Patient Education and Counseling 105 (xxxx) 670–678

Contents lists available at ScienceDirect

Patient Education and Counseling

journal homepage: www.elsevier.com/locate/pec

Nationwide implementation of the self-management program "Living well with COPD": Process and effectiveness evaluation using a mixed-methods approach

Alexandra Strassmann[a], Mathias Guler[b], Claudia Steurer-Stey[a,c], Kaba Dalla Lana[a], Tania Carron[d], Julia Braun[a], Philippe Giroud[b], Isabelle Peytremann-Bridevaux[d], Milo A. Puhan[a], Anja Frei[a,*]

[a] Epidemiology, Biostatistics und Prevention Institute, University of Zurich, Zurich, Switzerland
[b] Swiss Lung Association, Berne, Switzerland
[c] mediX Group practice, Zurich, Switzerland
[d] Center for Primary Care and Public Health (Unisanté), University of Lausanne, Lausanne, Switzerland

ARTICLE INFO

Article history:
Received 6 August 2020
Received in revised form 14 June 2021
Accepted 17 June 2021
Available online xxxx

Keywords:
Living well with COPD
Patient education
Chronic obstructive pulmonary disease
Self-management
Program implementation
Mixed-methods evaluation

ABSTRACT

Objective: To evaluate the nationwide implementation of the "Living well with COPD" program by the Swiss Lung Association in various cantons in Switzerland.
Methods: For the process evaluation, we used qualitative (interview, focus group) and quantitative (questionnaires, documentation analysis) methods to assess the implementation outcomes reach, dose, fidelity and acceptability. For the effectiveness, we performed a pre-post analysis of patient data collected at baseline and program end (after 14 months).
Results: Seven Cantonal Lung Associations implemented the program into their services according to plan, conducted it 13 times and included 122 COPD patients. Patients' attendance rate was 81% and coaches' fidelity to protocol 94%. Acceptance and satisfaction of all involved persons was high. Integration of the coaches' additional workload, uncertainties regarding roles and responsibilities and sustainable reimbursement were major challenges. Patients significantly improved in COPD specific quality of life and increased exercise capacity with on average 3.2 more repetitions in the 1-minute sit-to-stand test.
Conclusion: The program was successfully implemented throughout Switzerland with high acceptability and positive association with patients' quality of life.
Practice implications: Our findings support the broader multiplication throughout Switzerland and serves the international community since it is one of the first nationwide implementations beyond study settings.

1. Introduction

The burden of chronic obstructive pulmonary disease (COPD) is large for the health care system and patients, in particular for those with severe exacerbations requiring hospital admissions. More than 60% of COPD patients experience a hospital readmission due to an exacerbation within the first 13 months after discharge [1]. Pulmonary rehabilitations after experiencing an acute COPD exacerbation do often not provide follow-up care and patients' risk of entering a vicious circle of dyspnea and physical inactivity is high [2–4]. Therefore, skills to manage COPD on a day-to-day basis, to adapt and maintain healthy lifestyle behaviors that break drivers of the vicious circle and to react adequately and timely in case of an exacerbation are fundamental.

Self-management interventions have been shown to improve health outcomes in COPD patients but interventions are too heterogeneous to formulate clear recommendations [5,6]. "Living well with COPD" (LWWCOPD) is an evidence-based self-management program for COPD patients that has shown to reduce hospital admissions due to exacerbations and increase patients' quality of life [7–9]. This suggests that a nationwide uptake could significantly reduce the disease burden of COPD patients. The LWWCOPD program was implemented several years ago in two different areas in Switzerland targeting patients from the primary care setting

* Correspondence to: University of Zurich, Epidemiology, Biostatistics and Prevention Institute, Hirschengraben 84, CH-8001 Zurich, Switzerland.
E-mail address: anja.frei@uzh.ch (A. Frei).

https://doi.org/10.1016/j.pec.2021.06.018
0738-3991/

[10–12]. The present project, promoted by the Swiss Lung Association in collaboration with the Swiss Society for Pulmonology, aims to achieve a broader implementation in eleven locations throughout Switzerland. In the framework of this project, the LWWCOPD program was offered to a wide range of COPD patients with different disease severities.

However, a nationwide implementation of a patient education program has to cope with various challenges such as higher complexity in terms of communication, coordination and organization, local constraints and recruitment process of COPD patients [11]. It is well known that interventions that have been successfully developed and proven to be effective in academic and research settings may not be transferable to wider implementation or generalizable to other settings [13].

The aims of this study were to evaluate the nationwide implementation of the LWWCOPD program on patient- and provider-level by capturing how the intervention was delivered and exploring insights regarding the barriers and facilitators, and to assess the effectiveness of the program on the patient level. This evaluation contributes substantially to the knowledge on the transition from a few single-sites to a broad-scale implementation of patient education programs.

2. Methods

2.1. Study design

The LWWCOPD program was implemented by the Swiss Lung Association in seven Cantonal Lung Associations throughout Switzerland between January 2018 and February 2020. The implementation process followed a six-step approach and was developed by an expert team of the Swiss Lung Association and Swiss Society of Pulmonology (Fig. 1).

We used a mixed-methods approach and evaluated the implementation process on the level of COPD patients, coaches, program pulmonologists, program managers and master coaches with quantitative and qualitative methods. For the effectiveness evaluation, we analyzed quantitative data of COPD patients. The study was guided by the Medical Research Council (MRC) guidance on process evaluation as overarching framework [14] and the work by Proctor et al. [15] and Saunders et al. [16] regarding the implementation outcomes reach, dose, fidelity and acceptability. The study was approved by the Ethics Committee of the Canton of Zurich (Switzerland) (BASEC No. 2017-02077).

