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ORIGINAL RESEARCH

Evaluating the Feasibility and Pretesting the Impact of an Educational and Telemonitoring Program for COPD Patients in Lebanon

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Purpose: The objective of this study was to investigate the feasibility and pretest the effectiveness of an educational and telemonitoring program in a sample of Lebanese COPD patients to inform the design of a randomized study.

Patients and Methods: This study recruited a convenient sample of 15 patients from the pulmonology departments of four hospitals. Validated questionnaires were adapted to meet the context of this study in terms of adequacy, acceptability, adoption, fidelity, and cost. The impact of this program on quality of life and anxiety was measured by the COPD Assessment Test (CAT), the COPD Clinical Questionnaire (CCQ), and the Hospital Anxiety and Depression Scale (HADS). All measurements were performed before and after the intervention.

Results: All 15 participants who agreed to participate in this intervention found the program adequate and acceptable for addressing COPD-related issues. Regarding adoption, all participants declared having no difficulty explaining to others the content of the education sessions and that they would suggest this program to other COPD patients. In terms of effectiveness, six patients had improving in quality of life scores, and five patients had lower anxiety and depression scores compared to baseline measures. A knowledge assessment was done at the end of each session, showing an increase in knowledge for all participants. Skills were also assessed at the end of the program. Participants made no errors that had an impact on their health. Regarding the cost, it was difficult to evaluate the relative cost of this intervention given the economic situation in the country.

Conclusion: This study is the first to evaluate the application of telehealth to optimize COPD management in Lebanon. The approach proposed gave insights into the different obstacles and facilitating factors for implementing such a project to allow a large-scale work on the adaptation of the COPD patient to his disease in Lebanon.

Keywords: chronic obstructive pulmonary disease, quality of life, telehealth, knowledge, skills

Introduction

Chronic diseases are a major public health problem in Lebanon, contributing to 45% and 38.7% of premature deaths in men and women, respectively.[1,2] Patients with a chronic disease such as Chronic Obstructive Pulmonary Disease (COPD) face a double constraint: managing the disease and living with it.[3] Quality of life is significantly impaired in COPD patients due to the nature of this chronic, disabling disease, which is not well known by the general public.[4] However, understanding COPD makes it easier for patients to accept it and contributes to a better living.[5] Therapeutic education has been recognized as an integral and permanent part of the management of patients with chronic diseases.[6–8]

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Nevertheless, to date, there are no standard recommendations on the specific educational topics that should be included in the educational programs offered to COPD patients. Furthermore, there is a lack of educational centers or facilities for COPD patients in Lebanon and a near absence of studies related to the quality of life of Lebanese patients living with COPD.

As lung function may worsen over time, even with the best available care,[9] systematic follow-up showed to be essential in COPD patients. However, it requires human resources, time, and high expenses. Hence, telehealth is emerging as a new approach to chronic disease management, despite controversies about its effectiveness. Some studies concluded that telehealth in COPD patients does not produce recognizable or statistically significant improvements in the quality of life of these patients,[10] while others reveal a positive outcome in terms of hospitalization rates and stabilization of the clinical status of COPD patients.[11] In Lebanon, because of the diversity of the population's health, educational, and economic needs, some means of collaborative networking and remote interventions used in telehealth may be helpful and even necessary.

Therefore, our study aims to evaluate the feasibility, acceptability, and effectiveness of a therapeutic education program coupled with a telemonitoring system for COPD patients in Lebanon.

Methods

Study Design

This single-group non-randomized feasibility study was conducted to inform the design of a randomized study. Eligible participants were enrolled in a 6-week home-based educational and telemonitoring program. Quantitative data collection methods were used pre, per, and post-intervention.

Patient Involvement

Participants with COPD were not involved in setting the research question, study design development, or choice of outcome measures. However, it is planned to disseminate the main results to study participants and seek patient involvement in refining the study design prior to a full-scale trial.

Study Population

An empirical convenience sample was recruited based on the judgment of the pulmonologists and the willingness of patients to participate.

No formal calculation of the sample size has been performed since this feasibility study involves an intervention that has never been tested before on the Lebanese population.

Participants were considered eligible if they met the following criteria: age $\geq$ 18 years, a prior diagnosis of COPD, cognitively capable with a suitable health status to participate in the study according to the clinical consensus between nurses and physicians. Exclusion criteria consisted of participants diagnosed with lung cancer or having cognitive problems related to memory loss or speech disorders that would not allow a constructive exchange.

Intervention

Our intervention consisted of a home-based, personalized, therapeutic education program and a telemonitoring system. It was conducted in three phases:[12]

Phase I: The First Nursing Consultation

Phase I is the diagnostic phase, where the patient received the first home visit from the nurse to elaborate an educational diagnosis and define a personalized program. In this stage, the objectives were to get to know patients, identify their needs and expectations, identify the factors that promote learning and those that may limit it, and formulate the skills to be acquired, mobilized, or maintained, taking into account their priorities to plan an individual program. The nurse explained how the patient should use the oximeter to measure daily the oxygen saturation (SpO2), and how the information collected will be transmitted. The oximeter was connected to each patient phones through Bluetooth and

the spO2 was collected through internet to an online health platform that allows for frequent health status updates and rapid response, which can be important.

Phase II: The Education and Telemonitoring Sessions

Phase II is the educational phase, where the patient received one home visit per week from the nurse to encourage him/her to self-assess each of his/her risk factors so that he/she becomes aware that his/ her illness is not inevitable and that he/she can be involved in a behavioral change to reduce the risk of exacerbations plans and implements individual educational sessions. These sessions were conducted face-to-face (with/without the presence of a family caregiver), using educational tools such as PowerPoint presentations and videos. Our program consisted of 6 weekly education sessions. Session 1 was about COPD physiopathology, signs, and symptoms, session 2 included an overview of medications, session 3 was about detecting exacerbations, session 4 covered breathing strategies and exercise, session 5 was about adopting and maintaining a healthy lifestyle (smoking, diet, sleep), and session 6 explained stress and anxiety management. Sessions were individualized and conducted in order of patient preference. A booklet summarizing the content of these sessions was given to each participant. Telemonitoring was conducted throughout the program. Patients transmitted their SpO2 to the nurse every day (usually in the morning) and in case of subjective clinical worsening.

Phase III: The Last Nursing Consultation

Phase III is the evaluation phase, where the nurse assesses, face to face, the skills acquired by the patient during her las visit to patients' home. This stage enabled the nurse to highlight the changes that occurred in the patient and their maintenance over time. A follow-up by telephone was conducted after one month to assess whether the learning was maintained.

