

PHARMACOTHERAPY

Socioeconomic status and the quality of prescribing asthma drugs in Sweden

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Abstract

Introduction: Socioeconomic status (SES) is strongly associated with morbidity as well as with health care utilization and expenditure. The association between SES and quality of prescribing of asthma drugs is less studied. **Objectives:** The aim of this study was to examine the association between socioeconomic factors, i.e. education, income and country of birth, and the prevalence, incidence and adherence to guidelines for antiasthmatic drugs. **Methods:** This registry study includes all Swedish citizens aged 25–44 years who redeemed at least one prescription of an antiasthmatic drug during 2010. Incidence and prevalence was calculated. The adherence to guidelines was studied using two defined quality indicators. Heavy users were also assessed. **Results:** Incidence for antiasthmatic drugs was 18.4 per 1000 person-years and the prevalence 50.9 per 1000 inhabitants. Previously untreated patients who redeemed fixed combination ranged from 45% to 49%. Patients who purchase long-acting beta-2-adrenoceptor agonists (LABA) without inhaled corticosteroid ranged from 43% to 59%. Six percent of the population was classified as heavy users. **Conclusion:** The study showed a high incidence and prevalence of asthma drug use with a poor adherence to guidelines for rational drug prescribing. Fixed combination as first line asthma treatment as well as purchasing LABA without concomitant ICS was more common in patients born outside Scandinavia. Heavy users of short-acting bronchodilators were associated with male sex, high age, low income levels and low levels of education.

Keywords

Asthma, drug utilization, economics, guidelines, prescribing, socioeconomic

History

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Introduction

Asthma is a common disease with an estimated 300 million individuals affected worldwide [1]. Although modern asthma medication is relatively safe and effective, still many patients fail to achieve acceptable asthma control [2]. There are evidence-based guidelines for treatment and clinical trials have shown that good asthma control can be reached by the majority of patients [3,4].

Socioeconomic status (SES) is strongly associated with morbidity as well as with health care utilization and expenditure [5–7]. Associations have also been described between SES and for example low income, ethnicity and incidence and prevalence of asthma [8,9]. A nationwide

Swedish study of the prevalence of drug use in relation to education showed a higher prevalence of asthma drug use in patients with low education [10]. In a study from Denmark [5], high levels of education and income were independently associated with the use of inhaled corticosteroids (ICS).

Previously, we have shown that there are large differences between different regions and primary health care centers in the utilization of asthma drugs [11,12]. Large differences in adherence to guidelines were also observed. There was a striking skewness in patients' purchases of prescriptions for inhaled beta-2-agonists, with 10% of the patients accounting for 52% of the total volume in defined daily doses (DDDs). A regression analysis showed that only 23% of the observed variation in antiasthmatic drug expenditure could be explained by asthma severity, disease-specific quality of life and clinical practice [11]. The extent of influence of socioeconomic factors on variations in the quality of pharmaceutical asthma treatment is hitherto unknown.

The aim of this study was to examine the association between SES of the patients, i.e. education, income and country of birth, and the prevalence incidence and adherence to guidelines of antiasthmatic treatment.

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Materials and methods

Study design

This was an observational longitudinal registry study including all Swedish citizens aged 25–44 years who redeemed at least one prescription of an antiasthmatic drug during 2010. Individual patient data on dispensed drugs for 2006–2010 were used in the different analyses. Only patients below 45 years of age were included in the study in order to minimize bias related to the diagnosis of the patient since antiasthmatic drugs also are used for the treatment of chronic obstructive pulmonary disease [12]. The lower age limit was set at 25 to get more reliable data on education and income level.

Data sources

Data were retrieved from different registers and linked through the patient's unique personal identity numbers [13]. Disposable income, education and country of birth were extracted from registers held by Statistics Sweden (SCB) (<http://www.scb.se>). Data on dispensed drugs were extracted from the Swedish Prescribed Drug Register [14]. This register was established in July 2005 and contains data on dispensed prescriptions in ambulatory care for the entire Swedish population (99.8% population coverage with patient identities). All pharmaceuticals in the register are classified according to the Anatomical Therapeutic Chemical classification system (ATC) [15]. To check if the patient still was alive, the Swedish National cause-of-death register, which comprise all death among Swedish inhabitants, was used [16].

