

Smoking makes asthma expensive: a register-based study in Finland

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SUMMARY

SETTING: Chronic bronchitis and chronic obstructive pulmonary disease (COPD)/emphysema occur frequently among middle-aged and elderly asthma patients who smoke.

OBJECTIVE: To test how much this comorbidity increases the use and costs of health services in comparison with asthma alone.

DESIGN: A sample of 6000 adults with a clinical diagnosis of asthma was extracted from a nationwide health insurance register for a postal inquiry. Comorbidity and the use of health services were measured using a questionnaire. Data on medication expenses were obtained from the national prescription register.

RESULTS: Altogether 4956 individuals replied, of whom 3160 asthma patients aged ≥ 40 years (response rate 85%)

were chosen for this investigation. Asthma patients with COPD/emphysema (12% of the series) accounted for 21% of all doctor consultations, 39% of the total number of hospital in-patient days and 27% of the total expenses, of which one third were medication costs. The mean annual gross expenditure on treatment services and anti-asthma medications was €754 per patient for those with asthma alone and €2107 for those with concurrent COPD/emphysema. Current smoking further increased costs among COPD patients.

CONCLUSION: To prevent pulmonary comorbidity and the related high costs, cessation of smoking should be an integral part of the treatment provided for asthma patients.

KEY WORDS: asthma; COPD; costs; health care utilisation; smoking

THE BURDEN OF ASTHMA on health services, and particularly the substantial need for hospital in-patient care, have decreased as anti-inflammatory therapy has improved.^{1,2} However, smoking may affect the expression of asthma^{3–5} and the related use of therapeutic services. Furthermore, long-term smoking greatly increases the risk of chronic obstructive pulmonary disease (COPD),^{6,7} which may appear concomitantly with asthma and is more difficult to treat than asthma alone.⁸ COPD is also closely related to impaired functional capacity^{9–11} and is therefore likely to increase the need for health care. However, the effect of smoking and COPD on the consumption of medical resources by adult asthma patients has not been extensively explored.

The present study examines how smoking and related chronic obstructive pulmonary morbidity affect the use and costs of health care services and medications among registered asthma patients. The role of the subjects' functional capacity in these effects is also studied.

POPULATION AND METHODS

The national health insurance scheme in Finland covers all residents and, among other things, reimburses certain medication costs (at a standard rate of 42% from 2006 onwards), although a special reimbursement (72% from 2006 onwards) can be paid in the case of certain severe chronic diseases such as asthma and other COPDs. All patients entitled to this special reimbursement are centrally registered by the Social Insurance Institution (SII), for which purpose the diagnosis and severity of the disease should meet nationally determined criteria.¹²

A total of 156 755 persons aged ≥ 16 years were entitled to the special refund on medicines for asthma and other similar COPDs in 2000, implying a prevalence of 3.8%. For the purposes of the present study, a systematic sample of 6000 subjects was drawn from this population, excluding institutionalised persons.¹² A nationwide postal inquiry was carried out among this sample and elicited 4956 replies. Because the adverse pulmonary effects of smoking appear only after

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a relatively long period of exposure, a subgroup of asthma patients aged ≥ 40 years, i.e., the age group for which the risk of COPD is increased,^{6,7} was extracted from this population for the final study series. The response rate among this population was 85%. For comparison, smoking history was explored separately among subjects aged 16–39 years.

The costs attributable to the use of therapeutic services presented here are based on the mean unit costs for 2000 calculated by the National Research and Development Centre for Welfare and Health.¹³ These mean unit costs of a consultation with a health service doctor (€74), a visit to a hospital out-patient clinic for respiratory diseases (€145) and a day as an in-patient (€284) include all the staff expenses involved, costs of materials, equipment and outsourcing services, such as laboratory and X-ray examinations, cleaning and maintenance and overhead costs. The costs include charges paid by patients and correspond to the running costs in the public health care service, which bears the main responsibility for adult asthma care in Finland.^{1,12}

The annual gross expenses attributable to out-patient medicines under code R03 of the Anatomic Therapeutic Chemical (ATC) classification (drugs for obstructive airway diseases)¹⁴ were calculated from the SII register.

The study was conducted in compliance with the requirements of the Ethical Committee of the Faculty of Medicine, University of Oulu, Oulu, Finland.

