

Overdiagnosis of asthma in children in primary care:

a retrospective analysis

Abstract

Background

Asthma is one of the most common chronic diseases in childhood. According to guidelines, a diagnosis of asthma should be confirmed using lung function testing in children aged >6 years. Previous studies indicate that asthma in children is probably overdiagnosed. However, the extent has not previously been assessed.

Aim

To assess the extent and characteristics of confirmed and unconfirmed diagnoses of asthma in children who were diagnosed by their GP as having asthma or who were treated as having asthma.

Design and setting

Retrospective analysis in four academic primary healthcare centres in Utrecht, the Netherlands.

Method

Routine care registration data of children aged 6–18 years who received a diagnosis of asthma or were treated as having asthma were analysed.

Results

In only 16.1% ($n = 105$) of the children diagnosed with asthma was the diagnosis confirmed with spirometry, whereas in 23.2% ($n = 151$) the signs and symptoms did give rise to suspected asthma but the children should have undergone further lung function tests. In more one-half (53.5%, $n = 349$) of the children the signs and symptoms made asthma unlikely and thus they were most likely overdiagnosed. The remaining 7.2% ($n = 47$) were probably correctly classified as not having asthma. The main reasons for classifying asthma without children undergoing further lung function tests were dyspnoea (31.9%, $n = 174$), cough (26.0%, $n = 142$), and wheezing (10.4%, $n = 57$).

Conclusion

Overdiagnosis of childhood asthma is common in primary care, leading to unnecessary treatment, disease burden, and impact on quality of life. However, only in a small percentage of children is a diagnosis of asthma confirmed by lung function tests.

Keywords

asthma; children; diagnosis; guidelines; respiratory function tests; spirometry.

INTRODUCTION

Asthma is one of the most common chronic diseases in childhood and affects 5–10% of all children in the general population.^{1,2} A study conducted in the US in an at-risk population showed an asthma incidence rate among children aged 5–11 years and 12–17 years, respectively, of 11.1 and 4.4 out of 1000 children per year.³

International guidelines state that a combination of a suggestive medical history, physical examination, lung function tests, and additional tests will provide the information needed to ensure a correct diagnosis of asthma.^{2,4–6} Until the age of 6 years, asthma is a symptom diagnosis, because pulmonary function tests cannot be performed in children under this age. Assessment of lung function is regarded as essential for the diagnosis and therefore advised in all asthma guidelines to ensure a correct diagnosis, because signs and symptoms alone are insufficient.⁷ A study in the US found that 75% of family physicians perform spirometry on children. Surprisingly, only 36% of them indicate routine use to establish an asthma diagnosis as recommended by national guidelines.⁸

In the Netherlands lung function tests on children are not often performed because patients have to be referred to a hospital for the tests. This causes an extra barrier for GPs to complete a diagnosis of asthma. This is believed to lead to inaccuracy when detecting asthma in primary care in daily

practice, leading to overdiagnosis of the condition.

Previous studies have indicated that asthma is overdiagnosed in children. However, the scale of this overdiagnosis has not been quantified.^{9–11} Overdiagnosis gives rise to overprescription and incorrect use of medication, and to anxiety in parents and children. Therefore, the aim of this study was to assess whether the diagnosis of asthma and/or asthma treatment in children is preceded by the correct diagnostic process for asthma as recommended in international guidelines.

METHOD

Study population

Data were extracted from the medical files of children enlisted in the four academic primary healthcare centres in Utrecht, which are linked to the University Medical Center Utrecht. When data in the electronic medical files were incomplete, data were instead extracted from the paper medical records from health centres where patients were enlisted previously. Data on medication were obtained from the four pharmacies associated with the participating healthcare centres.

Patients were included who were aged 6–18 years on 15 April 2013 and who had received a diagnosis of asthma or were treated as having asthma with chronic inhalation medication. The asthma diagnosis was considered established when the International Classification of Primary

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How this fits in

Previous studies have indicated that asthma in children is probably overdiagnosed. The extent to which this occurs has not previously been assessed. This study is the first to investigate whether an asthma diagnosis and/or treatment given to children is preceded by a diagnostic process as recommended in the guidelines. It shows the need to follow the correct diagnostic strategy when diagnosing asthma in children.

