

Value of a shortened questionnaire in the description of asthma in 10–12-year-old pupils

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Asthma is a common and severe chronic disease in children influencing their quality of life and functioning at school. A 5-item asthma-screening instrument was developed and tested in 1052 children aged 10–12 years. Questionnaires were completed by parents and children separately and data were compared. Children reported less to be diagnosed by a medical doctor as having asthma compared with their parents, although children reported more to have certain asthma symptoms. No difference in prevalence of asthma was found between children and parents' answers. The absolute agreement for the scale was 92% and a good kappa agreement was found. Recoding the 'don't know'-answers in 'no'-answers resulted in a 4% misclassification. The short 5-item asthma screening tool can be valuable in the categorization of a subgroup of children likely to suffer from asthma in a survey. Recoding 'don't know'-answers to 'no'-answers is justified in large samples.

Anne Hublet, Dirk De Bacquer, Carine Vereecken and Lea Maes

Department of Public Health, Ghent University,
Ghent, Belgium

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Anne Hublet, Department of Public Health, Ghent University, University Hospital – Block A, De Pintelaan 185, 9000 Ghent, Belgium
Tel.: +32 9 240 36 85
E-mail: anne.hublet@ugent.be

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Asthma is a common and severe chronic disease in children and adolescents influencing their quality of life. Difficulties while playing with peers, doing sports, contacts with pets, sleeping disturbances but also negative emotions-like anxiety and worry can occur when having asthma (1–3). Asthma can interfere with normal school activities and cause problems with concentration, sport courses and absenteeism (4–6).

Asthma is also a growing problem as international studies indicate that the prevalence of asthma and symptoms of asthma in children is increasing (7). Reasons for the increase can be found in viral infections, aeroallergen exposures, weather and temperature changes, living conditions and parasitic infestations, but also in the Western lifestyle (8). Other studies indicate that the prevalence of diagnosed asthma may be slowed down or stabilized in the last 10 years after a large increase till 1990 (9). All studies show an increase of asthmatic symptoms (wheezing, night waking) (9, 10) but this increase may be restricted to mild symptoms (no increase in frequency of attacks) (7, 10).

The diagnosis of asthma in children and adults is difficult to make. First, there is no standard

definition of asthma applicable to all cases (11, 12). Secondly, no simple biological marker or simple clinical test exists to diagnose asthma (12, 13). Thirdly, the symptoms of asthma resemble the symptoms of a 'normal' cold. Fourthly, the chronic character of the diagnosis cannot be administered by a single clinical test (12). There is, in other words, no golden standard to diagnose asthma.

Questionnaires for detecting asthma are widely used because of their cost-effectiveness and because they are reasonably independent of immediate circumstances like time of the year, temperature, infections, treatment (11). Most asthma questionnaires are probing for diagnosis and asthma-related symptoms. Only asking for diagnosed asthma gives an underestimation of the prevalence of asthma because many children (and adults) are unaware of having asthma.

This study was conducted to develop a short questionnaire to assess asthma that could be included in the Health Behaviour in School-aged Children (HBSC)-survey (14). The HBSC-survey is a four yearly cross-national research study rooted in a lifestyle approach. Eleven, 13- and 15-year-old students are questioned about health

behaviours, body image, perception of the school, relations with parents and peers, and other psychosocial variables. By including a short asthma questionnaire in the survey, reasons for and consequences of asthma in young people can be studied.

In this paper, two questions are examined: (i) Can a short asthma questionnaire detect children with asthma in a survey? and (ii) Is it justified to recode 'don't know'-answers to the questions into 'no'-answers?

Methods

Questionnaire

The questionnaire used is based on two asthma screening instruments for children found in the literature, namely the Brief Paediatric Asthma Screen (BPAS) (15) and the International Study of Asthma and Allergies in Childhood (ISAAC)-questionnaire (16). The BPAS is a short questionnaire (five questions) with a good relative validity (a sensitivity of 74% and a specificity of 82% with as standard used a combination of self-reported history, physical examination and spirometry). This screening tool was developed to be filled in by the parents. The HBSC-study is, however, a self-reported questionnaire for children and adolescents, without guidance from parents or teachers.

The BPAS is based upon items from the ISAAC-questionnaire (16). This questionnaire can be used from the age of 13 (in 7–8-year-old children, the questionnaire is completed by the parents). The full questionnaire is too long to be included in the HBSC-study (15 questions).

The two questionnaires were combined in a short asthma instrument of five questions (weighted) with 'yes', 'no' and 'I don't know' as possible answers (Appendix 1). The scale results in three categories: asthma, possible asthma and no asthma.

