Social Network Analysis and Tele Homecare

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Abstract

The use of tele homecare solutions in Denmark is increasing and moving from locally anchored pilot projects to large-scale or even nation-wide projects. TeleCare North has finished and evaluated a large-scale project for patients with chronic obstructive lung disease (COL). Some of the experiences show, that the cooperation between the healthcare professionals can be improved – or need to be adjusted more explicitly to the tele homecare solution.

This study is part of a larger Ph.D.-study, that will focus on the cooperation and communication between the healthcare professionals in the new TeleCare North Heart Failure project, and will study collaborative relationships between the actors before and after the implementation of the Heart Failure solution.

The result from two literature reviews indicates that the area is novel and unstudied, since no articles have been written about SNA and telemedicine/tele homecare, but a few (16 in the review) have been written about SNA and health informatics.

Keywords

Telemedicine, Medical Informatics, Organizations, Organizational Change, Social Network Analysis

1 INTRODUCTION

This paper describes the background to the PhD, the methodological approaches and preliminary results of a literature review.

The use of telemedicine and tele homecare solutions in Denmark is increasing. Over the last years, there have been an increased amount of locally anchored pilot projects, but only a few have gone into operation – and even fewer have gone into large-scale projects or nation-wide projects (MedCom, 2017). From 2012 to 2015 Region North and later TeleCare North[1] hosted a large-scale project for patients with chronic obstructive lung disease (COL). The experiences from this project is used in a nation-wide project for COL in Denmark, but also used in a new TeleCare North large scale tele homecare project for patients with Heart Failure.

Even with focus on the organizational issues in the implementation of the COL-project, the experiences call for even more focus on the organizational issues. Among the experiences from the COL-project is, that "…it is an intensive work to adjust and adapt services and procedures to get coherent and effective processes."

(Region Nordjylland, 2015). Despite the focus on organizational issues, both the solution and the cooperation must be improved. The final report for the COL-project mentions the importance of "... a constructive and close cooperation across the core actors" (Region Nordjylland, 2015), and that the cooperation is not "... implemented to the bottom, and there must be continued focus on behavioural- and practice changes." (Region Nordjylland, 2015). Another experience from the COL project is, that in some places implementation has been more successful (measured by actors activity) than elsewhere: This could raise the question of why it is going well in some places and less well elsewhere, when it is the same technology solution that has been implemented.

TeleCare North has now initiated a new large-scale tele homecare project for citizens with Heart Failure. The new project is not only for another disease, but also gives the possibility to focus on some of the organizational and implementation issues from the COL-project. The hope is to be able to optimize the organizational results of the Heart Failure project or to be more explicit in seeing the background for the results in terms of the organizational side of the implementation.

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[1] Established in 2015 as a cooperation between 11 municipalities and Region North in Denmark. Supports tele homecare projects.

The focus of this Ph.D. study is the cooperation between the healthcare professionals before and after the tele homecare solution has been implemented, and the difference between the different organizations involved in the large-scale project.

The analysis of the relationship between the health care professionals will be based on Social Network Analysis (SNA), which is a structured approach to uncovering and describing networks (Waldstrøm and Engelbrecht, 2013; Provan and Milward, 2001; Pryke, 2017; Carrington and Scott, 2014).

The research objectives in the current study is, by using SNA, to give an insight to the difference between communication and relations between the actors in organizations, and to show whether there has been a change following the implementation of TeleCare North Heart Failure.

2 BACKGROUND

The purpose of the Ph.D. project is to carry out a descriptive/exploratory study (Andersen, 2013; de Vaus, 2002) to:

- Study collaborative relationships between the actors before and after the implementation of TeleCare North Heart Failure, to outline which degree of importance the implementation of TeleCare North Heart Failure has had on collaborative relationships
- Study whether there is a correlation between the co-operation relations and the outcome of the implementation, depending on which organization, the actors come from

The two purposes are chosen based on the evaluation of the COL-project and have been done in cooperation with TeleCare North. It is the intention that this PhD. project can help generate knowledge, that afterwards can help minimize the organizational challenges that emerged in the COL-project, in future tele homecare projects.

In this section, a brief description of the state-of-the art in the field of tele homecare in Denmark and SNA is given.

2.1 Tele Homecare

Telemedicine has been used by the Danish health service for many years for communication between health professionals, e.g. between Rigshospitalet in Copenhagen and Queen Ingrid Hospital in Nuuk, Greenland. Today, telemedicine has high priority in the Danish health service as a tool for optimizing treatment processes. Telemedicine allows patients to be dis-charged faster from hospitals, allows patients staying in their home to keep contact with health professionals from primary or secondary sectors, and health professionals can easily come into contact with colleagues in their own or other sector. Tele homecare or telemedicine for citizens has been tested through many (smaller) pilot projects in recent years.

