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Original Article

Telemedicine in Patients with Chronic Lung Disease
Is it the Way Forward?

Nielsen, Pernille Kofoed, MSc PhD
Associate Professor, School of Health and Nursing Bornholm, Minervavej 1, DK 3700 Roenne, Denmark

Hansen, Pia Palnæs, BScN, MA in European Ethnology, MMD
Director, School of Health and Nursing Bornholm, Minervavej 1, DK 3700 Roenne, Denmark

Ilkjær, Ingeborg, RN, MA in Nursing, PhD
School of Health and Nursing Bornholm, Minervavej 1, DK 3700 Roenne, Denmark

Correspondence: Nielsen, Pernille Kofoed, MSc, PhD, Associate Professor, School of Health and Nursing Bornholm, Minervavej 1, DK 3700 Roenne, Denmark E-mail: Pernille.nielsen@bhsund.dk

Abstract

Background: Patients with chronic obstructive pulmonary disease (COPD) underwent the telemedicine project - the "Digital Island" COPD briefcase project.

Aims: The aim was to obtain knowledge about how patients with COPD experienced and learned from being in an asynchronous as well as synchronous telemedical contact with a lung clinic, with particular focus on the influence it had on their health and quality of life (QOL).

Methodology: Twelve qualitative phenomenological interviews were collected in the patients' homes. The informants were men and women over 60 years of age, who suffered from COPD stage 3 or 4 according to GOLD criteria. All interviews were recorded with a dictaphone, transcribed verbatim in their entirety, and validated by the authors. The interview guide qualified in advance with a Patient Population Involvement interview. During the visits, it was also possible to observe the patients in their own homes.

Results: The COPD briefcase provides some practical opportunities for patients and relatives to deal with the challenges of severe to very severe COPD in everyday life. They experienced increased safety and faster contact with the nurses. The synchronous meeting was of inestimable importance. Even without entering data, they could contact the outpatient nurses, whom they knew and who knew them well, too. The patients experienced being known, being taken care of as well as a dependency of relatives.

Conclusions: The COPD briefcase project adds to patients' sense of safety and contributes to some extent to their QOL.Telemedicine seems to have great potential but does not seem to be suitable for all patients and implies the risk of increased inequality in health. The most important thing in terms of QOL was cohesion with relatives. Thus, future research is needed to clarify the role and experience as a relative.

Key Words: telemedicine; pulmonary disorders, chronic obstructive; COPD; pulmonary disease; patient perspective; quality of life; qualitative interviews; phenomenology

Introduction

In Denmark (population 6 million) approximately 400,000 patients suffer from chronic obstructive pulmonary disease (COPD), and the prevalence is increasing (Stockley *et al.*, 2007; Schmidt, Pedersen and Sørensen, 2014; Lange *et al.*, 2016). Telemedicine, which enables video or phone appointments between patients and their health care practitioners, is beneficial for both health and convenience e.g. (Dinesen, 2007; Nissen and Lindhardt, 2017; Liang *et al.*, 2021). Of greatest importance, telemedicine offers an increased patient safety and prevents repeated hospitalizations, which leads to both financial and resource-related savings.

In a Danish study of patients with COPD (Net-COPD) (Nissen and Lindhardt, 2017) an intervention with weekly submission of self-monitored values and regular video consultations as an alternative to visits in the respiratory outpatient clinic was evaluated. The patients with COPD experienced a lower level of stress during virtual consultations with the same nurse versus physical consultations, and thus a higher sense of safety.

The present study was undertaken in Bornholm which is an island under the Danish Capital Region and has a local catchment area of about 50.000 inhabitants and a close co-operation with the hospitals in Copenhagen.

In 2020 Bornholm's hospital initiated a project named "Digital Island". The project consisted of tele ambulatory services and teleconsultations to reduce hospital contacts and included implementation of a COPD briefcase with equipment for self-monitoring as a welfare technological tool for discharged patients with COPD. Approximately 300 patients with COPD are attached to the outpatient clinic on Bornholm. Since the start of the "Digital Island" COPD briefcase project 35 patients have been enrolled, of these 18 patients participated in the COPD briefcase project in the autumn 2022 from which the data for the present project were collected (personal communication Bornholm's Hospital).

