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Factors associated with knowledge of self-management of worsening asthma in primary care patients: a cross-sectional study

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ABSTRACT

Objective: Self-management is important for asthma control. We examined associations of patient- and healthcare-related factors with self-reported knowledge of self-management of worsening asthma.

Methods: Two asthma patient cohorts from 2012 ($n = 527$) and 2015 ($n = 915$) were randomly selected from 54 primary health care centers (PHCC) in central Sweden. Data were collected using patient questionnaires and questionnaires to the PHCCs. Logistic regression analyzed associations of relevant variables with knowledge of self-management of worsening asthma.

Results: In total, 63% of patients reported moderate to complete knowledge of self-management procedures. The adjusted OR for moderate to complete knowledge relative to high education level was 1.38 [95% CI 1.03–1.85]; for physician continuity 2.19 (95% CI 1.62–2.96); for a written action plan 11.9 (95% CI 6.16–22.9); for Step 2 maintenance treatment 1.53 (95% CI 0.04–2.24); and 2.07 (95% CI 1.44–2.99) for Step 3. An asthma/COPD nurse visit within the previous 12 months was associated with greater knowledge in women but not in men (p for interaction = 0.042). Smoking [OR 0.56 (95% CI 0.34–0.95)], co-morbidities ≥ 1 [OR 0.68 (95% CI 0.49–0.93)], and self-rated moderate/severe disease [OR 0.68 (95% CI 0.51–0.90)] were associated with low self-management knowledge.

Conclusion: Self-reported knowledge of self-management procedures was associated with a higher educational level, physician continuity, a written action plan, advanced treatment and, in women, visiting an asthma/COPD nurse. The results reinforce the importance of implementing guidelines of patient access to a specific physician, a written action plan, and structured education by an asthma/COPD nurse.

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Self-management; asthma; primary care; education level; patient-specific physician; written action plan; asthma/COPD nurse

Introduction

Asthma is a global health issue affecting millions of people (1). In Sweden, the prevalence in adults is approximately 10% (2,3). Management of asthma focuses on control, which includes minimizing symptoms and prevention of worsening outcomes (1,4). In recent years, self-management of asthma and its acute symptoms has been emphasized (1,5). Self-management education improves asthma control (6) and health-related quality of life and reduces exacerbation frequency (7,8) and severity (9), work absences, and

number of emergency hospital visits (10–12). Self-management education can be a cost-effective way of treating asthma sufferers (10,13), including those who might traditionally represent a greater challenge, such as the most elderly and those in immigrant communities (14–16). An important aspect of self-management is a structured action plan. Action plans may include written information, digital systems (17–19), and cell phone/tablet applications (20–22).

Self-reported knowledge of self-management has been established as an important factor in disease control and health-related quality of life in asthma

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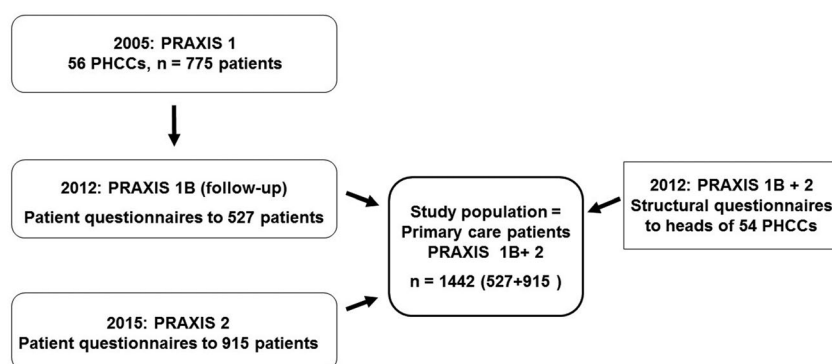


Figure 1. Flowchart illustrating data collection. PHCC = primary health care center.

patients (12,23). Studies have identified age at asthma onset, self-management education, frequency and intensity of exacerbations, health literacy, a written action plan, and regular medical review as factors affecting asthma self-management (22,24–26). Further research is needed, particularly to investigate factors associated with knowledge of self-management of worsening asthma and to clarify ways in which the structure of asthma care impacts self-management. The Swedish National Board of Health and Welfare guidelines prioritizes written action plans for managing worsening symptoms and structured education provided by asthma/COPD nurses (4,26). It is recommended that all primary health care centers (PHCC) include a certified asthma/COPD clinic with a specific physician assigned to each patient and a specialist nurse trained in spirometry-based diagnostics, smoking prevention, and provision of structured education (27,28). Consequently, it is imperative that we investigate the effectiveness of these practices on self-management knowledge and skill in asthma patients.