The first question of the short asthma screening instrument deals with asthma diagnosed by a doctor. If the answer is positive, the child is labelled as 'having asthma'. The three following questions deal with the most common symptoms of asthma: wheezing, wheezing after play and nocturnal cough. If the child has two of the three symptoms and has answered 'no' to the first question, the child is labelled as 'possibly having asthma'. Using only one symptom to label a child with possible asthma can lead to mistakes as, for example, coughing is not suitable as a single predictor for asthma (17). A last question refers to a consultation for wheezing in a hospital or emergency room. If the child has consulted a

doctor for wheezing and has answered 'no' to the first question, the child is labelled as 'possibly having asthma' as well.

The 'don't know'-answers were recoded in 'no' answers: if the child or adult does not know or does not understand 'wheezing' or 'asthma', he or she probably does not suffer from it. The recoded answers were seen as misclassified if parents answered positively to that question.

Study population

The questionnaire was pre-tested in 10–12-year-old children, the youngest age group of the HBSC-study. To have a substantial proportion of children with asthma in the sample (50 children), at least 833 children had to be questioned [asthma prevalence in Flanders 6% (18)]. The sample size was set on at least 1000 pupils. Therefore, a random sample of 42 schools was taken from all primary schools in east-Flanders (a region in the northern part of Belgium): 18 schools in a city, 19 schools in the countryside and five schools in an industrial zone. The coordinating authorities of the school-networks gave permission for the study. A recruitment letter with information of the study was sent to the school boards. Finally, 16 schools (38%) participated (five schools in a city, eight schools in the countryside and three schools in an industrial zone) and 1052 pupils were questioned. The telephone survey to non-participating schools revealed that especially schools in cities often are asked to participate in scientific studies. Together with the questionnaires, a letter was sent to the teachers with instructions to administer the questionnaires in the classroom. Instructions emphasized that anonymity had to be guaranteed. Filled in questionnaires had to be put in an envelope and sealed. The parents' questionnaire and informed consent form were handed out to the children and the children were orally instructed about the procedure to give the questionnaire to their parents and to get the filled in questionnaire back. If parents did not give permission to include their children in the study, the data from their child was excluded from the database. Eighteen children were excluded. There was a further lost of 102 questionnaires (73 child's questionnaires only and 29 parents' questionnaires only). Only complete data sets were included in the analyses ($n = 932$).

Statistics

The prevalence rates of the asthma scale and the asthmatic symptoms are calculated from the

child's questionnaires and the parental questionnaires. Differences in prevalence rates between children and parents are assessed by the McNemar chi-square test.

The level of agreement between the child's and parents' responses is evaluated using the absolute agreement (number of positive and negative answers to both child's and parents' questionnaire divided by total number of questionnaires) and kappa statistics with following interpretation: values between 0.0 and 0.4 indicating relatively poor agreement, values between 0.4 and 0.6 indicating moderate agreement, between 0.6 and 0.8 indicating good agreement and values between 0.8 and 1.0 as excellent agreement.

The 'don't know'-answers are analysed by calculating the misclassified or discordant answers ('don't know'-answers of the child compared with the 'yes' responses of the parents) and by examining the influence of this recoding on the scale.

Results

Characteristics of the sample

About half of the sample was boys (51.2%). Only 2.5% of the children had a foreign nationality, the others were all Belgians. Mean age of the respondents was 11.31 years (min: 9.88, max: 13.79) with a s.d. of 0.66 years.

Prevalence rates

Prevalence rates for 'asthma', 'possible asthma' (on the basis of two of the three asthma symptoms or going to the doctor for wheezing) and the asthma symptoms are given in Table 1. The prevalence for the whole group ($n = 932$) and the prevalence for the subgroup who reported both (child and parent) asthma or possible asthma ($n = 64$) are described. The prevalence of the symptoms in the asthma group reveals the perception of reported symptoms between parents and children (18).

Children reported less to be diagnosed as having asthma (5.4%) compared with their parents (6.7%) ($p = 0.04$), although children reported more to have certain asthmatic symptoms. This resulted in a higher prevalence of 'possible asthma' in children's reports (6.0% compared with 3.5% in the parental questionnaire). The two categories 'asthma' and 'possible asthma' combined, resulted in a prevalence of asthma of 11.4% according to the children's questionnaires ($n = 106$) and 10.2% according to the parental questionnaires ($n = 95$) ($p = 0.22$).