Outcomes Measures

Because an intervention will not be effective if it is not implemented well, it is important to know if the intervention is feasible and effective and if it is deployed correctly.[13] Based on Proctor's lists of outcome variables that can assess program implementation,[13] this study evaluated the adequacy, acceptability, adoption, fidelity, and cost of the intervention, using various tools adapted to our context: The pre-referral intervention team inventory (PRITI) to measure the acceptability,[14] the adoption of information technology innovation scale to measure the adoption,[15] parenting strategies questionnaire for adequacy,[16] and the utilization and cost questionnaire to evaluate the total cost of the intervention.[17]

At phases I and III, several tests were performed to pretesting the impact of the intervention: The COPD assessment test (CAT),[18] the COPD clinical questionnaire (CCQ),[19] and the Hospital Anxiety and Depression Scale (HADS).[20]

The skills and expertise of the participants were assessed using questions created for each session.

Adequacy

Adequacy is perceived as the appropriateness, relevance, or compatibility of the innovation or practice.[13] Therefore, participants were asked three questions to measure intervention adequacy: 1) Is this program appropriate? 2) Is this program helpful in your daily life? 3) Is this program compatible with your daily life? Responses ranged from 0 (not adequate) to 10 (adequate). The adequacy was assessed the first phase during the educational diagnosis (called D1) and in the third phase during the last consultation (called D2).

Acceptability

Acceptability (or "what" is acceptable) is the perception that a given service is pleasant, acceptable, or satisfying.[13] Acceptability is different from the broader concept of satisfaction. Acceptability is more specific and refers to particular steps, whereas satisfaction generally refers to the overall experience. Therefore, we assume that the acceptability assessed is dynamic and evolves with experience so we measured acceptability at all stages of the program. The statements selected to assess the acceptability of the intervention from the participants' perspective were as follows:

- To me, this program seems an acceptable way to address COPD issues.
- I find this education session acceptable to meet my original goal.
- This education session does not negatively impact my daily life.
- I like the tools used in this session (videos, power point presentation).
- I find the telemonitoring system acceptable to prevent COPD-related problems.
- The telemonitoring system does not seem to negatively impact on my daily life.
- I prefer other methods to manage COPD problems.
- Overall, the program seems beneficial to me.

Responses were rated on a 5-point Likert scale from 0 (no opinion) to 4 (strongly agree).

Adoption

Adoption is defined as the intention, initial decision, or action to try or employ an innovation or practice.[13] The statements assessing adoption were as follows:

- My participation in this program is voluntary, or my doctor expects me to use this program.
- I have difficulty explaining why this program is beneficial or not, or I have no difficulty telling others about the content of the educational sessions.
- I am willing to do this session again if needed, or I do not see the point of doing this session again.
- I would suggest this program to other COPD patients, or the program does not seem helpful for other people.

Fidelity

Fidelity is defined as the degree to which an intervention is implemented as prescribed by the original protocol. Achieving and measuring fidelity is subject to a number of challenges. Therefore, a second researcher was asked to assess fidelity in the implementation of this intervention, to evaluate whether the intervention was received and faithful to the original protocol, by comparing the original intervention and the implemented intervention in terms of (1) adherence to the program protocol and (2) the amount of program delivered.

Cost

This intervention was measured in terms of;

(1) general cost of the intervention: materials/patient, (2) Time taken by the nurse to go to the patient, (3) Time spent by the nurse at the patient home, (4) Number of hospitalizations and emergency room visits during the intervention/ patient.

Efficacy

COPD Assessment Test (CAT)

The CAT consists of eight questions measured on a 5-point scale, with scores ranging from 0 to 40. Higher scores indicate a higher impact of COPD on the patients' quality of life.[18]

Clinical COPD Questionnaire (CCQ)

The CCQ is a 10-item tool used to assess the quality of life of COPD patients. The total score, calculated by summing the scores of the ten questions and dividing the number obtained by ten (the number of items), ranges from 0 (very good health) to 6 (extremely poor health).[19]

Hospital Anxiety and Depression (HADS)

The HADS aims to measure symptoms of anxiety and depression and consists of 14 items, seven for the anxiety and seven for the depression subscale. Each item is scored on a response-scale with four alternatives ranging between 0 and 3. Recommended cut-off scores are 0–7 for normal, 8–10 for borderline and ≥ 11 for abnormal.[20]

Assessment of Knowledge and Skills of Participants

Knowledge was assessed at the beginning and the end of each educational session through a 5-item true-false questionnaire set by the researcher and related to the session.

Skills were evaluated at the end of the program through a checklist about the breathing strategies inspired by the technique elaborated by d'Ivernois and Gagnayre, which helps patients master their breathing.[21] The criteria sought were whether patients were able to identify the right moment to take the spray, whether they respected the chronology of the gesture, and whether they verified the effectiveness of their gesture. These criteria were evaluated according to the seriousness of the error:

1) the error or omission had health consequences;
2) the error or omission was minor with no consequences;
3) no error or omission; the patient has mastered the quality of the procedure.

Statistical Analysis

Five variables were selected to determine the feasibility of this research program: acceptability, adoption, adequacy, fidelity, cost and impact. Analyses were performed on SPSS version 25 (IBM SPSS Statistics for Windows). The Student's *t*-test was used to compare normally distributed continuous variables between two groups, the ANOVA to compare three groups or more, and the Chi-square for binary and/or categorical variables. Data were analyzed according to gender, age, stage of the disease, presence of a caregiver, duration of illness and medical coverage. P value less than 0.05 (≤ 0.05) is considered statistically significant.

Results

Of the 15 patients who agreed to participate in this intervention, 8 lived in the Greater Beirut, 5 in North Lebanon, and 2 in Mount Lebanon. The majority of the participants were females (8/15), with an average age of 77±9.7 years and 9±4 years of COPD diagnosis. Almost half of the respondents had a moderate stage of the disease (6/15), 7 a severe stage, and 2 had a very severe stage of their COPD. Most respondents had a family caregiver (11/15) and were financially responsible for their disease (9/15) (Table 1).

Table 1 Sociodemographic Characteristics

Socio-Demographic Characteristics of the Study Participants.	
Variables	Frequency (n), N=15 Average ± Standard deviation
Sex	Male (7) Female (8)
Age	77 years ± 9.7
Caregiver	Yes (11) No (4)
Stage of the disease	GOLD 2 (6) GOLD 3 (7) GOLD 4 (2)
Duration of illness	9 years ± 4
Health coverage	Without (9) With (6)

Notes: N: population size.

