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**Tele-delivered mindfulness-based cognitive therapy in chronic obstructive pulmonary disease:
A mixed-methods feasibility study**

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List of declarations

IF-V: EWII Telecare, Odense, Denmark provided hardware and software for the tele-based delivery of the intervention. EWII Telecare had no influence on the design, conduct or reporting of the present study. I had full access to all of the data in this study and I take complete responsibility for the integrity of the data and the accuracy of the data analysis.

MOC: The Author declare that there is no conflict of interest.

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ABSTRACT

Introduction

Mindfulness-based cognitive therapy (MBCT) has shown to reduce psychological distress in chronic obstructive pulmonary disease (COPD), but uptake and attendance rates of hospital-based, face-to-face MBCT are low. The present mixed-methods study evaluates the clinical feasibility of home-based, tele-delivered MBCT in COPD.

Methods

Eight COPD-patients (mean age: 72.6 yrs; 50% female) received a standardised 8-week MBCT programme delivered via home-based video-conferences in groups of four. Feasibility in relation to 1) clinical change, 2) attendance and 3) instructor-patient working alliance were evaluated with questionnaires and semi-structured interviews.

Results

Statistically non-significant reductions in psychological distress (Cohen's $d=0.504$; $p=0.399$) and physical health status impairment ($d=0.743$; $p=0.156$) were observed from pre- to post-intervention. Participant narratives about clinical outcomes focused on changes in how to relate to unpleasant sensations, i.e., through attentional flexibility, taking a pause and acceptance. The average attendance rate was 7.5 (SD=0.8) out of 8 sessions and no participants dropped out. The tele-based format appeared to accommodate participants' planning difficulties and promoted their ability and wish to participate. Although participant narratives suggested the tele-based format to be a barrier to developing a trusting and safe therapeutic environment, working alliance questionnaire scores were comparable to those found for face-to-face MBCT.

Discussion

The preliminary results indicate that Tele-MBCT is a clinically feasible intervention for reducing psychological distress and improving physical health status in COPD. Future large-scale, randomised controlled trials testing its efficacy should include analyses of potential mediators and moderators of the effect as well as careful monitoring of attendance and adverse events.

Keywords: *Telecare; mixed-methods design; COPD; psychological distress; physical health status*

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity and mortality worldwide.¹ In addition to physical symptoms such as breathlessness, cough and excessive mucus production, patients often report high levels of psychological distress.² COPD-patients experiencing psychological distress typically also report poor physical health status as well as frequent use of acute healthcare services,³ indicating a need for efficacious interventions for reducing psychological distress in this patient group.⁴

Mindfulness is “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment”.⁵ Stimulating this form of awareness through regular meditation practice has been shown to reduce psychological distress and relieve physical symptoms in cancer and chronic pain patients.^{6,7} Mindfulness-based cognitive therapy (MBCT) is a manualised 8-week, group-based psychological intervention combining mindfulness meditation with elements from cognitive behavioural therapy (CBT).⁸ MBCT has recently shown to reduce psychological distress in COPD in a randomised controlled trial with face-to-face MBCT delivered as an addition to a standardised pulmonary rehabilitation (PR) programme.⁹ Unfortunately, as is often seen for behavioural interventions in COPD,¹⁰ uptake and attendance rates were low (52% inclusion rate; mean number of MBCT sessions attended=4.0 (SD=2.74)). Among the reasons for COPD-patients’ non-attendance are activity limitations, travel issues and costs.¹⁰ Similar issues are seen in other physical health conditions, and synchronous and asynchronous tele-based delivery of MBCT (Tele-MBCT) has shown to be feasible in chronic diseases such as cancer, chronic pain and irritable bowel syndrome.^{11,12} While asynchronous, self-directed intervention types may be challenging for the present generation of COPD-patients (i.e. elderly population with relatively limited computer skills¹³), synchronous, facilitated tele-delivered medical consultations and PR programmes, in which health care professionals and patients communicate through a videoconference device, have shown to be feasible and acceptable in COPD.^{14,15} To date, however, little is known about the clinical feasibility of tele-delivered *psychological* interventions in COPD.

Using videoconferencing to deliver psychological intervention has received increasing empirical support, with the available studies indicating high levels of patient satisfaction.¹⁶ Yet, the field is still in its infancy, and concerns have raised that tele-delivered psychological interventions could negatively impact the development of a productive therapeutic working alliance and complicate

procedures for taking clinical responsibility of patients at a distance.¹⁷ Moreover, additional issues have been raised regarding technology-mediated presence, e.g., whether technology-mediated experiences evoke the same bodily, emotional and cognitive dynamics as a real experience and how this may influence clinical outcomes. Furthermore, little is known about individual variation in the experience of and responses to technology-mediated environments.^{18,19} Therefore, in addition to quantitative assessments of changes in pre-specified clinical parameters (i.e., psychological distress and physical health status), it is relevant to qualitatively explore individual patients' experiences with receiving and engaging in Tele-MBCT with the overall purpose of evaluating its clinical feasibility and identifying relevant design issues for future efficacy trials.

On this background, the aim of the present study was to evaluate the clinical feasibility of Tele-MBCT in COPD using a mixed-methods design to

- 1) measure pre-post-intervention clinical change in psychological distress and physical health status,
- 2) monitor drop-out rate and attendance rates (number of Tele-MBCT sessions attended),
- 3) measure the participants' perception of the therapeutic working alliance during the intervention, and
- 4) explore the participants' individual experiences with receiving Tele-MBCT.