Questionnaire

The respondents were asked to indicate whether they had been diagnosed as having asthma, chronic bronchitis, COPD or emphysema. They were classified into three groups: asthma alone, asthma with chronic bronchitis and asthma with COPD and/or emphysema. Asthma patients with all these pulmonary diseases were included in the COPD/emphysema group.

Smoking history was ascertained by the alternatives 'I have never smoked', 'I smoked regularly, but stopped', 'I smoke occasionally' and 'I currently smoke'. The latter two were combined in the analyses. Former smoking was analysed in one category regardless of the time elapsed since stopping smoking.

The subjects were asked to indicate whether they had been diagnosed as having coronary artery and/or other heart diseases or musculoskeletal disorders.¹⁵

The subjects' abilities to cope with activities in daily living and their functional capacity were evaluated by means of multiple choice items as used in a previous Finnish study.¹⁶ The activities concerned, as detailed in Table 1, were to be assessed on a four-point scale: 'I manage perfectly well/with slight difficulty/with

Table 1 Functional capacity by chronic obstructive pulmonary morbidity

	Asthma alone <i>n</i> (%)	Asthma and chronic bronchitis <i>n</i> (%)	Asthma and COPD/emphysema <i>n</i> (%)	Total <i>n</i> (%)	<i>P</i> value*
Subject manages					
Dressing and undressing					<0.001
Perfectly well or with slight difficulty	2341 (98.2)	245 (94.2)	349 (94.6)	2935 (97.4)	
With great difficulty or doesn't manage at all	44 (1.8)	15 (5.8)	20 (5.4)	79 (2.6)	
Tying shoe laces, kneeling and bending					<0.001
Perfectly well or with slight difficulty	2205 (92.3)	227 (84.4)	291 (79.1)	2723 (90.0)	
With great difficulty or doesn't manage at all	185 (7.7)	42 (15.6)	77 (20.9)	304 (10.0)	
Walking a couple of kilometres					<0.001
Perfectly well or with slight difficulty	1963 (82.7)	182 (67.7)	198 (52.9)	2343 (77.7)	
With great difficulty or doesn't manage at all	411 (17.3)	87 (32.3)	176 (47.1)	674 (22.3)	
Climbing one flight of stairs					<0.001
Perfectly well or with slight difficulty	2111 (89.5)	194 (74.3)	235 (65.5)	2540 (85.3)	
With great difficulty or doesn't manage at all	247 (10.5)	67 (25.7)	124 (34.5)	438 (14.7)	
Doing things that require great exertion, e.g., heavy cleaning or snow clearing, etc.					<0.001
Perfectly well or with slight difficulty	1532 (64.6)	104 (39.4)	121 (32.6)	1757 (58.4)	
With great difficulty or doesn't manage at all	840 (35.4)	160 (60.6)	250 (67.4)	1250 (41.6)	
Total number of activities presenting difficulties†					<0.001
None	1389 (62.9)	84 (34.9)	91 (27.4)	1564 (56.3)	
1–2	607 (27.5)	97 (40.2)	134 (40.4)	838 (30.1)	
3–5	211 (9.6)	60 (24.9)	107 (32.2)	378 (13.6)	
Data missing‡	289	35	56	380	
Mean (SD) number of activities presenting difficulties†	0.7 (1.1)	1.4 (1.5)	1.8 (1.5)	0.9 (1.3)	
Mean difference (95%CI)§	–0.7 (–0.9––0.6) –0.4 (–0.6––0.1)			–1.1 (–1.2––1.0)	

* χ^2 test for the distribution.

† Subject manages with great difficulty or doesn't manage at all.

‡ Data missing for 12.0% of cases.

§ Independent samples *t*-test for equality of mean numbers of activities presenting difficulties.

COPD = chronic obstructive pulmonary disease; SD = standard deviation; CI = confidence interval.

great difficulty/I can't manage at all'. The latter two categories were regarded as indicating problems in that respect.

The subjects were asked to report the number of consultations with a doctor and the number of days of hospital treatment they had received due to asthma during the last 12 months.

The current pattern of anti-asthma medication was assessed by presenting a list of all 35 brand names available on the Finnish market.¹⁴ Self-reported information on medication was compared with the register-based data on anti-asthma medications purchased and was supplemented if necessary. In the analyses, the anti-asthma medications were classified into nine categories,¹² as presented in Table 2. The use of long-acting β_2 -agonists was rare at the time of the survey¹² and thus was not studied here.