Care (ICPC) code for asthma (ICPC R96) was applied. A child was defined as using chronic inhalation medication when the prescription was filled by the pharmacy at least three times in the last 3 years. Note that one prescription contains enough medication to last for 3–6 months. Therefore children who are only in need of inhalation medication during the winter months would have sufficient medication with one prescription.

Data collection

The following data were collected from the medical files of each patient: age, sex, presence of the diagnosis asthma (ICPC R96), year in which diagnosis was given, whether the diagnosis was established according to the guidelines, number of episodes referred to by a GP as asthma exacerbation in 2012, use of chronic inhalation medication, type of medication, and the number of inhalation medication prescriptions in 2012.

Asthma diagnosis

Confirmed asthma. Asthma diagnosis was benchmarked by comparison with international guidelines.^{2,4–6} The asthma diagnosis for children aged >6 years was considered confirmed in case of recurrent dyspnoea or wheezing, with reversible bronchial obstruction confirmed with spirometry and, when needed, additional tests, such as a histamine challenge test, carried out by a pulmonary specialist.

Probable asthma. Children with a high probability of asthma based on a suggestive medical history and physical examination during an exacerbation, but without further lung function tests, are considered to probably have asthma. Furthermore, children who use chronic inhalation medication and do not have an asthma exacerbation could have properly regulated asthma. Therefore children who are in need of chronic inhalation corticosteroids or

who need beta-2 sympathomimetic drugs from the pharmacy at least three times a year were considered as having probable asthma.

Unlikely asthma. Children who did not have an exacerbation and used no or very little inhalation medication, no inhalation corticosteroid, and a maximum of two beta-2 sympathomimetic inhalers yearly were considered as unlikely to have asthma.

No asthma. Asthma was ruled out by a pulmonary specialist based on medical examination, physical examination, lung function tests, and a histamine provocation test.

Overdiagnosis. Children were classified as having an overdiagnosis if they were given the diagnosis asthma (ICPC R96) and fall in the 'unlikely asthma' or 'no asthma' group.

Symptom diagnosis asthma. Children aged <6 years, who cannot perform a spirometry, are given a symptom diagnosis. This symptom diagnosis should be reviewed when a child turns 6 years old. When this is not reviewed, a child will not be correctly diagnosed with asthma according to the guidelines.

Statistical analysis

Statistical analysis was performed using SPSS for Windows (version 20). For descriptive statistics, frequency tables and mean \pm standard deviation were used.

RESULTS

Study population

There were 4960 children aged 6–18 years enlisted in the four participating academic primary health care centres in Utrecht. Of these, 546 had the ICPC code for asthma. Another 106 children were included based on their use of chronic inhalation medication without the ICPC code for asthma, to give a total of 652 children. General characteristics of the children enrolled are given in Table 1. The mean age of children was 10.7 years (range 6–17 years). The asthma diagnosis (ICPC R96) was given in 83.7% of cases ($n = 546$). A total of 47.2% ($n = 308$) of these children used chronic inhalation medication. The mean number of exacerbations of the study population was 0.2 (standard deviation ± 0.4) in 2012.

Overdiagnosis

Of all 652 children who received the diagnosis asthma (ICPC R96) or were treated as having asthma, only 105 children

Table 1. Characteristics of children in study group (n = 652)

Parameter	n(%)
Mean age, years	10.7 ± 3.2 [range 6–17]
Sex	
Male	387 (59.4)
Female	265 (40.6)
Diagnosis of asthma (ICPC R96)	546 (83.7)
Medication use	308 (47.2)
Mean exacerbations in 2012, n ± SD	0.2 ± 0.4

ICPC = International Classification of Primary Care. SD = standard deviation.

(16.1%) had an asthma diagnosis that was confirmed by spirometry.

There were 151 children (23.2%) with probable asthma who should undergo further lung function testing to meet the criteria for a confirmed asthma diagnosis. A total of 349 (53.5%) of the children were overdiagnosed. Five children had no asthma, and 344 children were unlikely to have asthma. The remaining 47 children (7.2%) probably had no asthma, and were correctly not given the ICPC code R96 (Figures 1 and 2).