Study subjects

The study population was defined as patients aged 25–44 years at year 2010 who had redeemed at least one prescription on antiasthmatic drugs, i.e. the ATC codes presented in Table 1, referred to as “all asthmatics.” Purchase of antiasthmatics has in the age group 25–44 years been shown to be a good proxy for having asthma [17]. Patients older than 44 were excluded in order to minimize inclusion of patients with chronic obstructive pulmonary disease (COPD). Only subjects alive and residing in Sweden during the period 1 January to 31 December 2010 were included. If data on education, disposable income or origin of birth were missing, the patient was excluded (1768 individuals).

Definition of variables

The incidence (per 1000 person-years) was assessed by identifying the first time users of antiasthmatics after a drug-free run-in period of 720 days (2 years) [18], i.e. patients were identified as incident users if they purchased antiasthmatic drugs in 2010 and had no prescriptions dispensed within the preceding 2 years. The period prevalence was assessed as the proportion of subjects in the Swedish population who dispensed antiasthmatic drugs in 2010, expressed as numbers of users per 1000 inhabitants (patients/1000 inhabitants).

Lorentz percentiles and Lorentz curves were used to evaluate the skewness of use of antiasthmatics [18]. The Lorenz curve is a graphical presentation with the cumulative proportion of subjects purchasing drugs on the *x*-axis and the cumulative proportion of the total volume in DDD on the *y*-axis. We analyzed the Lorenz 10th and 50th percentiles, i.e. the proportions of the total volumes purchased by the top 10% of users and by 50% of all users, respectively.

To analyze different factors associated with heavy use, we defined a heavy user as an individual dispensed more than 400 DDD during a year for short-acting beta-2 agonists (SABA), long-acting beta-2-adrenoceptor agonist (LABA), ICS and fixed combinations, respectively. We also analyzed the total amount of the asthma drugs with a cut-off of >400 DDD. As used in previous studies, subjects were categorized according to their annual cumulative consumption in DDDs [5]. DDD were categorized in four groups: 1–99, 100–199, 200–399 and ≥ 400 .

Socioeconomic factors

Educational attainment was classified into four categories, representing distinct levels in the Swedish educational system. The lowest educational level (level 1) was equivalent to 9 years or less in primary school. Level 2 was equivalent to 10–12 years at secondary school. Higher educational levels were divided into post-secondary education less than 3 years (level 3) and post-secondary education 3 years or more (level 4).

Equalized disposable income per consuming unit was defined as the income for a single family member after taxation and adjusted for the number of family members, herein referred as disposable income. It was divided into three levels related to the total income distribution in the data set (population): high (fourth quartile, more than €21 950), middle (second and third quartile, €12 400–21 800) and low

Table 1. Pharmacological groups included in the study (ATC codes)^a.

Pharmacological group	ATC
Any asthmatic drug category	R03AC or R03AK04-06-07 or R03BA or R03DC or R03DX05
Selective beta-2-adrenoceptor agonists	R03AC
SABA (short-acting beta-2 agonists)	R03AC02 and R03AC03
LABA (long-acting beta-2-adrenoceptor agonist)	R03AC12, R03AC13, R03AC18
Fixed combination	R03AK04 (0.3%) R03AK06 R03AK07
Inhaled corticosteroids (ICS)	R03BA
Leukotriene receptor antagonist	R03DC
Omalizumab (anti-IgE)	R03DX05

^aThe Anatomical Therapeutic Chemical classification system (ATC).

income (first quartile, lower than €12 500) [5]. Currency exchange rates from 31 December 2010. The median income for the whole study population was €16 850.

Country of birth was classified as Sweden, other Nordic country (Denmark, Finland, Iceland and Norway), Europe (excluding the Nordic countries) and the rest of the world (excluding Europe).

