

Comparison of quality of life between asthmatic and healthy school children

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There are only a few studies which have assessed the impact of asthma on the quality of life (QoL) compared to healthy children. In this study we wanted to compare QoL between asthmatic and healthy children in a population based setting. We surveyed 2159 children aged 11–15 yr with a Child Health Questionnaire; a generic QoL measure for children. This method gives a profile of the QoL consisting of 11 scales giving a range from 0 to 100. Asthma was defined based on the ISAAC questionnaire on asthma and asthma symptoms. In all, 192 children (8.9%) reported to have asthma diagnosed by a doctor and 61 of them (2.8% of all children) had been symptomatic during the previous month. Among these symptomatic children significantly impaired QoL was observed in 8 of the 11 scales compared to non-asthmatics. The most affected scales were those defining the physical part of child's QoL: Mean General Health scores were 60 for asthmatic and 74 for non-asthmatic children and mean Bodily Pain scores 71 and 86, respectively. Symptoms during longer periods were associated with an overall decreased QoL. In conclusion, a child's asthma impairs the QoL and especially the physical dimensions.

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Asthma is an inflammatory disease, for which continuous, daily treatment is beneficial. However, a recent multi-center survey in Europe has shown that the actual treatment outcome from the patient point of view is far from the goals set by asthma guidelines, with a sizable proportion (38%) of patients having daily symptoms (1). There is also evidence that the association between symptoms and quality of life (QoL) is more obvious than the association between symptoms and objective tests (lung function, bronchial hyperreactivity test, and peak expiratory flow) (2). Thus, good QoL is an important outcome of successful treatment.

For the term 'quality of life' (QoL) there are several definitions (3, 4). The World Health Organization has defined QoL as 'the individual's perception of their position of life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns' (5, 6). According to Gill

and Feinstein, QoL is 'a uniquely personal perception, denoting the way individual patients feel about their health status and/or non-medical aspects of their lives' (7). Health is thus one of the major components affecting QoL.

Measuring QoL is a challenging issue from the methodological point of view. A number of different questionnaires measuring QoL have been developed both for adults and for children. Both diseases specific and generic instruments are available (6, 8, 9). Asthma-specific QoL measures are useful in measuring detailed disease specific changes in the QoL of asthmatic patients but these instruments cannot be used if the asthmatic patients are compared to the healthy individuals. Generic questionnaires provide a universal formula for evaluating the QoL but are less likely to detect small but clinically important changes in specific diseases. Asthma specific QoL measures have shown that treatment of symptomatic asthma improves the QoL (10, 11), but the

studies comparing the QoL between asthmatic children and healthy children are lacking (12). Moreover, many QoL studies rely on questionnaires to parents, although children and parents' perceptions about the child's QoL often differ (6, 13, 14). Therefore, obtaining QoL information directly from the child is preferred, especially in adolescents over 11 yr (14).

The purpose of this study was to compare the QoL between asthmatic and non-asthmatic children by evaluating the QoL in a random sample of school-aged children by a generic, self-administered questionnaire.