Statistical methods

The data were analysed using SPSS 13.0 software (SPSS Inc, Chicago, IL, USA). Statistical significances of differences were calculated using the independent samples *t*-test for continuous variables or the χ^2 test for categorical variables. $P < 0.05$ was considered significant.

Factors predicting the annual costs of anti-asthma medicines and treatment services due to asthma at the level of the most expensive 25% percentile in this population were explored by means of logistic regression. The variables used in the crude and adjusted stepwise forward multivariate models are presented in Table 3.

Analysis of non-response

An analysis of non-response in the postal inquiry has been reported elsewhere.¹⁵ Data on in-patient days

Table 2 Numbers of visits to a doctor and hospital in-patient days during the past 12 months and current use of anti-asthma medicines, by chronic obstructive pulmonary morbidity

	Asthma alone <i>n</i> (%)	Asthma and chronic bronchitis <i>n</i> (%)	Asthma and COPD/emphysema <i>n</i> (%)	Total <i>n</i> (%)
Visits to a doctor				
None	850 (34.1)	73 (26.5)	84 (21.6)	1007 (31.9)
1–3	1223 (49.0)	114 (41.3)	146 (37.6)	1483 (46.9)
≥4	423 (16.9)	89 (32.2)	158 (40.7)	670 (21.2)
Mean (SD) number of visits	1.93 (2.62)	2.90 (3.49)	3.75 (4.18)	2.24 (3.00)
Mean difference (95% CI)*	–0.97 (–1.31––0.64) –0.85 (–1.45––0.24) –1.82 (–2.13––1.52)			
In-patient days				
None	2208 (93.4)	222 (86.0)	255 (72.2)	2685 (90.2)
≥1 day	157 (6.6)	36 (14.0)	98 (27.8)	291 (9.8)
Data missing†	131	18	35	184
Mean (SD) number of days	0.78 (5.50)	1.55 (5.15)	4.13 (9.59)	1.25 (6.20)
Mean difference (95% CI)*	–0.77 (–1.47––0.06) –2.58 (–3.87––1.29) –3.35 (–4.03––2.65)			
Anti-asthma medicines				
Anti-inflammatory inhalations‡				
Yes	2016 (80.8)	214 (77.5)	322 (83.0)	2552 (80.8)
No	480 (19.2)	62 (22.5)	66 (17.0)	608 (19.2)
Inhaled short-acting β_2 -agonists§				
Yes	1943 (77.8)	187 (67.8)	234 (60.3)	2364 (74.8)
No	553 (22.2)	89 (32.2)	154 (39.7)	796 (25.2)
Inhaled anticholinergics¶				
Yes	214 (8.6)	67 (24.3)	149 (38.4)	430 (13.6)
No	2282 (91.4)	209 (75.7)	239 (61.6)	2730 (86.4)
Mean (SD) number of anti-asthma drugs#	2.38 (1.11)	2.92 (1.49)	3.03 (1.45)	2.51 (1.22)
Mean difference (95% CI)*	–0.54 (–0.68––0.39) –0.11 (–0.34–0.12) –0.65 (–0.77––0.52)			

* Independent samples *t*-test for equality of means.

† Data missing for 5.8% of the cases.

‡ Beclomethasone dipropionate, budesonide, fluticasone dipropionate (includes salmeterol-fluticasone combination), nedocromil and/or sodium cromoglycate.

§ Fenoterol, salbutamol and/or terbutalin.

¶ Ipratropium bromide and/or oxitropium bromide.

Inhaled short-acting β_2 -agonists (fenoterol, salbutamol and terbutalin), inhaled long-acting β_2 -agonists (formoterol and salmeterol), inhaled anticholinergics (ipratropium bromide and oxitropium bromide), inhaled corticosteroids (beclomethasone dipropionate, budesonide and fluticasone dipropionate), inhaled cromones (sodium cromoglycate and nedocromil), systemic corticosteroids (methyl prednisolone, prednisolone and prednisone), theophylline and aminophylline, leucotriene modifiers (montelukast and zafirlukast) and/or ephedrine.

COPD = chronic obstructive pulmonary disease; SD = standard deviation; CI = confidence interval.