Although clinical benefits of proactive interventions with a reduction in hospitalizations have been documented (Vitacca *et al.*, 2009; Segrelles Calvo *et al.*, 2014) literature on telemedicine in patients with COPD lacks qualitative studies that reflect the patient perspective (Krag *et al.*, 2023). By focusing on how patients and their spouses directly experience life with the COPD briefcase through their bodies and senses, we sought to get a deeper understanding of the COPD briefcase as a value-creating object.

The aim of the present study was to obtain knowledge about how patients with COPD experienced and learned from being in asynchronous as well as synchronous telemedical contact with the lung clinic once or twice a week, with particular focus on the influence this had on their health and quality of life (QOL).

Methodology

The "Digital Island" COPD briefcase project: The COPD briefcase contains an iPad, two saliva trays, a PEP (positive expiratory pressure) whistle and pulse oximeter. The briefcase was offered patients with severe to very severe COPD for personal use and to record data. The patients used the iPad to answer a fixed set of questions once or twice a week (Danish Health Authority, 2017). Patients were requested to transmit data on oxygen saturation, pulse rate, weight, as well as a symptom score based on disease-specific questions selected from the questionnaire, which dealt with the degree of shortness of breath, the nature of the cough, and a mucus and saliva test (Bornholms Hospital, 2020; Global initiative for chronic obstructive lung disease, 2024). A nurse from the pulmonary outpatient clinic evaluated the answers and could thereby observe the development of the patient's COPD-symptoms. If the values deviated, the patient was contacted by telephone, thereby supplementing the asynchronous contact of the COPD briefcase with the possibility of synchronous contact. Two nurses were associated with the local COPD briefcase project at the outpatient clinic.

Informants: Twelve patients from the "Digital Island" COPD briefcase project were recruited from the local pulmonary outpatient clinic in the period August 16 – September 30, 2022

***Inclusion criteria*:** Patients who suffered from COPD stage 3 or 4 according to GOLD criteria (Global initiative for chronic obstructive lung disease, 2024), (Table 1). The patients were tested according to the Medical Research Council scale (MRC) (Fletcher, 1960; Bestall *et al.*, 1999; Primary Care Respiratory Society, 2025) when allocated the local COPD briefcase.

***Exclusion criteria*:** Patients in the terminal stage of the disease were excluded, as they would be unable to complete an adequate interview (Kamal *et al.*, 2012). An overview of the patients' social context is presented in Table 2.

Data collection: Qualitative interviews were collected in the patients' homes. Relatives could be present at the interview.

Nine patients had spouses, and out of these, eight patients chose to have their spouse present during the interview. Each interview lasted between 25 and 45 minutes. All interviews were recorded by a dictaphone. To ensure credibility a themed interview guide with relevant and appropriate questions that encourage in-depth responses was designed and qualified in advance with a Patient Population Involvement interview (Sacristan *et al.*, 2016) and was themed as shown in Table 3. Transparency was defined as consisting of credibility, transferability, dependability, and conformity (Lincoln and Guba, 1985). During the visits, it was also possible to observe the patients in their own homes. The observations were written down immediately after the interviews.

Data analysis: All interviews were verbatim transcribed entirely and validated by the authors. The data was analyzed with thematic analysis based on Merleau-Ponty's work on meaning in our body experience in interaction with Verbeeks approach (Verbeek, 2005; Rosenberger and Verbeek, 2017). Merleau-Ponty emphasizes concepts, perception, intentionality and embodiment, and perceives the body as both objective and subjective at the same time (Thomas, 2005; Merleau-Ponty and Landes, 2012). This is a counter-discourse with how technology is used in healthcare. Verbeek complements and continues the approach of Merleau-Ponty and looks at the importance of the body from a technological perspective and helps to interpret the world for people. Verbeek works with core concepts about how mediation and transformation are linked to everyday life with telemedicine, and how a coherent relationship is created between understanding of technology and the influence of QOL in the life lived (Verbeek, 2005; Rosenberger and Verbeek, 2017).