Diagnostic criteria for the asthma diagnosis (ICPC R96)

Of the 110 children with the diagnosis asthma (ICPC R96) who underwent lung

function testing to confirm (reversible) bronchus obstruction, the diagnosis was confirmed in 105 cases (19.2%). In five children (0.9%) further lung function testing showed that they did not have asthma. However, the diagnosis asthma (ICPC R96) was incorrectly maintained.

In children who were given the diagnosis asthma without spirometry, a variety of diagnostic tests, anamnestic clues, and abnormalities in physical examination were probably the basis for receiving the diagnosis asthma (ICPC R96). Dyspnoea was the most frequent symptom (n = 174; 31.9%), followed by cough (n = 142; 26.0%), and wheezing (n = 57; 10.4%). In 36 cases (6.6%) the child was aged <6 years when last seen for a respiratory tract infection and met the criteria for a symptom diagnosis. For nine children (1.6%) having a prolonged exhalation during auscultation was the main criterion that was used for the diagnosis asthma. Peak flow measurement was the basis for the diagnosis for 10 (1.8%) children, whereas for eight children (1.5%) it was an allergy test (Figure 3).

Incidence of asthma

Incidence of the diagnosis asthma (ICPC R96) was 5.4 per 1000 children aged 6–18 years. Incidence was worked out by calculating the number of newly assigned ICPC codes in 2012 for children aged 6–18 years compared with the total number of children aged 6–18 years old on a reference date in 2012.

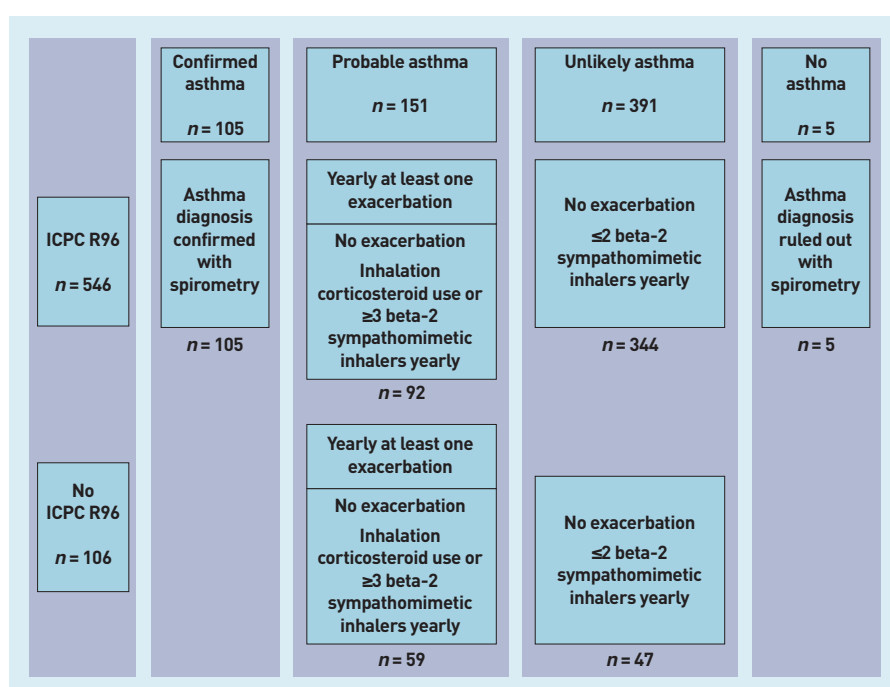


Figure 1. The number of children with and without ICPC code R96 (asthma) divided into the categories: confirmed asthma, probable asthma, unlikely asthma, and no asthma.

Figure 2. Percentage breakdown of the various asthma diagnosis categories.

