Telemedicine follow up of Chronic Obstructive Pulmonary Disease Integrated into a Patient-centered Health Care Team Setting

Impacts on Patient Empowerment and Safety

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Abstract—**Health care services are facing challenges with a growing ageing population prone to chronic conditions and multi-morbidities. Telemedicine applications have the potential to enhance patient's safety at home by monitoring of chronic diseases, promoting coping and independence. The research project Patients and Professionals in Productive Teams aims to study patient-centered teamwork across organizational borders, supported by technology. This paper describes the research agenda for a study on how telemedicine follow-up impacts on chronic obstructive pulmonary disease patients' quality of life and possible effects on patient empowerment, in the health region of Southern Norway. The outcome is expected to describe how telemedicine can be carried out and implemented in daily routines together with a patient-centred health care team with the aim to increase patient safety.**

Keywords—telemedicine; chronic obstructive pulmonary disease; remote monitoring; patient empowerment and coping; eHealth literacy

I. INTRODUCTION

Health care services are facing the challenge of individualizing treatment to a growing ageing population that is prone to chronic conditions and multi-morbidities. The prevalence of chronic diseases is increasing and chronic obstructive pulmonary disease (COPD) is predicted to be the fourth fatal disease globally in 2030 [1]. COPD patients are prone to have exacerbations with frequent admissions to hospital, leading to a reduced quality of life [2] and with increasing medical expenses for the society [3]. The World Health Organization (WHO) has emphasized the need for focusing on patient-centered health care service models and understanding how to operationalize patient-centered care with technology support [4]. There is a need for patient-centered health care teams, to carry out individualized care for patients with COPD, to increase the quality of care, patient safety and patient outcomes. Patient-centered health care teams operating across organizational borders, have a need for effective technological solutions that support the clinical pathways and facilitate coordination and information flow.

In this context, the research project *Patients and Professionals in Productive Teams* (3P) aims to study health care services that are run with a patient-centered teamwork model [5]. 3P is a 4-year long project (2015-2019), funded through Helseforsk, a cross-regional health research fund owned by the four Norwegian Regional Hospital Trusts [6]. The 3P project involves four innovation arenas in different health regions of Norway and Denmark, that are included in the research of models for patient-centered health care teams [7][8][9]. There are several research groups in the project, focusing on different aspects of patient-centered teamwork models, such as organizational factors, technology support and medical outcomes.

This paper presents the research agenda for one of the innovation arenas, which is a telemedicine central integrated with a patient-centred health care team, established in Risør municipality in Southern Norway. The telemedicine central was first established in the United4Health project [10], a part of the Seventh Framework Programme for Research of the European Union [11], to support remote monitoring of COPD patients living at home in the region. As a continuation of the remote monitoring of COPD patients, the project Telemedicine Agder (Telma) [12], is running with a focus on procurement and implementation of telemedicine technology in a consortium of several municipalities in Southern Norway. In the telemedicine central of Risør, the 3P project is run in conjunction with Telma. The 3P project particularly targets healthcare collaboration and teamwork models when carrying out telemedicine services. The service goals of the telemedicine central is to increase patient empowerment and to promote coping and independence for COPD patients in the region.

The research group carrying out the study of the telemedicine central is interdisciplinary, consisting of people with both medical and technical background. The research agenda targets how to integrate the telemedicine follow-up and support in the central with a patient-centred teamwork setting in the innovation arena.

The research questions (RQs) stated for the study are:

RQ1: *How can telemedicine monitoring of chronic obstructive pulmonary disease patients be integrated into a teamwork setting?*

RQ2: *How does telemedicine monitoring impact on patient empowerment to provide trust, confidence and self-management in the innovation arena?*

Following this introduction, the research methodology is presented. The technology in use, project status and expected outcomes are described in section III, IV and V.

II. RESEARCH METHODOLOGY

The study has a quantitative research design. COPD patients in need of telemedicine follow up in a defined region, will be included into a before-and-after study [13]. Patients can be referred to telemedicine follow up from hospital, General Practitioner (GP) or municipal health care services. The telemedicine service is carried out integrated with a patient-centered health care team in the region. When a patient is included into the research study, medical status and measurements are registered together with COPD assessment test (CAT) [14]. An evaluation of patient safety and involvement of health care professionals in a patient-centered team is made in a dedicated form. In addition, a validated questionnaire on eHealth literacy has to be filled in as a part of the inclusion process. The questionnaire eHealth Literacy Questionnaire was chosen for the study [15][16]. eHealth Literacy refers to a constellation of factors regarding traditional literacy and computer literacy [17]. eHealth literacy has been defined as "the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem" [18][19].

The medical registrations and the eHealth literacy questionnaire are repeated after 4-6 weeks of telemedicine follow-up, to compare the before and after results. The Norwegian Centre for Research Data has approved the study, with project number 51408 [20]. The participation in the study is voluntary and participants can withdraw at any time. All included patients will receive written information about the research study together with a consent form.

III. THE TECHNOLOGY

When a COPD patient has signed the consent form, a nurse from the telemedicine central will visit the patient at home for inclusion procedure. The nurse will provide user training regarding a device for pulse oximetry measurements and a tablet. The tablet is used for answering a symptom-specific questionnaire and sending the pulse oximetry measurements to a server. The nurses at the telemedicine central can access the measurements in a dedicated information and management system for telemedicine services. An automated health assessment system [21] is implemented as a color-coded triage function to show the actual condition of the patient; green indicates a stable condition, yellow indicates a worsened condition and red indicates a serious condition where the nurse will immediately initiate a video meeting for evaluation of necessary actions or interventions. The telemedicine technology is delivered from the Danish vendor Open TeleHealth [22].

IV. PROJECT STATUS

The 3P project started in 2015. Due to technical and legal issues, there was a delay in technology implementation and patient inclusion for the research study. The telemedicine technology was implemented at the telemedical central during the fall 2017 and the inclusion of patients started in September 2017. The planned interventions and registrations in the 3P research study will be executed until the end of 2019.

V. EXPECTED OUTCOMES

The research study is expected to report on how telemedicine follow-up of COPD patients can empower patients in their personal disease management. The eHealth literacy questionnaire will provide information on how these patients with COPD can interact with and operate telemedicine technology. This feedback is of importance in future technology development and design of health care services.

The evaluation on patient empowerment, will provide information on how telemedicine services impact on the patients' experienced safety during the intervention with technology and patient-centered team in the health region. In addition, this may have an impact on the patient's self-management of his/her chronic condition, being able to obtain a more independent life at home, and when needed receive quick response from specially educated nurses at the telemedicine central.

When preparing for sustainable implementation of technology in health care services, this study will provide relevant results informing the design of procedures and models on how to identify patients that might benefit from using a telemedicine intervention. Experiences on how patients use the telemedicine technology as a support in coping with chronic conditions will be important, and it is expected that patients with a high score in eHealth literacy can benefit more compared to patients not familiar with the use of technology. After study termination, the results will be published in a high impact medical or telemedicine journal.

The technology use and the information flow in the innovation arena, will be studied and evaluated by a research team from University of Agder, Norway with observations, interviews and workshops together with the nurses, technicians, administrators and patients of the telemedical central, previously described in [7]. Based on this evaluation, recommendations will be given on how technology and information flow can be tailored and customized to efficiently support patient-centered health care teams.

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