

Factors Associated with Patient Education in Patients with Chronic Obstructive Pulmonary Disease (COPD) – A Primary Health Care Register-Based Study

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Purpose: Patient education in chronic obstructive pulmonary disease (COPD) is recommended in treatment strategy documents, since it can improve the ability to cope with the disease. Our aim was to identify the extent of and factors associated with patient education in patients with COPD in a primary health care setting.

Patients and Methods: In this nationwide study, we identified 29,692 COPD patients with a registration in the Swedish National Airway Register (SNAR) in 2019. Data on patient education and other clinical variables of interest were collected from SNAR. The database was linked to additional national registers to obtain data about pharmacological treatment, exacerbations and educational level.

Results: Patient education had been received by 44% of COPD patients, 72% of whom had received education on pharmacological treatment including inhalation technique. A higher proportion of patients who had received education were offered smoking cessation support, had performed spirometry and answered the COPD Assessment Test (CAT), compared with patients without patient education. In the adjusted analysis, GOLD grade 2 (OR 1.29, 95% CI 1.18–1.42), grade 3 (OR 1.41, 95% CI 1.27–1.57) and grade 4 (OR 1.79, 95% CI 1.48–2.15), as well as GOLD group E (OR 1.17, 95% CI 1.06–1.29), ex-smoking (OR 1.70, 95% CI 1.56–1.84) and current smoking (OR 1.45, 95% CI 1.33–1.58) were positively associated with having received patient education, while cardiovascular disease (OR 0.92, 95% CI 0.87–0.98) and diabetes (OR 0.93, 95% CI 0.87–1.00) were negatively associated with receipt of patient education.

Conclusion: Fewer than half of the patients had received patient education, and the education had mostly been given to those with more severe COPD, ex- and current smokers and patients with fewer comorbidities. Our study highlights the need to enhance patient education at an earlier stage of the disease.

Keywords: chronic obstructive pulmonary disease, inhaler use, patient education, primary health care, register study

Introduction

Chronic obstructive pulmonary disease (COPD) is one of the leading causes of morbidity and mortality in the world¹ and the prevalence is estimated to be 7% in Sweden.² Primary health care is often the first contact for patients with COPD, and regardless of severity, most patients are diagnosed, treated and followed up in primary health care.³

The management of COPD consists of both non-pharmacological and pharmacological treatment; non-pharmacological treatment includes patient education.¹ Independent of disease severity, patient education is highly recommended in both the national and the international guidelines to prevent disease progression.^{1,4} In Swedish guidelines, patient education is recommended to be given in primary health care, often provided by nurses specialized through

higher education in asthma, allergy and COPD.⁴ Structured education programs cover areas such as disease-specific knowledge, smoking cessation support, prevention of exacerbations (for example, infection prophylaxis including vaccinations), pharmacological treatment including inhaler use, written treatment plans, diet, and physical activity.^{1,4} Self-management is recommended to approach these areas,¹ since it strengthens and develops patients' skills and behaviours to successfully manage their disease.⁵ Self-management interventions have been shown to improve quality of life and reduce respiratory-related hospital admissions.^{6,7}

Patients with COPD in primary health care have expressed a need for information, especially on how to improve their self-management skills.⁸ However, knowledge about the extent to which these patients receive patient education is lacking. The Swedish National Airway Register (SNAR) provides unique information on clinical characteristics, received treatment and patient education in patients with COPD. The aim of this study was to identify the extent of and factors associated with patient education in patients with COPD in a primary health care setting.

Materials and Methods

Study Design

This is a register study based on data from the SNAR that were linked to the Swedish Prescribed Drug Register (SPDR), the National Patient Register (NPR) and Statistics Sweden's longitudinal integrated database for health insurance and labour market studies (LISA).