2.2. Intervention: The LWWCOPD program

LWWCOPD is a well-established and standardized self-management program for COPD patients which has been translated and adapted to the Swiss context and validated in the Swiss primary care setting [7,11,12]. LWWCOPD included six group modules (each 90 min), an individual session with a coach and/or program pulmonologist and follow-up phone calls 1, 3, 6, and 12 months after the end of the group modules (Fig. 2). The group modules were held by at least one coach, and a program pulmonologist was present in one or both of the first two modules. The modules covered (1) preventing/controlling symptoms, (2) Medications/inhalers, (3) Breathing/coughing techniques, (4) Energy conservation, (5) Physical activity and (6) Healthy lifestyle. In module 1, a physical activity plan and in module 2 an action plan to early detect, react and prevent acute COPD exacerbations were introduced [18], which were reviewed and trained in an individual session with a coach/program pulmonologist. The group modules combined various pedagogical methods such as knowledge transfer, discussion, small group works, practical training and homework to motivate and activate patients. Coaches were also trained in motivational interviewing techniques. Patients' program participation was funded through various sources (Table A.1).

2.3. Study population

The study addressed five groups of persons who were involved in the program:

- *COPD patients* were recruited for the LWWCOPD program over health care institutions and from the general population (Supplemental material, Tables A.2 and A.3). Members of the Cantonal Lung Associations provided information on the program and verified eligibility for program participation. Program inclusion criteria were a physician-diagnosed COPD with any Global Initiative for Chronic Obstructive Lung Disease (GOLD) stage I-IV and being able to attend the group modules. Patients with cognitive impairment, severe mental disorders, insufficient knowledge of German or French, limiting comorbidities or other significant lung diseases (e.g., cystic fibrosis, pulmonary fibrosis) were excluded. Written informed consent for sharing their data for research purposes was necessary for study participation. A maximum of 12 patients could be assigned to a group.
- *Coaches* were employees of the Cantonal Lung Association who had to meet pre-defined criteria in terms of education and professional experience. They could contact their supervisor in case of interest. The coaching role resulted in either integrating new tasks into the previous workload or increasing the workload. All coaches attended a two-day training, which was conducted by pulmonologists and physiotherapists experienced delivering the LWWCOPD program.
- *Program pulmonologist* were pulmonologists working in hospitals or practices who were asked by the program manager to participate in the program. A program pulmonologist was designated and medically responsible for each group of patients, was present in at least one of the first two modules, completed the action plan, gave advice in medication and attended the individual session with the patient. The program pulmonologists attended the first half training day together with the coaches. The reimbursement of their work was not specified by the Swiss Lung Association; each Cantonal Lung Association specified it separately.
- *Program managers* were employees of the Cantonal Lung Association and were selected internally. They were responsible for the organization, coordination and implementation of the program in their canton and were in close collaboration with the program managers of the other cantons and the Swiss Lung Association.
- *Master coaches* were health care professionals with intensive training and experience in conducting the LWWCOPD program. They were responsible for the training of the coaches and program pulmonologists and visited the coach during the group modules. The Swiss Lung Association reimbursed their workload.

2.4. Outcomes and measurements of the process evaluation

The process evaluation was based on the established implementation outcomes "dose", "reach", "fidelity" and "acceptability" [14–16] which were assessed by following measurements:

- *Dose* refers to the amount of intervention that was delivered to the target group and was assessed by the number of programs and group modules, duration of the group modules and amount of delivered material (pedometer, elastic band for strength training, information on outpatient rehabilitation programs and action plan).
- *Reach* refers to the degree to which the target group was reached and was assessed by a screening and enrollment protocol, patients' attendance rates in the group modules and the percentage of performed follow-up phone calls.
- *Fidelity* refers to the degree to which the intervention was delivered according to the protocol. The coaches completed a checklist after each group module to report how many of the planned topics were actually covered in the modules.