The TeleCare North COL-project and the KIH Project (Clinical Integrated Home Monitoring) were the first two large-scale projects in the field of tele homecare in Denmark and form the basis for the nation-wide tele homecare project
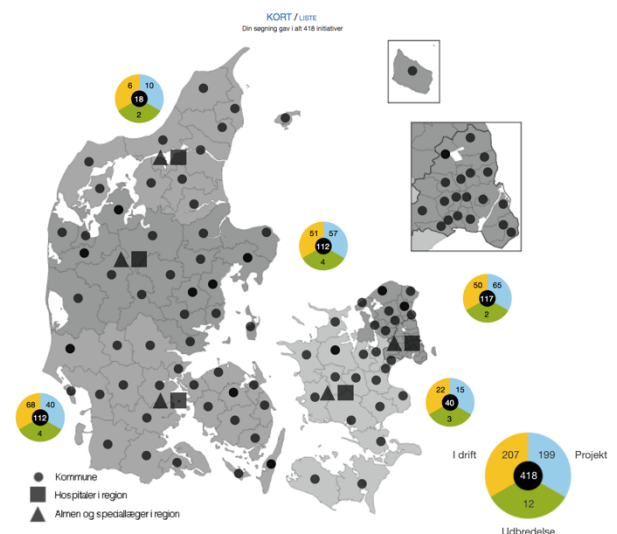
in Denmark to citizens with COL. The objective is: "... telemedicine must be an offer to all relevant citizens with COL across the country by the end of 2019." [9] and in the finance agreements of 2016, the Government, KL (Local Government Denmark) and Danish Regions agreed on a:

"... nationwide spread of telemedicine for citizens with COL by the end of 2019" (Finansministeriet 2015). Based on that, funds have now been allocated to ensure the first nation-wide tele homecare project in Denmark.

In "National Health Care Objectives"("Nationale mål for sundhedsvæsenet") (Sundheds og Ældreministeriet, KL and Danske Regioner, 2016) telemedicine/tele homecare are not mentioned directly, but several of the goals set out could include the use of tele homecare. These could include the objectives: "Better coherent patient pathways", "Strengthened efforts for chronic and elderly patients", "Increased patient involvement" and "More healthy living years".

According to "The Telemedicine Map" (figure 1) all Danish municipalities and regions are involved in at least one telemedicine project and in total, 418 telemedicine initiatives in Denmark were registered by the end of 2016 (MedCom, 2017). 207 were reported to be in operation and 12 as being in the dissemination phase. The figure below shows the distribution of initiatives per region based on whether the initiatives are in operation (I drift), in dissemination (Udbredelse) or in the case of an ongoing project (Projekt).

Figure 1 The Telemedicine Map of Denmark (MedCom, 2017).

2.2 Social Network Analysis

Social Network Analysis can be brought back to the 1930's, where an increasing number of anthropologists and sociologists began to look at social structures (Carrington and Scott, 2014; Scott, 2013). One of these was Radcliffe-Brown, who worked in the 1920's with the concept of "structuralist view of society" and mentioned "net-work of social relations" in a public lecture in 1937 (Carrington and Scott, 2014).

Other well-known researchers who participated in the birth of SNA were Lévi-Strauss, Lewin, Moreno, Warner

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and White (Carrington and Scott, 2014). The University of Michigan and Tavistock Institute in London therefore became central to the development of SNA (Carrington, and Scott, 2014). Today, SNA is a recognized approach to social network-ing with dedicated journals, such as "Social Network", "Journal of Social Structure" and "Connections", its own professional community (International Network for Social Network Analysis – http://www.insna.org) and dedicated computer programs for analysis and visualization of social networks (Carrington, and Scott, 2014).

Today SNA is widely used to describe social relations both within and between organizations, but also in areas as epidemiology, to describe infectious patterns and optimize efforts, fight against criminal gangs, terrorist networks and intelligence services (Waldstrøm and Engelbrecht, 2013). It is alleged, that it was using SNA, that the Americans found Saddam Hussein.

3 METHODS

The overall methodological approach is partly to compile a literature review to see how others have used SNA and to do an empirical study including the healthcare professionals involved in TeleCare North Heart Failure.

3.1 The literature review

The literature review will be based on Moher et al.'s (2009) PRISMA Model (Preferred Reporting Items for Systematic Reviews and Meta-Analysis), which consists of four phases and a 27-point overall checklist for the purpose of facilitating the preparation and reporting a protocol for a systematic literature review.

3.2 Method of empirical part of the study

Data collection to the SNA is based on an adapted "prospective panel longitudinal" study (de Vaus, 2001). Adapted, as the first data collection occurs after some of the respondents have begun to use or have been trained to use the TeleCare North Heart Failure solution. This could speak for calling the first data collection retrospectively, but since other respondents did not start to use or are trained to use the Heart Failure solution at the time of data collection, it is called "adapted". The "prospective panel longitudinal" is selected as the study follows the same population over time from before to after implementation (de Vaus, 2001; Bowling, 1997).

