documented experience of telemedicine large-scale solutions that have been in operation over a longer period of time. To gain such experience, five specific telemedicine initiatives have been launched: clinically integrated home monitoring; home monitoring for COPD patients; tele-psychiatry; internet psychiatry; and national telemedical assessment of ulcers.

To produce an overview of telemedicine solutions and as a first step to systematize the wealth of telemedicine experience, all existing telemedicine projects in Denmark have been mapped in a single database [6]. The objective of the database is to annually collect and publish an overview of the diffusion of telemedicine in health care. The mapping is updated continuously through a proactive outreach work from MedCom. For each telemedicine project, the database contains data in the following categories:

- Master data (title, aim, etc.)
- Involved actors (managers, users, etc)
- Disease area
- Activities (Consultation, diagnostics, screening, monitoring, shared care, etc.)
- Relation to specific trajectory programs
- Applied technologies (hardware, software, specific integration to other systems)

The inclusion criteria of the database has been the WHO definition of telemedicine: "*The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities*" [7]. The database contains data of 372 projects, which have been collected among national initiatives, initiatives in the five regions and the 99 municipalities in Denmark. As the private healthcare sector in Denmark with regards to health informatics and telemedicine is negligible, the coverage of the existing projects is regarded complete.

The database provides an opportunity to monitor the actual state of telemedicine in Denmark. The aim of this study is to

explore the numerous telemedicine projects in operation in Denmark with a particular focus on the aim of the telemedicine projects, the actors involved, the specific activities and the applied technology.

Methods

The study is designed as a cross section study. The data has been collected to the database from October 2013 to October 2014. Each Region has been responsible for the reporting in process and ongoing telemedicine projects. The regions and the municipalities have had the opportunity to enter the data directly into the database or sending the data to MedCom who then has completed the data entry process. MedCom has verified the data entered by the regions or the municipalities and the regions have verified the data entered by MedCom. For data viewing, the database has a query form interface as well as a graphic interface based on Google Maps. The complete content of the database can be downloaded in an excel format file.

Data Analysis

Parts of the data exist in the database as free text; however, a significant amount of the data is categorized and entered as numerical or dichotomous data. The analyses in this paper are limited to frequency counts of the central structured parameters and a few cross tabulations.

Results

372 telemedicine initiatives are included in the database. The majority of 204 initiatives are still in a project state, which means that development is still going on and they are financed by temporary funding. 157 are run in a daily operation modus, and 11 initiatives are in a stage of dissemination to regional or national coverage.

Disease Area

The initiatives cover a wide area of diseases. Figure 1 shows the distribution of the disease areas covered by the 372 initiatives. As some projects cover more than one area, this explains why the sum is exceeding the total number of initiatives.
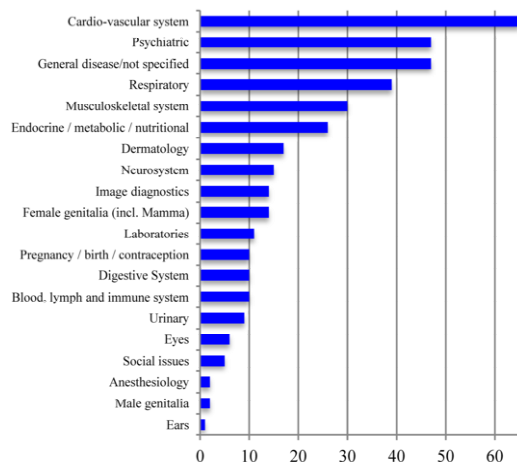

Figure 1 - Disease areas covered by the telemedicine initiatives in Denmark (n=372)

Cardiovascular diseases are the dominant area, closely followed by psychiatric diseases. The general disease area covers mainly general health survelliance in specific population groups, but can also include e.g., pain in geriatric areas, oncology in pediatric areas or ulcer assessment. Respiratory diseases are quite common for telemedicine initiatives, particularly COPD. Telemedicine systems for musculoskeletal diseases are predominantly directed at rehabilitation activities. Endocrine, metabolic and nutritional initiatives are various systems for diabetes patients. Denmark has a large program in telemedicine for ulcer surveilance where homenurses transmit images taken by a mobile phone or smartphone to the hospital based dermatologist or other health professionals.