Quality indicators for drug treatment of asthma

The following indicators were used to assess the adherence to guidelines for rational prescribing of antiasthmatics [12,19,20]:

- Proportion of patients initiated on fixed combinations of LABA and ICS (R03AK) with no prior or concomitant purchase of antiasthmatics the preceding 2 years.
- Proportion of patients purchasing LABA who had not purchased any ICS (R03BA and/or R03AK) 2 years prior to the purchase. According to the current guidelines, asthmatics should not use LABA without concomitant anti-inflammatory treatment with ICS [20].

As other quality indicators, these measures do not reflect appropriate treatment for all patients but may be used to indicate areas for improvement [21].

Data analysis/statistics

Descriptive statistical values [mean, median, 95% confidence interval (CI) and range] were calculated. Crude comparisons

of the overall utilization as well as the performance on the indicators in relation to the socioeconomic factors were performed using a multiple linear regression model. Crude and mutually adjusted differences are presented together with 95% CIs. Logistic regression using crude and adjusted odds ratios were calculated, although only the adjusted ones and 95% CIs are presented. All calculations were made using SAS version 9.2 (SAS Institute, Cary, NC).

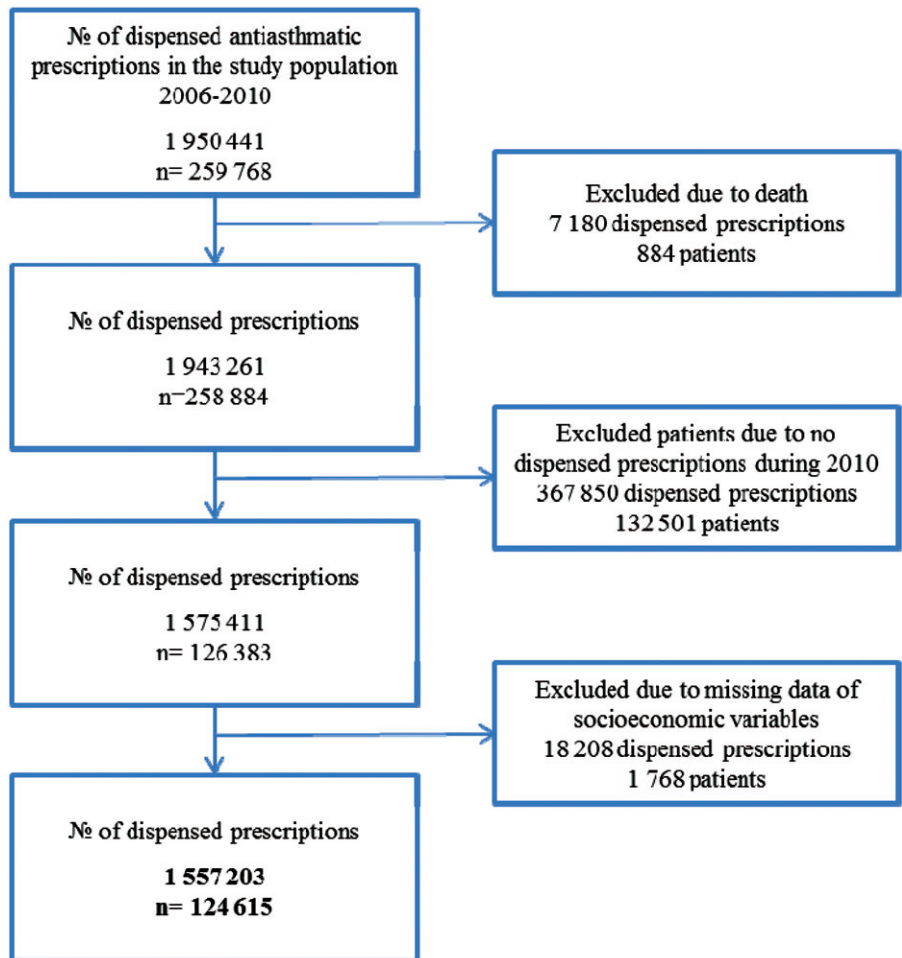
Ethics

The study was approved by the Ethics Committee of the Karolinska Institutet, Stockholm, Sweden (2007/1138-31, 2011/525-32, 2011/1001-32).