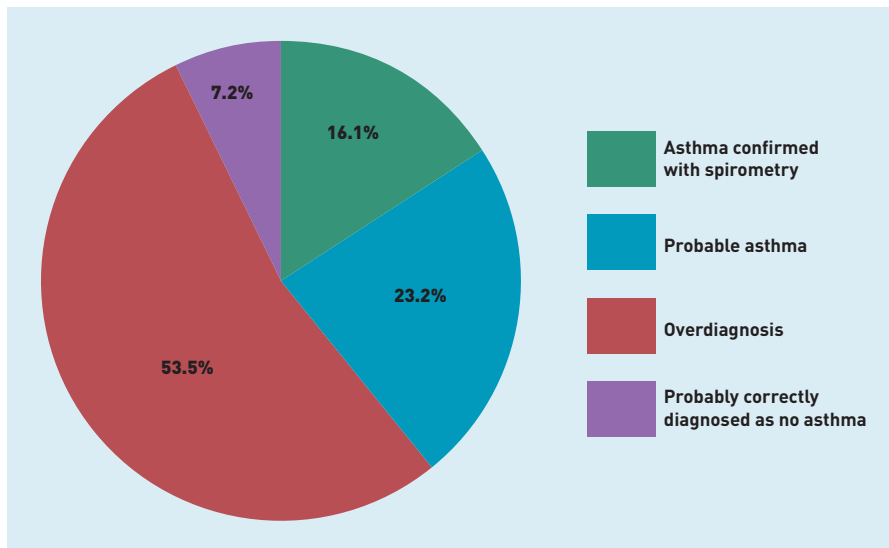


Figure 3. Diagnostic criteria for children's asthma diagnosis (ICPC R96).

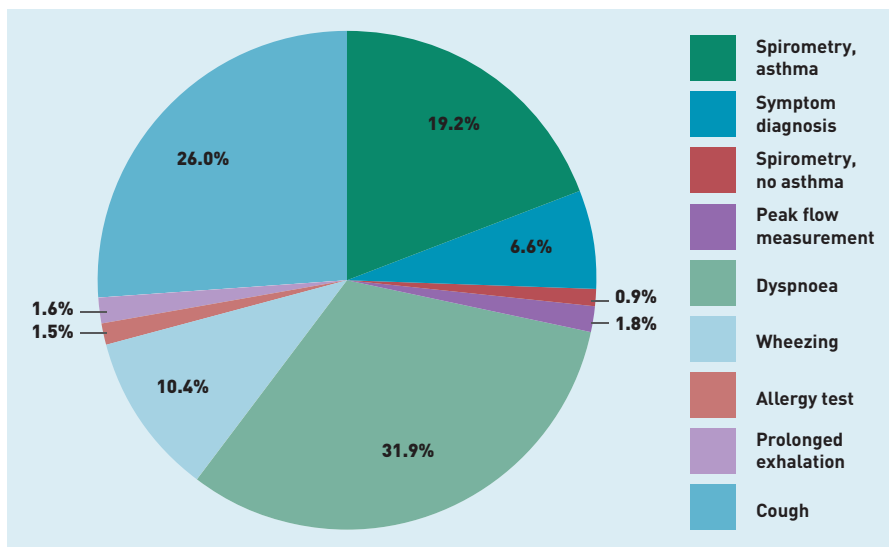
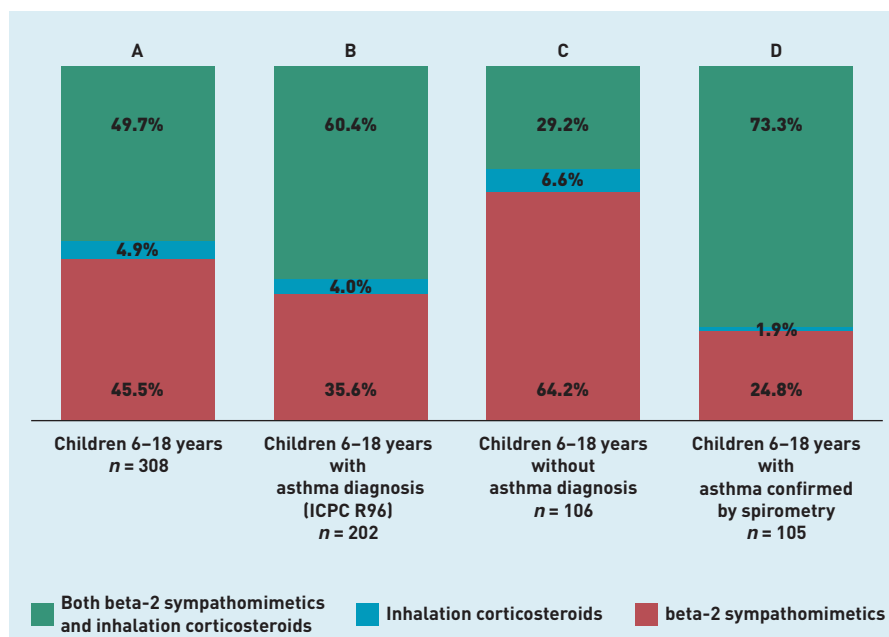