The objective of this study was to determine association of patient characteristics and healthcare-related factors with self-reported knowledge of self-management of worsening asthma, defined as exacerbations or deteriorations, in a Swedish population of primary care asthma patients.

Methods

Data collection

The original PRAXIS study (PRAXIS IA) was initiated in 2005. The present study population included the PRAXIS study primary care cohorts IB (follow-up cohort of PRAXIS IA from 2012) and II, from 2015, both comprising 54 randomly selected PHCCs in seven counties in central Sweden (8,12,29–31) (Figure 1). A total of 1442 patients, 527 from the 2012 follow-up of participants in the 2005 study, and 915 in 2015.

Subjects of both studies were randomly selected from adult patients with physician diagnosis of asthma (ICD-10 J45).

Data were collected by patient questionnaires, which included an item asking about level of knowledge of procedures to manage worsening asthma. In 2012, a questionnaire completed by the head of the PHCC provided information with respect to clinical services and resources.

Patient characteristics and variables

The patient questionnaires provided information on sex, age, education level, smoking status, co-morbidities, and self-rated severity of disease along with the treatment-related factors written action plan, assignment to a specific physician (physician continuity), level of maintenance therapy, and visits to an asthma/COPD nurse in the previous 12 months. A questionnaire completed by the head of the PHCC provided data on whether it included an asthma/COPD clinic and whether this clinic fulfilled the 2008 criteria for a certified asthma/COPD clinic (27).

Age was categorized as <40, 40–59, or ≥60 years. Education level was dichotomized education variable which identified high education level as at least three years full-time education beyond the Swedish compulsory school period of nine years. Smoking status was categorized as current daily smoking or nonsmoking (occasional, former smoker, and never smoked). Co-morbidities included any of the following conditions in the previous year: heart disease, diabetes, sleep apnea, anxiety and/or depression, rhinitis, and allergic rhino-conjunctivitis. Asthma severity self-assessed on a five-point scale was separated into two categories, with very mild or mild severity defined as mild and moderately severe, severe, or very severe categorized as moderate/severe. Maintenance treatment was classified as Step 1 (none), Step 2 [inhaled corticosteroids

Table 1. Patient characteristics.

Patient/clinic characteristics	Total <i>n</i> (%)	Moderate/complete knowledge <i>n</i> (%)	Little/no knowledge <i>n</i> (%)	<i>p</i> value
Female sex	859 (61)	569 (63)	290 (58)	0.053
Age <40	387 (28)	243 (27)	144 (29)	0.354
Age 40–59	573 (41)	362 (40)	211 (42)	
Age ≥60	445 (32)	298 (33)	147 (29)	
Low level of education	928 (67)	573 (64)	355 (71)	0.009
Current daily smoking	86 (6)	44 (5)	42 (8)	0.009
Co-morbidity, ≥1	1008 (72)	639 (71)	369 (73)	0.274
Self-rated moderate/severe disease	554 (44)	370 (44)	184 (44)	0.854
Written action plan	244 (17)	234 (26)	10 (2)	<0.0001
Patient-specific physician	901 (65)	382 (43)	95 (19)	<0.0001
Visit to asthma/COPD-nurse	269 (19)	207 (23)	62 (12)	<0.0001
Asthma/COPD clinic at PHCC	1233 (88)	793 (88)	440 (88)	0.926
Certified asthma/COPD clinic at PHCC	169 (11)	103 (11)	57 (11)	0.977
Step I (no maintenance treatment)	317 (23)	145 (16)	172 (35)	<0.0001
Step II (ICS only)	347 (25)	223 (25)	124 (25)	
Step III (ICS with LABA or LTRA)	719 (52)	520 (59)	199 (40)	

Patient and clinic characteristics with respect to knowledge of management of asthma exacerbations.

COPD = chronic obstructive pulmonary disease; PHCC = primary health care center; ICS = inhaled corticosteroids; LABA = long-acting beta agonists; LTRA = leukotriene receptor antagonists.

(ICS), and Step 3 (combination of ICS with long-acting beta-2-agonist or leukotriene antagonist).

The patient questionnaires included the item ‘Do you think you have sufficient knowledge of how to manage a worsening of your asthma?’ with possible responses being (1) Yes, absolutely, (2) Yes, a moderate level (3), Yes, a little, and (4) None. In the dichotomized variable analysis, response 1 or 2 was classified as moderate to complete and 3 or 4 as little to no knowledge.

