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Asthma prescription patterns for children: can GPs do better?

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ABSTRACT

Background: Assessing prescription patterns of asthma medication for children is helpful to optimize prescribing by general practitioners (GPs). The aim was to explore prescription patterns in children with physician-diagnosed asthma and its determinants in general practice. **Methods:** We used the Second Dutch National Survey of General Practice (DNSGP-2) with children aged 0–17 years registered in 87 general practices. All children with at least one asthma prescription were included (n = 2993). Prescription rates and prescription of continuous (≥ 3 prescriptions/year) versus intermittent asthma medication were calculated. Data, including several GP characteristics, were analysed using multivariate logistic regression accounting for clustering within practices. **Results:** During one year, 16% of the children with physician-diagnosed asthma (n = 3562) received no asthma medication. Of the 2993 children with asthma receiving asthma medication (on average 2.9 prescriptions/year), 61% received one or two prescriptions, 39% received three or more. Continuous medication with a bronchodilator and/or a corticosteroid was prescribed in 22% of these children. One out of 5 children receiving continuous medication was prescribed a bronchodilator only. In 7.5% of the prescriptions, asthma medications other than bronchodilators or corticosteroids were prescribed. Prescribing asthma medication varied widely between practices, but none of the children and GP determinants had an independent effect on prescribing continuous versus intermittent medication.

Conclusion: In general practice, the annual number of asthma prescriptions per child with asthma is relatively low. One in 20 children is prescribed bronchodilators only continuously, indicating room for improvement. Child and GP characteristics cannot be used for targeting educational efforts.

INTRODUCTION

Patterns of medication for children with asthma have changed over the last 20 years and many related guidelines have been issued. The Global Initiative for Asthma (GINA) recommended a stepwise approach with different asthma medications based on control of the asthma symptoms (1). The guidelines for childhood asthma issued by the Dutch College of General Practitioners correspond with the GINA guidelines (2,3). In these guidelines, bronchodilators (reliever medication) and corticosteroids (controller

medication) play the most important role in treating children with asthma in general practice. Nowadays, inhaled medications are preferred because they deliver the active agent directly to the airways (1–3). Antibiotics and cromones are not recommended for the treatment of childhood asthma in general practice (4–8).

Before the age of six years, it is not possible to make a firm diagnosis of asthma (9,10). Therefore, most asthma guidelines make a distinction between asthma therapies for children younger than versus older than six years of age, respectively. However, one study showed that at most 50% of all children receiving asthma medication had a registered diagnosis of asthma; and, that asthma medication is frequently prescribed at an early age to children who at an older age do not have asthma (11). In addition, a larger variation in general practitioners' (GPs) prescription patterns is reported for children younger than six years compared with older children (12).

In the aim to develop effective strategies to optimize the prescribing of asthma medication for children with physician-diagnosed asthma (13), the present study examined prescription patterns of asthma medication by GPs and the possible effect of children's age on this pattern. Furthermore, we studied whether differences in characteristics of GPs and children were related to prescription of intermittent and continuous asthma medication

METHODS

Second Dutch National Survey of General Practice

Data used in this study were derived from the most recent nationwide study DNSGP-2, conducted in 2001 by the Netherlands Institute for Health Services Research (NIVEL) (14). During a one-year registration period, 195 GPs in 104 practices throughout the Netherlands participated in the data collection. In the Netherlands, general practices have a fixed patient list, all inhabitants are listed in a general practice, and GPs have a gate-keeping role for specialized care. The patients enlisted in the participating practices were comparable to the general Dutch population with respect to age, gender, and type of health care insurance. The participating GPs constituted a representative sample of the total population of Dutch GPs according to age of the GP, region, and location of the practice (rural/urban); the only exception was that single-handed GP practices were under-represented (14).

During the registration year, GPs (who were intensively trained in medical coding) recorded data on all contacts, including face-to-face consultations, telephone contacts and repeat prescriptions. When a patient presented two health problems within one consultation, these were coded separately. GPs were instructed to code contact diagnoses according to the International Classification of Primary Care (ICPC) and medical drug prescriptions were coded according to the Anatomical Therapeutically Classification (ATC) coding system (15,16). In the registration year, for all 79 272 listed children (aged 0–17 years) the GPs issued 146 816 prescriptions. This study was carried out according to Dutch legislation on privacy.