Adequacy

At the end of the program, the mean score for all three adoption questions increased. For the question "Is this program appropriate?", the average score increased from 7.73±0.57 to 8.6±0.6 (P=0.000). The score for the question "Would this program be helpful in your current life?" increased from 7.26±1.28 to 8.2±0.7 (P=0.004). As for the question "Is this program compatible with your current life?", the average score increased from 7.2±1.27 to 7.8±0.95 (P=0.004).

Acceptability

All participants found this program an acceptable way to address COPD-related issues. A significant relationship was noted between the age of the participants and the acceptability of this program. Indeed, this program seemed to be more acceptable for participants aged 82 years and younger (3.62±0.51; p=0.05), females (3.57±0.53; p=0.234), those with a severe stage of the disease (3.57±0.53; p=0.368), without a caregiver (3.5±0.57; p=0.662), and without financial coverage for COPD (3.44±0.52; p=0.693) (Table 2). All participants agreed that the educational sessions met their original objective. However, the acceptability, relative to each session, varied. The respiratory strategy and physical exercise session (S4) had a mean score of 3.8±0.4 and the lifestyle session (S5) 3.6±0.47 (Table 3). All participants either strongly agreed (score=4) or agreed (score=3) that education sessions did not negatively impact their daily life. All participants found PowerPoint presentations, videos, and booklet to be quite acceptable tools. As for the telemonitoring system, only eight participants had the necessary equipment for its proper functioning, ie, internet connection and cell phone or IPad. While seven participants agreed to use the telemonitoring system, one patient refused, assuming it would complicate their life. All seven patients who used the telemonitoring system reported that it did not negatively impact

Table 2 Acceptability and Sociodemographic Variables

This Program Seems an Acceptable Way to Address COPD Issues (Note/4)		
Variables	**Acceptability**	**P value**
Age ≤ 82 year	3.62±0.51	0.05
>82 year	3.14±0.377	
Sex Male	3.25 ±0.46	0.234
Female	3.57±0.53	
Stage of COPD Gold 2	3.33 ± 0.51	0.368*
Gold 3	3.57 ± 0.53	
Gold 4	3	
Caregiver No	3.5±0.57	0.662
Yes	3.36±0.5	
Duration of illness ≤ 10 years	3.5±0.52	0.277
>10 years	3.2±0.44	
Health coverage Without	3.44±0.52	0.693
With	3.33±0.51	

Notes: P value calculated with *t* test, *P value calculated with ANOVA test.
Abbreviations: Note/4, the total score for acceptability equal 4.

Table 3 Acceptability Score Relative to Each Session

	I Find This Education Session Acceptable to Meet My Original Goal (Note/4)															
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	Average
S1	4	3	3	4	3	4	4	3	3	4	3	4	4	4	3	3.53 ± 0.49
S2	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3.06 ± 0.24
S3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3 ± 0
S4	4	4	3	4	3	4	4	4	3	4	4	4	4	4	4	3.8 ± 0.4
S5	4	3	4	4	3	4	4	4	3	4	4	4	3	3	4	3.66 ± 0.47
S6	4	3	3	3	3	3	3	3	3	3	4	3	4	4	4	3.33 ± 0.47

Abbreviations: P, patients; S, session; Note/4, the total score for this question equal 4.

their daily lives. One participant was uncompliant in terms of daily monitoring of saturation. None of the participants had an answer to the question "I prefer other methods to help us manage COPD problems", while five participants mentioned the lack of inhalation devices (treatment) due to the current socioeconomic crisis in the country. Overall, all participants found the program beneficial.

Adoption

All participants declared that their participation in this program was voluntary. All participants agreed that they have no difficulty explaining to others the content of the education sessions and that they would suggest this program to other COPD patients.

As for the question "I am willing to repeat this session if needed" responses varied depending on the educational session. Four participants answered that they would repeat S1 (COPD physiopathology, signs, and symptoms), five participants would repeat S2 (overview of medications), 8 participants would repeat S3 (detecting exacerbations), and almost all participants would repeat S4 (breathing strategies and exercise), S5 (adopting and maintaining a healthy lifestyle), and S6 (stress and anxiety management).

Fidelity

In the protocol, it was planned that the first and last sessions of the intervention take place in the nurse's office. This clause was not respected. Given the risk of COVID-19 contamination in the hospital, the entire program took place at the participants' homes while respecting the protective measures. The educational sessions could not be delivered every week, given the situation in Lebanon and the imposed lockdown due to COVID-19. Some sessions were done every two weeks.

Furthermore, the material provided to the patients consisted of the booklet and the monitoring material. It did not include the summary sheet of the educational diagnosis, as foreseen in the protocol to limit the risk of contamination due to COVID-19.

All the educational sessions were completed, except for the telephone follow-up. Only 13 participants could be contacted due to the death of two patients during the month following the intervention.

Cost

The cost of this procedure was measured in terms of time and materials. The total distance traveled by the nurse during the entire intervention period was 5552 Km, each worthing 0.15 USD of gas. The average time spent by the nurse with a patient per eight sessions was 429.56 min. In Lebanon, the wages of a hospital nurse are about 10,000 LBP/60 minutes, equivalent to 6.5 USD/60 minutes at the official rate of 1 USD=1500 LBP. Thus, the cost related to the time the nurse spent per one patient is 46 USD. The cost of materials for educational sessions was 100 USD/patient (cost of booklet, and educational materials), while that for the telemonitoring services was 143 USD/patient (including the cost of the

saturomètre). Hence, the overall cost of the intervention was 200 USD/patient (educational sessions only) and 244 USD/patient (including telemonitoring services).

It is noteworthy that, the intervention throughout this study was free of charge. The patients did not cover any cost. During the intervention, one patient was hospitalized for one week due to a condition not related to COPD.

Impact

CAT

The CAT questionnaire assess the impact of COPD on the patients' quality of life.[18] The scores ranging from 0 to 40 and a higher scores indicate a higher impact. At the end of the program, 8 patients had the same baseline score after the 6 weeks of the intervention (P1, P3, P4, P7, P8, P9, P12, P14), 6 patients had more effective scores than at baseline (P2, P5, P10, P11, P13, P15) while one patient had a deterioration of his quality of life (P6). Participants with improved CAT scores were in the age range ≤82 years, with severe COPD (GOLD 3), diagnosed for ≤10 years, and with a caregiver (Table 4).