Table 3 Predictors of annual costs per subject ($n = 2711$) at the level of the most expensive 25% percentile in the series. Crude and aOR for the variables together with their 95%CI calculated by logistic regression

	Anti-asthma medicines $\geq$ €592		Treatment services* $\geq$ €296		Anti-asthma medicines and treatment services* $\geq$ €962	
	Crude OR (95%CI)	Adjusted OR [†] (95%CI)	Crude OR (95%CI)	Adjusted OR [†] (95%CI)	Crude OR (95%CI)	Adjusted OR [†] (95%CI)
Sex						
Men	1		1		1	
Women	0.87 (0.71–1.06)		1.06 (0.87–1.31)		0.89 (0.72–1.10)	
Age, years						
40–49	1	1	1	1	1	1
50–59	1.65 (1.24–2.19)	1.64 (1.24–2.18)	1.50 (1.13–1.99)	1.46 (1.10–1.93)	1.65 (1.21–2.24)	1.64 (1.21–2.23)
60–69	1.49 (1.10–2.01)	1.45 (1.08–1.95)	1.03 (0.76–1.40)	1.00 (0.75–1.34)	1.72 (1.24–2.36)	1.72 (1.26–2.35)
≥ 70	2.10 (1.52–2.91)	2.02 (1.48–2.76)	1.10 (0.79–1.54)	1.12 (0.82–1.52)	2.00 (1.41–2.82)	2.05 (1.47–2.85)
Smoking history						
Never	1	1	1		1	1
Former smoker	1.41 (1.13–1.77)	1.50 (1.22–1.85)	1.21 (0.96–1.52)		1.38 (1.10–1.74)	1.47 (1.18–1.81)
Current smoker	1.65 (1.28–2.14)	1.73 (1.34–2.22)	1.23 (0.95–1.60)		1.64 (1.25–2.14)	1.71 (1.32–2.22)
Chronic obstructive pulmonary comorbidity						
Asthma	1	1	1	1	1	1
And chronic bronchitis	1.01 (0.74–1.39)	0.98 (0.72–1.35)	1.69 (1.25–2.28)	1.74 (1.28–2.32)	1.26 (0.92–1.73)	1.23 (0.90–1.67)
And COPD/emphysema	2.04 (1.57–2.65)	2.04 (1.57–2.65)	2.54 (1.95–3.30)	2.65 (2.05–3.42)	2.87 (2.20–3.74)	2.86 (2.20–3.71)
Difficulties in functional capacity [‡]						
None	1	1	1	1	1	1
1–2	1.64 (1.32–2.03)	1.56 (1.27–1.93)	2.24 (1.80–2.78)	2.23 (1.80–2.75)	2.33 (1.87–2.91)	2.23 (1.80–2.77)
≥ 3	1.80 (1.35–2.41)	1.71 (1.29–2.26)	3.49 (2.61–4.65)	3.48 (2.63–4.60)	2.79 (2.08–3.74)	2.64 (1.99–3.51)

* Consultations with a doctor in out-patient care or at a hospital out-patient clinic for respiratory diseases, and hospital in-patient days.

[†] Adjusted for sex, age, smoking history, chronic obstructive pulmonary morbidity and difficulties in functional capacity (method = stepwise forward).

[‡] Subject manages with great difficulty or does not manage at all in dressing/tying shoe laces, kneeling and bending/walking a couple of kilometres/climbing one flight of stairs/doing things that require great exertion, e.g. heavy cleaning or snow clearing, etc.

aOR = adjusted odds ratio; CI = confidence interval; COPD = chronic obstructive pulmonary disease.

were missing for 184 subjects (5.8% of the total). Persons aged ≥ 60 years or with COPD/emphysema were slightly under-represented in this respect.

RESULTS

Subjects

The final patient series comprised 3160 subjects, of whom 2496 (79.0%) had asthma alone, 276 (8.7%) had asthma and chronic bronchitis and 388 (12.3%) had asthma and COPD and/or emphysema (Table 4).

Smoking history

Current smokers accounted for 17.4% ($n = 541$) of the asthma patients aged ≥ 40 years, and nearly one third ($n = 944$, 30.4%) were ex-smokers (Table 4). Both current and ex-smokers were more common among asthma patients with other concurrent pulmonary morbidity. Less than a third of asthma patients with COPD/emphysema had never smoked. Cessation of smoking was more common than current smoking in all three disease categories.