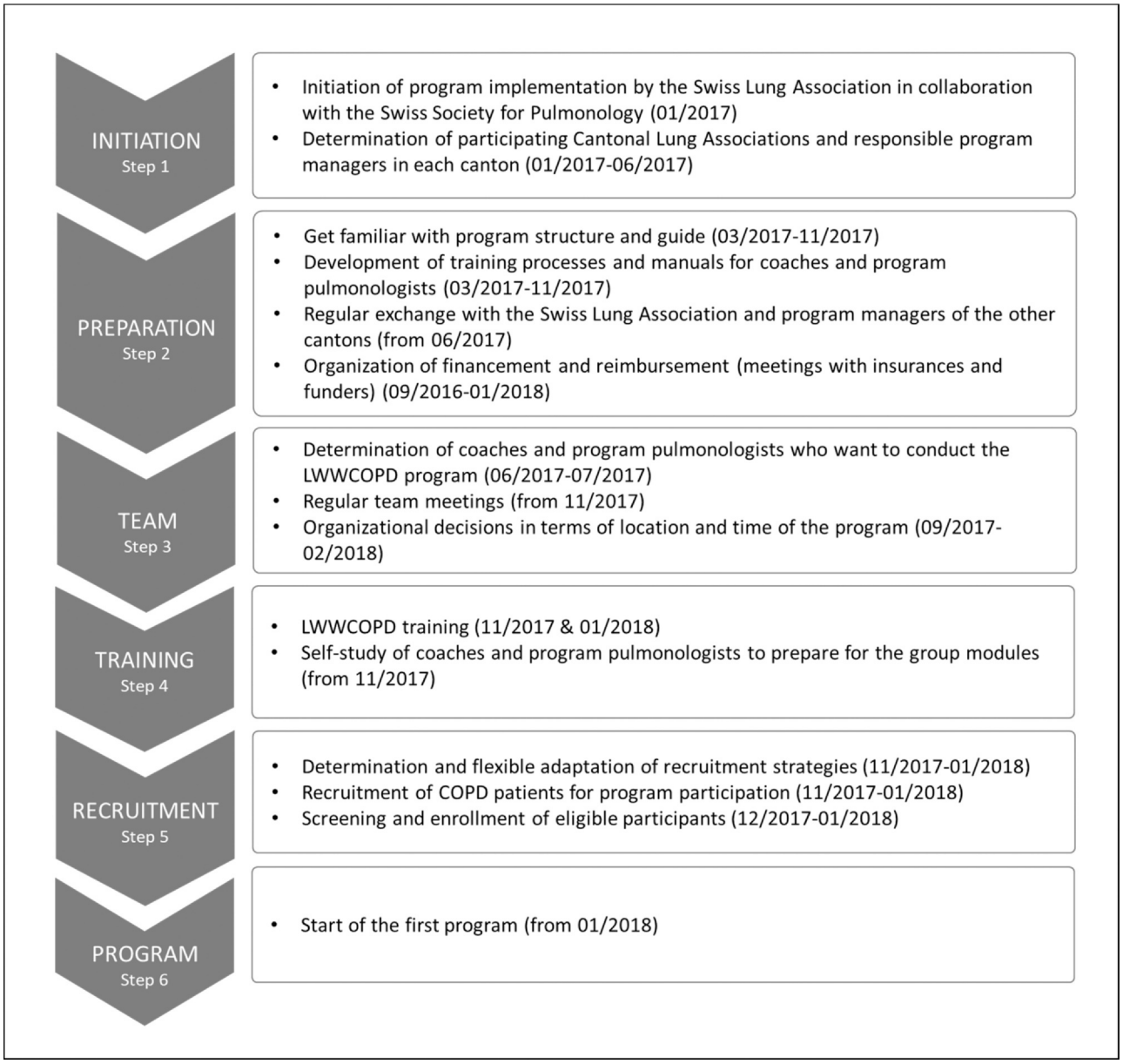

Fig. 1. Implementation process of the "Living well with COPD" program in various Cantonal Lung Associations throughout Switzerland, including time frames.

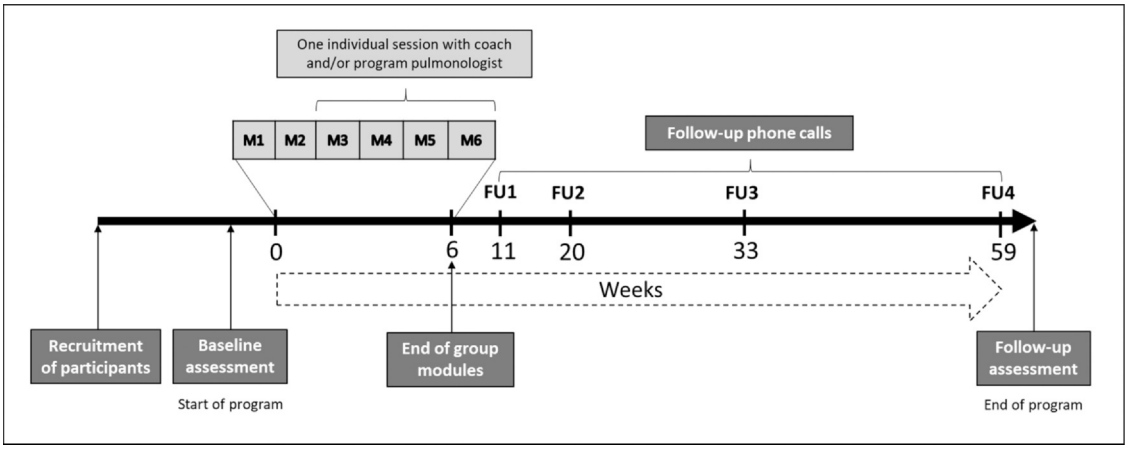

Fig. 2. Design of the "Living well with COPD" program. M1-M6 = module 1–6; FU = follow-up.

Additionally, a master coach visited the coaches during the group modules and completed the same checklist (one visit per coach and module).

- *Acceptability* refers to the degree to which the program was perceived as meaningful, appropriate and satisfactory. Semi-structured interviews with the seven program managers from the Cantonal Lung Associations (five from the German and two from the French speaking cantons) were conducted at the end of the group modules. Furthermore, a focus group with six coaches from five German speaking Lung Associations was held after each coach had experienced the entire program. In addition, patients and coaches were asked to answer two questions on five-point Likert scales after each group modules regarding their overall opinion (range: “very bad” to “very good”) and their satisfaction with the amount of practical information provided (range: ”not satisfied at all” to ”highly satisfied”). Patients were also asked to fill out a questionnaire after the completion of all six group modules and 12 months later on an eleven-point Likert scale to assess how the program helped them to better manage their disease in everyday life (range: 0 “not better” to 10 “much better”). A questionnaire was sent to all of the eight program pulmonologists of the German speaking Cantonal Lung Associations.

2.5. Outcomes and measurements of the effectiveness evaluation

For the effectiveness evaluation, data from the patients were collected prior to the start of the group modules (baseline assessment) and 12 months after end of the group modules (follow-up assessment). The primary outcome was the Chronic Respiratory Disease Questionnaire (CRQ), a disease-specific questionnaire to assess health-related quality of life (HRQoL) [19]. The CRQ contains 20 questions on a 7-point Likert scale (with lower scores indicating worse HRQoL) that are divided into the four domains “dyspnea”, “fatigue”, “emotional function” and “mastery”. Secondary outcomes were the modified Medical Research Council (mMRC) for assessing the severity of dyspnea (0–4 scale) [20], COPD Assessment Test (CAT) for measuring the impact of COPD on patient’s wellbeing and daily life (0–5 scale) [21], six questions regarding confidence in COPD self-management (0–10 scale), 1-minute sit-to-stand test (1-min STS) to assess functional exercise capacity [22,23], amount of inpatient treatments and outpatient consultations and the number of event-based COPD exacerbations within the previous 12 months. An exacerbation was defined as a worsening of dyspnea and/or cough and/or sputum and a new prescription or dose increase of a systemic corticosteroid and/or an antibiotic. Detailed descriptions of the secondary outcomes are provided in the Supplemental material (Table A.4).

2.6. Data analysis

2.6.1. Qualitative analysis

The interview and focus group guides were developed in exchange between the research teams in Zurich and Lausanne and the Swiss Lung Association. The questions followed the sequence of the implementation process. The evaluation of the interviews and the focus group was based on qualitative content analysis. The German and French interviews with the program managers were audio recorded, transcribed by native speakers and read into the MAXQDA 2018 computer program [24]. For the text analysis, categories were determined a priori in English. Native speakers assigned relevant text passages in the German and French interviews to the English categories and clarified uncertainties and ambiguities regarding categorization or understanding with each other. The category system was continuously expanded and adapted in the further analysis process. In a next step, the passages of the French and German interviews were combined. We summarized the most frequent statements for the qualitative evaluation. The evaluation of the focus group was carried out analogously.