Specifically, a 'convergent parallel' type of design²⁰ was applied, with quantitative and qualitative data collected independently and then analysed to contribute to the understanding of the same particular phenomenon.

METHODS

The methodology and reporting of the present study has been subjected to a comprehensive critical appraisal using instruments for evaluating mixed-methods research (GRAMMS assessment of reporting;²¹ Sale & Brazil's assessment of methodology²² (see Supplementary file S1)

Patients with a spirometry-confirmed (forced expiratory volume in 1 second <50%) COPD-diagnosis were invited to take part in the present feasibility study. The participants were recruited from the control group of a larger study.⁹ After having provided informed consent, and after having completed a baseline questionnaire package, a touch-screen computer for conducting videoconsultation (EWII Telecare, Odense, Denmark) was installed in the participants' homes and a brief individual test call from the MBCT instructor was made. As part of the test call, the MBCT instructor and each participant settled on a convenient date and time for an individual pre-

intervention clinical interview (see below). All participants were then invited to take part in eight group-based, videoconference sessions, constituting the Tele-MBCT intervention described in the following. The touch-screen computers were removed after termination of the Tele-MBCT intervention, followed by participants completing post-intervention questionnaires and taking part in individual qualitative research interviews.

Intervention

The Tele-MBCT intervention was based on the manualised MBCT programme²³ originally developed to prevent relapse in major depression and adjusted to meet the needs of COPD-patients.⁹ Tele-MBCT was comprised of an initial 30-60 minutes individual interview followed by eight weekly 120-minute group sessions of meditation, mindfulness movement activities and cognitive exercises. Participants were encouraged to practice mindfulness meditation individually at home between sessions for an approximate duration of 20-30 minutes per day. The eight sessions were led by a clinical psychologist (IF-V). Weekly handouts and an audio compact disc (CD) with meditation and mindful movement exercises were sent by post to each participant prior to the first Tele-MBCT group session. For further details concerning the intervention content, see Farver-Vestergaard et al.⁹

Since participants were recruited from an elderly sample (mean age of the mother sample=67.2 yrs⁹) we did not expect all participants to have their own computer. Therefore, the Tele-MBCT intervention was delivered via touch-screen computers installed in the participants' homes prior to the first session. The computers had integrated camera, speaker and microphone, allowing each participant to see, hear and speak to the instructor and the other participants. The instructor operated a provider station to make a group call to all participants prior to each session and to terminate the call after each session. The instructor contacted service providers in instances of technical issues.

Quantitative evaluation

The clinical parameters of psychological distress and physical health status impairment were assessed pre- and post-intervention. Psychological distress was assessed with the Hospital Anxiety and Depression Scale (HADS).²⁴ Its 14 items yield a total score ranging from 0-42, with higher scores representing higher levels of distress. Physical health status impairment was measured with the COPD Assessment Test (CAT).²⁵ It consists of eight items resulting in a total score ranging from 0-40, with higher scores representing higher levels of impairment. Both questionnaires have shown satisfactory psychometric properties in COPD (HADS Cronbach's $\alpha=0.82$; CAT $\alpha=0.92$).⁹

For each individual participant, the total number of MBCT sessions (0-8) attended as well as the potential wish to withdraw from the intervention were registered. Average attendance and drop-out rates for the whole sample were computed.

Between session four and five, participants completed the Working Alliance Inventory (WAI),²⁶ measuring their perceptions of the therapeutic instructor-patient working alliance. Total scores range from 12-84 with higher scores representing a better alliance.

Paired *t*-tests were performed to explore changes in HADS and CAT scores after Tele-MBCT.

Qualitative evaluation

Semi-structured qualitative interviews were conducted with all participants immediately after completion of the Tele-MBCT programme either in the participant's own home or via telephone (the interview guide is shown in Supplementary file S2). Interviews were conducted by a research assistant (NCS) with a background in psychology and experience within the field of psychological intervention in COPD. All interviews were transcribed verbatim by a second research assistant. The analysis was based on the *thematic analysis* framework.²⁷ The six iterative phases of analysis started with a thorough and detail-oriented reading of research interviews and moved gradually towards a condensed understanding of the data through the identification and definition of themes. The initial coding of data was based on an inductive approach, but as the analysis moved towards the definition of themes, it took a more deductive approach with focus on areas of the data that complemented the quantitative evaluation (i.e., clinical change, attendance and working alliance). It was sought to provide as balanced an account of experiences as possible by actively seeking conflicting utterances under a given theme. The analysis was primarily carried out by the first author (IF-V), supplemented with discussions with the interviewer (NCS) and other colleagues.²⁸ During the analytical process, a reflective logbook was kept, using the NVivo software (NVivo, Version 11.3.0.773; QSR, 1999-2016).

RESULTS

In the period from February to May 2016, a total of eight out of 47 invited COPD-patients (17%) were enrolled in the study and allocated to two treatment groups of four participants each (reasons for non-participation: 8 patients preferred face-to-face MBCT; 25 patients were not interested in receiving any form of MBCT at the time of recruitment; 6 patients did not respond to our telephone calls). The individual participant and total sample characteristics at baseline, as well as HADS, CAT and WAI scores are shown in Table 1. Three participants (number 2, 3 and 5) reported a pre-

to-post treatment reduction of the HADS, while an increase was observed in one participant (number 1). Five participants reported a reduction of the CAT after Tele-MBCT (number 1, 4, 5, 6 and 7), while two participants reported an increase (number 2 and 8).