Locality of Service

The telemedicine activities take place at many different localities, but the absolute predominant locality is in the hospital. 55% of all the initiatives include activities at hospital units. 31% have activities at municipal institutions (nursing homes, rehabilitation centres, social institutions etc.). 30% include activities at patients' or citizens' home. 6% take place at outpatient clinics, and 4% take place at GP' offices or local psychiatric units.
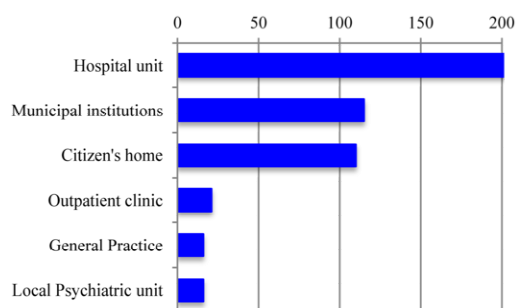

Figure 2 - Locality of service for telemedicine initiatives.

Hardware

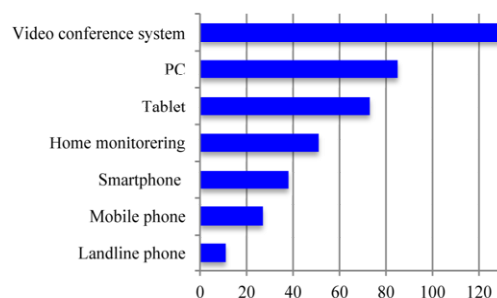Figure 3 shows what hardware is used in the telemedice initiatives.

Figure 3 - Hardware used in the telemedicine initiatives

Video conference systems are used widely as they are included in many different tele services. Most of the cases as traditional video conferencing between various professional groups located in different hospitals, but also when teleinterpretation is necessary in the treatment of patients who do not speak Danish or English. Video cenferencing technologies are also applied in rehabilitation projects for instructing patients in their home, and to communicate with COPD patients.

Personal computers, tablets, and smartphones are used mainly in hospitals and municipal institutions by health professionals, whereas homemonitoring equipment is used in patients' home. Mobile phones and landline phones are used very little compared to the other more advanced technologies.

Integration to Other Health Care Data Systems

Few of the 372 telemedicine projects integrate to other health care data systems, as shown in Figure 4. 15 projects integrate to Electronic Health Record data in hospitals, and eight projects integrate to a GP system of which five also integrate to a hospital EHR. Seven projects integrate to homecare records in the municipalities, and six to the national health portal "Sundhed.dk".
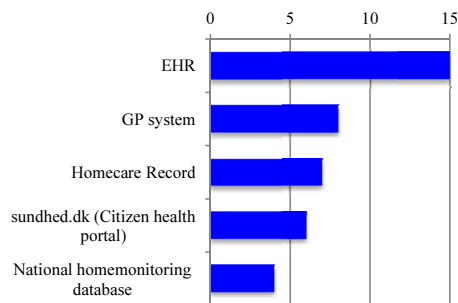

Figure 4 - Integration to other health care data systems

Discussion

It has been surprising how many projects have been reported to the database. Obviously the relatively broad definition of telemedicine from WHO can be interpreted to include a wide range of projects. For instance the high number of projects that use video conferencing will in a few years probably not be regarded as telemedicine projects, but just a normal part of professional communication as it is in many other sectors. The broad interpretations of telemedicine recur in other official documents in Denmark as well as in documents from private interest groups, not to mention the debate in general. From this perspective, the study cannot contribute with a precise presentation of the most important key aspects of a telemedicine solution – the spectrum remains very broad in the general discourse, as pointed out by Greenalgh et al [8].