2.6.2. Quantitative analysis

We performed pre-post analyses on complete patient data that were collected at baseline and follow-up assessment. The *t*-test for dependent samples was used to examine the change between continuous baseline and follow-up measurements, and the McNemar’s test to compare paired proportion of patients who smoke cigarettes at baseline and follow-up. In addition, we used a mixed linear regression model to identify possible predictors of changes in the primary outcome variable between baseline and follow-up. The dependent variable was the difference of the CRQ subscale values at follow-up and baseline. We included the following potential predictors from the baseline assessment into the model: Sex, age, COPD GOLD stage (I-II vs. III-IV) and number of exacerbations in the previous 12 months. The seven Cantonal Lung Associations were included as a random effect to account for potential clustering. The analyses were conducted in R Version 3.6.1 [25].

3. Results

3.1. Study population of the process evaluation

The process evaluation encompassed data from all patients (n = 122, not restricted to complete cases), 16 coaches, eight program pulmonologists, seven program managers and two master coaches. The six coaches in the focus group (five were female) were on average 44.5 years of age (range: 30–57 years), have been working for the Lung Association for on average six years (range: 2.5–15 years) and with a 75% workload (range: 50–100%). Four of the six coaches attended both training days. All program pulmonologists (5 out of 8 male) completed the questionnaire.

3.2. Study population of the effectiveness evaluation

The effectiveness evaluation included only patients who completed the program. In total, 122 patients started the program. The sex ratio was balanced (53% male) and the patients were on average 69 years at baseline (Table 1). From those who started the program, 24 dropped out due to various reasons (Fig. 3). Four follow-up assessments were not conducted, these patients could therefore not be included in the effectiveness evaluation.

Table 1
Patients’ characteristics at baseline.

	Total (n = 122)
Male sex	64 (52.5)
Age, years	69.3 ± 8.2
Smoking status*	
Never smoker	3 (2.5)
Former smoker	94 (78.3)
Current smoker	23 (19.2)
COPD GOLD stage III-IV*	61 (51.1)
Number of COPD exacerbations in the previous 12 months*	
0	51 (44.0)
1–2	47 (40.5)
> 2	18 (15.5)
Number of patients in each Cantonal Lung Association	
Basel	10 (8.2)
Bern[a]	22 (18.0)
Solothurn	11 (9.0)
Thurgau[b]	23 (18.9)
Valais[c]	23 (18.9)
Vaud	4 (3.3)
Zurich[d]	29 (23.8)

Data are presented in n (%) or mean ± standard deviation. COPD = chronic obstructive pulmonary disease; GOLD = Global Initiative for Chronic Obstructive Lung Disease. * Data contain missing values for smoking status (n = 120), GOLD stage (n = 116) and number of exacerbations (n = 116). [a] Two locations, [b] two groups, [c] two locations with three groups in total, [d] three locations.

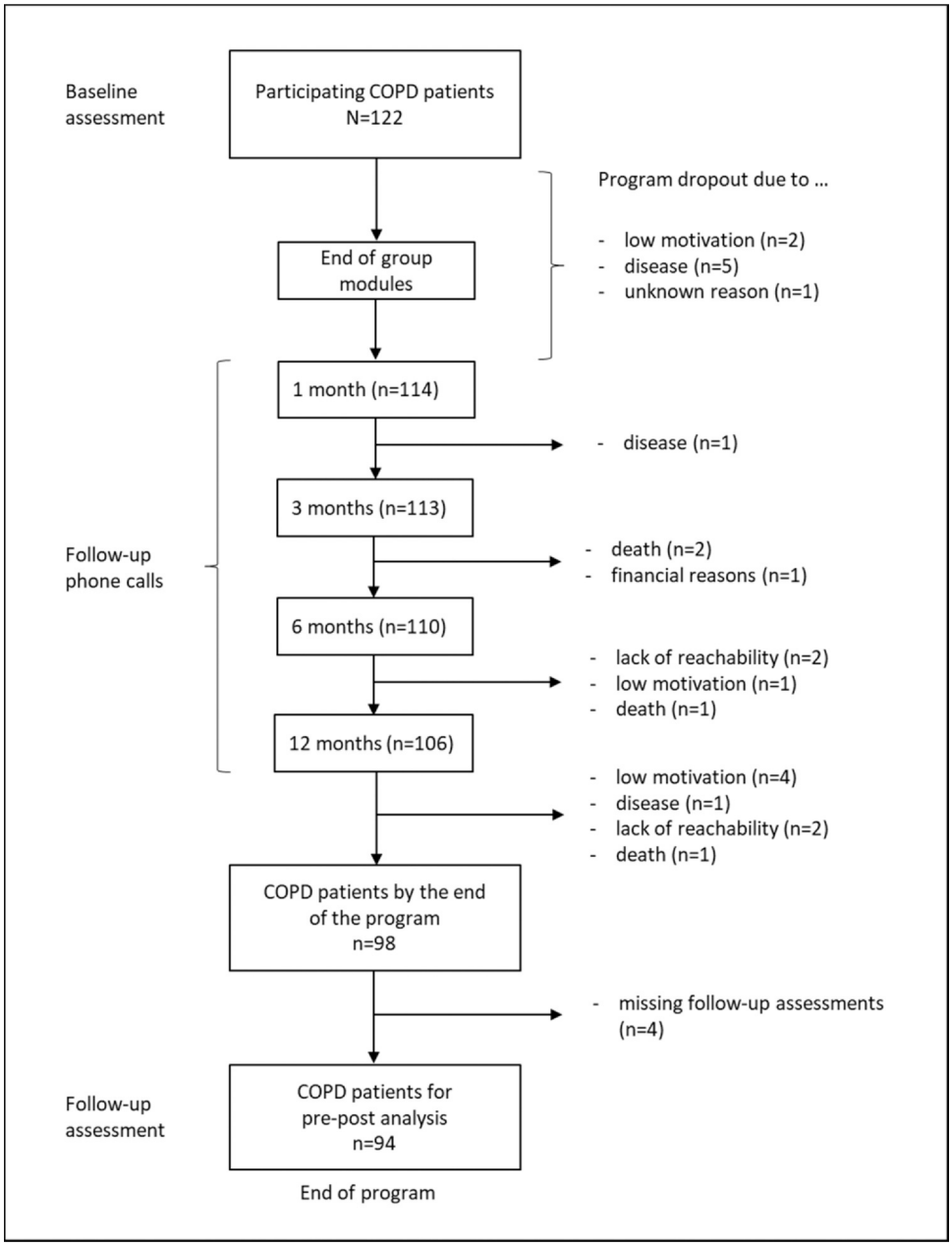

Fig. 3. Flow of patients during the program and reasons for program dropout. COPD = chronic obstructive pulmonary disease.