[Insert Table 1 near here]

Quantitative results

On average, a medium (Cohen's $d=0.50$), but statistically non-significant reduction in HADS scores was observed from pre- to post-intervention ($t(7)=0.90$, $p=0.399$). Likewise, a medium ($d=0.74$), non-significant reduction in CAT scores was seen from pre- to post-intervention ($t(7)=1.587$, $p=0.156$). The average attendance rate was 7.5 (SD=0.8) out of 8 sessions, and no participants dropped out. The average WAI score assessed between session four and five was 68.88 (SD=10.72).

Qualitative results

The themes emerging from the qualitative analysis complement the quantitative data by relating to 1) clinical change, 2) attendance and 3) working alliance.

[Insert Table 2 near here]

Theme 1: Changes in relating to unpleasant symptoms

When asked about what they had gained from the intervention, participants generally described a change in how they *related* to unpleasant psychological symptoms and physical sensations from before to after the intervention. Three prominent areas of change were identified: First, several participants described an experience of increased attentional flexibility (Table 2, Quote 1), including an improved capability of being aware of both positive and negative aspects of life (Table 2, Quote 2). Second, taking a pause – physically and mentally – is another example of changes in ways of relating to unpleasant experiences (Table 2, Quote 3). Third, a number of participants mentioned increased acceptance as a new way of dealing with unpleasant sensations (Table 2, Quote 4). Not all participants reported changes right away. One participant stated: “*I’m feeling as I’ve felt all along*” (Participant 3). Later in the interview, however, this participant described that the intervention had made her aware of the importance of pausing before action: “*It [Tele-MBCT] taught me a whole lot about not just reacting straight away. Take a moment to make sure that your head agrees with your response.*”

Theme 2: Practical aspects of attendance

In relation to attendance, the participants described a number of practical benefits related to the tele-delivered format of the intervention. Most participants experienced the home-based format and the associated reduction of travel burden, positively. First, the tele-based format appeared to make planning of the day easier, which was perceived by several participants as a very important aspect when attending a large number of treatment sessions (Table 2, Quote 5). Second, a few participants expressed that the home-based format had a positive influence on their choice to participate in the intervention at all, and one participant declared that without the tele-based format, she would not have been *able* to take part at all (Table 2, Quote 6).

Theme 3: Relational aspects

Finally, the tele-based intervention also appeared to influence the relational aspects of taking part in the intervention sessions. Negative influences of the tele-based format mentioned included an experience of a reduced and disturbed personal contact with the other participants and the instructor, often caused by technical problems (i.e. disruption due to an unstable video connection). According to some participants, this led to difficulties in creating an atmosphere of trust and safety, which in turn was perceived as a barrier to the willingness to disclose certain personal experiences and feelings (Table 2, Quote 7). One participant expressed the need for a hotline for participants who are left alone with their worries and concerns, each time the video-consultation was, timely or untimely, disconnected. In spite of these negative influences on the quality of participating in the sessions, most participants reported that, over time, the personal contact with fellow participants and the instructor developed into a warm, respectful and caring relationship (Table 2, Quote 8). Among the positive influences mentioned were that the tele-based format demanded more intense management of the group dynamics, which led to increased concentration – something several participants felt was lacking in face-to-face interventions they had attended (Table 2, Quote 9). Moreover, the tele-based format used in the present study did not allow groups of more than four participants plus the instructor, and several participants mentioned that this allowed more time to address the issues of each participant, which was perceived positively (Table 2, Quote 10).

DISCUSSION

The present study is among the first to evaluate the clinical feasibility of a tele-delivered psychological intervention in COPD, using a mixed-methods design. Overall, the quantitative study results are concerned with three areas: 1) clinical change, 2) attendance and 3) working alliance,

with the qualitative data on participant experiences complementing and expanding on the quantitative results.

Clinical change

The results of the quantitative evaluation indicated that, for psychological distress, an average reduction of 1.5 points on the HADS was seen after Tele-MBCT, representing a clinically relevant improvement (minimal clinically important difference (MCID) for the HADS=1.5 points).²⁹ The average improvement corresponds to a medium effect size (Cohen's $d=0.50$). Concerning physical health status, the average reduction of 1.5 points of the CAT did not exceed the suggested MCID of 2 points.³⁰ However, the magnitude of the average improvement was medium-to-large ($d=0.74$). For both outcomes, the differences failed to reach statistical significance, which is likely due to the small number of participants included in the present feasibility study. Looking at individual participants' change scores after Tele-MBCT, only three participants reported improvements of HADS scores, and the average improvement described above appeared to be driven by a single participant (number 5) reporting a considerably large improvement. Five individual participants reported an improvement in CAT scores after the intervention and there were no apparent outliers. Summing up observations across individuals, it appears that it was not the same participants who experienced improvements both in psychological distress and physical health status. Moreover, individual participants with relatively high levels of psychological distress at baseline tended to report post-treatment improvements in HADS scores. In contrast, individual participants who reported improvement of physical health status after the intervention had relatively low levels of CAT scores before the intervention. Based on these findings, future efficacy studies should consider taking baseline levels of psychological distress and physical health status into account when including patients. When considering the qualitative results, participant narratives focused on changes in how they *related* to psychological and physical concerns and symptoms. Changes included a) attentional flexibility, which also encompassed a broader awareness of both positive and negative aspects of life, b) pausing and improved pacing of physical and mental activities and c) increased acceptance of difficult thoughts and feelings. The ability to pause has previously been described as an important facet of optimal COPD management,³¹ and attentional flexibility and acceptance are inherent concepts in the theory of how mindfulness-based intervention achieves its outcomes.³² While this could be taken as suggesting that the participants may have learned to interpret their experiences through the narrative of mindfulness intervention, the accounts obtained

in the present study may also provide indications of possible mechanisms of change to be tested further through mediational analyses in larger trials.