Study Population

The study sample was collected from the SNAR, which is a national quality register containing data on all levels of care for patients with COPD and asthma in Sweden. It contains information about which patient education has been received, and other clinical variables.⁹ Until 2019, the register included data on approximately 80,000 patients with a COPD diagnosis, according to the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10), code J44.⁹ The present study included all patients with COPD and a recorded visit to a primary health care centre in 2019 (n=39,179). Patients under 30 years of age (n=10) and patients with a concomitant diagnosis of asthma (ICD-10 J45) (n=9477) were excluded. In total, 29,692 patients were included in the analysis. Informed consent is not required in Sweden when anonymised public register data is used for research and was therefore not obtained. The study was approved by the Swedish Ethical Review Authority (2019–04915; 2020–00508).

Register Data

The SNAR provided data on the health care visit in 2019 and the preceding 24 months (ie, based on the last observation carried forward (LOCF)) on sex, age, body mass index (BMI), forced expiratory volume in 1 second as percent of predicted value (FEV₁%), COPD Assessment Test (CAT) score, modified Medical Research Council dyspnoea score (mMRC), whether a written treatment plan had been issued, and comorbidities. The LOCF between 2014 and the visit in 2019 was used to determine patient education, smoking status and offered smoking cessation support. Data on educational level and pharmacological treatment were collected in 2019 from the LISA and SPDR. Data on hospitalization were collected from the visit date in 2019 in the SNAR and the preceding 12 months in the NPR. An overview of the registers used, extracted variables and year of extraction is presented in [Table 1](#).

Definitions

Patient education was defined as an affirmative answer to the question in the SNAR regarding receipt of “structured patient education in the past 5 years”. This question was followed by the question

Which of the following items has been given at today's meeting: disease-specific knowledge, self-management, risk factors, pharmacological treatment including inhaler use, or COPD school?

The latter item, COPD school, was defined as patient education given in a group during repeated meetings. If COPD school was not reported, patient education was given individually. Multiple answers were possible.

Table I Overview of Registers, Year of Extracted Variables

Register	Swedish National Airway Register (SNAR)		National Patient Register (NPR)	Statistics Sweden (LISA)	Swedish Prescribed Drug Register (SPDR) Dispensed Medication/ATC Codes	
Year	LOCF 2014–2019	2019, and LOCF, last 24-month period	2018–2019	2019	2019	
Variables	Patient education Smoking status Smoking cessation support	Sex Age BMI FEV ₁ % predicted CAT mMRC Written treatment plan Depression/ anxiety Diabetes CVD	COPD hospitalization (ICD- 10 J44 main diagnosis)	Educational level	Inhalation treatment Corticosteroids Depression Diabetes CVD	R03AC02-03 (SABA), R03BB01 (SAMA), R03AC12,13,18,19 (LABA), R03BB04-07 (LAMA), R03BA (ICS), R03AL03-07 (LABA/LAMA), R03AK (ICS/LABA), R03AL08,09, 11,12 (ICS/LABA/LAMA) H02AB01,02,06,07 N06 A10A, A10B C01–03, C08

Abbreviations: ATC, Anatomical Therapeutic Chemical; BMI, body mass index; CAT, COPD Assessment Test; CVD, cardiovascular disease; FEV₁, forced expiratory volume in 1 second; ICD-10, International Statistical Classification of Diseases and Related Health Problems, 10th revision; LISA, longitudinal integrated database for health insurance and labour market studies; LOCF, last observation carried forward; mMRC, modified (British) Medical Research Council dyspnoea score.

Body mass index (BMI) was dichotomized into $<22 \text{ kg/m}^2$ and $\geq 22 \text{ kg/m}^2$. A BMI <22 in patients with COPD is classified as malnourished.⁴

Educational level was categorized into primary school (usually 9 years), secondary school (usually 12 years) and tertiary school (>12 years).

Smoking status was categorized into never smoker, ex-smoker and current smoker. Offered smoking cessation support was reported as support ever offered to current smokers.

Comorbidities (depression, diabetes and cardiovascular disease (CVD)) were retrieved by searching for diagnoses registered in the SNAR and data on dispensed pharmacological treatment in the SPDR.