The empirical part of the research project is divided into two phases:

1. Prior to implementing TeleCare North Heart Failure
2. After implementation of TeleCare North Heart Failure

By the end of 2016, the prior-study had been performed. A questionnaire was sent to 11 municipalities, 4 hospitals, and 172 GP's using an electronic questionnaire in SurveyXact, where access was via mail sent to the respondents.

Due to a low response rate from the municipalities, the research design has been changed, and only eight municipalities will be part of the pre-/post-study based on questionnaires.

To increase the data for studying whether there is a correlation between the cooperation relations and the outcome of the implementation, depending on which organization the actors come from, the post-study will be based on interviews instead of questionnaires. Actors from all included organizations will be interviewed – even if they have been part of the pre-/post-study based on questionnaires. This also gives an opportunity to compare data retrieved by questionnaires and by interviews.

After the post data collection and analysis, it is planned to hold a focus group interview to discuss the result and possible explanations of these with selected respondents. The combination of quantitative and qualitative study will be done with inspiration from mix-methods (Curry et al., 2013: O'Cathain and Murphy, 2008) and successive triangulation (Hollensen, 1996) to seek an explanation of the results from the quantitative study.

The purpose of applying SNA in this study is to use a recognized approach to analyse the communication/relations between the healthcare professionals in the TeleCare North Heart Failure project. The aim is to explain and, if so, to what extent the relationship between health professionals' changes after the implementation of TeleCare North Heart Failure. The reason for looking only at the healthcare professionals is justified by the fact, that the experience from the COL-project does not include the citizens/patients, but points to organizational relationships among and between the healthcare professionals.

The networking approach is considered relevant, as the implementation of the TeleCare North Heart Failure project goes across organizational borders in and between the primary and secondary health sectors.

4 THE LITTERATURE REVIEW

In this section two literature reviews seeking telemedicine and health informatics projects that had used SNA are mentioned.
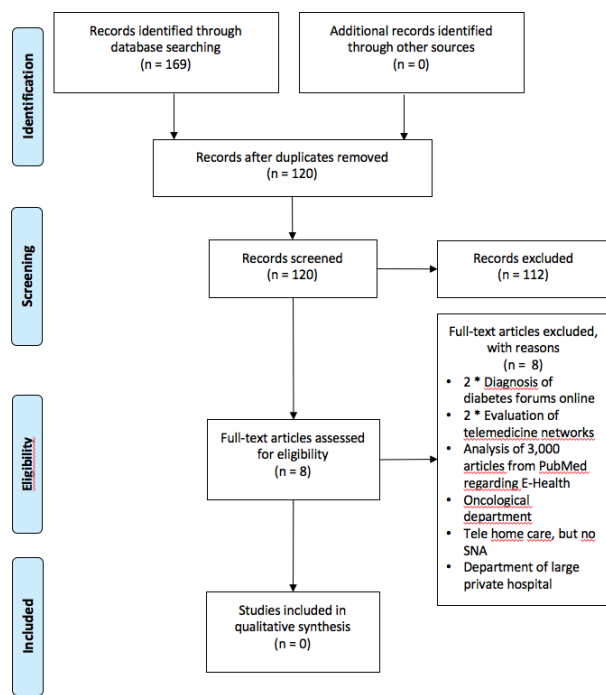
4.1 Literature review: SNA and tele homecare

By the end of 2016 a literature study was performed. The intention was to analyse the use of SNA in tele homecare projects. Despite an extensive literature search using PRISMA (Moher, 2009), no papers were included.

Two search blocks were used – one with "tele home care" OR "tele homecare" OR "home telecare" OR "home tele care" OR "telemedicine" OR "telemedicine" OR "tele medicine" OR "tele medicine" – and one with "social network analysis", but later changed to "network analysis" to extended the search.

The searches were performed in: Cinahl, Cochrane, Embase/Emtree, Google Scholar, ProQuest, PubMed, Scopus, and Web of Science. The PRISMA model (figure 2) shows the amount of records identified before/after

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removal of duplicates, records screened, and full-text articles accessed for eligibility – and that no articles are included.

The conclusion is that – at the moment – no researchers have published papers in scientific journals, to document the use of SNA in tele homecare projects.

Figure 2 PRISMA for literature review: SNA and tele-medicine/tele homecare.

4.2 Literature review: SNA and health informatics

To make the search wider, tele homecare was replaced with health informatics, and a new literature study was done in January 2017. PRISMA was still used and the two search blocks were "health information system" OR "health IT" OR "health information technology" OR "health informatics" OR "medical information technology" OR "medical informatics" and "social network analysis". The searches were performed in: Cinahl, Cochrane, Embase, ProQuest, PsycInfo, PubMed, Scopus, and Web of Science.