Attendance

The average attendance rate was considerably higher in the present study (7.5 out of 8 sessions) than in a recently published RCT of face-to-face delivered MBCT (4.0 out of 8 sessions).⁹ Complementing these findings, the qualitative results suggest that the tele-based format met the participants' needs for being able to plan their day and improved their ability and willingness to participate, which resonates with the findings of a qualitative study of tele-delivered MBCT in cancer.¹² It is unknown, however, whether higher attendance rates in itself leads to improved outcomes. Reasons for non-attendance may vary, including perceptions of insufficient treatment gains or negative attitudes towards the intervention. Furthermore, adherence between sessions (e.g., engaging in home practice; integrating mindfulness in everyday life activities) may be more important for intervention outcomes than the number of attended treatment sessions.²³ Future studies should supplement measures of session attendance with between-sessions adherence to home practice as well as registering reasons for non-attendance. The inclusion rate of the present study was relatively low (17%). This finding should, however, be interpreted in the light of patients being recruited after having already participated in a RCT with frequent (five measurement points), comprehensive questionnaires and a long follow-up period (six mths).⁹

Working alliance

The average perception of the therapeutic alliance in the present study (WAI: Mean=68.88, SD=10.72) was comparable to the results obtained in an RCT of face-to-face MBCT using the same instructor as in the present study (WAI: Mean=63.67, SD=13.63).⁹ This finding supports the feasibility of Tele-MBCT, as non-specific factors such as the working alliance have been suggested to be as important in technology-delivered interventions as in face-to-face therapy.¹⁷ The qualitative results of the present study complement these findings by indicating that the tele-based format could negatively influence the personal contact with the instructor and between fellow participants, thereby possibly reducing trust and feelings of safety. Similar concerns related to issues of confidentiality and the impersonal nature of tele-based interaction have previously been reported.^{12,33} It has been recommended that ethical and safety procedures should be considered and thoroughly described in future studies, e.g., by including face-to-face clinical interviews and monitoring of adverse events.^{17,34} Moreover, participant narratives emphasised technical problems

as interfering with the therapeutic relationship, which is in line with findings from other studies.³⁵ Technological issues should therefore be monitored and explored in more detail in future studies, e.g., paying special attention to patients living in remote areas where internet connectivity may be relatively poor.

On the other hand, participants in the present study also reported positive influences of the tele-based format on relational aspects, including more efficient management of the group dynamics. Taken together, whether positively or negatively, the tele-based format appears to influence relational aspects, which may in turn influence outcomes. Future studies are therefore recommended to explore the influence of relational aspects, e.g., by including measures such as the Distance Communication Comfort Scale.³⁶ In the longer term, as new generations are aging, the COPD-population will be predominated by people who are more adept to tele-based communication, and relational aspects of tele-delivered psychological intervention may perhaps become less of an issue.³⁷

Limitations

As this was a feasibility study, certain limitations should be taken into account when interpreting the results. First, due to the small sample size, the statistical power and precision is limited, and change scores (pre-post quantitative data) should not be interpreted as an indicator of treatment effect, but rather as a clinical summary of a number of individual cases. Second, the participants were a convenience sample recruited from the control arm of a larger randomised trial testing the efficacy of face-to-face MBCT,⁹ and the participants in the present study may therefore have had a more positive attitude towards psychological intervention than COPD-patients in general. Third, a control group was not included, and we can therefore not be certain whether similar changes over time could have occurred spontaneously. Fourth, questionnaire contents might have influenced participant narratives in the subsequent interview.

Perspectives

The results of the present study suggest that Tele-MBCT could be a clinically feasible intervention in COPD. Future, large-scale randomised controlled trials are needed to explore the efficacy of Tele-MBCT on the outcomes of psychological distress and physical health status in COPD. Based on the present findings, future studies could preferably include a) inclusion criteria related to baseline levels of psychological distress and physical health status, b) mediational analyses of MBCT-related factors, e.g., attentional flexibility and acceptance, and moderating influences of

tele-related factors, e.g., distance communication and tele-presence, c) monitoring of session attendance and between-session adherence as well as underlying reasons for (non-)attendance and d) careful consideration and description of ethical and safety procedures. Finally, and on a more general level, the question of cost-effectiveness of telehealth in COPD remains unanswered,^{15,38} and is of crucial relevance for the implementation of tele-delivered interventions such as Tele-MBCT.³³ Therefore, future trials could be improved by including comprehensive short- and long-term health economic analyses, as well as delivering the intervention via a desktop-based application as a less costly alternative to the touch-screen computers installed in patients' homes for the purpose of the present study.

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DECLARATION OF CONFLICTING INTERESTS

EWII Telecare, Odense, Denmark provided hardware and software for the tele-based delivery of the intervention. EWII Telecare had no influence on the design, conduct or reporting of the present study. The first author had full access to all of the data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis. The remaining authors declare that there is no conflict of interest.