Results

A total of 1.95 million prescriptions of antiasthmatic drugs were dispensed to 260 000 individuals in Sweden, 2006–2010 (Figure 1, flowchart). For the associations between socioeconomic factors and antiasthmatic drug use, we excluded patients for which there were no valid socioeconomic data available. A total of 124 615 subjects (58% women) had at least one dispensed drug in 2010 and were included in the study (Figure 1). This corresponded to a total of 5.1% of the Swedish population, 4.2% of men and 6.0% of women in 2010. On average, patients redeemed 3.1 prescriptions with a median of 2 (range: 1–60) and a variance of 10.2 in 2010. The characteristics of the patients in the study is shown in Table 2.

Figure 1. Flow charts of the data process.



The most commonly used drugs were SABA, dispensed to 45% of all patients. This was followed by ICS (27%) and fixed combinations (18%). Six percent of all patients were dispensed LABA and 4% were other antiasthmatics. The proportion treated increased with age and the distribution between the different drugs was similar in all age groups (not shown). One third (32%) of the study population had only one prescription dispensed during the year. During the 5-year period, 2006–2010, 8% of all individuals had only one prescription of antiasthmatic drug dispensed, 71% of these prescriptions were SABA and 16% were ICS.

Incidence and prevalence

In 2010, the total incidence for antiasthmatic drugs was 18.4 per 1000 person-years and the prevalence was 50.9 per 1000 inhabitants (not shown). Women had an incidence and prevalence which was approximately 50% higher than men (Table 3).

The amount of drugs dispensed during the year varied considerably between patients (Figure 2). Similar proportions of high consumers were found for all the different

pharmacological groups with, for example, 10% of SABA users accounted for 40% of the redeemed volume and 10% of ICS users accounted for nearly 34% of the volume (Figure 2, Table 3).

Heavy users

Six percent of the study population was classified as heavy users of antiasthmatic drugs (>400 DDD), 68% of these were heavy users in SABA and 31% in both SABA and LABA (not shown). Heavy use of SABA appeared to be associated with male sex, high age, low education and income level but being born outside Scandinavia was associated with a lower risk for heavy use of SABA (Table 5). Low income was associated with heavy use of any of the studied drugs (Table 5). The results persisted after adjusting for the variables included. About 2% of the population was heavy users in more than one pharmacological group. Considering heavy users of fixed combination, our analysis showed no major difference between patients dispensed fixed combinations with formoterol compared with fixed combination with salmeterol (not shown).

Table 2. Characteristics for individuals in Sweden in the age interval of 25–44 years dispensed at least one antiasthmatic drug in 2010.

	Men (%)	Women (%)	Total (%)
Total number of subjects	52 274 (41.5)	72 341 (58.5)	124 615
Age			
25–29	19.1	19.4	19.3
30–34	22.6	21.8	22.1
35–39	27.6	27.3	27.4
40–44	30.8	31.5	31.2
Educational level			
1 (low)	11.5	9.9	10.6
2	51.4	43.5	46.8
3	14.6	14.9	14.8
4 (high)	22.5	31.7	27.8
Disposable income			
Low (First quartile)	20.5	28.3	25
Middle (Second and Third)	48.3	51.2	50
High (Fourth quartile)	31.2	20.5	25
Country of birth			
Sweden	87.6	86.4	86.9
Other Nordic countries	1.5	1.9	1.8
Europe apart from Scandinavia	3.3	3.5	3.4
Other countries excl. Europe	7.7	8.2	7.9