Present study

For the present analysis, data from 17 practices were excluded: in 9 practices data were incomplete and in eight practices less than 20 asthma prescriptions for children were issued during the registration year - we assumed that GPs had failed to adequately record the ICPC code R96 (asthma). From the remaining 87 practices (174 GPs), data of all children (0–17 years) with physician-diagnosed asthma (ICPC R96) were selected. No attempts were made to validate this diagnosis.

Patients

Data on all 2993 children with a diagnosis of asthma, who received at least one prescription for asthma medication during the consultation, were included in the analyses. The number of contacts resulting in a prescription related to asthma was used to assess the proportion of children who used asthma medication, and to assess the prescription patterns of the GPs. We classified the children in two age groups (0–5 and 6–17 years) and by sex.

GPs' characteristics

Characteristics of all GPs were obtained through a mailed questionnaire. Data were collected on age, sex, degree of urbanisation (rural versus urban), single-handed practice or not, practice size (number of listed patients), workload (number of patients per full-time equivalent GP), self-reported use of national guidelines (once a week or less versus more than once a week), whether they were involved in GP training, seeing pharmaceutical representatives, and reluctance to prescribe newly introduced drugs (entirely disagree and disagree versus hesitation, agree and entirely agree).

Prescribed medication

For the registration period, we calculated the number of children receiving (a) bronchodilators only (ATC: R03A, R03CC); (b) corticosteroids only (ATC: R03BA, H02AB); (c) the exclusive combination of bronchodilators and corticosteroids; and (d) other respiratory medication only (i.e. without bronchodilators and/or corticosteroids). We considered distinguishing between short-acting and long-acting bronchodilators, but preliminary data-analysis revealed that the latter constituted only about 5% of prescribed bronchodilators. Therefore, these two categories were combined. Asthma medication prescription pattern was classified as intermittent (one or two per year) or continuous (≥ 3 per year).

Data analysis

The prescription pattern was analysed for all children (0–17 years) and for the two age groups (0–5 years and 6–17 years) separately.

To assess which GP characteristics were associated with prescribing continuous asthma medication, alternating logistic regressions (ALRs) were used to estimate the associations of interest (17). ALR alternates between generalized estimated equations (GEE) to estimate the effect of the potential risk factors adjusted for the effect of clustering at the practice level, and logistic regression analysis to estimate the pair-wise odds ratios (ORs) between 2 children that belong to the same practice. In this way, we corrected for possible clustering of children within practices.

RESULTS

Overall prescription rates for asthma in children

During the one-year registration period the diagnosis asthma was recorded for 3562 children attending the participating general practices (4.3% of all children 0–17 years). Of these, 16% ($n = 569$) received no prescription during one year despite an asthma diagnosis and 84% ($n = 2993$) received at least one prescription for asthma. During 6686 contacts with these children, a total of 8740 prescriptions were issued; 3798 for children aged 0–5 years and 4942 for children aged 6–17 years. The mean number of prescriptions for asthma per child/per annum was 2.9 (median 2, range 1–27 per child/annum); 2.7 in the younger age group and 3.1 in the older age group, respectively. Of the 2993 children receiving an asthma prescription, 36% received only one prescription, 25% received two, and 39% received three or more prescriptions.

Medication types

Table I shows, which types of asthma medication were prescribed by the GPs in contacts with children with asthma by age category (0–5 and 6–17 years) and by sex. Of all 6 686 contacts that resulted in an asthma prescription, a bronchodilator was prescribed in 53% and a corticosteroid in 51%. Antibiotics were prescribed in 4% and anticholinergics, leukotriene antagonists (LTRAs), mucolytics and cromones were seldom prescribed.

[TABLE 1]

In the younger age group, less bronchodilators (47% versus 57%, respectively; $P < 0.001$) but more corticosteroids (56% versus 48%, respectively; $P < 0.001$) were prescribed as compared to the older age group. Antibiotics (4.9% versus 2.6%) and anticholinergics (3% versus 1.2%) were relatively frequently prescribed to children less than six years of age versus older children ($P < 0.001$).

Variation in medication types between general practices

Taking into account the proportion of children prescribed a bronchodilator alone; the distribution of practices had a 25th percentile, median and 75th percentile of 19%, 28% and 36%, respectively. Related data for corticosteroids alone were 11%, 18% and 24%, respectively, and for the combination of a bronchodilator and a corticosteroid 5%, 9% and 15%, respectively.