Current smoking was more common among men than women ($n = 256$, 22.0% vs. $n = 285$, 14.6%), as was previous smoking ($n = 570$, 49.1% among men vs. $n = 374$, 19.3% among women, $P < 0.001$). Current smoking was most frequent in those aged 40–49 years among both men and women, while previous

smoking became more common with advancing age among men, but was most frequent in the age group 40–49 years among women (Figure 1). Only one man in five aged ≥ 70 years had never smoked, compared to 77.2% of women.

In a separate analysis among subjects aged 16–39 years, 171 (46.0%) men and 314 (51.7%) women had never smoked. Altogether 159 (42.7%) men and 212 (34.9%) women were current smokers, whereas respectively 42 (11.3%) and 81 (13.4%) had stopped ($P = 0.049$).

Of all subjects aged ≥ 16 years, 912 (22.3%) were current smokers (415 [27.1%] men and 497 women [19.5%]).

Functional capacity

Two subjects in five ($n = 1216$, 43.7%) experienced one or more problems related to their functional capacity or ability to cope with daily activities. Altogether 72.6% of the asthma patients with COPD/emphysema had at least one such difficulty, whereas this occurred in 37.1% of those with asthma alone (Table 1). The problems most commonly mentioned concerned heavy physical exertion (1252 cases, 41.6%).

Out-patient care

A total of 7068 visits to a doctor on account of asthma had accumulated in the course of the previous

Table 4 Sex, age, smoking history and occurrence of defined somatic diseases, by chronic obstructive pulmonary morbidity

	Asthma alone <i>n</i> (%)	Asthma and chronic bronchitis <i>n</i> (%)	Asthma and COPD/emphysema <i>n</i> (%)	Total <i>n</i> (%)
Men	881 (35.3)	93 (33.7)	206 (53.1)	1180 (37.3)
Women	1615 (64.7)	183 (66.3)	182 (46.9)	1980 (62.7)
Age, years				
40–49	600 (24.0)	19 (6.9)	33 (8.5)	652 (20.6)
50–59	692 (27.7)	59 (21.3)	67 (17.2)	818 (25.9)
60–69	666 (26.7)	98 (35.7)	113 (29.0)	877 (27.8)
≥70	538 (21.6)	100 (36.1)	175 (45.2)	813 (25.7)
Smoking history				
Never	1388 (56.6)	114 (42.2)	118 (31.0)	1620 (52.2)
Former smoker	669 (27.3)	98 (36.3)	177 (46.5)	944 (30.4)
Current smoker	397 (16.2)	58 (21.5)	86 (22.6)	541 (17.4)
Data missing*	42	6	7	55
Coronary artery and/or other heart disease				
No	1970 (78.9)	175 (63.4)	235 (60.7)	2380 (75.3)
Yes	526 (21.1)	101 (36.6)	153 (39.3)	780 (24.7)
Musculoskeletal disorders†				
No	1293 (51.8)	95 (34.7)	149 (38.4)	1537 (48.7)
Yes	1203 (48.2)	181 (65.3)	239 (61.6)	1623 (51.3)

* Data missing for 1.7% of the cases.

† Osteoarthritis, back problems and/or rheumatoid arthritis.

COPD = chronic obstructive pulmonary disease.

12 months (2.24 per patient), of which 1530 (21.6%) were visits to a hospital out-patient clinic. Altogether, 65.9% of the subjects with asthma alone, 73.5% of those with concurrent chronic bronchitis and 78.4% of those with COPD/emphysema had made at least one visit to a doctor (Table 2). The mean number of all out-patient visits increased with the prevalence of concurrent obstructive pulmonary morbidity.

Asthma patients with concomitant chronic bronchitis were responsible for 802 visits (11.4%), of which

180 were to a hospital out-patient clinic (22.4%) (Figure 2). The numbers of visits made by asthma patients with COPD/emphysema were 1458 (20.6%) and 465 (31.9%), respectively.

Asthma patients with COPD/emphysema who were current smokers had each made an average of 4.51 visits to a doctor, whereas asthma patients who had never smoked and had no such comorbidity had made 1.91 visits per person ($P < 0.001$).