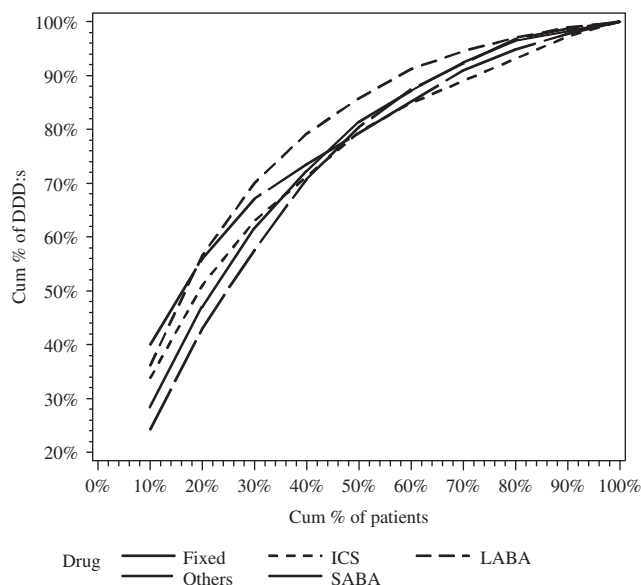


Figure 2. Lorenz curves for antiasthmatics dispensed in 2010. The graph shows the cumulative proportion of users of each drug that is accounted for by percentiles of individuals, ranked according to their annual drug consumption.

Table 3. Incidence, prevalence and Lorentz percentiles for antiasthmatic drugs dispensed in Sweden during 2010.

	Incidence ^a (per 1000 person-years)		Prevalence (per 1000 inhabitants)		Lorentz percentile ^b	
	Men	Women	Men	Women	10	50
Short-acting beta-2 agonist (SABA)	12.7	20.1	28.6	42.0	40.0	79.3
Long-acting beta-2 adrenoceptor agonist (LABA)	1.2	2.0	3.2	5.3	36.1	85.8
Inhaled corticosteroids (ICS)	7.2	11.4	16.2	25.6	33.8	79.5
Fixed combination	3.4	4.7	12.2	16.4	28.5	81.4
Others ^c	0.9	1.4	2.2	3.5	24.3	80.4
Total	14.7	22.2	41.8	60.3		

Study population aged 25–44 years.

^aIncidence was determined as the proportion of individuals in Sweden purchasing antiasthmatics during 2010 that had no prescriptions dispensed during the previous 2 years (washout period).

^bThe proportions of the total volumes purchased by the top 10% of users and by 50% of all users, respectively.

^cLeukotriene receptor antagonist (R03DC) and Omalizumab (R03DX05).

Quality indicators

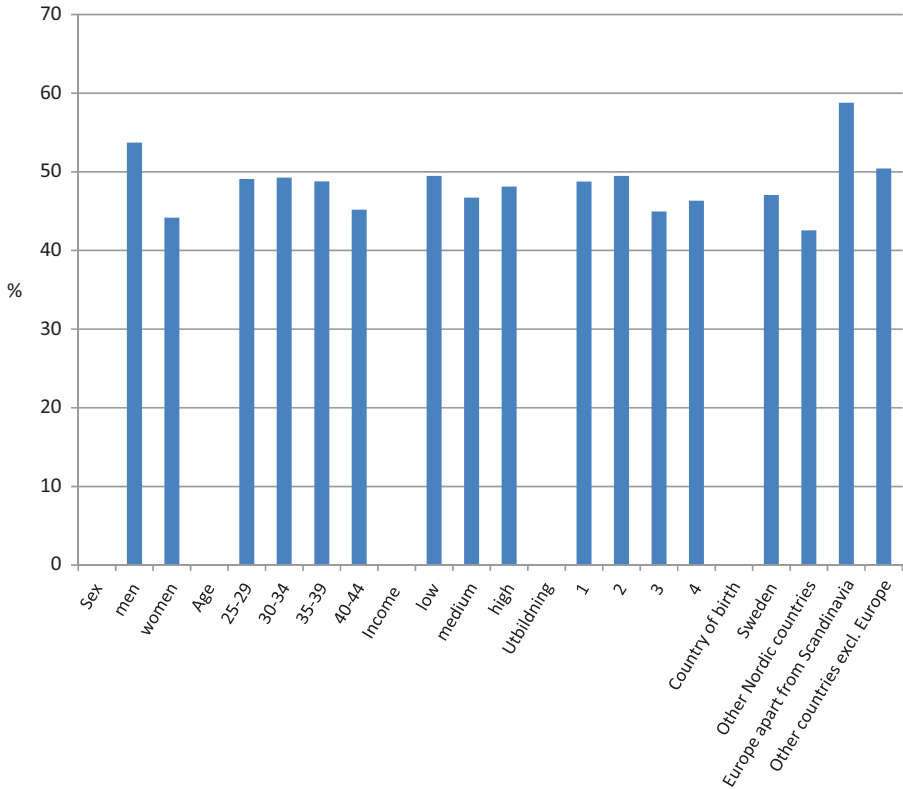
The proportion of previously untreated patients who redeemed prescriptions of fixed combination of LABA and ICS ranged from 45% to 49% regardless of age, income and educational level (Table 4). Patients born in countries other than Sweden started their asthma treatment with fixed