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Table 1. Individual participant and total sample characteristics

Participant no.	Gender	Age	Work	FEV1 % predicted	HADS total pre	HADS total post	HADS change	CAT total pre	CAT total post	CAT change	WAI total midway
1	Male	71	Retired	34	8	9	1	20	14	-6	71
2	Male	79	Retired	43	17	15	-2	25	26	1	69
3	Female	76	Retired	49	20	17	-3	23	23	0	60
4	Male	78	Retired	46	13	13	0	16	13	-3	76
5	Female	85	Retired	54	35	23	-12	22	21	-1	84
6	Male	60	Full-time	27	18	18	0	19	15	-4	79
7	Female	76	Retired	33	11	15	4	19	18	-1	54
8	Female	56	Retired	19	5	5	0	19	21	2	58
Total sample	50% women	M=72.6 SD=9.9	87.5% retired	M=38.1 SD=11.9	M=15.9 SD=9.3	M=14.4 SD=5.5	MD=1,5 CI=-2.45–5.45	M=20.4 SD=2.8	M=18.9 SD=4.6	MD=1,5 CI=-0.73–3.73	M=68.88 SD=10.72

Abbreviations: CAT (COPD Assessment Test); CI (95% confidence interval); FEV1% predicted (Forced expiratory volume in 1 second, percentage of predicted value in age-matched normative sample); HADS (Hospital Anxiety and Depression Scale); MD (Mean difference); WAI (Working Alliance Inventory)

Table 2. Qualitative themes and subthemes with supporting data extracts from semi-structured interviews

Theme	Subtheme	Quote (Participant no.)
Changes in relating to unpleasant symptoms	Attentional flexibility	Quote #1 <i>"Participant: I think I forget about it [the physical pain]. I don't think it goes away. I just think you forget about it. Interviewer: Maybe you direct your attention towards something else? Participant: That is my sensation, anyway. Because it is there all the time, the pain."</i> (Participant 2)
		Quote #2 <i>"This is about awareness, and awareness is certainly good. And having an awareness of both positive and negative situations – that is what it is all about. You have to be aware of both. [...] If one cannot see neither the positive nor the negative, then life will be shitty. Quite frankly."</i> (Participant 1)
	Taking a pause	Quote #3 <i>"And then I have gotten some tools. And exercises. And a method for sitting down and immersing oneself, regardless of whether it's to do with a pause. [...] I think I may have used that beforehand, because I get so short of breath, that my body needs a break. That is one of the only things, that I had to learn the hard way. And that's why I think that it's a good think to participate in a course like this where you can talk about it. [...]. It [mindfulness practice] makes people slow down. For me it's purely physical. Pulse and system, but also lungs. The lung system. While what she's doing, that's awareness, you know soothing the mind."</i> (Participant 8)
	Acceptance	Quote #4 <i>"It is really nice that she [the instructor] says that now you have to lie down and you can't keep the thoughts away and that's completely alright, too. I can almost hear her say that it's okay. That has been lovely, and I really take that with me onwards."</i> (Participant 7)
Practical aspects of attendance	Need for planning	Quote #5 <i>The advantage [of the tele-based format] was that you didn't have to leave the house at 10 am. [With tele-MBCT] the days started out nice and quietly. And then you could have lunch on time."</i> (Participant 3)
	Willingness and ability to participate	Quote #6 <i>And I have been glad that it is home-based. Otherwise I wouldn't have been able to participate. So I would not have participated, if it had not been via the tele-monitor. [...] But I wanted to participate just as much as those people, who are still able to run around and play ball up against the walls and stuff like that. I just can't do that. And they [respiratory clinic] are not good at creating courses for people like me, who are too ill."</i> (Participant 8)
Relational aspects	Negative aspects of tele-based format	Quote #7 <i>"Participant: But opening up has been difficult. I only opened up 90 %. Interviewer: Would it have been easier to completely open up, if you were sitting across from each other? Participant: Yes, I think I would get it all out then. And that has been a big thing for me. Interviewer: Is it because it makes you feel safer to physically sit across from a person? Participant: I think so. You'll be quick to figure out if it is someone you trust and if the chemistry is there"</i> (Participant 5)
	Positive aspects of tele-based format	Quote #8 <i>"Also gradually, as the session moved forward, then it was as if we really knew each other. As time passed. [...]. That was amazing that you could get so close when other people were there. To expose yourself, when total strangers were listening."</i> (Participant 2)
		Quote #9 <i>"It is my experience that when you meet via the tele-monitor, [...] there is more respect for when the instructor says something than when you meet in person. When you meet in person people talk. But that is a normal interaction-thing. That if you feel like the instructor isn't saying something, that capture your attention, then you can spent the time whispering to your neighbour. You can't do that here. [...]. People exhibit a different discipline and that means that you can be more effective in a "distal learning universe" than if you meet in person"</i> (Participant 8)
		Quote #10 <i>"Well the upside of using the tele-monitor and of not being more people than we were, were that if someone raised their hand they got to say something. And it was not like the same people talked all the time, which is often the case on courses like these. There can be people who talk more and longer than others. But here it's limited. Also because we only were four. Then you can say something quickly. [...] And if you have a</i>

comment. You get to say that quicker as well, than in courses were you are face to face because such courses would probably include more people.” (Participant 7)

Supplementary file S1. Methodology and reporting assessments for mixed-methods studies

Good reporting of a mixed methods study (GRAMMS) (Cathain, Murphy & Nicholl, 2008)		
Number	Description	Page number in manuscript
1	Describe the justification for using a mixed methods approach to the research question.	3-4
2	Describe the design in terms of the purpose, priority and sequence of methods	4
3	Describe each method in terms of sampling, data collection and analysis	4-6
4	Describe where integration has occurred, how it has occurred and who has participated in it	6
5	Describe any limitation of one method associated with the present of the other method	10
6	Describe any insights gained from mixing or integrating methods	Abstract, 7-11

Reference

Cathain, A. O., Murphy, E., & Nicholl, J. (2008). The quality of mixed methods studies in health services research. *Journal of Health Service Research & Policy*, 13: 92-98