Table 4 CAT, CCQ and Sociodemographic Variables

Variable	Score CAT		Score CCQ	
	No change/ worsening (Patient/15)	Improvement (Patient/15)	No change/ worsening (Patient/15)	Improvement (Patient/15)
Age				
≤ 82 years	4	4	2	6
> 82 years	5	2	5	2
P value	0.6		0.13	
Sex				
Male	5	3	5	3
Female	4	3	2	5
P value	1		0.31	
Stage of COPD				
GOLD 2	4	2	5	1
GOLD 3	4	3	4	3
GOLD 4	1	1	1	1
P value	0.897		0.526	
Caregiver				
No	3	1	2	2
Yes	6	5	5	6
P value	0.6		1	
Duration of illness				
≤ 10 years	6	4	3	7
>10 years	3	2	4	1
P value	0.713		1	
Health coverage				
Without	6	3	5	4
With	3	3	2	4
P value	0.62		0.6	

CCQ

The CCQ tool was also used to assess the quality of life of COPD patients. The score ranges from 0 (very good health) to 6 (extremely poor health).[19] At the end of the intervention, a decrease in score was noted in 8 patients (P2, P4, P7, P10, P11, P13, P14, P15), no changes were seen in 4 participants, and a deterioration in health status was identified in 3 patients (P5, P6, P9). Participants with an improvement in the CCQ score belong to the age group ≤ 82 years, female, with severe COPD (GOLD 3), diagnosed for ≤ 10 years, and with a caregiver (Table 4).

HADS

The HADS aims to measure symptoms of anxiety and depression. Scores ranged between 0–7 for normal, 8–10 for borderline and ≥ 11 for abnormal.[20] The anxiety score did not change in 6 of the participants after the intervention, 5 patients had an increased score, and 4 patients had a decreased score. Regarding the depression score, the intervention was effective in 5 patients, not effective in 2 patients, and did not induce changes in 8 patients.

SpO2

Seven patients agreed to participate in the telemonitoring system in whom an increase in SaO2 value from baseline was noted with distant desaturation periods. P2 had a saturation limit that varied between 89% and 95%; at the end of the program, this value increased to 91–95% (Figure 1). In P3, the saturation at baseline varied between 89% and 93%, reaching 93–95% at the end of the program (Figure 2). P11 joined the program with a saturation between 87% and 92%; it was about 89–93% at the end of the intervention (Figure 3). For P12, the saturation was between 93% and 96% at the end of the program, higher than the baseline value of 92–95% (Figure 4). After having periods of drops to 91%, the saturation of P13 varied between 93% and 95% at the end of the program (Figure 5). The saturation of P14 reached 97% after having varied between 92% and 95% at the beginning of the program (Figure 6). The lower saturation limit of P15 was 93% at the end of the program, after varying between 90 and 91% at baseline (Figure 7).

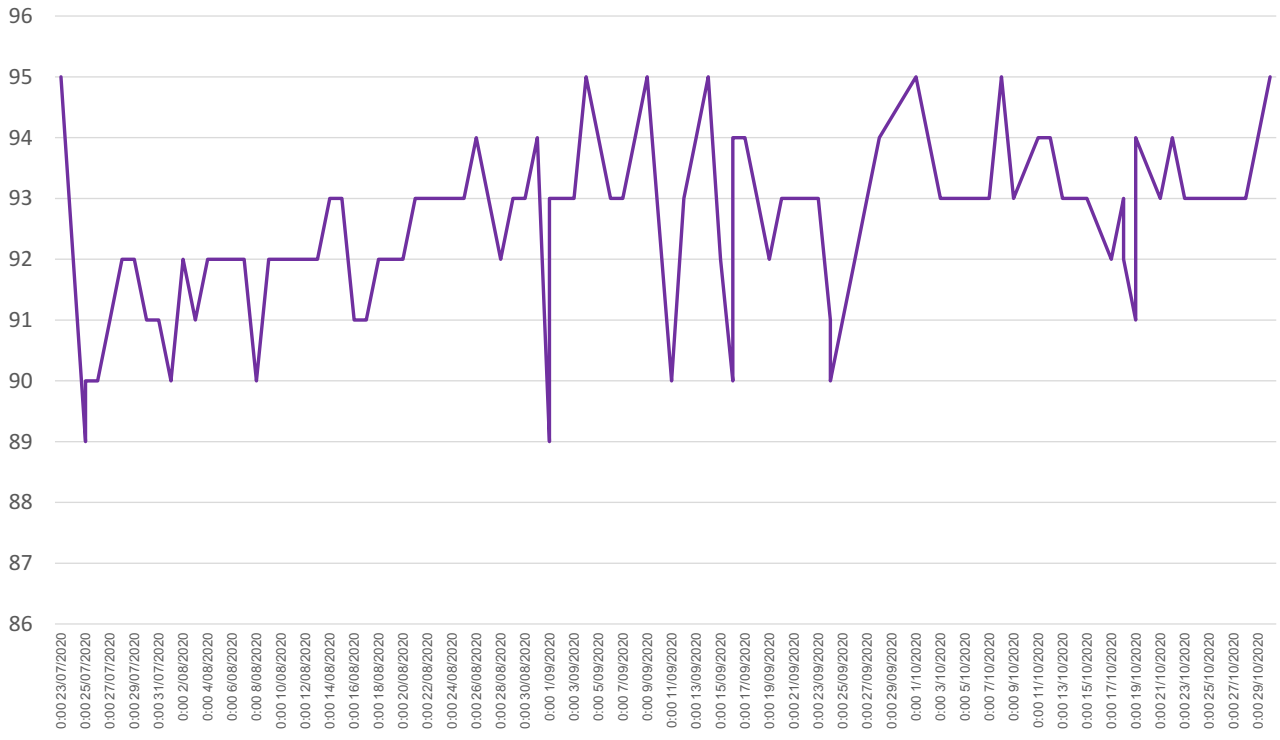

Figure 1 SpO2 variation for Patient 2 throughout the program.