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) grade 1–4 classification was used to categorize patients into GOLD 1 (mild; $\text{FEV}_1 \geq 80\%$), GOLD 2 (moderate; $50\% \leq \text{FEV}_1 < 80\%$), GOLD 3 (severe; $30\% \leq \text{FEV}_1 < 50\%$) and GOLD 4 (very severe; $\text{FEV}_1 < 30\%$).¹ The Swedish reference values by Hedenström were used to calculate $\text{FEV}_1\%$ predicted.^{10,11} If post-values were missing, pre-values were used.

GOLD group A, B and E classification was used to categorize patients into GOLD A (low symptom burden and low exacerbation risk), GOLD B (high symptom burden and low exacerbation risk) and GOLD E (low or high symptom burden and high exacerbation risk). To define symptom burden, the CAT was used. A CAT score <10 indicated low symptom burden, while $\text{CAT} \geq 10$ indicated a high symptom burden.¹² The CAT is a validated questionnaire consisting of eight questions with a maximum total score of 40.¹³ In case of missing CAT scores, the mMRC was used. An mMRC 0–1 indicated low symptom burden and $\text{mMRC} \geq 2$ high symptom burden. Patients with 0 or 1 moderate exacerbation during the past year (none leading to hospitalization) were considered to have a low exacerbation risk. Moderate exacerbations were defined as a dispensed course of treatment with oral corticosteroids (OCS). High exacerbation risk was ≥ 2 moderate exacerbations or one exacerbation, leading to hospitalization during the past year.¹

Inhalation treatment was retrieved from the SPDR using Anatomical Therapeutic Chemical (ATC) codes for dispensed medication from the pharmacy. Inhalation treatment was categorized into short-acting Beta-2 stimulants (SABA), short-acting muscarinic antagonist (SAMA), long-acting muscarinic antagonist (LAMA), long-acting Beta-2 stimulants (LABA) and inhaled corticosteroids (ICS), or the combinations LAMA/LABA, ICS/LAMA, ICS/LABA or ICS/LAMA/LABA. Combinations could be administered in fixed-dose combination inhalers or in separate inhalers.

Written treatment plan was defined as an affirmative response to the following question in the SNAR: Has the patient been provided a written treatment plan (ie, action plan)?

Statistical Analyses

Data were expressed as mean and standard deviation (SD) for continuous variables, and number and percentage for categorical variables. Chi-2 test was used for categorical variables, and independent sample *t*-test was used for

continuous variables when comparing patients with and without patient education. Unadjusted logistic regression was performed with patient education as dependent variable and sex, age, BMI, GOLD grades 1–4, GOLD A, B and E, smoking status, educational level and comorbidities as independent variables. Besides sex and age, only variables with statistically significant associations in the unadjusted analysis were included in the adjusted analysis. A separate category for patients with missing values for each of the variables BMI, GOLD 1–4, GOLD A, B and E, smoking and education level was used to increase power. A p-value <0.05 was considered statistically significant. Version 26 of SPSS was used for data analysis.

Results

Basic Characteristics

Of 29,692 patients with COPD, 56% were women, and the mean age was 73 ± 9 years. Altogether 13,081 (44%) had received patient education (Table 2). Of patients who had received education, 72% (32% of all patients) had received education on pharmacological treatment including inhaler use, 67% (29% of all patients) on disease-specific knowledge, 42% (18% of all patients) on self-management, 34% (15% of all patients) on risk factors and 2% (0.8% of all patients) had participated in a COPD school.

Table 2 Characteristics of All Patients with Chronic Obstructive Pulmonary Disease (COPD), by COPD Patients Having Received and Not Having Received Patient Education