Material and methods

Study subjects

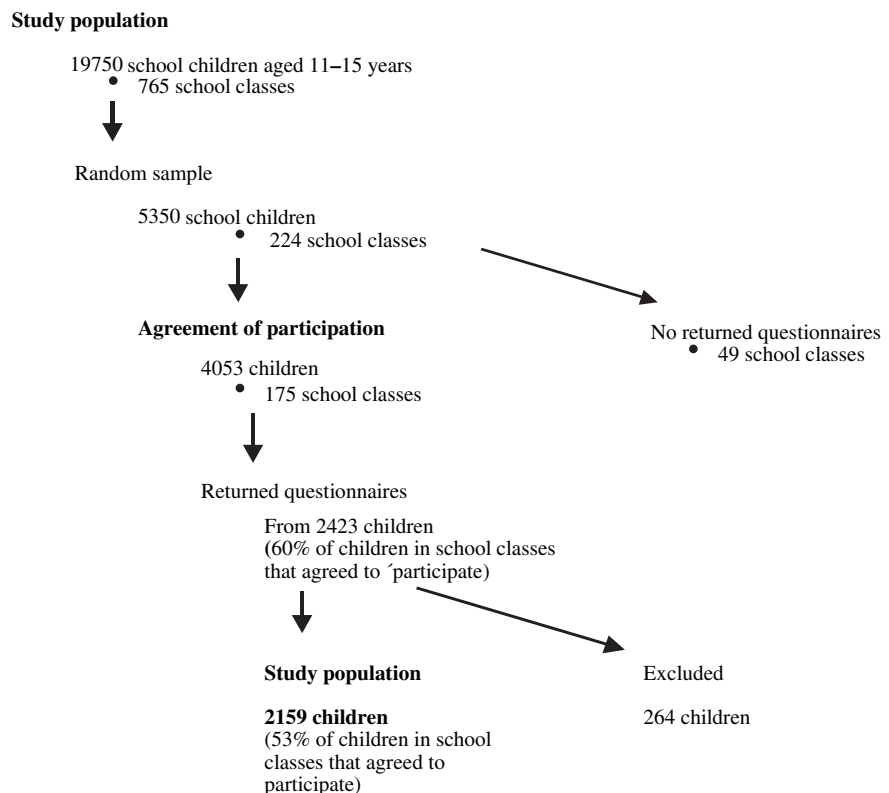
The study was carried out as a cross-sectional, questionnaire-based survey among the 11- to 15-yr-old school children in three Finnish cities (Kuopio in Eastern Finland, Tampere in Central Finland and Turku in South-West Finland) with altogether 452,000 inhabitants. The list of schools, classes and number of pupils in each class were obtained from the local education departments, which were also asked the permission for carrying out the study. The sample size calculations were made based on the results of an

Australian study (12). In that study, the active quality of life (AQoL) scores were impaired among the children with asthma when compared to the non-asthmatic children [Australia: mean (s.e.) AQoL score 3.9 (0.65) vs. 4.15 (0.4); England: 3.94 (0.65) vs. 4.05 (0.4), respectively]. We wanted to design a study with 80% power and a significance level of 0.05 (alpha). The prevalence of asthma was assumed to be 5% in our population (15). Using these assumptions, the range of the required sample size was wide, being 5600 if the results from England were used and 1100 when using the results from Australia (12). To be conservative, we randomly selected 224 classes in 84 schools, including 5350 pupils, into the sample of this study (Fig. 1).

Study design

The survey was carried out during February and March 2001. This is the season in Finland when there is no birch pollen in the air and also other allergenic particles are rare. Thus we were able to avoid the influence of the pollen season and life-disturbing long-term allergic rhinoconjunctivitis on the symptom reporting (15). Other conditions affecting the QoL besides asthma were taken into account in the statistical analyses. The head teachers of chosen schools were

Fig. 1. Study protocol and numbers of participants.



contacted by telephone (by VM) and after agreement the exact course of the study was explained to them. Both the child's and the guardian's questionnaires were sent to the head teachers of the selected schools, to be distributed via teachers to the randomly selected classes. The children took home the parental questionnaires and after return of these and the written consent, filled in their own questionnaire at school (Fig. 1). Despite of the head teachers' initial agreement of the study there were nine schools (10% of all schools chosen to the study) and 49 whole school classes (22% of all school classes chosen to the study) that did not return any questionnaires. Altogether 2423 (60%) questionnaires of children and/or their parents from the classes participating in the study were returned to the study center. From these, a total of 264 children were excluded due to missing parental consent forms ($n = 251$) or missing data ($n = 13$). The mean age of all including 2159 children was 13.2 yr (s.d. 1.4) and 45.6% were boys.

Three definitions for children having asthma or symptoms were used: (1) those who had ever had asthma diagnosed by doctor with or without symptoms in the previous month (2) those who had asthma diagnosis and wheezing attacks during the previous month and (3) those who had wheezing attacks during the previous year with or without asthma diagnosis. All these three groups were separately compared to those who had ever had neither wheezing attacks nor asthma diagnosis.