Table 1. Prevalence rates of diagnosed asthma, possible asthma and asthmatic symptoms

Scale and symptoms	Total sample ($n = 932$), N (%)		Asthma group† ($n = 64$), N (%)	
	Child's questionnaire	Parents' questionnaire	Child's questionnaire	Parents' questionnaire
Diagnosed asthma	50 (5.4)	62 (6.7*)	46 (71.9)	47 (73.4)
Wheeze 12 months	81 (8.7)	68 (7.3)	46 (71.9)	45 (70.3)
Wheeze after play	91 (9.8)	49 (5.3**)	38 (59.4)	36 (56.3)
Nocturnal dry cough	134 (14.4)	106 (11.4*)	30 (46.9)	42 (65.6)
To doctor for wheeze	33 (3.5)	51 (5.5*)	23 (35.9)	37 (57.8)
Possible asthma	56 (6.0)	33 (3.5)	18 (28.1)	17 (26.6)
Asthma + possible asthma	106 (11.4)	95 (10.2)	64 (100)	64 (100)

†Asthma group = children and parents report both that the child has diagnosed asthma or possible asthma.

*McNemar's $p < 0.05$ when comparing child's and parents' reports.

**McNemar's $p < 0.001$ when comparing child's and parents' reports.

The most pronounced difference in reported symptoms between child and parent is wheezing after exercise or play. A total of 9.8% of the children reported to have suffered from wheezing after exercise compared with only 5.3% of the parents reporting their child having this symptom ($p < 0.001$). Slightly more children reported to suffer from nocturnal cough (14.4%) than their parents (11.4%) ($p = 0.03$). On the contrary, parents reported more visiting a doctor for wheezing (5.5% compared with 3.5% for children) ($p = 0.01$). No difference in the prevalence was found for wheezing in the last 12 months.

The most prevalent symptom in the diagnosed and possible asthma group is wheezing in the last 12 months (71.9% for children and 70.3% for parents). The least prevalent symptom was visiting a doctor or hospital for wheezing for the children (35.9%) and wheezing after play for the parents (56.3%).

For the children diagnosed as having asthma (parents' questionnaire) ($n = 62$), 33.3% was diagnosed with asthma by their general practitioner (GP) and 66.7% was diagnosed by a specialist.

Level of agreement

In Table 2, the level of agreement is shown between parents' and children's questionnaires (Table 2).

The absolute agreement for the scale and the asthma symptoms was generally high and ranged from 83.5% for nocturnal cough to 97% for diagnosed asthma. The kappa agreement was good for diagnosed asthma ($\kappa = 0.74$) and moderate for the symptoms and scale (going from

Table 2. Level of agreement between child and parents' reports

Scale and symptoms	Child yes parent yes, N (%)	Child yes parent no, N (%)	Child no parent yes, N (%)	Child no parent no, N (%)	Absolute agreement (%)	Kappa (95% CI)
Diagnosed asthma	42 (4.5)	8 (0.9)	20 (2.1)	862 (92.5)	97.0	0.73 (0.64–0.83)
Wheeze 12 months	41 (4.4)	40 (4.3)	27 (2.9)	823 (88.4)	92.8	0.51 (0.41–0.61)
Wheeze after play	37 (4.0)	54 (5.8)	12 (1.3)	827 (88.9)	92.9	0.49 (0.39–0.60)
Nocturnal cough	43 (4.6)	90 (9.7)	63 (6.8)	735 (78.9)	83.5	0.27 (0.18–0.35)
Doctor for wheeze	19 (2.0)	14 (1.5)	32 (3.4)	867 (93.0)	95.0	0.43 (0.29–0.56)
Asthma	42 (4.5)	8 (0.8)	15 (1.6)	795 (85.3)	91.2	0.56* (0.48–0.64)
Possible asthma	13 (1.4)	43 (4.6)	16 (1.7)			
Possible + asthma	64 (6.9)	42 (4.5)	31 (3.3)	795 (85.3)	92.2	0.59 (0.51–0.68)

*Kappa for variable with three categories: asthma, possible asthma and no asthma.

Table 3. Proportion 'don't know'-answers in children and discordant answers (compared with parents' reports) after recoding

	Child answered 'don't know', N (%)*	Parent answered 'yes', N (%)†
Diagnosed asthma	96 (10.3)	8 (8.3)
Wheeze in 12 months	174 (18.7)	15 (8.6)
Wheeze after play	158 (17.0)	3 (1.9)
Nocturnal cough	196 (21.0)	20 (10.2)
Visit emergency room wheeze	36 (3.9)	4 (11.1)

*Percentage of total group (n = 932).

†Percentage of group children who answered 'don't know'.

0.43 to 0.59). Only nocturnal cough had a kappa lower than 0.40, indicating a poor agreement.

Weighted kappa for the scale was 0.64 (95% CI: 0.57–0.72) indicating a good agreement. The weighted kappa considers the categories ordered going from no asthma, over maybe or possibly having asthma to having asthma.

Analysis of 'don't know'-answers

Many children (43.7%, n = 407) answered 'don't know' to one or more questions. These answers were recoded as 'no's'. Proportions of 'don't know'-answers and the misclassified-answers (= 'yes' answers in the parental questionnaire) are shown in Table 3.