The observation notes were used to qualify the data analysis: The authors began the analysis individually by reading all the transcriptions repeatedly. Coding of the transcriptions were performed in six categories, see Table 4. The results of the categories: 1. Demographics, and 2. Social context, are shown in Table 2. The results of the other four categories: 3. Severity of the illness, 4. The COPD briefcase, 5. Psychological conditions, and 6. Quality of life with COPD were clustered into patterns and synthesized to illuminate the phenomenon and constitute the themes. Two main themes and ten subthemes emerged from the data analysis, as shown in Table 5. Dependability was ensured with a phenomenological approach based on reflective inquiry and description of the lived experience of patients with a COPD briefcase. To ensure transferability a description of the study setting and participant characteristics was provided to make the findings relevant to other settings. In terms of confirmability, one of the researchers has extensive experience with this patient group (Ilkjær, 2012).

Ethical considerations: Prior to the interviews, oral and written information was given and written informed consent from patients was obtained. According to Danish legislation, this type of research is exempted from ethical approval. The study was performed in compliance with the Helsinki Declaration (World Medical Association, 2024). Interviews were encrypted and the anonymity of the participants ensured.

Results

The analysis revealed two main themes, ***Importance of the COPD briefcase for patients***, and ***Transformation of the patient role.*** The COPD briefcase provides some practical opportunities for patients and relatives to deal with the challenges of severe to very severe COPD in everyday life. See Table 5.

Importance of the COPD briefcase for patients: There was a difference in how patients with COPD experienced and managed the briefcase, and how they related to both the technology and the healthcare system. Safety and trust in the COPD briefcase were evident among the patients. They experienced increased safety and faster contact with the nurses.

All participants in the study had long standing COPD, and some with standing orders for antibiotics. It was expected that the patients' experience of illness would enable them to catch exacerbations in the bud and avoid hospitalization and report their condition via the briefcase instead. The weekly contact with the health service via the COPD briefcase was not only a matter of safety and control. Thus, several of the patients had nuanced views on the function of the briefcase.

"*It'a good enough*" said patient L, yet his illness was so advanced, that he knew, he was vulnerable and needed help from others to maintain everyday life. He was aware of his dependence on his wife.

Some patients were modest and unsure about the technology. E.g., patient E had been unwell for a week and had not called the outpatient clinic to ask what to do. She had a fervent desire to prevent hospitalization, but she lacked knowledge as well as experience with the briefcase, as it was her daughter who came once a week to operate on it. Patient E had a visit twice a day by a care worker, who had limited experience to assess any change in the patient's condition.

When the asynchronous meeting focusses only on biomedical data, it can be difficult to react when the patient's functional level has deteriorated. None of the patients reported that they had been reassessed based on the MCR (Fletcher, 1960; Bestall *et al.*, 1999; Primary Care Respiratory Society, 2025), but they clearly reported their performance in relation to their health status, which corresponded to the observations during the interviews.

Transformation of the patient role

Most patients used the briefcase to measure and to send the requested data to the outpatient nurses. They were themselves responsible for the quality of the data, and they showed a certain understanding that it serves their own health to do it well. It was the meeting that matters, and which helped the patients to provide QOL and safety in their everyday life. This means that a small set of recorded data opens for other care options, which according to many of the interviewed patients, were essential to cope with each day with very severe COPD. The synchronous meeting was of inestimable importance to them.

Even without entering data, the patients could contact the outpatient nurses, whom they knew and who knew them well, too. The patients experienced being known, being taken care of as well as a dependency of relatives.

There was a difference in how the patients acted in relation to the COPD briefcase. Patient D felt that measurement once a week was enough, and sometimes she forgot to do it. Moreover, she felt that responsibility for her well-being was not mutual but laid with the health service.

While Patient D had bad compliance, other patients were active in monitoring their lung function and felt great responsibility for their own treatment. Some patients were intermittently motivated depending on the situation with effort after acute admission.

Others did a lot to avoid being hospitalized. Most patients were uncomfortable being admitted and felt they were unable to communicate with the staff about their physical condition.