Critical appraisal criteria for quantitative and qualitative methods (Sale & Brazil, 2004)

Goals of criteria	Qualitative methods	The present study	Quantitative methods	The present study
Truth value (Credibility vs. internal validity)	Triangulation of sources	<i>This is a mixed-methods study where data come from the sources of questionnaires (quantitative) and semi-structured interviews (qualitative) with the purpose of understanding the same particular phenomenon – in this case, the clinical feasibility of tele-MBCT in COPD.</i>	Extraneous or confounding variables identified	<i>Not included</i>
	Triangulation of methods	<i>This is a mixed-method study with a “convergent parallel” design (Caffery et al., 2017), which means that quantitative and qualitative data are gathered independently and then analysed to contribute to the understanding of the same particular phenomenon – in this case, the clinical feasibility of tele-MBCT in COPD. (manuscript p. 4)</i>	Extraneous or confounding variable(s) or baseline differences controlled for in the analysis	<i>Not included</i>
	Triangulation of investigators	<i>The analysis was primarily carried out by IF-V supplemented with discussions with the interviewer (NCS) and other colleagues (manuscript p. 6)</i>	Statement about comparability of control group to intervention group at baseline	<i>No control group included (mentioned in the limitations section of the manuscript, p. 11)</i>
	Triangulation of theory/perspective	<i>Not included</i>	Statement that comparison group was treated equally aside from intervention	<i>No control group included (mentioned in the limitations section of the manuscript, p. 11)</i>
	Peer debriefing	<i>Not included</i>	Informed consent stated	<i>Participants gave informed written consent as part of the larger study from which they are included (see Farver-Vestergaard et al., 2018)</i>

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	Negative case analysis or searching for disconfirming evidence	<i>In the analysis, we sought to give as balanced an account of experiences as possible by actively seeking conflicting utterances under a given theme. (manuscript p. 6)</i>	Ethical review undertaken	<i>The larger study from which the sample of the present study is recruited has been approved by the Central Denmark Region Committee on Health Research Ethics (see Farver-Vestergaard et al., 2018)</i>
	Member checks	<i>Not included</i>	Statement that confidentiality protected	<i>Stated in both oral and written information prior to consent (not included in manuscript)</i>
	Use of quotations	<i>In the results sections, exemplifying quotations are given for each theme (Manuscript Table 2)</i>	-	-
	Informed consent stated	<i>All participants gave informed consent to interview participation, specifically (Manuscript p. 4)</i>	-	-
	Ethical review or human subject review undertaken	<i>The larger study from which the sample of the present study is recruited has been approved by the Central Denmark Region Committee on Health Research Ethics (see Farver-Vestergaard et al., 2018)</i>	-	-
	Statement that confidentiality protected	<i>Stated in both oral and written information prior to consent (not included in manuscript)</i>	-	-
	Consent procedures described	<i>Consent procedures were described to all participants in the information material prior to consent (not included in manuscript)</i>	-	-
Applicability (Transferability/ Fittingness vs. External validity/ Generalisability)	Statement of purpose	<i>The overall purpose of the present mixed-methods study is to evaluate the clinical feasibility of tele-MBCT and to identify focus points for the design of future efficacy trials.</i>	Statement of purpose	<i>The overall purpose of the present mixed-methods study is to evaluate the clinical feasibility of tele-MBCT and to identify focus points for the design of future efficacy trials.</i>
	Statement of research question(s)	<i>How does individual participants experience taking part in tele-MBCT</i>	Objective of study explicitly stated or described	1) <i>measure change in the outcomes of psychological distress and physical health status impairment from pre- to post-intervention,</i> 2) <i>monitor attendance rates (i.e. number of tele-MBCT sessions attended) and drop-out rate,</i>

			3) <i>measure participants' perceived quality of the therapeutic working alliance mid-way through the intervention,</i>
Phenomenon of study stated	<i>An eight week tele-based psychosocial intervention called tele-delivered mindfulness-based cognitive therapy (tele-MBCT). More specifically, the study explores its clinical feasibility, which naturally includes participants' perceptions.</i>	Description of intervention if appropriate	<i>The MBCT intervention is described in detail by Farver-Vestergaard et al., 2018. The tele-MBCT intervention was delivered via touch-screen computers that were installed in the participants' homes prior to the first session. The computers had integrated camera, speaker and microphone, allowing each patient to see, hear and speak to the other participants and the instructor. The instructor operated a provider station in order to make a group call to all participants prior to each session and to terminate the call after each session. The provider station also had integrated devices enabling the instructor to see, hear and speak to all participants. The instructor contacted service providers directly in instances of technical issues.(manuscript p. 5)</i>
Rationale for the use of qualitative methods	<i>Concerns are raised that the tele-delivered format could negatively influence the clinical feasibility of specific psychosocial intervention programmes. While the field is still in its infancy, however, clinical parameters of interest have not yet been identified, and there is therefore a need for 'bottom-up' explorations of individual participants' experiences of tele-MBCT.</i>	Outcome measure(s) defined	<i>The outcomes of psychological distress and physical health status impairment were measured pre- and post-intervention. Psychological distress was assessed by the Hospital Anxiety and Depression Scale (HADS). Its 14 items yield a total score ranging from 0-42, with higher scores representing higher levels of distress. The questionnaire is validated and frequently used in COPD. Physical health status impairment was measured by the COPD Assessment Test (CAT). It consists of eight items resulting in a total score ranging from 0-40, with higher scores representing higher levels of impairment. (manuscript p. 5)</i>
Rationale for the tradition within qualitative methods	<i>Analysis was based on the framework of thematic analysis as described by Braun and Clarke (2006). A realist epistemological approach was taken where an account of explicit meanings across the data set is sought.</i>	Assessment of outcome blinded	<i>Questionnaires were labelled with an ID-number, such that questionnaires did not include name or other personal identifiers. (not described in manuscript)</i>