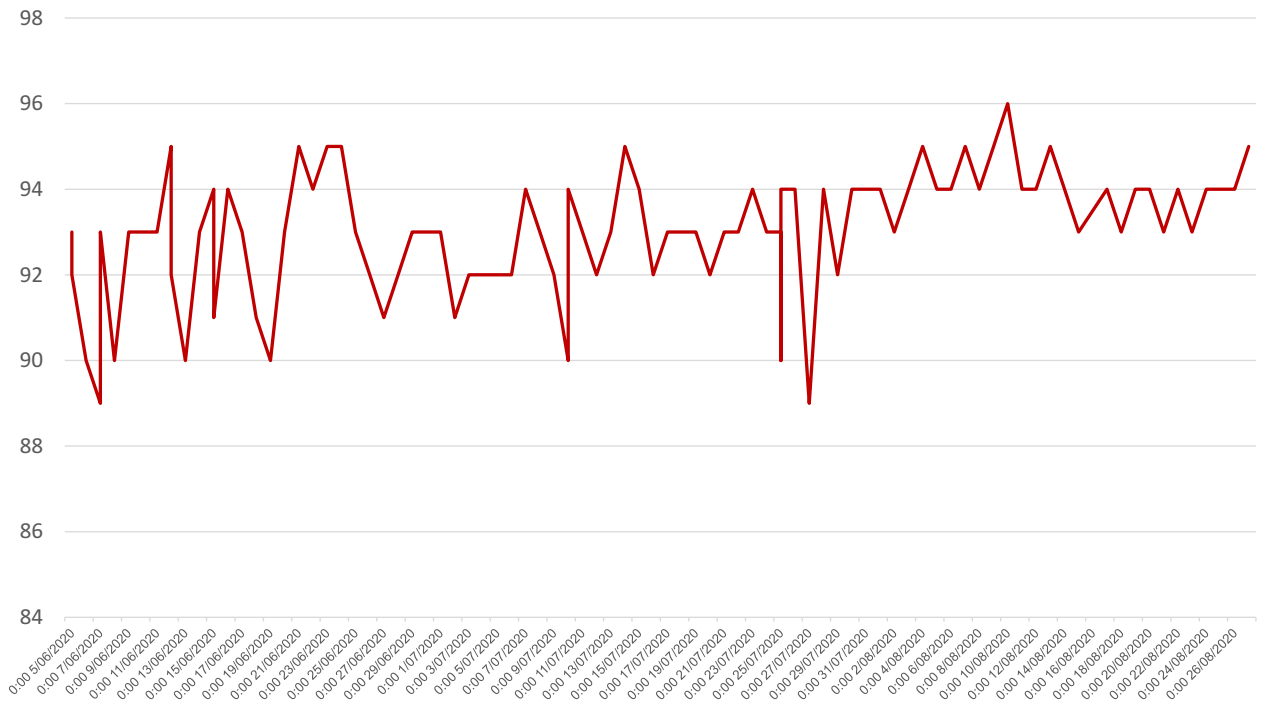

Figure 2 SpO2 variation for Patient 3 throughout the program.

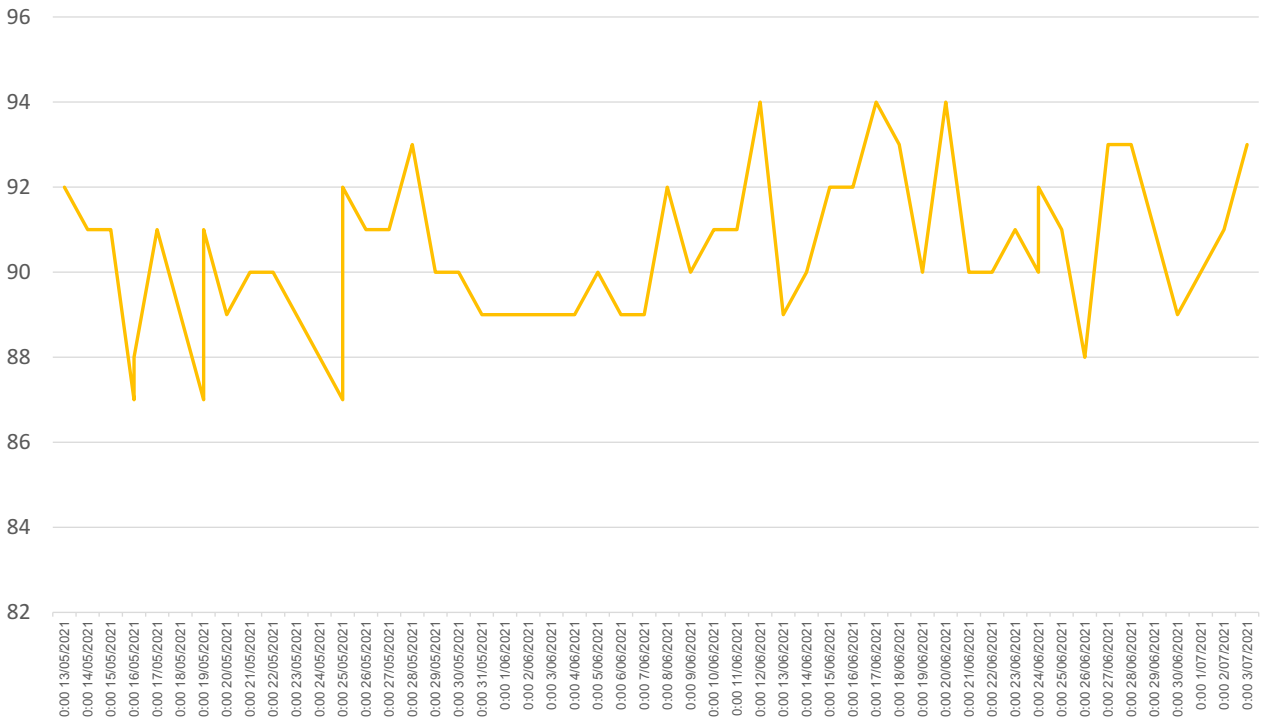

Figure 3 SpO2 variation for Patient 11 throughout the program.