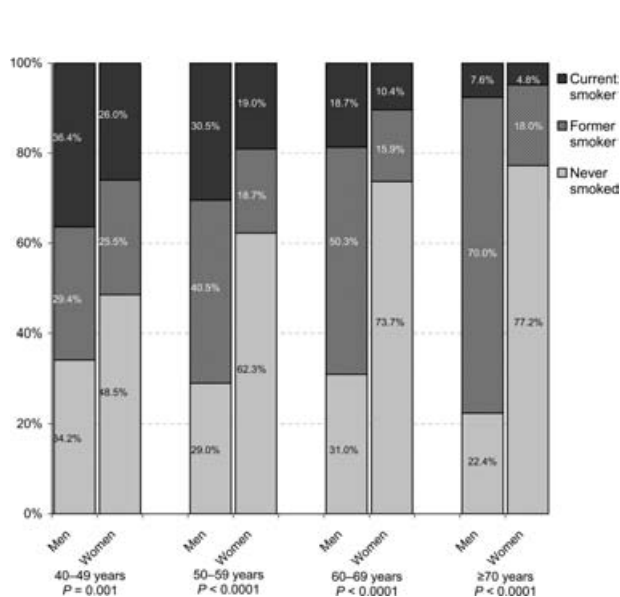


Figure 1 Smoking history in men ($n = 1162$) and women ($n = 1943$) by age. P values calculated for men vs. women in each age group using the χ^2 test. Data on smoking missing for 55 cases (1.7% of the total).

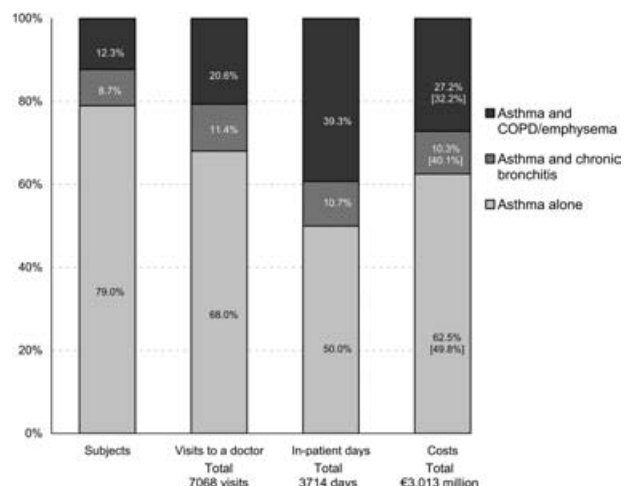


Figure 2 Distribution of subjects ($n = 3160$), their visits to a doctor, hospital in-patient days and the costs attributable to the use of these services and anti-asthma medicines, by chronic obstructive pulmonary morbidity. Percentages of medication costs in the total costs of each category of pulmonary morbidity in brackets. Data on in-patient days missing for 184 cases (5.8% of the total). COPD = chronic obstructive pulmonary disease.

In-patient care

A total of 291 patients (9.8%) had been hospitalised for asthma within the last 12 months (Table 2) and a total of 3714 treatment days (1.25 per patient) had accumulated.

Those who had chronic bronchitis in addition to asthma had spent 400 days in hospital care (10.7%) and those with COPD/emphysema 1459 days (39.3%) (Figure 2).

Asthma patients with COPD/emphysema who were current smokers had been hospitalised for an average of 5.82 days per person, whereas asthma patients who had never smoked and had no such comorbidity had had only 0.76 in-patient days per person ($P < 0.001$).

Anti-asthma medicines

The use of anti-inflammatory inhalation therapy was similar in the groups with or without pulmonary comorbidity, but those with COPD/emphysema were less likely to be taking short-acting β_2 -agonists and more likely to be taking anticholinergics (Table 2).

The mean number of anti-asthma drugs taken by this population was 2.51 (standard deviation [SD] 1.22); it was 2.38 (1.11) for those with asthma alone and 3.03 (1.45) for those with COPD/emphysema as well.

Costs

The direct costs arising from doctors' consultations and the use of in-patient services and anti-asthma medicines in this series of patients totalled €3.013 million, of which asthma patients with COPD/emphysema accounted for €0.819 million altogether (27.2%) and €0.414 million in hospital treatment costs alone (39.3%) (Figure 2). Doctors' consultations and hospital services represented a gross expenditure of €1.687 million, of which hospital treatment accounted for €1.055 million (62.5%).