Methods

The questionnaire for the child. To measure the QoL The Child Health Questionnaire (CHQ-CF87) designed for measuring the QoL of over 10-yr-old children was used (16, 17). This questionnaire was chosen because it is a generic instrument that has been thoroughly validated and standardized also in Finnish language (18). It has been used in a number of countries and for various diseases. Self-administered CHQ-CF87 consists of 87 multi-item questions including a broad range of dimensions focusing on physical, mental, and psychosocial functioning as well as on components of family impact and risk behavior. A profile of the QoL is retrieved, consisting of 11 domains: physical functioning, role/social-physical, general health, bodily pain and discomfort, family activities, role/social-emotional, role/social-behavioural, self esteem, mental health, behavior, and family cohesion. The individual scale scores were

normalized by a scoring program to a range from 0 (the worst) to 100 (the best), according to the CHQ manual (16). Further information is also available by contacting the principal author of the manual in writing at jml@healthact.com.

Beside the QoL questionnaire there was a short questionnaire asking the child's allergic and respiratory symptoms over the previous month.

The parental questionnaire. The parental questionnaire was used to gather information about background characteristics of the child such as family history and social class. They were also asked about the allergic and respiratory symptoms over the previous year and diagnosis of asthma and other chronic diseases. These questions—as well as the symptom-questions over the previous month asked from the child—were modified from the international study of asthma and allergy on childhood (ISAAC)-questionnaire by choosing the appropriate questions for this study and by asking the symptoms during the last month period instead of during the last year period as was done in the ISAAC-questionnaire (19).

Statistical analysis

The data was analyzed using the SPSS statistical software (SPSS for Windows, Version 10.0). The QoL results are expressed as mean QoL scale scores and the respective standard deviations (s.d.). The crude pair-wise comparisons in group means were performed using the independent samples *t*-test (16). Since the distributions of QoL scores were often skewed, we performed all pair-wise comparisons also by using the non-parametric Mann–Whitney *U*-test. We also counted 95% confidence interval for the healthy children for even more clarification of the subject. Multiple linear regression models were fitted to examine independent associations of asthma with the QoL scores. The confounding factors that were taken into account were sex, geographical area (Turku, Tampere, Kuopio), social class, family size, death, or divorce in the family, atopic dermatitis of the child (the most common allergic disease of Finnish children during the winter time), smoking of the child and the presence of other serious illnesses of the child. These confounding factors were chosen based on clinical experience and international GINA guidelines (20). The scores of each QoL scale were analyzed by separate regression models. Adjusted *p*-values obtained from these models are presented (Table 1).

Table 1. The mean (s.d.) QoL scores, by asthma groups, in comparison to control children

QoL-scale	QoL-scores $\pm$ s.d.			
	Wheezing attacks during previous month [†] and MD asthma [‡] (n = 61)	Wheezing attacks during previous year [‡] (n = 245)	Asthma ever [‡] (n = 192)	Control population = never asthma or wheezing attacks ^{†‡} (n = 1792)
Physical functioning	90.5 $\pm$ 10.0***	93.3 $\pm$ 9.5***	95.0 $\pm$ 7.6**	97.7 $\pm$ 6.6
Role/social-physical	94.5 $\pm$ 9.2*	94.7 $\pm$ 11.9***	96.2 $\pm$ 10.3*	98.0 $\pm$ 7.8
General health	59.5 $\pm$ 16.9***	63.4 $\pm$ 15.7***	65.4 $\pm$ 16.5***	74.1 $\pm$ 13.6
Bodily pain	70.8 $\pm$ 21.2***	74.7 $\pm$ 23.0***	79.3 $\pm$ 21.5***	86.0 $\pm$ 17.4
Family activities	76.4 $\pm$ 18.0*	79.0 $\pm$ 17.9***	81.1 $\pm$ 18.3	84.2 $\pm$ 16.9
Role/social-emotional	92.5 $\pm$ 12.3	89.9 $\pm$ 17.5***	92.9 $\pm$ 13.4	94.3 $\pm$ 13.0
Role/social-behavioral	94.2 $\pm$ 12.9	93.0 $\pm$ 15.9***	95.6 $\pm$ 11.6	96.9 $\pm$ 10.5
Self esteem	74.1 $\pm$ 15.4*	75.4 $\pm$ 15.6***	76.4 $\pm$ 15.6**	80.8 $\pm$ 14.8
Mental health	69.7 $\pm$ 13.4*	69.2 $\pm$ 14.1***	71.9 $\pm$ 13.7**	75.3 $\pm$ 12.0
Behavior	75.6 $\pm$ 13.2*	75.9 $\pm$ 13.4***	78.1 $\pm$ 13.4*	81.3 $\pm$ 12.1
Family cohesion	76.6 $\pm$ 17.9	74.3 $\pm$ 22.8	74.7 $\pm$ 23.2	76.8 $\pm$ 21.2