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Description of study context	<i>As a response to the relatively low attendance (average: 4 out of 8 treatment sessions) and uptake rates in our randomised controlled trial of hospital-based, face-to-face MBCT (se Farver-Vestergaard et al., 2018) we decided to conduct the present feasibility study of a home-based tele-delivered version of the intervention (tele-MBCT).</i>	Description of setting or conditions under which data collected	<i>Participants filled in all questionnaires at home. (Not described in manuscript).</i>
Statement of how setting was selected	<i>With the purpose of testing the clinical feasibility of tele-MBCT, the home-based setting was chosen to maximise the ecological validity and clinical relevance of the study.</i>	Design stated explicitly i.e. case study, cross-sectional study, cohort study, RCT	<i>Mixed-methods feasibility study.</i>
Sampling procedure described	<i>All control group participants of the larger study previously described (Farver-Vestergaard et al., 2018) were asked to participate in the present feasibility study. Those who did not wish to receive the tele-based version of MBCT were offered face-to-face MBCT instead and, hence, were not part of the present feasibility study.</i>	Subject recruitment or sampling selection described	<i>All control group participants of the larger study previously described (Farver-Vestergaard et al., 2018) were asked to participate in the present feasibility study. Those who did not wish to receive the tele-based version of MBCT were offered face-to-face MBCT instead and, hence, were not part of the present feasibility study.</i>
Justification or rationale for sampling strategy	<i>The above sample strategy was chosen primarily for pragmatic reasons. The limitations of the sample strategy are described on page 10 in the manuscript)</i>	Sample randomly selected	<i>No.</i>
Description of participants or informants	<i>Participant characteristics are described in Table 1 in the manuscript.</i>	Inclusion and exclusion criteria for subject selection stated explicitly	<i>Inclusion criteria for the larger study, from which the participants of the present study were included, were 1) a spirometry-confirmed (forced expiratory volume in 1 s < 50%) COPD diagnosis together with a Medical Research Council dyspnoea score of ≥ 3, and 2) physical capability to attend the exercise component of pulmonary rehabilitation at the time of inclusion. Exclusion criteria were 1) a comorbid diagnosis of stroke, dementia or unstable coronary heart disease and 2) an inability to speak or understand Danish.</i>

Data gathering procedures described	<i>Semi-structured qualitative interviews were conducted with all participants immediately after completion of the tele-MBCT programme either in the patients' own home or via telephone (the interview topic guide can be found in Supplementary Material 1). Interviews were conducted by a research assistant (NCS) who had a background in psychology and experience within the field of psychological intervention in COPD. (manuscript p. 6)</i>	Study population defined or described	<i>Participant characteristics are described in Table 1 in the manuscript.</i>
Audiotaping procedures described	<i>Interviews were recorded and stored safely as mp3 files. Upon storage, they were immediately deleted from the recording device. (Not described in manuscript)</i>	Source of subjects stated i.e. sampling frame identified	<i>Sampling frame described in detail by Farver-Vestergaard et al. 2018 (not described in manuscript)</i>
Transcription procedures described	<i>All interviews were transcribed verbatim by an independent research assistant. (manuscript p. 6)</i>	Source of controls stated	<i>No control group included (mentioned in the limitations section of the manuscript, p. 11)</i>
Field note procedures described	<i>The interviewer (NCS) shared her interview reflections with the first author/analyst (IF-V), who regularly took field notes during the data collection and analysis phases. Notes were managed using Nvivo software. Notes are in Danish and can be obtained upon request. (not included in manuscript)</i>	Selection of controls described	<i>No control group included (mentioned in the limitations section of the manuscript, p. 11)</i>
Data analysis described	<i>The six iterative phases of analysis started with a thorough and detail-oriented reading of research interviews and gradually moved towards a condensed understanding of the data through the definition of themes, as suggested by Braun and Clarke (manuscript p. 6)</i>	Control or comparison group described	<i>No control group included (mentioned in the limitations section of the manuscript, p. 11)</i>
Coding techniques described	<i>The initial coding of data was based on an inductive approach, but as the analysis moved towards the definition of themes, it took a more deductive approach where the focus was on areas of the data that supplemented the</i>	Statement about nonrespondents or dropouts	<i>Participants completed all questionnaires and there were no dropouts. (manuscript p. 7)</i>

	<i>elements in the quantitative evaluation (i.e., outcomes, attendance rate and working alliance). (manuscript p. 6)</i>		
Data collection to saturation specified	<i>The interviewer sought saturation by asking follow-up questions such as “can you please tell a bit more about that?” or “is there anything else you want to add?” (not described in manuscript)</i>	Missing data addressed	<i>Not relevant.</i>
Statement that reflexive journals or logbooks kept	<i>During the analysis process, a reflective logbook was kept, using the NVivo software. (manuscript p. 6)</i>	Power calculation to assess adequacy of sample size or sample size calculated for adequate power	<i>Not relevant as this is not an efficacy study, but a study exploring the clinical feasibility of the intervention.</i>
Description of raw data	<i>Interview recordings were securely stored as mp3 files, and deleted after transcription and anonymization. The anonymised transcription raw data was stored and managed, using the Nvivo software. Moreover, in the initial analysis phase (see Braun & Clarke, 2006), transcription raw data was printed on paper to allow for more in-depth familiarising with the data material. (not described in manuscript)</i>	Statistical procedures referenced or described	<i>Dependent t tests were performed to estimate the average change of psychological distress (the Hospital Anxiety and Depression Scale) and physical health status impairment (the COPD Assessment Test) post-intervention (manuscript p. 5)</i>
-	-	P values stated	<i>See page 6 in the manuscript.</i>
-	-	Confidence intervals given for main results	<i>Confidence intervals for the mean difference in HADS scores from pre- to post-intervention: Mean diff.=1.5, 95% CIs [-2.45 – 5.45] Confidence intervals for the mean difference in CAT scores from pre- to post-intervention: Mean diff.=1.5, 95% CIs [-0.73 – 3.73]</i>