367 records were screened, and selected on title and abstract, 25 full-text articles were assessed for eligibility. After full-text reading, 16 articles were included in the qualitative analysis (see figure 3).
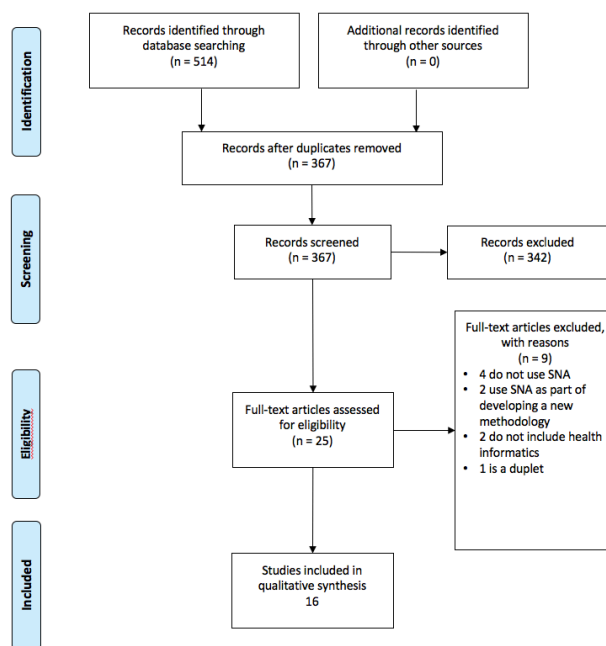
Two of the 16 articles were Ph.D. theses (Benham-Hutchins, 2008; Raman, 2009), three from conferences/symposiums, and 12 from scientific journals (Computers in Biology and Medicine, International Journal of Medical Informatics, Journal of Biomedical Informatics, Journal of Medical Internet Research, Journal of Organizational Computing &Electronic Commerce, Journal of the American Informatics Association, Studies in Health Technology and Informatics, and Technology Innovation Management Review). Most of the articles (11) are from

USA, one from Canada, one from Australia, and two from Europe.

4.3 Preliminary results of the literature review

A wide span of methodology approaches is used – from data mining in log-files, to survey and observational cross-sectional studies.

The analysis in the 16 articles have been performed using APL2/iGraph, ATLAS Ti, Clairlib, Cytoscape, Gephi, GUESS, MATLAB, NetMiner, Netdraw, ORA (Organizational Risk Analyzer), Pajek, SNA Package in R, SPSS, UCINET, and Visone. Most of the articles illustrate results in a combination of tables and network diagrams.

Figure 3 PRISMA for literature review: SNA and health informatics

To summarize the major findings from the literature review, we would like to site Anderson, Aydin (Andersen et al., 1994): "Social network analysis can be used to analyze relationships among health care providers, departments within health care organizations and other organizations…This methodology can also be used to better understand changes in communication patterns or other interactions over time."

5 EXPECTED RESULT

Before SHI 2017 in August, the literature review for SNA and health informatics will be finished, and the conclusions will be part of the oral presentation.

Later the result from the empiric study will be published, and the intention is to focus on the methodology experiences and to increase the knowledge of the organizational issues when implementing a tele homecare solution.

On the methodology side, the intention is to demonstrate that SNA is a useful tool for quantifying changes in

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collaboration before/after implementation of a tele homecare solution.

On the empirical side, the intention is to give TeleCare North a quantitative insight into how relationships and collaboration change after implementation of a tele homecare solution. The intention also includes a qualitative analysis through a final discussion of the outcome of SNA, to chart why the cooperation has changed/not changed. Perhaps the conclusion also will propose what can be done to change the cooperation.

This is in an expectation of providing knowledge that can be used to address and possibly minimize the organizational challenges in the relationships and cooperation between the health professionals and across the sectoral border. In addition, if a difference can be seen among the involved organizational units.

6 DISCUSSION

Using PRISMA for the literature review gave a structural approach to the review. In the first review covering SNA and tele homecare, working with two search blocks gave the possibility to change each of them individually, to extend the search for articles covering SNA and tele homecare. A change of "social network analysis" to "network analysis" gave more articles in the search result, but none of these articles could be included in the review.

As the results from the literature reviews indicates, the area is novel and unstudied since no articles could be included in the review focussing on SNA and tele homecare. By using SNA in this study focussing on a tele homecare solution for Heart Failure, our intention is to contribute to more scientific knowledge regarding the use of SNA in relation to tele homecare.

The two-sided use of SNA will give knowledge in relation to a before/after study and a study focusing on the difference from implementing the same tele homecare solution in different organizations.

7 ACKNOWLEDGMENTS

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