Statistics

The frequency of patients reporting moderate to complete knowledge of self-management of worsening asthma was calculated. Chi-squared tests and cross-tabulations were used to calculate differences in patients with moderate to complete from those reporting little to no knowledge of self-management. Multiple logistic regression was used to investigate associations with the dependent variable self-reported knowledge of self-management of worsening asthma. The investigated variables were chosen *a priori* and included the categorical variables sex, age, education level, smoking status, presence of comorbidity, self-rated severity of disease, written action plan, physician continuity, visit to an asthma/COPD nurse in the previous 12 months, level of maintenance treatment, and access to an asthma/COPD clinic at the PHCC. The multivariate model was repeated using access to a certified asthma/COPD clinic substituted for access to an asthma/COPD clinic. The multivariate model was also repeated stratified by sex and age (<65 and ≥65 years). Multiplicative interaction analyses used sex and age with each relevant variable. Analyses were

performed with SPSS v. 24 (SPSS Inc, Chicago). A *p* values of <0.05 was considered significant.

Ethics

The project is a part of the PRAXIS study, which was approved by the Regional Ethical Review Board of Uppsala (DNr 2011/318). Written informed consent was obtained from all participants.

Results

Patient characteristics

The 2012 and 2015 cohorts included 527 and 915 PHCC asthma patients, respectively (62% female), ranging age from 18 to 82 years. Patient characteristics associated with knowledge of self-management of acute asthma symptoms are presented in Table 1.

Factors associated with knowledge of self-management of worsening asthma

In the multivariable logistic regression (Table 2), high educational level, written action plan, physician continuity, and treatment steps II and III were significantly associated with moderate to complete knowledge of self-management of worsening asthma. Current daily smoking, one or more comorbidities, and self-rated severe disease were significantly associated with little to no knowledge of worsening asthma self-management. When the multivariate model was repeated substituting access to a certified asthma/COPD clinic for access to an asthma/COPD clinic at the PHCC, no difference was observed (data not shown).

Table 2. Logistic regression associations between patient and care related factors and having sufficient knowledge of management of asthma exacerbations.

Patient characteristics	Unadjusted OR (95%CI)	<i>p</i> value	Adjusted OR (95% CI)	<i>p</i> value
Sex				
Female	Ref	0.054	Ref	0.230
Male	1.25 (1.00–1.56)		1.18 (0.90–1.54)	
Age groups				
<40	Ref	0.903	Ref	0.462
40–59	1.02 (0.78–1.33)	0.208	0.88 (0.64–1.23)	0.646
≥60	1.20 (0.90–1.60)		0.92 (0.64–1.32)	
Education				
Low	Ref	0.010	Ref	0.032
High	1.37 (1.08–1.73)		1.38 (1.03–1.85)	
Current smoking				
No	Ref	0.010	Ref	0.031
Yes	0.56 (0.36–0.87)		0.56 (0.34–0.95)	
Co-morbidity				
No	Ref	0.274	Ref	0.015
Yes	0.87 (0.68–1.11)		0.68 (0.49–0.93)	
Self-rated severity of disease				
Moderate	Ref	0.854	Ref	0.008
Severe	0.98 (0.77–1.24)		0.68 (0.51–0.90)	
Written action plan				
No	Ref	<0.0001	Ref	<0.0001
Yes	17.2 (9.06–32.8)		11.9 (6.16–22.9)	
Specific responsible doctor				
No	Ref	<0.0001	Ref	<0.0001
Yes	3.18 (2.45–4.13)		2.19 (1.62–2.96)	
Visited asthma/COPD-nurse				
No	Ref	<0.0001	Ref	0.061
Yes	2.11 (1.55–2.87)		1.42 (0.98–2.04)	
Asthma/COPD clinic at PHCC				
No	Ref	0.926	Ref	0.454
Yes	0.98 (0.71–1.37)		1.16 (0.78–1.73)	
Treatment status				
Step I (No regular treatment)	Ref	<0.0001	Ref	0.031
Step II (ICS only)	2.13 (1.56–2.91)	<0.0001	1.53 (1.04–2.24)	<0.0001
Step III (ICS + LABA or LTRA)	3.10 (2.36–4.08)		2.07 (1.44–2.99)	

The investigated variables were chosen *a priori*.

OR = odds ratio; COPD = chronic obstructive pulmonary disease; PHCC = primary health care center; ICS = inhaled corticosteroids; LABA = long-acting beta agonists; LTRA = leukotriene receptor antagonists.

Stratification and interaction analysis by sex showed that a visit to an asthma/COPD-nurse in the previous 12 months was significantly associated with higher self-management knowledge in women, but not in men (p for interaction = 0.038). Smoking was associated with insufficient self-management knowledge in males ($p = 0.033$). No effect of age was found (data not shown).

Discussion

Main findings

The primary finding of this multi-center study is that high level of education, written action plan, physician continuity, and advanced asthma maintenance treatment are independently associated with self-reported knowledge of self-management of worsening asthma in Swedish primary care patients. Visits to an asthma/COPD nurse in the previous 12 months was associated to moderate to complete self-management knowledge in women but not in men.