	All Patients n=29,692	Patient Education n=13,081 (44%)	No Patient Education n=16,611 (56%)	p-value
Basic characteristics				
Women, n (%)	16,574 (56)	7377 (56)	9197 (55)	0.077
Age, yrs, mean (SD)	73 (9)	72 (9)	73 (10)	<0.001
Patients with BMI data, n (%)	26,261 (88)	12,647 (97)	13,614 (82)	<0.001
BMI (kg/m^2), mean (SD)	27 (6)	27 (6)	27 (6)	0.163
BMI <22	5292 (20)	2513 (20)	2779 (20)	0.274
Patients with educational level data, n (%)	29,292 (99)	12,939 (99)	16,353 (98)	<0.001
Primary school, n (%)	10,340 (35)	4488 (35)	5852 (36)	0.006
Secondary school, n (%)	13,657 (47)	6167 (48)	7490 (46)	
Tertiary school, n (%)	5295 (18)	2284 (18)	3011 (18)	
Patients with smoking status data, n (%)	26,545 (89)	12,791 (98)	13,754 (83)	<0.001
Never smoker, n (%)	4168 (16)	1380 (11)	2788 (20)	<0.001
Ex-smoker, n (%)	11,729 (44)	6399 (50)	5330 (39)	
Current smoker, n (%)	10,649 (40)	5013 (39)	5636 (41)	
COPD characteristics				
Patients with FEV ₁ data, n (%)	17,844 (60)	10,678 (82)	7166 (43)	<0.001
FEV ₁ % predicted, mean (SD)	60 (17)	59 (17)	62 (17)	<0.001
GOLD 1, n (%)	2486 (14)	1312 (12)	1174 (16)	<0.001
GOLD 2, n (%)	10,408 (58)	6215 (58)	4193 (59)	
GOLD 3, n (%)	4247 (24)	2673 (25)	1574 (22)	
GOLD 4, n (%)	703 (4)	478 (5)	225 (3)	
Patients with CAT data, n (%)	18,523 (62)	11,327 (87)	7196 (43)	<0.001
CAT score, mean (SD)	13 (7)	13 (6)	13 (7)	0.548
CAT score <10, n (%)	5854 (32)	3577 (32)	2277 (32)	0.665
CAT score ≥20, n (%)	3376 (18)	2043 (18)	1333 (19)	
Patients with data on GOLD groups A, B, E, n (%)	19,442 (66)	11,708 (90)	7734 (47)	<0.001
GOLD A, n (%)	5903 (30)	3492 (30)	2411 (31)	<0.001
GOLD B, n (%)	10,785 (56)	6484 (55)	4301 (56)	
GOLD E, n (%)	2754 (14)	1732 (15)	1022 (13)	

Notes: Where data were missing, percentages were calculated for reported data for each variable. **Missing values:** BMI, n=3431; CAT, n=11,169; educational level, n=400; FEV₁, n=11,848; GOLD A, B, E, n=10,250; smoking, n=3147.

Abbreviations: BMI, body mass index; CAT, COPD Assessment Test; FEV₁, forced expiratory volume in 1 second; GOLD, Global Initiative for Chronic Obstructive Lung Disease; SD, standard deviation.

There was no difference in gender or BMI between patients who had received and patients who had not received patient education, but patients who had received education were slightly younger. Patients who received patient education were more often ex-smokers (Table 2) and had fewer comorbidities (depression, diabetes and CVD) when compared to those who had not received patient education (Figure 1).

COPD Characteristics

The mean FEV₁% predicted in all patients was $60 \pm 17\%$ and the majority of the patients were classified as GOLD 2 and GOLD B. Patients who had received patient education had more severe disease, according to GOLD grading criteria (Table 2).

Inhalation and Non-Pharmacological Treatment

Of all patients, 86% had been dispensed an inhaler by the pharmacy; there was a higher proportion of patients who had received patient education among those who had received inhalation treatment. The combinations LAMA/LABA and ICS/LAMA/LABA were more common among patients who had received education (Table 3).

Patients who had received patient education had about twice as many records of offered smoking cessation support, spirometry and CAT as those who had not received patient education (Table 2). A higher proportion of patients who had received education had records of a written treatment plan; however, this result was not statistically significant (Table 3).

Factors Associated with Receipt of Patient Education

The adjusted logistic regression model showed that GOLD grades 2, 3 and 4, GOLD E, ex-smoker and current smoker were all positively associated with receipt of patient education. The presence of CVD and diabetes were both inversely associated with patient education. Categories with missing data on GOLD 1–4, GOLD A, B and E, and smoking status were also inversely associated with patient education (Table 4). The results of the unadjusted logistic analysis are presented in Supplementary Table 1.