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. p -Values have been adjusted (multivariate regression models) for age, sex, geographical area, social class, family size, death, or divorce of the family, atopic dermatitis of the child, smoking of the child and the presence of other serious illnesses of the child. s.d., Standard deviation; MD asthma, doctor diagnosed asthma. [†]Child-reported. [‡]Parent-reported.

Ethics

The study protocol was approved by the ethics committee of Tampere University Hospital and written informed consent was obtained from the parents of included children.

Results

Prevalence of asthma or wheezing

The number of children with either an asthma diagnosis ever or wheezing attacks during previous year was 367 (17%) and 1792 children (83%) were reported never to have had an asthma diagnosis or wheezing attacks. Asthma diagnosis was reported by 192 (8.9%) children, of whom 61 (2.8% of the study population) had wheezing attacks during last month. Wheezing attacks during the previous year irrespective of an asthma diagnosis had 245 (11.3%) of children (Table 2).

Comparison of QoL scores in groups of children

In all three asthma subgroups, the QoL was statistically significantly impaired in most of the

QoL scales when compared to those children who had never had asthma diagnosis or wheezing as a symptom. The strongest effect was seen in the group of asthmatic children who had been symptomatic over the previous month. In this group the 8 of 11 QoL scales were statistically significantly impaired and the most affected were General Health scale and Bodily Pain scale (Table 1 and Fig. 2). The finding was in the same direction but less marked in children with an asthma diagnosis ever irrespective of the symptoms. Wheezing attacks during the previous year impaired 10 of the 11 QoL scales significantly, but the differences were not as remarkable as in the other groups (Table 1).

The results of the crude comparisons did not change when the comparisons were made by the non-parametric Mann–Whitney test instead of the t -test. Likewise, after adjustment for the pre-defined confounders in the multivariate models the differences between the asthma groups were not significantly changed, more over they remained statistically significant.

Discussion

Only a few studies have been published assessing the impact of asthma on QoL, or comparing the QoL of asthmatic and healthy children (12). The present study compared the QoL between asthmatic and healthy children as children themselves see it.

According to our results, childhood asthma, especially when recently symptomatic, impairs the QoL when compared to non-asthmatic children. Also asthmatic children with recently asymptomatic disease had an impaired QoL.

Table 2. Prevalence of asthma and asthma symptoms

	n = 2159 (%)
Asthma or asthmatic symptoms	367 (17.0)
Diagnosed asthma	192 (8.9)
Diagnosed asthma and wheezing attacks during previous month	61 (2.8)
Wheezing attacks during previous year with or without asthma diagnosis	245 (11.3)
Never asthma or wheezing attacks	1792 (83.0)