The question on nocturnal cough seems to be the most problematic. 21.0% of the children did not know the answer to the question. Ten percentage of these answers were misclassified (when taking the parents' questionnaire as reference). Wheezing in the last 12 months is an important symptom of asthma. Nineteen percentage of the children did not know the answer to this question. 8.6% of these children had parents who indicated that their child suffered from wheezing.

The influence of this misclassification on the calculation of the asthma scale was further analysed. Twenty children or 2.1% of the total sample (n = 932) were labelled as 'having asthma'

or 'possible asthma' based on their answers, but not by their parents. Seventeen parents or 1.82% of the total sample indicated their child had 'asthma or possible asthma', but not according to the child. In total, 37 children or 3.97% of the total sample was misclassified as a result of the recoding in comparison with the parents' questionnaire.

Discussion

Only asking for diagnosed asthma in a survey can lead to an underestimation of the prevalence of asthma. In the present study, young children report more asthmatic symptoms than their parents, while parents report slightly more diagnosed asthma in their child. These results were also found in Lara et al. (20) and Braun-Fahrlander et al. (19). By including only four short questions, a better estimation of asthma prevalence can be attained (when compared with parents' reports). This short questionnaire can easily be included in large-scale surveys, like the HBSC-survey, without a lot of extra efforts. Existing questionnaires are maybe more precise in detecting asthma (15, 16), but are not always convenient to include in an existing questionnaire for 10–12-year-old children: the questionnaire may be too long (16), must be filled in by parents (15, 16) or make use of a video (13). A common problem with questionnaires is the wording as language can affect the reliability and validity of the results in a survey (20). Especially, the translation of 'wheezing' can cause problems as not every language has a word for wheezing. Phankingthongkum et al. (21) showed that bad translation could miss up to 67% of the asthma cases. In this study, the wording of the ISAAC-questionnaire is used.

The absolute agreement between parental reports and children's reports was generally high (83.5–97%) and comparable with the results of Braun-Fahrlander et al. (19) in adolescents. The kappa agreement ranged from low to good

(0.27–0.73) and was slightly higher than the results of Braun-Fahrlander et al. (19). More important than looking at the individual symptoms, are the results of the asthma scale. The kappa agreement was moderate to good (0.59 when taking asthma and possible asthma together, 0.56 when using the three categories).

In this study, parents' reports are used as reference. The literature (20, 22) suggests that children above 10 yr may be more valid reporters than their caregivers, when comparing with pulmonary function test results. Parents may underestimate the symptoms their children experience and only report the more severe symptoms. Also, they can only report symptoms if they are present when the symptoms occur or when their child tells about the symptoms. This may explain the low absolute agreement for nocturnal cough.

When recoding the 'don't know'-answers to 'no' answers, few misclassifications of the children on the scale were found (compared with parents' answers). This recoding is found justified, especially in young children and in large-scale surveys. When not suffering from asthma or certain asthmatic symptoms, children may not know the words used to describe the disease or the symptoms [like wheezing (23)]. When recoding all these answers as missing, a large part of the sample is lost (in the present study, 44%).

A limitation of this study is the absence of a clinical test for diagnosing asthma to validate the data. A limited budget was one reason for not including the use of a golden standard. The fact that no single test can detect asthma is a second reason. To partly overcome this problem, the possibility of contacting the doctor treating the children, was considered. Of the 73 respondents with inconsistent results on the scale, only 50 parents gave permission to contact the GP. Of these 50 GP, only 41 wanted to participate in the study. It was decided that a sample of 41 was too small to draw conclusions. The reason why parents or GP's refused was not asked. GP's often indicated that they did not see the child anymore, they did not have records of the child or they had too much work. Contact with the school medical doctor revealed that parents are not keen on sharing personal, medical information with the school or other persons as this is part of their privacy.

A second limitation of the study concerned the questionnaire and the lack of testing the grade of severity of asthma and asthmatic symptoms. This may be important when looking at trends over time as the prevalence of severe asthma may stay stable, while the occurrence of mild symptoms may increase

(9). However, including questions that examine the grade of severity, makes the questionnaire too long to be included in large-scale surveys on a wide variety of health behaviours, like the HBSC-survey.

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Appendix 1. The Health Behaviour in School-aged Children (HBSC)-asthma instrument

1. Has the doctor ever told you that you have asthma?	'Yes', label: 'having asthma'
2. Have you had wheezing or whistling in the chest in the last 12 months?	'Yes' to two of the three questions and 'no' to question 1, label: 'possibly having asthma'
3. In the last 12 months, has your chest sounded wheezy during or after exercise?	
4. In the last 12 months, have you had a dry cough at night, apart from a cough associated with a cold or a chest infection?	'Yes' and 'no' to question 1, label: 'possibly having asthma'
5. In the last 12 months, have you been to a doctor, an emergency room, or a hospital for wheezing?	