Prescribing intermittent or continuous asthma medication

Table II shows the type of asthma prescription, intermittent (1–2 prescriptions/year) and continuous (≥ 3 prescriptions/year) prescribed for children aged 0–5 years and 6–17 years during the registration period.

[TABLE 2]

Combining the data for intermittent and continuous medication, a bronchodilator only was prescribed in 35% of the children ($n = 2993$), a corticosteroid only in 24%, a combination of bronchodilator and corticosteroid in 33%, and in 7.5% of the children only other respiratory medication (i.e. without a bronchodilator and/or corticosteroid) was prescribed.

Overall, medication was prescribed continuously in 22% of the children. In 1 in 5 of these, 4.4% of all children, only bronchodilators were prescribed.

Younger children (0–5 years) less frequently received a ‘bronchodilator only’ prescription for continuous use than older children (boys 1.9% versus 5.1%, $P < 0.001$; girls 3.2% versus 6.9%, $P < 0.001$); for continuous ‘corticosteroid only’ prescriptions no differences were found.

GP characteristics

Table III presents data on the general practices. The mean age of the GPs was 46 years, most were male (76%), and the majority (62%) had a practice in an urban area. Two-thirds trained GP trainees; in most practices GPs saw pharmaceutical representatives, and most GPs (88%) were reluctant to prescribe new drugs.

[TABLE 3]

Determinants for intermittent or continuous bronchodilator or corticosteroid prescription

Multivariate logistic regression showed that none of the child or GP characteristics had an independent effect on prescribing intermittent versus continuous medication in children with asthma (Table IV). The ORs were estimated for both age groups separately. Except for a very small effect (OR = 1.01) for prescribing continuous asthma medication by male versus female GPs in children aged 6–17 years, no differences in determinants were found.

[TABLE 4]

DISCUSSION

During the one-year registration period, over 60% of the children received only one or two prescriptions for asthma. In over 50% of the prescriptions the GP prescribed a bronchodilator or a corticosteroid; in only 7.5% of the children other types of respiratory medication were prescribed. In accordance with the Dutch GP Guideline (3), the proportion of prescribed antibiotics, mucolytics and cromones was very small. In

22% of all children, bronchodilator or corticosteroids were prescribed by the GPs on a continuous basis. A bronchodilator only was prescribed continuously in almost 5% of the children. None of the child or GP-related determinants had an independent effect on prescribing intermittent or continuous medication.

Strengths and limitations of this study

The present study used data derived from the DNSGP-2 (14). The strength of this unique representative study is that it provides information on a relatively large group of children, and their GPs, in a country in which GPs act as gatekeepers to secondary care, and appropriate guidelines are disseminated. Therefore, our results can be assumed to represent the daily prescription behaviour among Dutch GPs for childhood asthma.

Although the data we used are several years old, we do not believe this is a major limitation. The outcome would not differ greatly when more recent data would have been available.

A possible limitation is the exclusion of GPs who failed to record adequately the ICPC code asthma specifically in children. It is known that some GPs are reluctant to label symptoms as asthma; however, despite the immaturity of the diagnosis asthma, medication is often prescribed (11). These children with potential asthma, but without physician-diagnosed asthma, were not included in the present study and enabled us to study a more homogenous population.

Alternatively, in the present study an asthma diagnosis as registered by the GP was accepted as a valid diagnosis. However, this may not accurately reflect the actual number of asthmatic children in the study population, because some GPs may make the diagnosis asthma too easily or provisionally label the child as asthmatic. This is supported by the fact that some children received only one prescription during a whole year, and 16% received no medication despite an asthma diagnosis.

The registration period for asthma medication was set at one year and the prescription pattern within this time frame was analysed. However, prescriptions issued shortly before the registration period may have affected subsequent prescribing.

Interpretation

In the present study 3798 prescriptions were issued for all children with asthma aged 0–5 years, and 4942 prescriptions for the larger group of children with asthma aged 6–17 years. The mean number of prescriptions in the older age group (3.1) was higher than in the younger age group (2.7). This relatively large amount of prescriptions in the older age group could be explained by the higher proportion of established asthma diagnoses (18).