Those who lived alone were dependent on help, and it was not always easy if there were alternating care workers with limited experience with patients with COPD. Three of the informants received daily help from care takers. Relatives often played a significant role in care, medication management, transport, cleaning, cooking, etc. In general, it was apparent how grateful the patients were to their relatives.

*Table 1. The GOLD criteria**

Stage	Criteria	
GOLD 1	Mild	$FEV_1 >= 80\%$ predicted
GOLD 2	Moderate	$50\% <= FEV_1 < 80\%$ predicted
GOLD 3	Severe	$30\% <= FEV_1 < 50\%$ predicted
GOLD 4	Very severe	$FEV_1 < 30\%$ predicted

*** According to (Global initiative for chronic obstructive lung disease, 2024)**

Table 2. Characteristics of the informants

Designation Sex Age	Civil status	Housing	Previous profession
A Man 70	Married/cohabiting Children in the local environment	One-story house	Previous unskilled work Public pensioner
B Man 83	Married/cohabiting Children in the local environment	Farm	Previous unskilled work Public pensioner
C Man 71	Married/cohabiting Children in the local environment	One-story house	Previous skilled work Public pensioner
D Woman 63	Divorced/single No children in the local environment	Two-story house	Previous unskilled work Public pensioner
E Woman 72	Widowed/single Children in the local environment	One-story house	Previous unskilled work Public pensioner
F Woman 64	Married/cohabiting Children in the local environment	One-story house	Previous unskilled work Public pensioner
G Woman 73	Married/cohabition Children in the local environment	One-story house	Previous skilled work Public pensioner
H Woman 62	Married/cohabiting No children in the local environment	One-story house	Previous unskilled work Public pensioner
I Man 78	Married/cohabiting Children in the local environment	One-story house	Previous unskilled work Public pensioner
K Woman 62	Married/cohabiting Children in the local environment	One-story house	Previous unskilled work Public pensioner
L Man 69	Married/cohabiting No children in the local environment	One-story house	Previous skilled work Public pensioner
M Woman 72	Divorced/single No children in the local environment	Two-story house	Previous skilled work Public pensioner

Table 3. The interview themes

	Interview themes
1	Medical history
2	Experiences being included in the local COPD briefcase project
3	Reflections of the meaning of being included in the local COPD briefcase project
4	Strengths and weaknesses of the connection between the home and the hospital
5	The importance of the family's efforts in connection with the tele-suitcase
6	Reflections on own responsibility for the COPD situation

Table 4. Coding categories

	Coding categories
1	Demographics
2	Social context
3	Severity of illness
4	The COPD briefcase
5	Psycological conditions
6	Quality of life with COPD

Table 5. Analysis of the patients' experience with the COPD briefcase.

Meaning Unit	Subtheme	Main theme
"It has made a lot of sense. It is just a kind of reassurance, just like I know – they keep an eye on me once a week and so that I know that if there is anything I can just contact them out there, or they' ll call you…" (Patient A)	Safety	Importance of the COPD briefcase for patients
"Well, I don't have to wait to get treatment, because there are still only two (nurses) there has something to do with me. It's like they take care of us, that way you can feel safer" (Patient H)	Waiting Time	
"Perhaps for a newly diagnosed person,	Seniority	

it can mean a lot. But not me because I'm such an old hand at this. Oh, and my wife too. It's good enough. We have settled in…" (Patient L)		
"... should you see a doctor? Or you just must wait and wait." (Patient E)	Modesty	
"What I'm missing in the briefcase….: Quite ordinary things, because you don't get them in your briefcase. It's only those completely fixed measurement items. I'd like a question to come in : Are there any things that have become more difficult for you within... a certain period. This applies to all COPD patients." (Patient M)	What is missing	
"They know me very well, right? The pulmonary nurse she has had me throughout the process while I've had COPD, hasn't she? It means a lot. It actually does. That safety is quality of life somewhere, right? I don't have to wait to be treated, because there are still only the two nurses that hat have anything to do with me." (Patient D)	Known	Transformation of the patient role
"It's like they take care of us. That way you can feel safer" (Patient D)	Taken care of	
"Sometimes I also forget to take the test there" (Patient D)	Forget	
"I am very happy with my wife. Otherwise, I would be in a bad situation. So, I am. Then I wouldn't have been sitting here, anyway." (Patient L)	Dependent	
"So, it's mostly him (the husband) who helps. He helps with everything." (Patient K)		
"… I actually think it was stressful… having a lot of different people running around and having to explain all the time – and they were all busy trying to get me back to being myself, right. So, I could handle it all myself, right? It was just under the surface, wasn't it?" (Patient D)	Pushed	