The mean annual gross expenditure on treatment services, i.e., visits to a doctor and in-patient care together with anti-asthma medicines, was €953 per patient; the sum increased with growing obstructive

pulmonary morbidity (Table 5). The mean gross expenditure on treatment services alone was €533 per patient, i.e., 55.9% of the total direct costs.

The mean total direct cost for subjects with asthma and COPD/emphysema who had never smoked was €1228, for former smokers it was €2558 and for current smokers it was €2505 (Table 5).

The register-based annual expenses attributable to anti-asthma medicines in this population totalled €1.326 million, of which inhalation corticosteroids accounted for 53.4%. Asthma patients with chronic bronchitis accounted for total medication costs of €0.124 million (9.4%) and those with other respiratory comorbidities for €0.264 million (19.9%). Five hundred and twenty-seven subjects (16.7%) had no registered purchases of anti-asthma drugs. They were more likely to belong to one or other of the two youngest age groups, had asthma only or had made no visits to a doctor.

The mean cost of asthma medications for subjects with asthma alone who had never smoked was €354, for former smokers it was €404 and for current smokers €402. The mean cost of inhalation glucocorticoids alone was respectively €201, €234 and €218.

Comorbid COPD/emphysema, age ≥ 50 years and previous or current smoking were found to be predictive of total costs and the costs of asthma medicines alone at the level of the most expensive 25% percentile in this population; problems in functional capacity were also associated with costs of this magnitude (Table 3).

DISCUSSION

By comparison with patients with clinically diagnosed asthma only, smoking-related obstructive pulmonary diseases substantially increase the use of health services and the resulting costs. Concurrent COPD almost triples the total direct costs per asthma patient and increases the costs of in-patient care alone more than five-fold. A history of current or previous smok-

Table 5 Mean annual gross expenditure attributable to asthma care, by chronic obstructive pulmonary morbidity

	Asthma alone	Asthma and chronic bronchitis	Asthma and COPD/emphysema			All patients in the series	
			All patients	Smoking history			
				Never	Former smoker		Current smoker
Direct costs	€754	€1122	€2107	€1228	€2558	€2505	€953
Treatment services*	€378	€671	€1428	€720	€1761	€1821	€533
Visits to a doctor	€167	€261	€362	€294	€381	€425	€199
In-patient care	€211	€411	€1065	€426	€1379	€1396	€333
Anti-asthma medicines†	€375	€450	€679	€507	€797	€671	€419

* Based on the mean unit costs calculated by the National Research and Development Centre for Welfare and Health for a consultation with a health service doctor (€74), a visit to a hospital out-patient clinic for respiratory diseases (€145) and a day as an in-patient (€284).

† Anti-asthma medicines purchased according to the national prescription register.
COPD = chronic obstructive pulmonary disease.

ing further increases the costs for these patients. The impact of comorbid COPD was of the same magnitude as in earlier comparisons between subjects with asthma or COPD alone.^{17,18}

The majority of the costs related to COPD patients are derived from the use of hospital services, while medications and out-patient services dominate the cost structure for the rest of the asthma population. This reveals the severity of smoking-related COPD in comparison with asthma alone and the difficulty of treating it. Comorbid COPD is also associated with impaired functional capacity and the need for assistance with daily activities,^{10,11} which further increases the costs both to the individual and to society.

The future does not look promising, as smoking remains frequent, especially among female asthma patients, as women with asthma seem to be less inclined to stop smoking than men. Smoking may lead to loss of the protective long-term effect of inhalation corticosteroids on lung function.⁵ The incidence of COPD and other smoking-related morbidities will probably become far greater in the future; the influence of this trend is already visible in the frequency of COPD-related emergency treatment episodes, which has increased in women but remained stable among men.¹⁹ One positive sign, however, is the decline in the need for hospital care due to asthma.^{1,2} The health care system should devote increasing resources to the prevention and treatment of obstructive pulmonary diseases to avoid early retirement and excess mortality.^{20–22}

Smoking is also harmful for asthma patients who do not yet have other chronic obstructive disorders. Active smoking may reduce the short-term efficacy of inhaled corticosteroids and even increase the need for medication to control airway inflammation.⁴ This emphasises the importance of motivating young asthma patients not to start smoking.