Figure 4. Types of chronic inhalation medication used.



Chronic inhalation medication use and exacerbation

Children without an asthma diagnosis (column C in Figure 4) who did use chronic inhalation medication used primarily a beta-2 sympathomimetic and 79.2% ($n=84$) filled in their prescriptions up to two times a year. Almost all these children had no exacerbations (98.8%, $n=83$). This in contrast to the children who underwent further lung function tests: most (73.3%, $n=77$) used a combination of an inhalation corticosteroid and a beta-2 sympathomimetic (column D in Figure 4), and 53.6% ($n=56$) filled their prescription up to two times a year. Approximately one-third (34.3%, $n=36$) of these children had one or more exacerbations a year.

DISCUSSION

Summary

In this study, overdiagnosis of asthma was found in more than half of the children, leading to unnecessary treatment, disease burden, and impact on their quality of life. Only in a few children was the diagnosis of asthma confirmed using lung function tests, despite this being recommended in international guidelines.

Strengths and limitations

This study is the first to investigate whether an asthma diagnosis and/or treatment given to children is preceded by a diagnostic process as recommended in the guidelines. There are certain potential limitations to be considered in order to interpret the findings in this study correctly. The group of children selected for this study are patients enlisted in the four academic primary healthcare centres in a newly developed large residential area in Leidsche Rijn, part of the city of Utrecht, the Netherlands. The average age in this area is slightly younger than the overall Dutch population (32.1 years compared with 41.0 years). However, there are no reasons to assume that the children in this area have different characteristics from the average Dutch population in this age band. Furthermore, the incidence of the diagnosis asthma found in this study is comparable to that found in a previous US study.³

Different diagnostic behaviour and compliance with guidelines in these academic practices could have led to an underestimation of incorrect diagnosis in the average Dutch primary care setting.

Normal spirometry alone does not exclude asthma diagnosis. However, these children were reviewed by a pulmonary specialist who carried out additional tests when needed.

Medication use was established by cooperation of the four pharmacies associated with the participating healthcare centres. It is possible that some children had a different pharmacy from the one associated with the healthcare centres. However, this will only be the case in a very small minority because the pharmacies are in the direct vicinity of the health centres and there is a direct link between patients' files in the healthcare centres and these local pharmacies.

Because children who are in need of chronic inhalation corticosteroids or who require beta-2 sympathomimetic drugs from the pharmacy at least three times a year were considered as children with probable asthma, overtreatment could have been underestimated.

Comparison with existing literature

Other studies have suggested overdiagnosis based on questionnaires filled in by parents.^{10,11} However, to the authors' knowledge this is the first study to investigate whether an asthma diagnosis and/or treatment given to children was preceded by a correct diagnostic process based on data from medical files.

The fact that in this study lung function tests in the initial assessment were only used in a few children is consistent with previous reports of widespread underuse of spirometry in paediatric asthma.¹²

Implications for practice

To avoid overtreatment, medicalisation, and anxiety in parents, a more structured diagnostic strategy including lung function testing in children under suspicion of having asthma is warranted. Empirical diagnosis of asthma should be avoided and symptom diagnosis is a better option until asthma is established based on symptoms and lung function tests. Lung function tests for children are still underused in primary care. However, to increase their use, steps are currently being taken to educate primary care personnel to perform these tests in children. In addition, access to lung function tests for children in hospitals should perhaps also be improved.

Funding

None.

Ethical approval

Ethical approval was not required because anonymised data was used.

Provenance

Freely submitted; externally peer reviewed.

Competing interests

The authors have declared no competing interests.

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