3.3. Process evaluation

3.3.1. Dose

The program was conducted with 13 groups of patients at eleven different locations of seven Cantonal Lung Associations. The group modules lasted on average 115 min, i.e. 25 min (range: 10–45 min) longer than according to the protocol (n = 19 of 71). 10 out of 11 locations provided a pedometer in module 1, and 8 out of 11 locations provided an elastic band and distributed information on outpatient rehabilitation programs in module 5. At the end of the group modules, 83% patients reported to have an action plan.

3.3.2. Reach

The screening protocol was completed by 8 out of 11 locations. Based on these protocols, 83% of the subjects who were interested to participate in the LWWCOPD program met the program inclusion/exclusion criteria. Finally, 89% of those decided to participate. The average percentage of patients attending the group modules was 81%, ranging from 74% (module "Energy conservation") to 89% (module "Preventing and controlling symptoms"), however, the attendance rate was missing from 2 out of 11 locations. The percentages of performed follow-up phone calls were 97.4% at 1 month, 95.6% at 3 months, 95.5% at 6 months and 88.7% at 12 months.

3.3.3. Fidelity

Based on the coaches' checklists for each group module, 94% of the topics were covered on average and across all group modules. Module "Medications and inhalers" had the lowest (83%) and module "Breathing and coughing techniques" the highest rate (98%) of covered topics. Based on the external evaluation of the master coaches, 84% of the topics were covered on average, with the lowest rate of 62% in module "Medications and inhalers" (only one external evaluation available).

Table 2
Facilitators and barriers at different stages of the implementation, gained by the analyses of the interviews (program managers), focus group (coaches) and questionnaires (program pulmonologists).

	Facilitators	Barriers/challenges
	Preparation & organization	
Program managers	• Good cooperation between Cantonal Lung Associations and Swiss Lung Association • No issues in finding coaches • Regular meetings with team members • No time management issues in the Cantonal Lung Association where program has already been implemented	• Unclear situation regarding reimbursement of the program • Finding enough COPD patients for participation • Different requirements in each canton • High effort for program pulmonologists and coaches for first implementation
	Training	
Coaches	• Content and material of program clear and conveyed in a comprehensible manner • Previous experience in motivational interviewing, group leading and with COPD patients	• Coaches' training very intensive, and few practical exercises compared to theory • Time between training and first group module very short
	Program execution	
Program managers	• Good interaction with other involved parties (e.g., general practitioners, physiotherapists)	• Unclear assignment of roles and duties between coach and program pulmonologist
Coaches	• Good coach-patient interaction • Program content relevant to COPD patients • Practicality of the action plan • Extension of the group modules to 120 min • Attendance of a pulmonologist for medical questions • Patients well reachable by phone • Good cooperation with program pulmonologist	• Challenged by patients with different COPD stages • Some topics considered to be inappropriate to discuss in a group or lack of structure of single modules • Design of action plan very complex • Lack of time during group modules • Unclear responsibility and high effort for completing the action plan • Being on time with follow-up phone calls • Difficulties in receiving medical information from treating pulmonologist • Integrating time effort for the program into everyday work schedule
Program pulmonologists	• Good cooperation with coach • Acknowledge patient education programs as useful • Previous experience in patient education • Handbook useful for preparation and group modules	• Patients' medical history and medication often not available • Lack of time and uncertainty regarding completing action plan and prescribing medication • Little experience in group leading • Group modules very scripted • Intransparent monetary compensation
	Future outlook	
Program managers	• Program in accordance with governmental health strategy • Close collaboration with treating pulmonologists to simplify recruitment and reimbursement • Keep a responsible program manager in each Cantonal Lung Association for better coordination	• Uncertainty regarding future quality assurance of the program • Unclear situation regarding long-term reimbursement of the program

COPD = chronic obstructive pulmonary disease.

3.3.4. Acceptability

3.3.4.1. Professionals. The main reasons for implementing the LWWCOPD program was that it is an evidence-based program with focus on tertiary prevention and the prospect of sustainability through long-term care of COPD patients. Overall, acceptance and satisfaction of the involved professionals with the program was very high; they particularly acknowledged the meaningfulness of the program. Table 2 overviews the facilitators and barriers at different stages of the implementation reported by the professionals, condensed from the extensive amount of results gained by the analyses of the interviews, focus group and questionnaires.

Following suggestions for improvements evolved from all the results gained by program managers, coaches and program pulmonologists: (1) explicit integration of coaches' time effort into their everyday work schedule, (2) provide video material for coaches' training and adapt training content to their professional background, (3) clarify the role between coach and program pulmonologist, (4) clarify responsibilities between program pulmonologist, general practitioner and treating pulmonologist, (5) further evaluate content of single modules and the action plan with possible adaptations, (6) reduce content of modules or extent module duration to two hours, (7) assess training requirements for new program pulmonologists and (8) define uniform monetary compensation for program pulmonologists.

3.3.4.2. Patients. Most of the patients assessed the group modules as "good" or "very good" without noticeable differences between modules. Patients reported highest satisfaction with modules providing practical information such as "Healthy lifestyle" (79% highly satisfied) and the lowest for "Energy conservation" (49% highly satisfied). Most of the patients reported that the program content helped them to better manage their COPD (85% within range 8–10) and that they could better cope with everyday life (70% within range 8–10). At the end of the modules, 67–68% of the patients evaluated "Breathing/coughing techniques" and "Physical activity" as the most helpful modules for COPD self-management, at follow-up, 69% of the patients still reported highest satisfaction with "Breathing/coughing techniques" (Supplemental material, Fig. A.1).