Table 4. Proportion of patients initiated on fixed combinations who had not been treated with other antiasthmatic drugs during the two preceding years.

	Proportion initiated on fixed combination without prior use of other antiasthmatics, % (95% CI)
Sex	
Men	49.23 (47.51–50.95)
Female	44.02 (42.52–45.52)
Age	
25–29	44.79 (42.09–47.49)
30–34	45.88 (43.41–48.35)
35–39	45.46 (43.32–47.6)
40–44	48.04 (46.08–50.0)
Disposable income	
Low	45.7 (43.68–47.72)
Medium	45.58 (43.57–47.59)
High	48.12 (46.46–49.78)
Educational level	
1	48.51 (45.16–51.86)
2	45.71 (44.04–47.38)
3	44.57 (41.67–47.47)
4	47.31 (45.14–49.48)
Country of birth	
Sweden	44.66 (43.42–45.9)
Other Nordic countries	54.41 (45.95–63.87)
Europe apart from Scandinavia	56.53 (51.46–61.6)
Other countries excl. Europe	52.75 (49.3–56.2)

By age, sex, education, disposable income and country of birth 2010.

Figure 3. Proportion of patients treated with LABA in 2010 that had not purchased any ICS prior (2 years) or concomitant in different groups according to age, sex, educational level, disposable income and country of birth, respectively.



combinations to a greater extent than patients born in Sweden (Table 4).

The proportion of patients who purchased LABA without prior or concomitant ICS was lower in women than in men and higher in patients born outside Scandinavia (Figure 3).

To examine whether different washout periods without any antiasthmatic drugs dispensed could influence the results, we made a sensitivity analysis using periods of 365, 540 and 720 days (not shown). Since no major differences could be detected, we chose 720 days (2 years) in the analyses.

Discussion

We assessed the associations between socioeconomic factors of patients and the prevalence and incidence as well as potentially irrational utilization patterns such as high use of bronchodilating treatment and poor adherence to guidelines for rational drug therapy.

Incidence and prevalence

We found an overall prevalence rate of 5.1% in the study population. This figure corresponds well to a recent review estimating the overall prevalence of asthma in adults at 5–7% in the total population [22]. The higher prevalence in women found in our study is also consistent with previous studies. Some studies have also shown that women with asthma seek care more often than men, and it is consequently more likely that they will receive a prescription [23,24].

Almost one third of all patients (32%) only purchased one prescription of antiasthmatics during 2010. The majority of these prescriptions were SABA. The reasons for only redeeming one prescription are unclear, since most adult asthmatics are believed to need daily maintenance treatment.

Table 5. ORs (adjusted) for different factors associated with heavy users, i.e. patients purchasing >400 DDD of antiasthmatic drugs during 2010.