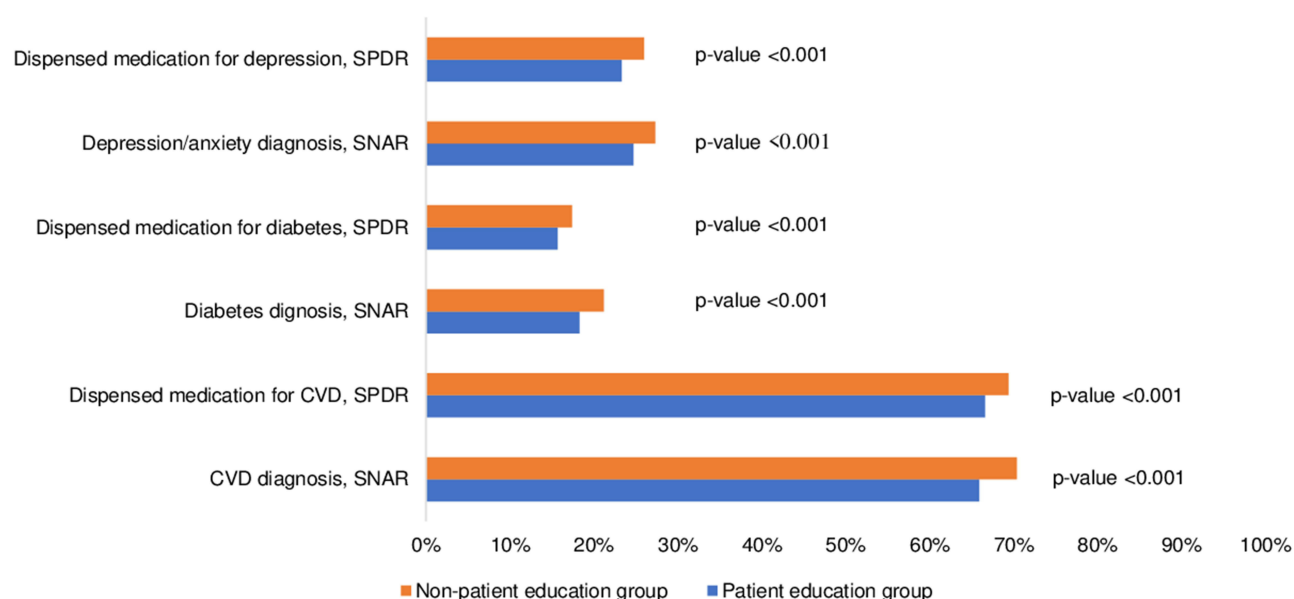


Figure 1 Comorbidities in patients with chronic obstructive pulmonary disease (COPD). Comparison between patients having received and patients not having received patient education. Data on comorbidity derived from the Swedish Prescribed Drug Register (SPDR) and the Swedish National Airway Register (SNAR) are given separately. **Abbreviation:** CVD, cardiovascular disease.

Table 3 Inhalation and Non-Pharmacological Treatment of All Patients with Chronic Obstructive Pulmonary Disease (COPD), by COPD Patients Having and Not Having Received Patient Education

	All Patients n=29,692	Patient Education n=13,081 (44%)	No Patient Education n=16,611 (56%)	p-value
Inhalation treatment				
No inhalation treatment, n (%)	4185 (14)	1254 (10)	2931 (18)	<0.001
SABA or SAMA only, n (%)	1440 (5)	565 (4)	875 (5)	<0.001
LAMA, n (%)	5922 (20)	2642 (20)	3280 (20)	0.334
LABA, n (%)	795 (3)	306 (2)	489 (3)	0.001
ICS, n (%)	682 (2)	196 (2)	486 (3)	<0.001
LAMA/LABA, n (%)	5304 (18)	2834 (22)	2470 (15)	<0.001
ICS/LAMA, n (%)	539 (2)	215 (2)	324 (2)	0.049
ICS/LABA, n (%)	2335 (8)	799 (6)	1536 (9)	<0.001
ICS/LAMA/LABA, n (%)	8490 (29)	4270 (33)	4220 (25)	<0.001
Non-pharmacological treatment				
Written treatment plan, n (%)	2527 (9)	2095 (16)	432 (3)	0.893
Offered smoking cessation support, n (%)	6176 (58)	3984 (80)	2192 (39)	<0.001