3.3.4.3. Coaches. Most of the coaches described module "Breathing and coughing techniques" as "very good" (75%), lowest satisfaction had "Healthy lifestyle" (25% very good) and "Energy conservation" (29% very good). They reported highest satisfaction with modules providing practical information for "Breathing and coughing techniques" (75% highly satisfied) and "Healthy lifestyle" (58% highly satisfied) and lowest for "Energy conservation" (29% highly satisfied).

3.4. Effectiveness evaluation

3.4.1. Primary outcome

Patients had higher scores in all four CRQ domains at the follow-up compared to the baseline assessment (Table 3). The change in HRQoL was statistically significant in three of four domains: Dyspnea

Table 3
Results from the pre-post analysis of the effectiveness evaluation.

Outcome	Baseline	Follow-up	Change	(95% CI)	*p* value
CRQ (n = 94)					
Dyspnea	4.39 ± 1.3	4.70 ± 1.4	0.32	(0.11–0.52)	< 0.01
Fatigue	4.41 ± 1.1	4.51 ± 1.3	0.11	(−0.13 to 0.34)	0.37
Emotional function	4.82 ± 1.1	5.05 ± 1.2	0.24	(0.03–0.44)	0.02
Mastery	4.83 ± 1.2	5.29 ± 1.3	0.46	(0.18–0.74)	< 0.01
mMRC (n = 88)	1.85 ± 1.1	1.68 ± 1.2	-0.17	(−0.39 to 0.05)	0.13
CAT (n = 89)	16.69 ± 6.8	16.03 ± 7.5	-0.65	(−1.73 to 0.43)	0.23
1-min STS (n = 53)	23.91 ± 8.3	27.06 ± 10.1	3.15	(1.69–4.61)	< 0.001
Confidence					
Pulmonary medication (n = 88)	8.81 ± 2.3	9.34 ± 1.4	0.53	(−0.03 to 1.10)	0.06
Inhalation (n = 85)	8.84 ± 1.9	9.34 ± 1.4	0.51	(0.04–0.97)	0.03
Physical activity (n = 87)	8.31 ± 2.2	8.03 ± 2.4	-0.28	(−0.81 to 0.26)	0.31
Worsening of symptoms (n = 87)	7.46 ± 2.3	8.51 ± 1.5	1.05	(0.49–1.61)	< 0.001
Emergency medication according action plan (n = 24)	8.33 ± 2.2	8.54 ± 2.0	0.21	(−1.10 to 1.52)	0.75
Consult a physician/ pulmonologist (n = 85)	8.19 ± 2.1	8.78 ± 1.6	0.59	(0.11–1.07)	0.02
COPD exacerbations[a] (n = 90)	1.28 ± 2.1	1.12 ± 1.8	-0.16	(−0.61 to 0.30)	0.50
≥1 exacerbations, n (%)	49 (54.4)	49 (54.4)			
Outpatient medical treatments[a] (n = 92)	8.89 ± 5.6	6.07 ± 5.6	-2.83	(−4.13 to −1.52)	< 0.001
≥1 outpatient treatments, n (%)	89 (96.7)	85 (92.4)			
Inpatient medical treatments due to COPD[a] (n = 90)	0.46 ± 1.1	0.38 ± 1.0	-0.08	(−0.30 to 0.15)	0.49
≥1 inpatient treatments, n (%)	21 (23.3)	18 (20.0)			
Days in hospital due to COPD[a] (n = 94)	3.08 ± 7.1	3.35 ± 8.0	0.27	(−1.31 to 1.86)	0.82
Smoking status (n = 93)					
Current smoker, n (%)	18 (19.4)	13 (14.0)	-5	(0.00 to 1.09)	0.07

Only patients with complete data were included in these analyses. Data are presented as mean ± standard deviation, unless not otherwise stated. Differences in mean were calculated using the t-test for dependent samples, except for the smoking status where the McNemar's test was used. CRQ = Chronic Respiratory Disease Questionnaire (lower scores indicating worse HRQoL); mMRC = modified Medical Research Council (higher value indicating higher severity of dyspnea); CAT = COPD Assessment Test (higher value indicating higher impact); 1-min STS = 1-minute sit-to-stand test; COPD = chronic obstructive pulmonary disease; CI = confidence interval. [a] In the previous 12 months.

(+0.32 points), emotional function (+0.24 points) and mastery (+0.46 points). In all four domains, the baseline CRQ value predicted the change in the domain during the program, i.e. patients with higher baseline values showed a smaller improvement in the respective domain (Supplemental material, Table A.5). In the domains "dyspnea" and "mastery", patients with a GOLD stage III-IV had smaller improvements in dyspnea and mastery, respectively. All other predictors did not have an impact on the change in the respective CRQ domain.

3.4.2. Secondary outcomes

There was no evidence for a difference in the mean scores of the mMRC and CAT between baseline and follow-up (Table 3). In contrast, there was very strong evidence for improved exercise capacity with on average 3.2 more repetitions in the 1-min STS at follow-up compared to baseline. We also found moderate evidence for a difference of confidence in performing the inhalation properly (+0.51 points) and knowing when to consult a physician or pulmonologist (+0.59 points), and a very strong evidence for a difference in detecting a worsening of COPD symptoms (+1.05 points). There was very strong evidence for a reduction in seeking any kind of outpatient medical treatment by 2.8 (less) treatments at follow-up. There was no evidence for an impact on the number of COPD exacerbations, inpatient medical treatments due to COPD or days in hospital due to COPD. The proportion of current cigarette smokers decreased from 19% to 14% between baseline and follow-up (smoking cessation rate 28%), four out of 18 patients stopped cigarette smoking and one patient changed to an e-cigarette. The evidence that the program had an impact on cigarette smoking cessation was weak (p = 0.07).

4. Discussion and conclusion

4.1. Discussion

Overall, the LWWCOPD program was implemented according to plan in several locations of the Cantonal Lung Associations throughout Switzerland. Patients' attendance rate was satisfactory and most of the program elements could be conducted according to the protocol. We found a generally high satisfaction and acceptance of the involved persons. COPD patients had significantly improved HRQoL and exercise capacity, and sought less outpatient medical care in the course of the program. Moreover, 28% of the patients who smoked at baseline quit cigarette smoking by the end of the program.