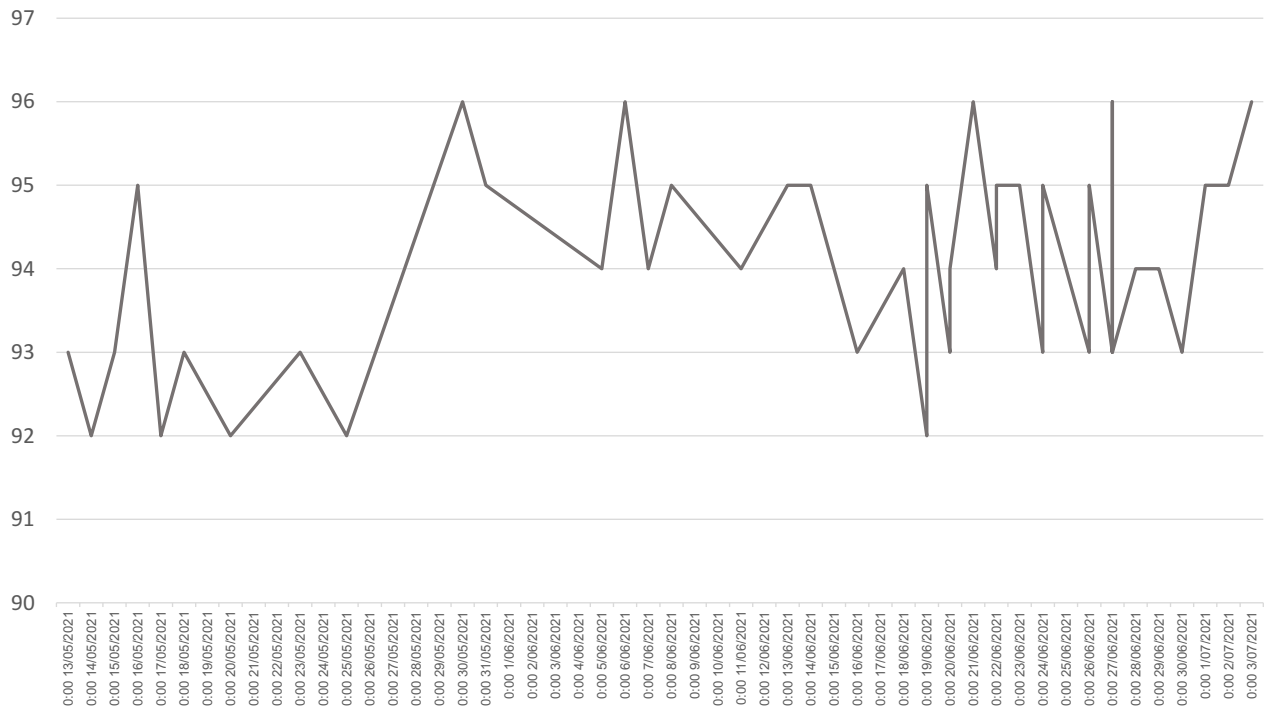

Figure 4 SpO2 variation for Patient 12 throughout the program.

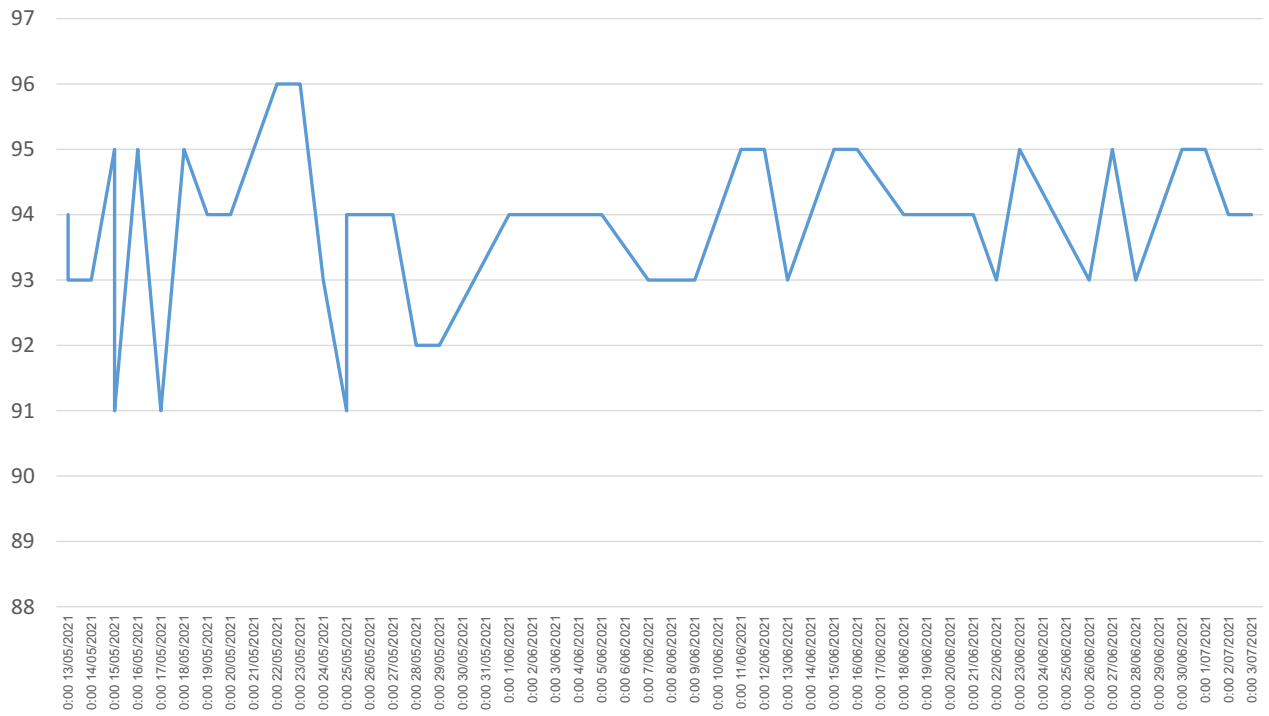

Figure 5 SpO2 variation for Patient 13 throughout the program.