Abbreviations: ICS, inhaled corticosteroid; LABA, long-acting Beta-2 receptor agonist; LAMA, long-acting muscarinic receptor antagonist; SABA, short-acting Beta-2 receptor agonist; SAMA, short-acting muscarinic receptor antagonist.

Table 4 Adjusted Logistic Regression Analysis with Patient Education as the Dependent Variable

	OR (95% CI) Adjusted
Male	Ref.
Female	1.05 (1.00–1.11)
Age	1.00 (1.00–1.00)
GOLD 1	Ref.
GOLD 2	1.29 (1.18–1.42)
GOLD 3	1.41 (1.27–1.57)
GOLD 4	1.79 (1.48–2.15)
Missing: GOLD grades 1–4	0.55 (0.50–0.61)
GOLD A	Ref.
GOLD B	1.04 (0.97–1.11)
GOLD E	1.17 (1.06–1.29)
Missing: GOLD group A, B, E	0.21 (0.19–0.23)
Never smoker	Ref.
Ex-smoker	1.70 (1.56–1.84)
Current smoker	1.45 (1.33–1.58)
Missing: smoking status	0.40 (0.35–0.47)
Primary school	Ref.
Secondary school	1.01 (0.96–1.08)
Tertiary school	0.96 (0.89–1.04)
Missing: educational level	0.96 (0.75–1.23)
Cardiovascular disease	0.92 (0.87–0.98)
Diabetes	0.93 (0.87–1.00)
Depression/anxiety	1.01 (0.95–1.08)

Notes: Significant associations are given in bold.

Abbreviations: BMI, body mass index; CI, confidence interval; GOLD, Global Initiative for Chronic Obstructive Lung Disease; OR, odds ratio.

Discussion

In this study, which included nearly 30,000 patients with COPD from primary health care, fewer than half of the patients had received patient education. Education on pharmacological treatment including inhaler use was most common. Patients who had received patient education were more often ex-smokers or current smokers and had a more severe disease. Patients with CVD and diabetes were less likely to have received education about COPD. Patients who had received patient education had also received more interventions in line with the guidelines, such as offered smoking cessation support, spirometry and symptom assessment using the CAT.

In our study population, 44% of the patients had received patient education. Compared to a previous study from the SNAR including about 8000 patients,¹⁴ it is a duplication. In Sweden, the National Board of Health and Welfare has set a target that $\geq 80\%$ of patients with COPD should receive patient education.¹⁵ Even though the percentage of patients who receive patient education has increased in Sweden in recent years, there is still a need for improvement to ensure good and equal care.

Education on pharmacological treatment including inhaler use was the most common education received. This is in line with the result from a systematic review about educational programmes on COPD, where medications were one of the most frequent topics.¹⁶ However, incorrect inhaler use is common, and one study showed that half of the patients used their inhaler incorrectly.¹⁷ Correct inhaler use is necessary for the drug to reach the lungs¹⁸ and has been associated with fewer exacerbations and better health status and lung function.¹⁹ Despite the finding that education on inhaler use was the most common in our study, only one-third of all patients had received this education. This highlights the need to increase the frequency and quality of education on inhaler use.