Conversely, current daily smoking, greater self-rated asthma severity, and comorbidities were identified as factors significantly associated with little to no self-reported knowledge of self-management of worsening asthma. The association of a higher level of education with knowledge of self-management has been reported previously (25). It is possible that a higher level of education is associated with patients who are more concerned with their health and self-management of a chronic condition. A higher level of education could also be a marker for higher income and socio-economic level, with greater potential to obtain knowledge and skill in asthma management and control.

Our study results were consistent with those of previous research establishing the use of written action plans as an important factor in asthma control and patient self-management (22). Approximately 17% of our study participants had a written action plan in place, although they are highly prioritized in the guidelines of the Swedish National Board of Health and Welfare (26), emphasizing the importance of stressing implementation of this procedure.

The finding of high associations of self-management knowledge with care provided by a specific physician emphasizes the importance of continuity in primary care (32).

Higher maintenance treatment level was significantly associated with greater knowledge of self-management. Advanced treatment is used in patients with more severe conditions, and patients with more severe asthma have more frequent contact with healthcare both on a primary and secondary level, possibly explaining this discrepancy. Conversely, we found that more severe self-rated disease was associated with less knowledge of self-management. We speculate that low knowledge of procedures to address acute asthma symptoms may influence the subjective grade of disease severity.

Additional health conditions and daily smoking were positively associated with low knowledge of asthma self-management. Comorbidities and smoking are associated with characteristics that may alter behavior and perception or produce accumulated of risk. We speculate that comorbid conditions might shift primary focus from the asthma. Furthermore, both comorbid conditions and smoking have been shown to impact asthma control and to influence the efficacy of, or compliance with, treatment (33).

It is unclear why a visit to an asthma/COPD-nurse was associated with self-rated knowledge only in females. It is possible that female patients are more interested in, and aware of, their health and have more contact with primary care (34,35), potentially making them more attentive and receptive to self-management education.

The main strength of this investigation is that the study was conducted at multiple sites providing primary care to patients with a physician diagnosis of asthma. Most Swedish asthma patients are managed in primary care settings, which makes the generalizability high. Another strength is that we examined both patient- and care-related factors, making the results more comprehensive. We chose to focus only on the primary care population, allowing evaluation of organizational factors such as asthma/COPD-clinics at PHCCs, which would not have been possible with a mixed primary/secondary care population. In addition, our population of 1442 patients are relatively large compared with many previous studies in this field.

In our study, we combined the cohorts IB and II from the PRAXIS study population, as both cohorts completed an extensive patient questionnaire including the item on self-management knowledge. Although the IB-cohort is a follow-up from a study conducted in

2005, our cohorts were temporally close (2012 and 2015), and since mortality in asthma is low, selection bias related to survival should have been minimal.

Our study showed no better effect of a certified asthma/COPD clinic than any asthma/COPD clinic, possibly due to the low number of certified clinics.

A major limitation is that most patient data were self-reported, potentially introducing bias. Patients with low health literacy might also have had limited ability to complete questionnaires accurately. Another limitation is that we have no data of objective measurements such as lung function. However, our intention was to perform a real-life study including patients with a physician diagnosis of asthma.

As self-management of acute and deteriorating asthma symptoms is critical to asthma control and quality of life in asthma patients, it is important to identify factors associated with self-management knowledge.

Based on the results of this study, allocation to a specific physician and a clinical structure that includes physician continuity in cases of chronic conditions might be of special benefit for asthma patients suffering from other health conditions. An important clinical implication of our results would be the value of written action plans and asthma/COPD nurses in asthma care.

In Sweden, nurse-based asthma/COPD clinics integrated into the PHCC are recommended. Updated criteria of certified asthma/COPD clinics in Sweden have recently been suggested, emphasizing the importance of patient education and physiotherapy (27,28). Further research with respect to structure of asthma/COPD clinics and the components of asthma/COPD nurse visits relative to patient outcomes would be of clinical interest.

Conclusion

In this study of Swedish asthma patients from primary care, a higher level of education, a written action plan, ongoing care from a specific physician, and a higher level of asthma maintenance treatment were positively associated with self-reported knowledge of asthma exacerbation self-management. In females, an asthma/COPD nurse visit in the previous 12 months was also associated with moderate to complete knowledge. Patients with other health conditions were more likely to report little or no knowledge of self-management. The findings support the importance of implementing and enforcing current guidelines with respect to written action plans and structured education by asthma/COPD nurses, and prioritizing ongoing care provided

by a patient-specific physician for patients with additional health conditions.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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