A potential limitation in this research may lie in distinguishing other chronic obstructive pulmonary morbidity in asthma patients, particularly in smokers. The effect of such comorbidities on the consumption of asthma-related health care resources may therefore be underestimated. Owing to recall bias, the reporting of consultations may be inaccurate, particularly in elderly patients with multimorbidity. The questionnaire method does not, however, differ from that used in other epidemiological studies of COPDs.²³

The direct costs considered in this cross-sectional research represent gross expenditure in a subgroup of Finnish asthma patients and cannot therefore be extrapolated to the whole asthma population, nor is it directly comparable with those calculated in other settings. Also, the source data did not include mild cases of asthma or institutionalised patients, who would probably have increased the costs further and magnified the contribution of COPD.

In conclusion, frequent use of health services and the consequent high costs are closely associated with asthma

patients who smoke and have concurrent COPD/emphysema and impaired functional capacity. Preventing young asthma patients from starting smoking and stressing the importance of its cessation should be an integral part of the treatment provided for asthma.

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R É S U M É

CONTEXTE : La bronchite chronique et l'emphysème ou la bronchopneumathie chronique obstructive (BPCO) surviennent fréquemment chez les patients asthmatiques fumeurs, d'âge moyen ou avancé.

OBJECTIF : Evaluer dans quelle mesure cette comorbidité augmente l'utilisation et les coûts des services de santé par comparaison avec un asthme isolé.

SCHEMA : On a extrait d'un registre national d'assurance de santé un échantillon de 6000 adultes avec un diagnostic clinique d'asthme en vue d'une enquête par voie postale. On a déterminé la comorbidité ainsi que l'utilisation des services de santé au moyen d'un questionnaire. Les données sur les dépenses de médicaments ont été obtenues à partir du registre national de prescriptions.

RÉSULTATS : On a obtenu au total 4956 réponses parmi lesquelles on a choisi pour cette recherche 3160 asthmatiques âgés de 40 ans ou davantage (taux de réponse 85%).

Les asthmatiques atteints en outre de BPCO ou d'emphysème (12% de la série) ont été responsables de 21% de toutes les consultations médicales, de 39% du nombre total de jours d'hospitalisation et de 27% des dépenses totales, parmi lesquelles un tiers étaient des coûts de médicaments. Les dépenses brutes annuelles moyennes concernant les services de traitement et les médicaments anti-asthmatiques ont été de €754 par patient chez ceux atteints d'un asthme isolé et de €2107 chez ceux ayant simultanément de la BPCO ou de l'emphysème. Parmi les patients BPCO, le fait d'être actuellement fumeur a augmenté davantage les coûts.

CONCLUSION : L'arrêt du tabagisme devrait faire partie intégrante du traitement fourni aux patients asthmatiques de façon à prévenir une comorbidité pulmonaire et les coûts élevés qui lui sont attribuables.

R E S U M E N

MARCO DE REFERENCIA : La bronquitis crónica y la enfermedad pulmonar obstructiva crónica (EPOC) y el enfisema son frecuentes en los pacientes asmáticos fumadores de mediana edad y ancianos.

OBJETIVO : Evaluar en qué medida esta comorbilidad aumenta el uso y los costos de los servicios de salud, en comparación con los casos exclusivos de asma.

MÉTODOS : Se escogió una muestra de 6000 adultos con diagnóstico clínico de asma, a partir de un registro nacional de seguro médico, para una consulta postal. La comorbilidad y el uso de los servicios de salud se midieron mediante un cuestionario. Los datos sobre los gastos en medicamentos se obtuvieron del registro nacional de recetas médicas.

RESULTADOS : Se obtuvieron 4956 respuestas, de las cuales se escogieron para la investigación 3160 de pa-

cientes asmáticos a partir de los 40 años (tasa de respuesta 85%). Los asmáticos con EPOC o enfisema (12% de la serie) motivaron el 21% de todas las consultas médicas, el 39% del número total de días de hospitalización y el 27% de los gastos totales, un tercio de los cuales correspondieron a costos de medicamentos. El gasto bruto anual medio en servicios de tratamiento y en medicamentos antiasmáticos fue €754 por paciente en aquellos con asma solo y €2107 en aquellos con EPOC o enfisema concomitantes. El tabaquismo actual aumentó los costos en los pacientes con EPOC.

CONCLUSIÓN : Con el fin de prevenir la comorbilidad en las enfermedades pulmonares y los altos costos que de ella se derivan, el abandono del tabaquismo debe constituir parte integrante del tratamiento propuesto al paciente asmático.