Discussion

The aim of the study was to investigate how patients with COPD experienced and learned from being in synchronous as well as in asynchronous telemedical contact with the lung clinic, with particular focus on the influence this had on their health and QOL.

In general, the COPD briefcase project increased patients' sense of safety and to some extent their QOL. Most important in terms of QOL were the cohesion with relatives, which should be a subject for future research. Our findings corresponded to the results from an earlier randomized clinical trial, Net-COPD project (Nissen and Lindhardt, 2017) where

regular video consultations were used instead of outpatient visits. In the study patients with COPD evaluated the role of telemedicine in management of severe COPD. It was concluded that the video consultations in the Net-COPD project gave the patients, as well as the relatives, a feeling of safety.

Although telemedicine seems to have great potential from conducting medical visits over the computer to monitoring patients' vital signs, it does not seem to be suitable for all patients and implies the risk of increased inequality in health.

In our study, patients differed in their compliance and their experience with the COPD briefcase. In general, they were responsible for their own health with the help of their relatives. However, the study indicated that, in case of disease progression, the briefcase could not entirely capture the loss of daily function.

Using telemedicine, in this case the COPD briefcase, creates new ways for patient collaboration in a healthcare setting. The patient plays a leading role in the workflow through the submission of self-observed medical data. This changes the well-known workflows of the clinic and the forms of collaboration. It alters the way treatment and disease prevention are organized. Direct contact is replaced by the patient's self-monitoring; patients are given responsibility on their own health, which results in a greater awareness of their own situation and thereby a greater disease insight. But it also implies greater inequality due to different levels of IT competences.

By receiving data about the patients, a focus is created for the meeting between the patient and the healthcare system. Information that can be processed from both sides, but in different ways and with different roles. The clinic receives specific measurements from the patients which means that the clinical responsibility for conveying the right answers lies with the patient. If data is not within the expected range, responsibility is handed over to the healthcare system and first then responsibility is shifted away from the patient.

Patients themselves are responsible for the quality of the data they report, but there is a risk of erroneous measurements due to faulty technique and performance. Minor errors can be difficult to catch, and disease progression may be overlooked. Erroneous measurements may also occur despite adequate instruction. However, most patients used the briefcase correctly and understood that it served their own health to use it well.

It remains unclear whether the feeling of safety was due to the tele data or due to the contact with the staff. Our data supports that meeting with the patient matters and increases QOL and safety in everyday life. However, what matters most is contact with the outpatient nurses and meeting the same staff who know them well.

Our findings also point to a clear dependence on relatives. Being unable to participate in daily activities gave several of the patients a feeling of a gradual systematic reduction. However, this was only one side of the loss, the other side concerned the exclusion - social death, which severely affects the individual's QOL. Some of the patients were ambivalent. Help and contact with the outpatient clinic was necessary but at the same time they wanted to manage their own life.

The Danish TELEKAT project (for Telehomecare, Chronic Patients and the Integrated Healtcare System) (Dinesen, Huniche and Toft, 2013) conducted qualitative interviews and participant observation with 22 patients with COPD. The data analysis was inspired by Wenger et al. (Wenger, White and Smith, 2009) and four different types of attitudes to telerehabilitation emerged among patients with COPD: indifference, learning as part of situations in everyday life, feeling of safety, and motivation for performing physical training. The patients with COPD circulated between these four positions depending on their actual emotional and physical state.

Another Danish study (Mathar, Fastholm and Sandholm Larsen, 2015) calculated the cost-benefit of the extent to which tele video consultations for patients with COPD made their lives easier or harder, and concluded that further research was needed to clarify how to distinguish between patients who may benefit or were distressed by the tele video consultation.