GPs generally treat children with mild or moderate asthma (1,19). In the present study, this is supported by the large amount of children with only one or two prescriptions. The current guidelines recommend a two-step approach for asthma medication: start with a bronchodilator and add a low-dose inhaled corticosteroid when symptoms have failed to disappear or have worsened (1–3). Single prescriptions, which could be tentative, were more common for bronchodilators (72%) than for corticosteroids (54%). Most prescriptions were for a bronchodilator only (31%), corticosteroid only (18%) and a combination of both (21%) for children with asthma of all ages and sex. These percentages are similar to those found in Germany (20).

Inhaled corticosteroids are the most effective asthma ‘controller’ drugs in children and the cornerstone for continuous asthma medication (1–3). The continuous asthma medication group in our study consisted of a high proportion of corticosteroids alone and in combination with bronchodilators (80%). In the light of current asthma guidelines (1–3), prescribing bronchodilators alone in 20% of the children with continuous asthma medication (4.4% of all children) is unexpectedly high and suggests room for improvement. This finding of relatively high number of continuous bronchodilator prescriptions was also found in two recent primary care studies in the UK (21,22). Most likely, these children also need inhaled corticosteroids.

Furthermore, one would expect older children to have a clearer diagnosis of asthma, and therefore, receive more corticosteroids continuously than children aged 0–5 years (11,12,22,23). However, in the present study only a small difference was found (18.2% versus 16.9%).

In the methods section, we already mentioned the very low proportion of long-acting bronchodilators (LABAs) in the bronchodilator group. The evidence for the effectiveness of using LABAs in children with asthma in primary care is lacking (1,2).

At the time of our study, leukotriene receptor antagonists (LTRAs) were not used widely, which is however, in line with a recent study in primary care in the UK (24). LTRAs provide clinical benefit in children but generally less than low dose corticosteroids (25,26).

Since asthma guidelines have long been available, we expected that medication other than bronchodilators and corticosteroids would be prescribed in a minority of cases (1–3). Indeed, in only 7.5% of the children was ‘other’ medication prescribed for asthma, with a low percentage (3.5%) for antibiotics.

Age and sex of the child had no independent effect on prescribing continuous versus intermittent bronchodilator and/or corticosteroid medication. Our finding that sex was not associated with prescribing continuous asthma medication is in contrast to other reports (20,27).

We also expected GP determinants to be associated with prescribing continuous asthma medication. Zuidgeest et al., found the variation in prescribing patterns among GPs for children less than six years of age to be higher than for older children (12). The results of the present study imply that GP characteristics cannot be used for targeting education on prescription patterns.

Implications for clinical practice and research

It is noteworthy that during the one-year registration period many GPs issued only one or two asthma prescriptions per child. Future studies should establish whether these children do in fact need only one prescription, or whether they are undertreated and might benefit from more prescriptions, or from a combination of a bronchodilator and a corticosteroid.

The wide variation in prescribing behaviour between general practices also needs further investigation. Prescribing a bronchodilator as continuous medication is not recommended by any guideline. GPs should be aware of this type of over-prescribing in the asthmatic child.

CONCLUSIONS

In conclusion, the present study shows that in general practice the number of prescriptions per child issued for asthma is relatively low. The prescribing behaviour for bronchodilators and corticosteroids varies widely. 20% of children receiving continuous prescriptions were prescribed bronchodilators only (4.4% of all children), indicating room for improvement. No specific child or GP characteristics, useful for targeting education on prescription patterns, were identified.

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[TABLES]

Table I. Types of asthma medication prescribed in 2993 children with asthma (aged 0–17 years) in 6686 contacts resulting in a prescription for asthma (%)

Age group	0–5 years			6–17 years			All Total
	Boys	Girls	Total	Boys	Girls	Total	
Sex							
Total number of contacts	1850	1086	2936	2023	1727	3750	6686
Type of asthma medication							
Bronchodilators	47.6%	46.0%	47.0%	55.4%	59.4%	57.2%	52.8%
Corticosteroids	57.0%	53.8%	55.8%	49.6%	46.0%	48.0%	51.4%
Antibiotics	4.9%	5.0%	4.9%	3.0%	2.1%	2.6%	3.6%
Anticholinergics	2.9%	3.1%	3.0%	1.1%	1.3%	1.2%	2.0%
Leukotriene antagonists	0.2%	0.3%	0.2%	1.0%	1.1%	1.0%	0.7%
Mucolytics	0.4%	0.5%	0.4%	1.0%	0.5%	0.7%	0.6%
Cromones	0.3%	0.3%	0.3%	0.2%	1.2%	0.6%	0.5%

Sum of proportions > 100%, because during a consultation more than one prescription could be issued.