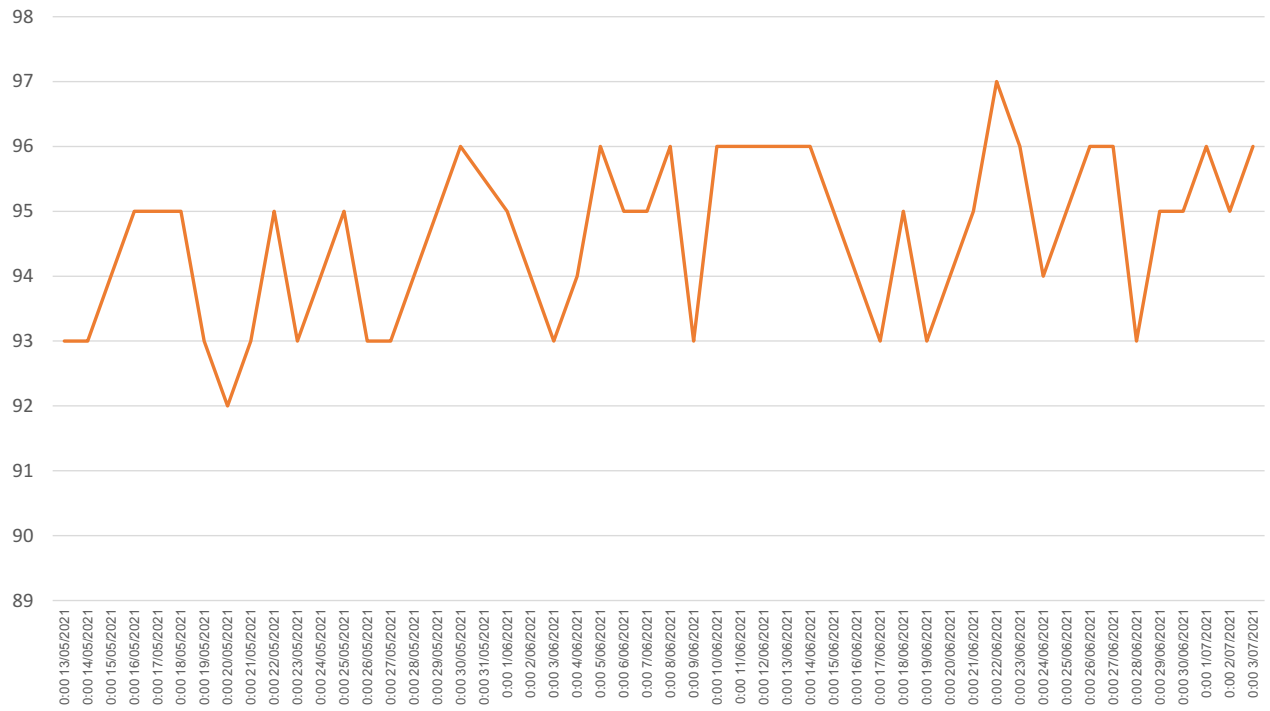

Figure 6 SpO2 variation for Patient 14 throughout the program.

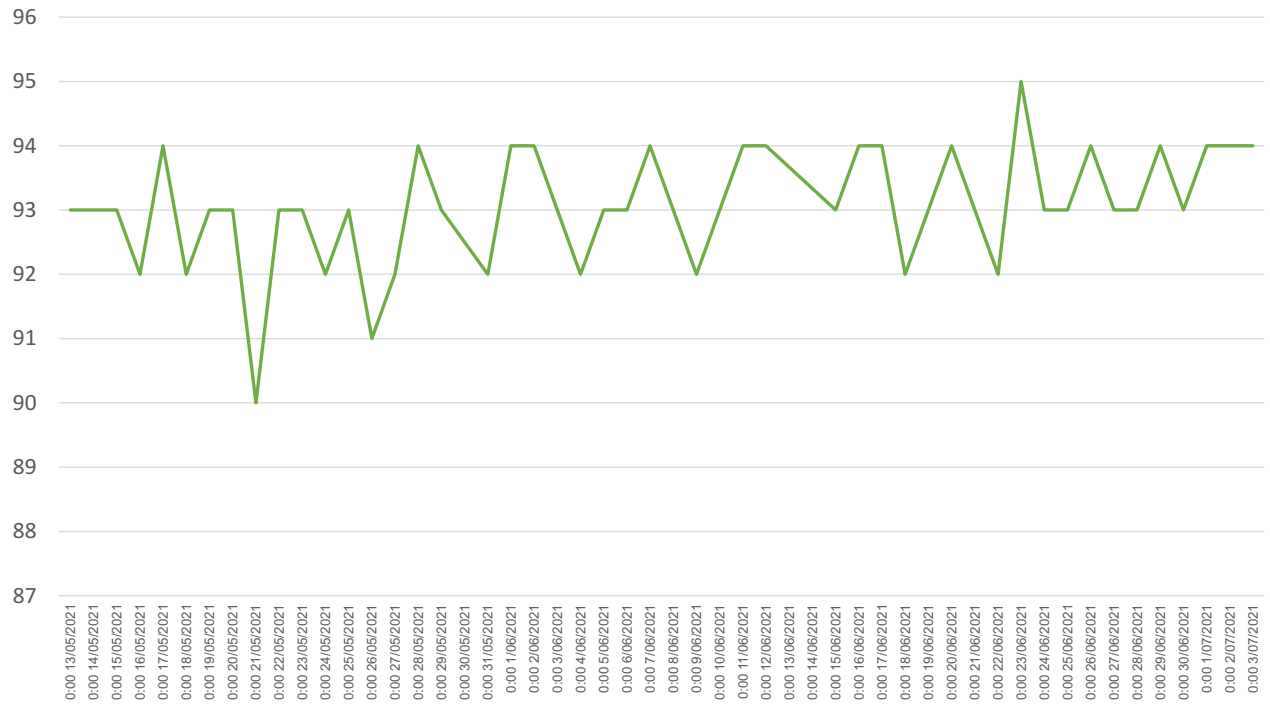

Figure 7 SpO2 variation for Patient 15 throughout the program.

Assessment of Knowledge and Skills

The knowledge of participants was assessed at the beginning of each educational session and the end of the same session using a 5-item true-false questionnaire. The results showed that all participants had a lack of knowledge related to their disease. At the end of each session, the majority of participants answered all questions correctly (Table 5).

The skills of participants were evaluated at the end of the program through a checklist created about respiratory strategies. Participants made no errors that had a health consequence, but five of them made errors with no health consequences regarding the timing of the gesture. Also, 11 participants omitted the gesture verification step.

Discussion

The results of this feasibility study show that this program might be feasible and acceptable to the Lebanese population.

A significant relationship was noted between the age of the participants and the acceptability of this program (≥82 years, 3.62 + 0.51; p=0.05). A previous study has shown that younger individuals with COPD reported more symptoms of anxiety and depression, worse health-related quality of life, and more breathlessness only if they were single, suggesting that young individuals, particularly those who are single, have unique needs due to their young age at onset of severe chronic disease.[22] This finding can explain the acceptability of our program by younger participants who do not have a caregiver (3.5±0.57; p=0.662).

Studies have shown that COPD management can be more difficult in socioeconomically disadvantaged populations.[23] Most participants (9/15) in this study indicated that they were not financially supported in managing their disease and having difficulties in accessing medications and transportation. Furthermore, the results have shown that this program was more acceptable for participants without financial coverage for COPD (3.44±0.52; p= 0.693). Therefore, a more

Table 5 Assessment of Participant's Knowledge

	S1 (Note/5)		S2 (Note/5)		S3 (Note/5)		S4 (Note/5)		S5 (Note/5)		S6 (Note/5)	
	Beginning	End	Beginning	End	Beginning	End	Beginning	End	Beginning	End	Beginning	End
P1	2	4	5	5	2	4	2	4	2	3	2	4
P2	4	5	5	5	4	5	3	4	4	5	3	4
P3	3	3	3	5	3	4	4	5	3	5	1	3
P4	4	5	5	5	3	4	5	5	3	5	4	5
P5	4	5	1	4	3	4	1	3	5	5	2	3
P6	5	5	5	5	4	5	1	4	2	4	4	5
P7	2	5	5	5	2	4	5	5	1	3	3	4
P8	5	5	5	5	4	5	5	5	5	5	5	5
P9	5	5	5	5	5	5	5	5	2	3	2	3
P10	5	5	5	5	5	5	2	4	5	5	5	5
P11	4	5	3	4	4	5	4	5	4	5	4	5
P12	3	4	3	5	4	5	3	5	3	5	4	5
P13	3	5	5	5	4	5	4	5	4	5	3	4
P14	3	5	3	5	3	5	2	4	2	4	3	3
P15	3	4	4	5	5	5	3	4	4	5	4	5
P value	0.001		0.016		0.000		0.000		0.000		0.000	

Abbreviations: P, patient; S, session.

comprehensive chronic disease intervention, involving assistance in accessing treatment, may be more acceptable and beneficial for COPD patients in Lebanon.