The national strategy from 2012 [5] specifically mentions the following 5 initiatives as focus areas:

Clinically integrated home monitoring

Home monitoring for COPD patients

Demonstration and dissemination of telepsychiatry (Teleconferencing between health professionals)

Demonstration of Internet psychiatry (Depressions)

Dissemination of telemedical assessment of ulcers

The initiative on clinically integrated home monitoring was meant to include 2,000 patients in Denmark's largest cross-sector home monitoring project meant to run 2012-14. Patients with COPD, diabetes or inflammatory bowel disease as well as pregnant women with and without complications should be included in the project. The main objective was to provide experience of utilising a common technical solution for home monitoring of different groups of patients and to ensure coherent treatment procedures across the sectors in the health service. It was also the aim of the project to develop integration with the existing IT infrastructure, such as the EHR systems. Apart from a high number of projects concerned with cardiovascular diseases, which often is the monitoring of patients in their own home, it is difficult to see a significant concordance with the registrations in the database and the ambitious aims in the clinically integrated home monitoring initiative. As this is a cross section study, it is only possible to report on factual data from simple frequency counts and cross tabulations of the data available, hence it is not feasible to point to causal explanations of the observations.

Concerning the other initiatives there is a significant convergence between the strategy and the areas of diseases reported to the national telemedicine database.

The most predominant area of diseases is cardio-vascular disease. The projects in this category are often the monitoring of patients in their own home, but we also find many of the projects using information and communication technology to communicate between health professionals either individually or as a tele-video conference. The other main disease areas include the traditional chronic somatic diseases (Diabetes, COPD, Arthritis etc.) and the psychiatric area. The psychiatric area has two different categories of systems. One is termed telepsychiatry, which is video conferencing between psychiatric health care professionals to provide better courses of treatment for adult psychiatric patients. The other category, Internet psychiatry, is psychiatric treatment through an online IT program that is supposed to help patients suffering from depression. It is estimated that approximately 250,000 Danes suffer from depression, 30 percent of whom do not receive any treatment. It is estimated that four times more patients can be treated as in conventional treatment. The majority of the projects that indicate they cover general disease is mainly because they do not specify the area more precisely or because they cover more than one disease area, and therefore feel they are not covered by the list of disease areas.

The predominant localization for telemedicine projects registered in the database is professional institutions e.g. hospital units, municipal institutions, outpatient clinics, general practices, or psychiatric clinics. Activities in the patients' home are only stated by 106 of the 372 projects. This could underline the significance of the use of telemedicine to health professional communication.

The Methodological Approach

The data has been open for registration of projects to those responsible for the telemedicine projects in the five regions and 99 municipalities in Denmark. It has also been possible to send the data to MedCom to have them assist with data entry. However, as the decision on which projects to register has been up to the regions and municipalities, it is possible that some of the most active authorities have registered projects that are marginal to telemedicine, and more closely related to wellfare technologies. One example is a project focusing on the use of robot vacuum cleaners in the home of chronic deseased elderly citizens. Other projects might have been overlooked because of limited manpower in the municipalities and regions.

There are also large variations in the categorizations of the single parameters. Some projects have been very active in reporting - all the different technologies involved and, all the disease areas that they might face in the project, whereas other projects have underreported, omitting important fields. The validity of the database will be improved by a systematic validation of all the projects. However, the current state of the database is assessed to be valid for a broad characterization of the situation for telemedicine dissimination in Denmark.

Conclusion

In relation to the national strategy for telemedicine in Denmark, the database gives an overview of the initiatives in the regions and municipalities. It shows that the elements of the strategy are well prioritized following the guidelines in the strategy. The very large number of projects could also indicate a lack of national coordination.

A national coordinated evaluation of all the initiatives could improve the outcome of the projects in relation to both health outcome and cost related to development, implementation, and deployment.

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