Table II. Type of asthma prescription for children with asthma aged 0–5 years ($n = 1398$) and 6–17 years ($n = 1595$) during a one-year registration period.

Age	0–5 years			6–17 years			All Total
	Boys	Girls	Total	Boys	Girls	Total	
Sex	$n = 860$	$n = 538$	$n = 1398$	$n = 876$	$n = 719$	$n = 1595$	$n = 2993$
Number of prescriptions							
1			38%			35%	36%
2			26%			23%	25%
3			36%			41%	39%
Prescription type							
Intermittent medication (1 or 2 prescriptions per medication type)							
Bronchodilators only	31.7%	32.3%	31.9%	30.4%	30.2%	30.3%	31.0%
Corticosteroids only	20.1%	21.2%	20.5%	17.4%	15.3%	16.4%	18.3%
Bronchodilators + corticosteroids	22.2%	18.6%	20.8%	22.0%	20.9%	21.5%	21.2%
Continuous medication (≥ 3 prescriptions per medication type)							
Bronchodilators only	1.9%	3.2%	2.5%	5.1%	6.9%	6.0%	4.4%
Corticosteroids only	6.3%	6.7%	6.4%	5.0%	5.2%	5.1%	5.7%
Bronchodilators + Corticosteroids ^a	11.4%	9.1%	10.5%	12.9%	13.3%	13.1%	11.9%
Only other respiratory medication ^b	6.4%	8.9%	7.4%	7.2%	8.2%	7.6%	7.5%

^a ≥ 3 prescriptions bronchodilators and/or ≥ 3 prescriptions corticosteroids.

^bi.e. without bronchodilators and/or corticosteroids.

Table III. Characteristics of 174 general practitioners (GPs) in 87 general practices.

Mean age, years (SD)	46.5 (5.5)
Male sex	76.3%
Urban	62.1%
Single-handed practice	49.1%
Practice size, mean (SD)	4272 (2333)
Workload (number of patients per full-time equivalent GP) (SD)	2666 (481)
Consulting general practice national guidelines more than once a week	52.7%
GP trainer	67.1%
Seeing pharmaceutical representatives	74.1%
Reluctant to prescribe new drugs	88.2%

Table IV. Relation between GP and child determinants and prescribing continuous asthma medication (≥ 3 prescriptions/year) for children with asthma aged 0–17 years ($n = 2993$). Multivariate logistic regression analysis.

	Children 0–5 years ($n = 1398$)		Children 6–17 years ($n = 1595$)	
	OR (95% CI)	<i>P</i> -value	OR (95% CI)	<i>P</i> -value
Child's characteristics				
Age of child	1.07 (0.99–1.17)	0.09	0.99 (0.95–1.03)	0.78
Female child	0.99 (0.69–1.29)	0.95	1.13 (0.85–1.41)	0.33
GP's characteristics				
Age of GP	1.00 (0.96–1.05)	0.56	0.98 (0.95–1.02)	0.34
Male GP	1.00 (0.99–1.01)	0.06	1.01 (1.00–1.01)	0.02
Urban practice	1.17 (0.98–1.38)	0.16	1.08 (0.94–1.22)	0.23
Single-handed practice	1.41 (0.96–2.61)	0.15	0.73 (0.53–1.15)	0.09
Workload (1000 patients/fte)	1.00 (0.99–1.01)	0.82	1.00 (0.99–1.01)	0.94
Consulting national guidelines > 1/week	1.00 (0.99–1.01)	0.99	0.99 (0.99–1.01)	0.89
GP trainer	1.00 (0.99–1.01)	0.21	1.00 (0.62–1.38)	0.99
Seeing pharmaceutical representatives	1.00 (0.99–1.01)	0.38	1.00 (0.99–1.01)	0.94
Reluctant to prescribe new drugs	1.00 (0.99–1.01)	0.38	1.00 (0.99–1.01)	0.10

Odds ratio, OR; fte, full-time equivalent GP.