	-	-	Data gathering procedures described	<i>After having consented to participation in the study, participants received the pre-intervention questionnaire by post. All pre-intervention questionnaires were completed and returned prior to the first tele-MBCT session. Participants completed and returned the Working Alliance Inventory after the fourth sessions if the tele-MBCT (midway). Post-intervention questionnaires were completed and returned immediately after the eighth and final session of tele-MBCT. (manuscript p. 4-5)</i>
	-	-	Data collection instruments or source of data described	<i>Pen-and-paper questionnaires</i>
	-	-	At least one hypothesis stated	
	-	-	Both statistical and clinical significance acknowledged	
Consistency (Dependability vs. Reliability)	External audit of process	<i>The analysis was primarily carried out by IF-V supplemented with discussions with the interviewer (NCS) and other colleagues (manuscript p. 6).</i>	Standardisation of observers described	<i>The primary researcher (IF-V) served both as the MBCT-instructor and the main data analyst. To minimise risk of bias, data were labelled with ID number instead of names or any other person-sensitive data. (not described in manuscript).</i>
Neutrality (Confirmability vs. Objectivity)	External audit of data and reconstructions of the data	<i>Both a long version and a short version of the “story” of the thematic analysis (see Braun & Clarke, 2006), was read by and discussed with the interviewer (NCS). Themes were redefined on the basis of other researchers’ perspectives. Moreover, data extracts/quotations were translated from Danish to English by three independent research assistants, and a final version was agreed upon. (not described in manuscript)</i>	-	-

Bracketing	<i>Both a long version and a short version of the “story” of the thematic analysis (see Braun & Clarke, 2006), was read by and discussed with the interviewer (NCS). Themes were redefined on the basis of other researchers’ perspectives. (not described in manuscript).</i>	-	-
Statement of researcher’s assumptions or statement of researcher’s perspective	<i>The primary researcher (IF-V) served both as the MBCT-instructor and the main data analyst. To minimise the risk of a narrow perspective, it was decided that another researcher (NCS) should carry out interviews. Whenever the primary researcher (IF-V) noted potential bias, e.g. when translating data extracts from Danish to English, assistance from independent researcher was sought. (not described in manuscript).</i>	-	-

References

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Caffery, L. J., Martin-Khan, M, Wade, V. Mixed methods for telehealth research. *J Telemed Telecare* 2017; 23: 764-769.

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Sale, J. E. M., Brazil, K. A strategy to identify critical appraisal criteria for primary mixed-methods studies. *Qual Quan* 2004; 38: 351-365.

Supplementary file S2. Interview guide

Topic	Suggested questions
General experience of the MBCT intervention	<ul style="list-style-type: none"> - What was it like to take part in the intervention? - What did you get out of taking part?
General experience of using the tele-monitor	<ul style="list-style-type: none"> - What do you think it would have been like to take part in the intervention face-to-face instead of via the tele-monitor? - Would you have preferred a face-to-face format? - What has been the advantages of using the tele-monitor? - What has been the disadvantages of using the tele-monitor?
Information telephone call	<p>Cue: A few weeks before the intervention started, you received a telephone call from [name of instructor], asking if you were willing to participate and informing you about the tele-based format.</p> <ul style="list-style-type: none"> - What were your thoughts about the project at that time? - What were your thoughts on having a tele-monitor installed in your home? - What made you consent to participation? - Was there something you would have liked to know or would wish had been different at this point?
Installation of tele-monitor and test-call	<p>Cue: You had a visit from [name of installer], who installed the tele-monitor in your home. Together you made a short test call to [name of instructor] where you settled on a time for the individual pre-class interview.</p> <ul style="list-style-type: none"> - What was it like to have the tele-monitor installed in your home? - Was there something you would have liked to know or would wish had been different at this point?
Individual pre-class interview via the tele-monitor	<p>Cue: About a week before the group intervention started, you had an individual pre-class interview with [name of instructor] via the tele-monitor (approximately ½ hour). You told her about yourself and she told you about the MBCT intervention.</p> <ul style="list-style-type: none"> - What was it like to use the tele-monitor by yourself for the first time? - What was it like to talk to [name of instructor] in this way? - Was there something you would have liked to know or would wish had been different at this point?
MBCT intervention	<ul style="list-style-type: none"> - What was it like to meet the group via the tele-monitor for the first time? - What was it like to meet for the following sessions? Did anything change over the course of the 8 weeks? - Please describe your relationship with the other participants - Please describe your relationship with [name of instructor] - Was there something you would have liked to know or would wish had been different at this point?
Additional topics	<ul style="list-style-type: none"> - Who have you told about this project? What do you typically tell them? - How has your spouse (if he/she has one) reacted in relation to this project? - Is there something important about this project that we haven't covered yet? Do you have any questions? - What could we do better for other participants in the future?