The time required to prepare and organize the program for the first time was generally underestimated. Consequently, some cantons experienced difficulties in integrating their workload into everyday work schedule. Hence, coaches worked beyond their usual workload. Since this was the first implementation of the program for most cantons, we can expect that the effort will be substantially reduced with a further implementation. Furthermore, the cantons started the program even though short- and long-term reimbursement of the program was not secured. Considering the short preparation time, the cantons did not face major challenges in compiling a new team. The recruiting process of COPD patients varied greatly between cantons, however, program managers agreed that recruitment needs to be more efficient in future. The coaches described the training as both helpful and very intensive, and the time between training and program start as too short.

The coaches were challenged by a tight schedule in the group modules. As a result, the sessions were officially extended to 120 min shortly after the program was launched. The exacerbation action plan was perceived as helpful for the patients, but several cantons reported difficulties in completing the action plan on time. One reason was that patients' medical history and medication list was not available for each patient. Although collaboration between coaches and program pulmonologists was considered to be very good, the distribution of roles and responsibilities was often unclear.

The program managers described the future outlook as positive since the LWWCOPD program is a part of tertiary prevention and has lasting effects on patients' health which is accordance with the Swiss governmental health strategy [26]. However, program reimbursement is still not ensured in every canton and represents a major concern.

In terms of effectiveness, patients had higher scores in three of four CRQ subscales. The change in the subscale mastery was just below the minimal clinically important difference of 0.5 points [27]. However, in a similar study in Valais (Switzerland) a change of 0.5 points was reported (n = 46) [11] and a change of 0.54 in a controlled Swiss study [12]. The improvement in the 1-min STS test by 3.2 repetitions is above the minimal important difference of three repetitions [23]. The smoking cessation rate in this program was substantial and close to the observed success with pharmacological interventions for smoking cessation after one year (35% smoking cessation rate) [28]. This finding is impressive since the program did not include specific smoking cessation support.

This study has some limitations. This was a real-life implementation of a patient education program, therefore, the results can only be generalized to patients who are motivated to participate in such a program and not to COPD patients in general. The quantitative and qualitative results may not be generalizable to the whole French speaking part of Switzerland since data collection was incomplete (i.e., French speaking part was not represented in the focus group, partly missing data). Furthermore, using a control group would have been more appropriate than a pre-post analysis to estimate the program effectiveness. However, there are several randomized trials that showed an effect of the LWWCOPD program and a prospectively planned controlled study in a primary care setting with 467 COPD patients showed significant improvements in HRQoL and considerable lower exacerbation rates and health care use when receiving the LWWCOPD program [12]. There were 24 patients who dropped out during the program and could not perform the follow-up assessment: They were mainly male (70.8% vs. 47.8%), but they did not differ greatly in terms of age and COPD GOLD stage.

A strength of this study is the evaluation of a real-life implementation. By examining various involved persons and combining qualitative and quantitative methods, we gained a comprehensive picture on whether the program was perceived as meaningful, appropriate and satisfactory and whether the program was associated with patients' quality of life when implemented on a broader scale.

4.2. Conclusion

This study shows that the LWWCOPD program was successfully implemented in Switzerland and resulted in high acceptance and satisfaction of all involved persons. It was also positively associated with patients' quality of life, exercise capacity, confidence in COPD self-management and lower utilization of outpatient medical care.

4.3. Practice implications

This is one of the first studies presenting results from a nationwide implementation of an education program for COPD patients beyond the study setting. Therefore, these findings are of great international interest and can be used as a guidance for the implementation in other countries. The process evaluation provides suggestions for improvements that are essential to further promote the nationwide implementation of the program.

Funding

Funding for this study was provided by the Swiss Lung Association.

CRediT authorship contribution statement

Milo A. Puhan, **Isabelle Peytremann-Bridevaux**, **Mathias Guler**, **Anja Frei** and **Alexandra Strassmann** were involved in the study design. **Mathias Guler** and **Philippe Giroud** from the Swiss Lung Association were responsible for the nationwide implementation of the program. **Claudia Steurer-Stey**, **Kaba Dalla Lana**, **Karin Lörvall** and **Pierre-Olivier Bridevaux** conducted the training for the coaches. **Anja Frei** and **Tania Carron** conducted the interviews, and **Sarah Ziegler** moderated the focus group. **Alexandra Strassmann** and **Tania Carron** coded and analyzed the interviews. **Alexandra Strassmann**, **Anja Frei**, **Mathias Guler** and **Philippe Giroud** supported the data collection. **Alexandra Strassmann** and **Julia Braun** performed quantitative data analysis. **Alexandra Strassmann** and **Anja Frei** prepared the manuscript, all authors contributed to drafts of the paper and approved the final draft. All authors read and approved the final manuscript.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: The Swiss Lung Association promoted the nationwide implementation of this program in collaboration with the Swiss Society for Pulmonology and funded this study. Milo Puhan and Isabelle Peytremann-Bridevaux are board members of the Swiss Lung Association. Mathias Guler is project manager and Philippe Giroud division manager and deputy director of the Swiss Lung Association. Alexandra Strassmann, Claudia Steurer-Stey, Kaba Dalla Lana, Tania Carron, Julia Braun and Anja Frei declare no conflict of interests.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.pec.2021.06.018.