	SABA (95% CI)	Fixed comb. ^a (95% CI)	LABA (95% CI)	ICS (95% CI)	Any of the drugs (95% CI)
Sex					
Men (reference)	–	–	–	–	–
Women	0.86* (0.78–0.95)	1.07 (0.98–1.17)	0.95 (0.75–1.22)	1.00 (0.88–1.12)	0.97 (0.93–1.00)
Age					
25–29	0.74* (0.63–0.87)	0.96 (0.83–1.11)	0.96 (0.63–1.44)	0.89 (0.73–1.08)	0.88* (0.83–0.93)
30–35 (reference)	–	–	–	–	–
35–39	1.08 (0.94–1.24)	1.20* (1.06–1.37)	1.20 (0.85–1.70)	1.38* (1.18–1.62)	1.16* (1.10–1.23)
40–44	1.27* (1.12–1.45)	1.44* (1.28–1.63)	1.25 (0.90–1.75)	1.59* (1.36–1.85)	1.40* (1.33–1.47)
Education level					
1	1.65* (1.47–1.86)	1.13 (0.99–1.30)	1.65* (1.17–2.33)	1.05 (0.87–1.27)	1.15* (1.06–1.22)
2 (reference)	–	–	–	–	–
3	0.56* (0.47–0.66)	0.89 (0.79–1.02)	0.82 (0.57–1.20)	1.03 (0.88–1.21)	0.93* (0.88–0.98)
4	0.35* (0.30–0.41)	0.96 (0.86–1.06)	0.90 (0.67–1.22)	1.12 (0.99–1.27)	0.91* (0.87–0.95)
Disposable income					
Low	1.35* (1.21–1.50)	1.18* (1.06–1.30)	1.32* (1.01–1.74)	1.20* (1.05–1.37)	1.13* (1.08–1.18)
Middle (reference)	–	–	–	–	–
High	0.88 (0.78–1.01)	0.90* (0.80–1.00)	0.74 (0.53–1.03)	0.95 (0.83–1.08)	0.96 (0.92–1.01)
Country of birth					
Sweden (reference)	–	–	–	–	–
Other Nordic countries	0.86 (0.61–1.21)	1.07 (0.80–1.45)	1.37 (0.63–2.96)	1.31 (0.95–1.82)	0.99 (0.87–1.13)
Europe apart from Scandinavia	0.38* (0.26–0.56)	0.69* (0.52–0.90)	0.62 (0.27–1.41)	0.56* (0.39–0.81)	0.52* (0.46–0.59)
Other countries excl. Europe	0.46* (0.37–0.57)	0.94 (0.81–1.10)	0.63 (0.35–1.11)	0.52* (0.40–0.67)	0.65* (0.61–0.71)

* $p < 0.05$. ^aNo significant differences in OR depending on the type of LABA in fixed combinations.

Atopic asthma only during the pollen season, i.e. springtime in Sweden, might be one explanation for periodic use. Other possible explanations are obstructive symptoms elicited by viral infections, or exercise or the use of antiasthmatics as a tool to diagnose obstructive airways disease. A fifth possibility is non-compliance, i.e. the treatment is used sporadically by the patient and not regularly as recommended.

We also made a comparison between the Swedish populations of the same age as our study population and found that the level of education, disposable income and proportion of foreign-born was in line with the Swedish population (<http://www.scb.se>).

Heavy users

High use of short-acting bronchodilators as needed is a marker of frequent symptoms, and patients exhibiting this pattern have an increased risk of severe asthma events [25]. We found that high use of short-acting bronchodilators was associated with male sex, high age, low income levels and low levels of education, indicating that more efforts are needed in order to improve asthma control in patients with these characteristics. Interestingly, a similar pattern was seen for high use of LABA and fixed combination, possibly reflecting the fact that formoterol can also be used as needed since it has a quick onset of bronchodilating action, and that some patients use a fixed combination of formoterol and budesonide both as maintenance and reliever medication. However, our analysis showed no major difference between patients dispensed fixed combinations with formoterol compared with the fixed combination with salmeterol. The relation between low disposable income and purchase of ICS may be caused by more severe disease, irrational use, poor inhalation technique, etc. This was not further investigated.

Utilization

There were large differences between individuals in the amounts of asthma drugs purchased. This is in concordance with other studies [5]. In this study, 10% of the SABA users accounted for 40% of the redeemed volume. This disproportionate utilization pattern may be expected since asthma severity and exacerbation frequency may differ substantially between patients [26]. Furthermore, some patients may purchase large amounts of SABA as rescue medication in order to deposit it in different places, such as at home, at work, in the gym bag, etc. It was surprising, though, that similar disproportions were found for ICS and fixed combinations. This may indicate an irrational use of drugs such as inadequate inhalation technique or that ICS are used sporadically rather than for regular maintenance treatment as recommended. The disproportionate utilization pattern may, however, also be a consequence of patients adapting their purchase patterns in order to minimize their co-payment. In Sweden, there is a uniform national ceiling on the total amount that a patient could pay for all medicines during a 12-month period for subsidized drugs (SEK 1800, year 2010; <http://www.tlv.se>). All prescriptions are valid for 1 year from the date of issue unless otherwise stated and most prescriptions for chronic treatment can be redeemed several times. The reimbursement system requires patients not to redeem new drugs until two-thirds of the previously redeemed amount is expected to have been consumed and patients are allowed to purchase a supply for a maximum of 3 months each time they visit the pharmacy. However, this is difficult for the pharmacist to estimate for antiasthmatic drugs, considering the large individual variation in dosage. Thus, there is a potential to purchase larger amounts than needed in periods when the threshold for complete reimbursement has been reached.