The current literature indicates that multidimensional and comprehensive interventions are needed to address the complex and progressive nature of COPD. However, it is unclear which components or combinations of interventions can result in consistent improvements in patient outcomes.[23] The results of this study have shown that the respiratory and physical exercises (3.8± 0.4) and lifestyle sessions (3.66±0.47) had the highest acceptability score.

Recruitment appears to be a global problem. It is considered one of the main challenges and recognized as the most considerable barrier.[24] In this intervention, of the 50 patients contacted, only 15 agreed to participate. However, despite all the constraints faced during this year, no dropout has been encountered. When analyzing recruitment figures in our study, it appears that there is variability according to the stage of the disease. Indeed, 13 of the 15 participants had a disease stage that varied from moderate to severe, ie, 6 patients GOLD 2 and 7 patients GOLD 3. Therapeutic education is been shown essential at all stages of the disease.[25] However, this feasibility study has shown that this therapeutic intervention could be more accepted and effective in Lebanon for patients with moderate (GOLD 2) and severe COPD (GOLD 3).

Furthermore, education showed to have an impact on quality of life.[26,27] Indeed, our intervention revealed an improvement in quality of life for half of the participants (6 patients for the CAT score and 8 patients for the CCQ score). The incidence of anxiety and depression also decreased after education sessions. However, anxiety and depression are common psychological problems and are associated with poor prognosis in COPD.[28,29] A study has suggested that monitoring of indicators could be improve quality of life and anxiety-depression scores in COPD patients.[30]

Regarding the telemonitoring system, the use of telehealth in Lebanon is limited.[31] Although smartphones (80%) and the internet (76%) are highly used,[32] telehealth activities include small-scale interventions for refugees, poor populations,[33] and well-defined medical tasks.[34] In our study, seven patients used the telemonitoring system and reported that it did not negatively affect their daily life. These patients were satisfied with their participation in this trial. Indeed, the Lebanese population has multiple barriers that can hinder their access to health care. In this context, the adoption of telehealth can help democratize access to health care, increase awareness, and improve education.[35] Telehealth services can improve access to health services and reduce health care costs, thus presenting great benefits to all Lebanese residents.[35] The widespread adoption and use of telehealth services can also mitigate other social problems, such as traffic and pollution.[36] Furthermore, a study has shown that the experience of telehealth during the COVID-19 pandemic appears to have contributed to greater openness and willingness to adopt telehealth in Lebanon.[35]

Strengths and Limitations

This study was a small-scale, single-group, feasibility study using a convenience sample recruited across four sites. As a result, the generalizability of our results to the broader COPD population is limited. However, the primary objective of this study was to determine the feasibility of a home-based educational program with telemonitoring as a novel way to manage COPD in Lebanon. Hawthorne effect[37] (defined as a positive effect observed that is not related to the intervention but is simply due to the fact that this group feels observed, hence the modification of its behavior) can be seen in our study because of the absence of blinding inherent to the design of the protocol. Consequently, a telephone follow-up was conducted one month after the intervention to assess retention. Also, to reduce the effect of confirmation bias, the tendency to favor information that confirms preconceived ideas, a second judge was asked to assess whether the intervention was received and faithful to the original protocol.

Given the current situation in the country and the continuous and rapid change in the value of the Lebanese pound, it was difficult to evaluate the relative cost of this intervention. Therefore, it was decided to keep the official value of 1500 LBP for 1 USD, which may present a bias and an unrealistic view of the current cost of such an intervention in Lebanon.

On the other hand, our intervention included an online health platform that allows for frequent health status updates and rapid response, which can be important.

The innovative aspect of this study lies not only in the use of a telemonitoring system but also in the conduct of education sessions at the participants' homes. In Lebanon, until now, there is no decree governing the organization and

conduct of an educational program for patients living with a chronic disease. Educational programs conducted in Lebanon remain limited to the framework of a study in the hospital; until now, no center or structure of education for patients living with COPD exists in Lebanon. Also, to date, no health insurance in Lebanon covers the use of telehealth systems or even educational programs.

Nerveless, this program is an opportunity for professionals, particularly nurses, to strengthen their capacity. This intervention can be seen as a source of nursing leadership in the care of patients in close cooperation with different health professionals, including physicians, physiotherapists, dieticians, and pharmacists. Also, this intervention could reinforce and make known the importance of the role of the nurse in the out-of-hospital environment, which is not well-recognized in Lebanon.

Results from this study will serve to inform a larger-scale study which can address some of the limitations noted here.

Conclusion

Disease-specific education is an essential part of COPD treatment that affects patients' quality of life and emotional state. This educational program improved patients' knowledge of the disease. Furthermore, this feasibility study showed that this intervention could be more accepted and effective in Lebanon among younger patients with COPD stages 2 and 3. The results of this study have shown that the sessions concerning respiratory and physical exercises and lifestyle received the highest acceptability score. Our findings suggest that health insurance initiatives covering education programs and telehealth interventions could be of great interest. In addition, with appropriate support, researcher and patient may be able to work together in a constructive and mutually beneficial manner. The patient could participate in the educational session as a peer education method. This collaboration could contribute to new scientific discoveries.

Abbreviations

COPD, chronic obstructive pulmonary disease; SpO2, oxygen saturation; CAT, COPD assessment test; CCQ, COPD clinical questionnaire; HADS, Hospital Anxiety and Depression scale.

Data Sharing Statement

The dataset may be available from the corresponding author (Rita Georges Nohra) upon reasonable request.

Ethics Statement

This study has been approved by HDF Ethics Committee record (CEHDF 1519, November 4, 2019). All participants were informed about the purpose of the study, that was conducted in accordance with the Declaration of Helsinki. Written consent was obtained from each participant. The study protocol was registered on clinicalTrials.gov 11 December 2019, NCT04196699 and published.[12]

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Disclosure

The authors report no conflicts of interest in this work.

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