References

[1] Garcia-Aymerich J, Farrero E, Félez MA, Izquierdo J, Marrades RM, Antó JM. Risk factors of readmission to hospital for a COPD exacerbation: a prospective study. Thorax 2003;58:100–5. https://doi.org/10.1136/thorax.58.2.100

[2] Puhan M, Gimeno-Santos E, Cates C, Troosters T. Pulmonary rehabilitation following exacerbations of chronic obstructive pulmonary disease. Cochrane Database Syst Rev 2016;12:CD005305. https://doi.org/10.1002/14651858.CD005305.pub4

[3] Troosters T, Casaburi R, Gosselink R, Decramer M. Pulmonary rehabilitation in chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2005;172:19–38. https://doi.org/10.1164/rccm.200408-1109SO

[4] Ramon MA, Ter Riet G, Carsin AE, Gimeno-Santos E, Agustí A, Antó JM, et al. The dyspnoea–inactivity vicious circle in COPD: development and external validation of a conceptual model. Eur Respir J 2018;52:1800079. https://doi.org/10.1183/13993003.00079-2018

[5] Zwerink M, Brusse-Keizer M, van der Valk P, Zielhuis G, Monninkhof E, van der Palen J, et al. Self management for patients with chronic obstructive pulmonary disease. Cochrane Database Syst Rev 2014;3:CD002990. https://doi.org/10.1002/14651858.CD002990.pub3

[6] Effing T, Monninkhof E, van der Valk P, Zielhuis G, EH W, van der palen J, et al. Self-management education for patients with chronic obstructive pulmonary disease. Cochrane Database Syst Rev 2007;17:CD002990. https://doi.org/10.1002/14651858.CD002990.pub2

[7] Bourbeau J, Julien M, Maltais F. A disease-specific self-management program reduced hospital utilization and improved health status in COPD. ACP J Club 2003;139:65. https://doi.org/10.7326/ACPJC-2003-139-3-065

[8] Living Well with COPD, (n.d.). ⟨https://www.livingwellwithcopd.com/⟩(accessed May 14, 2020).

[9] Bourbeau J, Julien M, Maltais F, Rouleau M, Beaupré A, Bégin R, et al. Reduction of hospital utilization in patients with chronic obstructive pulmonary disease: a disease-specific self-management intervention. Arch Intern Med 2003;163:585–91. https://doi.org/10.1001/archinte.163.5.585

[10] Carron T, Peytremann-Bridevaux I. Evaluation du programme pilote "Soins intégrés BPCO valais – Mieux vivre avec une BPCO": acceptabilité, faisabilité et efficacité [Evaluation of the pilot program "Integrated care COPD valais - Living well with COPD": acceptability, feasibility and effect. Lausanne: Institut Universitaire de Médicine Sociale et Préventive; 2016.

[11] Carron T, Bridevaux P-O, Lörvall K, Parmentier R, Moix J-B, Beytrison V, et al. Feasibility, acceptability and effectiveness of integrated care for COPD patients: a mixed methods evaluation of a pilot community-based programme. Swiss Med Wkly 2017;147:w14567. https://doi.org/10.4414/smw.2017.14567

[12] Steurer-Stey C, Dalla Lana K, Braun J, Riet G, Puhan MA. Effects of the "Living well with COPD" intervention in primary care: a comparative study. Eur Respir J 2018;51:1701375. https://doi.org/10.1183/13993003.01375-2017

[13] Glasgow RE, Vinson C, Chambers D, Khoury MJ, Kaplan RM, Hunter C. National institutes of health approaches to dissemination and Implementation science: current and future directions. Am J Public Health 2012;102:1274–81. https://doi.org/10.2105/AJPH.2012.300755
[14] Moore GF, Audrey S, Barker M, Bond L, Bonell C, Hardeman W, et al. Process evaluation of complex interventions: Medical Research Council guidance. Br Med J 2015;350:h1258. https://doi.org/10.1136/bmj.h1258
[15] Proctor E, Silmere H, Raghavan R, Hovmand P, Aarons G, Bunger A, et al. Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda. Adm Policy Ment Health 2011;38:65–76. https://doi.org/10.1007/s10488-010-0319-7
[16] Saunders RP, Evans MH, Joshi P. Developing a process-evaluation plan for assessing health promotion program implementation: a how-to Guide. Health Promot Pract 2005;6:134–47. https://doi.org/10.1177/1524839904273387
[18] Howcroft M, Walters EH, Wood-Baker R, Walters JAE. Action plans with brief patient education for exacerbations in chronic obstructive pulmonary disease. Cochrane Database Syst Rev 2016;12:CD005074. https://doi.org/10.1002/14651858.CD005074.pub4
[19] Guyatt GH, Berman LB, Townsend M, Pugsley S, Chambers LW. A measure of quality of life for clinical trials in chronic lung disease. Thorax 1987;42:773–8. https://doi.org/10.1136/thx.42.10.773
[20] Bestall JC, Paul EA, Garrod R, Garnham R, Jones PW, Wedzicha JA. Usefulness of the Medical Research Council (MRC) dyspnoea scale as a measure of disability in patients with chronic obstructive pulmonary disease. Thorax 1999;54:581–6.
[21] Jones PW, Harding G, Berry P, Wiklund I, Chen W-H, Leidy NK. Development and first validation of the COPD Assessment Test. Eur Respir J 2009;34:648–54. https://doi.org/10.1183/09031936.00102509
[22] Bohannon RW. Sit-to-stand test for measuring performance of lower extremity muscles. Percept Mot Sk 1995;80:163–6. https://doi.org/10.2466/pms.1995.80.1.163
[23] Crook S, Büsching G, Schultz K, Lehbert N, Jelusic D, Keusch S, et al. A multicentre validation of the 1-min sit-to-stand test in patients with COPD. Eur Respir J 2017;49:1601871. https://doi.org/10.1183/13993003.01871-2016
[24] VERBI Software, MAXQDA 2018 [computer software], 2018. ⟨https://www.maxqda.de⟩.
[25] R. Core Team, R: A language and environment for statistical computing. R Foundation for statistical computing, 2019. ⟨https://cran.r-project.org/bin/windows/base/⟩.
[26] Gesundheitsförderung Schweiz, Strategie 2019–2024 [Strategy 2019–2024], 2018. ⟨https://gesundheitsfoerderung.ch/ueber-uns/stiftung/auftrag-ziele-und-strategie.html⟩ (accessed June 23, 2020).
[27] Cazzola M, Hanania NA, MacNee W, Rüdell K, Hackford C, Tamimi N. A review of the most common patient-reported outcomes in COPD – revisiting current knowledge and estimating future challenges. Int J Chron Obstr Pulm Dis 2015;10:725–38. https://doi.org/10.2147/COPD.S77368
[28] Ucar EY, Araz O, Yilmaz N, Akgun M, Meral M, Kaynar H, et al. Effectiveness of pharmacologic therapies on smoking cessation success: Three years results of a smoking cessation clinic. Multidiscip Respir Med 2014;9:9. https://doi.org/10.1186/2049-6958-9-9