Quality indicators

In our previous study [12], large regional differences in the percentage of patients' dispensed fixed combination as their first antiasthmatic treatment were seen. In fact, when addition of LABA has been studied in such an unselected patient population, no clinical benefit compared with placebo has been shown [27]. In the clinical setting, severe symptoms may cause physicians to prescribe fixed combinations. Nevertheless, according to the national guidelines, fixed combination of LABA and ICS should not be tried until patients fail to reach asthma control on regular ICS and SABA as needed. It seems as though more patients born outside Sweden get fixed combination as their first antiasthmatic treatment. It may be that foreign-born patients who seek care present with more serious symptoms or that non-compliance is feared due to, for example, language difficulties and therefore, they get fixed combination as first line therapy.

Also, we found that a large percentage of the patients were dispensed LABA without any prior dispensing of ICS. This is a potential safety hazard, since LABA in monotherapy can mask symptoms without treating the underlying inflammation. It has been associated with increased risks of severe events linked to asthma [28]. National guidelines advice against such use, even though formoterol is sometimes used as a reliever medication. According to the Swedish guidelines for the treatment of asthma in adults [20], leukotriene receptor antagonists are recommended as add-on therapy to ICS but not instead of ICS. Thus, leukotriene receptor antagonists are not included in this quality indicator.

Patients born outside the Nordic countries seemed to buy LABA without concomitant ICS to a larger extent than patients born in Sweden. The proportion of men redeeming prescriptions of LABA but not purchasing ICS was also larger than the proportion of women exhibiting the same pattern. Whether these groups redeemed prescriptions of LABA without concomitant ICS as a result of non-compliance, or if doctors have different prescribing patterns, depending on the patients' gender or origin needs to be further investigated. It is noteworthy that patients born in other countries do not seem to get asthma treatment according to the guidelines to the same extent as inborn Swedish patients. This puts patients born in other countries at increased risk of not getting optimal pharmacological treatment, and in the case of purchasing LABA without concomitant ICS, it raises serious safety concerns [28–30]. Concerning these two measures of purchasing antiasthmatics according to the guidelines, the observed differences in this study could not be explained by the patients' level of education or income. This was contrary to our expectations, since previous studies have shown correlations with level of education and income [5,31].

The strengths of this study are that the data are based on the Swedish Prescribed Drug Register, which is one of the largest population-based databases on dispensed drugs in the world [32]. Moreover, a sensitivity analyses on the length of the washout period to identify incident patients were conducted. A limitation of the study is the lack of indication or diagnosis in the registries. Also that dispensing is not the same as prescribing nor is it the same as consumption. For instance, patients may use asthma medication prescribed

to other family members or not use the purchased medication. Another limitation may be that the variable of education may not contain all the education data for persons who received their education outside Europe. Also the variable of income is difficult to analyze and compare. We have used the most common variable in Swedish studies, disposable income.

Conclusion

We found an annual incidence of antiasthmatic drug use of 1.5% and an overall prevalence rate of 5.1% in the Swedish population. Poor adherence to guidelines for asthma treatment, such as fixed combination as first line asthma treatment or purchasing LABA without concomitant ICS was more common in patients born outside Scandinavia. Heavy use of short-acting bronchodilators was associated with male sex, high age, low income levels and low levels of education. Thus, socioeconomic factors of the patients influenced the pattern of redeemed anti-asthmatics.

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Declaration of interest

The authors declare that they have no conflict of interest.

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