It is well known that patient education with self-management interventions can reduce respiratory-related hospitalizations.^{6,7} In our study, patients in GOLD groups A and B had received education to a lesser extent than patients in GOLD group E. A recent publication from the SNAR has shown that patients in GOLD group A and B with one exacerbation during the last year have a high risk for future exacerbations and hospitalization.²⁰ Frequent exacerbations are associated with a decline in lung function and increased morbidity and mortality, which may lead to hospitalization.^{21,22} Therefore, patient education should be given earlier in the course of the disease. This might support patients in avoiding exacerbations and may give them the best opportunity to affect the course of the disease and slow down its progression. Furthermore, written treatment plans, ie, action plans, visualize for the patients how to recognise a deterioration in symptoms and when to initiate changes in treatment with the aim to prevent exacerbations. In our study, written treatment plans were more common in the group that had received patient education, but not significantly so. A previous review highlights that action plans given together with short education and ongoing support increase treatment with corticosteroids and antibiotics and reduce hospitalisation due to exacerbations.²³ Thus, an interesting area of future research would indeed be to investigate the outcomes of written treatment plans given with or without structured patient education.

Our results showed that patients with CVD and diabetes were less likely to have received patient education. A possible explanation for this could be that these patients with COPD already received relevant education on lifestyle factors and interventions like smoking cessation and rehabilitation during follow-up of their comorbid diseases. However, multimorbidity is common in patients with COPD,²⁴ and in patients with multimorbidity, COPD is often de-prioritized by primary health care physicians. The reasons for deprioritizing COPD are shown to be time pressure, lack of awareness, local routines, negative personal views, and low patient motivation.²⁵ The reason might also be that physician relies on the COPD nurses skills, which results in a decrease in own patient education efforts.⁸ These findings highlight that there is a need to put more focus on COPD in primary health care.

In our study, patients who had received patient education also received other interventions in line with the guidelines, such as offered smoking cessation support, spirometry and symptom assessment using the CAT.^{1,4} Previous studies in several countries have shown low adherence to COPD guidelines.^{14,26} In Sweden, the primary focus of nurse-led COPD clinics is support for patient education, self-management and smoking cessation,²⁷ which is in line with the guidelines. Patients who have visited a nurse-led COPD clinic have been reported to have fewer exacerbations^{28–30} and hospitalizations, and reduced treatment costs.²⁸ Altogether, our results emphasize the importance of nurse-led COPD clinics, since these specialized nurses can provide education and interventions according to the guidelines.

Strengths and Weakness of the Study

A major strength of our study is its generalizability, which is due to the inclusion of a large number of COPD patients from primary health care centres. Another strength is the use of clinical data from the SNAR such as spirometry values and CAT scores, which cannot be obtained in other national registers. When linking the SNAR to other registers, we received data on exacerbations, which enabled us to classify patients into GOLD groups A, B and E. However, there is a possibility that the patients had received OCS for a condition other than COPD, which can be seen as a limitation. On the other hand, treatment with OCS is an established way to identify moderate exacerbations in COPD.^{1,20,31}

One factor that should be addressed is that patients who have received patient education have most likely met a nurse,¹⁶ and this may have also been the case in our study. In Sweden, nurses focus on providing patients with education in self-management and, further, with smoking cessation support.²⁷ A limitation of the use of register-based studies with clinical data is that there are missing values. To handle missing and increase the statistical power, we performed an adjusted model by including missing data on lung function, GOLD A, B and E and smoking status as separate categories. The reverse association between missing variables and receipt of patient education supports our finding that patient education also enhances other interventions.

Conclusion

Fewer than half of the patients with COPD had received patient education. Patient education had mostly been given to those with more severe disease, ex- and current smokers and patients with fewer comorbidities. Our study highlights the need to enhance patient education at an earlier stage of the disease.

Acknowledgment

Acknowledgement is given to all the patients and health care professionals who contribute with registrations in SNAR. Further acknowledgements are given to the SNAR steering committee and register coordinators.

Funding

This work was supported by the Swedish Heart-Lung Foundation under Grant 20200548.

Disclosure

CS reports personal fees from AstraZeneca, and institutional fees from Chiesi and TEVA outside the submitted work. MG reports personal fees from AstraZeneca, Boehringer Ingelheim and OrionPharma outside the submitted work. AL reports personal fees from GlaxoSmithKline, outside the submitted work. KT, ABZ, EW have no conflicts of interest to disclose in this work.

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