Our results are consistent with these findings, but more studies are needed. Thus, we recommend individually adapted care, asynchronously as well as synchronously, virtual but also continuously physical, depending on the patient, and the circumstances.

The patients in our study appreciated synchronous contact. The advantage here was that they could explain themselves directly.

During our interviews and observations, we found that when the task became too complicated, the patient was left in limbo. Patients in the more advanced stages of the disease more often felt exposed to acute situations where the briefcase did not help them. Acute admissions, of which there were many, became profound existential experiences, filled with anxiety, powerlessness, hopelessness, and concerns about death.

We observed that many of the interviewed patients were in fact no longer in stage 3 according to the GOLD scale (Global initiative for chronic obstructive lung disease, 2024), as their lung function seems to have declined further since the time of inclusion. The patients with COPD describe that they experienced significant functional loss in daily life, compared to the time they were included in the COPD briefcase project, which reduced their QOL.

Thus, it seems that the self-reported data conveyed through the COPD briefcase did not always pick up changes in physical ability, which is important to be aware of in the future.

Observations and interviews with the twelve patients as well as the preliminary Patient Population Involvement interview agree that the relatives were of great importance in everyday life and in handling of the COPD briefcase. Patients with COPD without relatives had a more vulnerable position. Relatives did a great job, but they were worried and lacked support to cope with difficult situations. Some patients had given up receiving help from care workers in their own home, because of frequently changing staff, with inadequate knowledge and experience with COPD.

Patient L (male, 69 years old) said: *"We have arranged ourselves"*. He was aware of his dependence on his wife. And was – like many other patients in a dependent relationship – ambivalent. On the one hand, help and contact with the outpatient clinic was necessary and on the other hand, he wished to manage his own life. This creates a degree of inequality, as the patient always will experience the encounter with a helper (the nurse as well as the relatives) as a receiver-helper relationship.

Patients were aware of the risk of death, especially in case of emergency admissions, but none of the patients talked directly or indirectly about palliative care, only that they needed more help and that they were worried about the future. Despite this, we observed a great will to create a good life, where the most important thing in terms of QOL was the cohesion with their relatives.

Methodological considerations/ limitations/ strengths and weaknesses

Twelve patients, who were the highest possible number in the “Digital Island” COPD Briefcase Project, participated in the interviews. All interviews were completed over the course of a week, and the data analysis took place afterwards. Observations during the interviews at the patients home enhanced the understanding of the interviews and furthermore contributing to data saturation (Fusch and Ness, 2015).

The patients represented a homogenous group as they all participated in the same intervention and were affiliated with the same two nurses at the outpatient clinic.

At the same time, the participants in the study represented a heterogenous group regarding age, gender, marital status and seniority in the briefcase project.

One limitation was that all patients were recruited from the same hospital and were allocated to the same two nurses. Thus, the findings reflect only one nursing tradition and may have been different had patients from other and larger hospitals been included. The clinically weakest patients were not recruited, which may have an impact on the results.

Conclusions: In conclusion, the COPD briefcase project adds to patients' sense of safety and to some extent contributes to their QOL particularly because the COPD briefcase offered the opportunity to get through to the outpatient clinic quickly when was needed. Another important reason for the feeling of safety was the relationship with the nurses in the pulmonary outpatient clinic who had known the patients for years. The patients also appreciated synchronous contact via the telephone. However, the study indicated that telemedicine does not seem to be suitable for all patients as the compliance and the telemedical competences as well as the quality of the measurements of data differ between patients. Finally, cohesion with relatives in daily life weighted heigh in QOL.

Implications for future research and practice: Telemedicine seems to have great potential. However, it implies the risk of increased inequality in health. Patients with COPD belong to the older patient group, not all of whom have information technology experience. This means that a large group of patients with COPD are excluded from being offered the COPD briefcase and miss out on the benefits this may bring. Since many care workers have a poor understanding of what patients with special needs could accomplish in their daily lives, additional knowledge, teaching, and training would greatly benefit preventive health care. Finally, the study gave a view of how complex life lived with severe and very severe COPD is, and how great a burden rests on the closest relatives. Future research is needed to clarify their role, importance, and experience as a relative.

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