QOL Scores

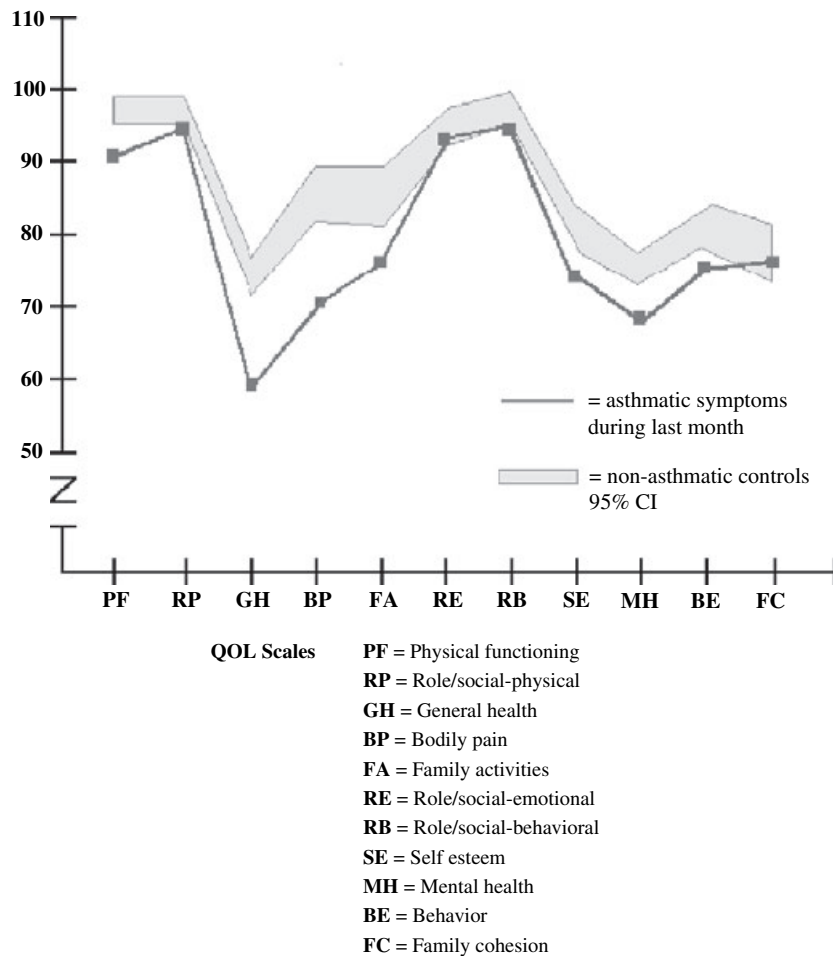


Fig. 2. The mean QoL scores of asthmatic symptoms (doctor diagnosed asthma and wheezing attacks) during last month compared to non-asthmatic controls.

Having had wheezing attacks during a longer period of time was also associated with the decrease in QoL, i.e., symptoms without the diagnosis seems to have an effect on QoL.

To be able to compare healthy and asthmatic children, the only method that could be used was the generic QoL instrument in our setting. To cover as many dimensions as possible we chose the CHQ, which is a thoroughly validated and standardized questionnaire including a broad range of dimensions in QoL. Minor changes in the QoL of asthmatic children caused by the disease may remain undetected when a generic instrument is used but since the reference group consisted of healthy children we were not able to use the disease specific questionnaire.

The strength of the present study is assessing QoL by questionnaires that the children themselves responded to. It has been stated before that parents' perception of over 11-yr-old children's QoL is poor (13, 14). It has also been shown that the short term QoL can be obtained

from children themselves, while for longitudinal purposes information should be collected from parents (21).

There are previous studies that have assessed QoL as seen by the children themselves. One study showed that Australian children with all stages of asthma suffer QoL deficits whereas British children with only severe asthma have deficits of QoL when compared to their healthy peers (12). In that study it was noted that the QoL scores of Australian healthy children were generally higher than British children raising the question of possible cultural differences. Another study consisting adults demonstrated that the predictors of QoL depend on asthma severity (10). We did not assess the severity of asthma, but the impairment in QoL was clearer when there had been symptoms in the previous month. It has also been shown that treating asthma and achieving asthma control associates with a significant improvement in QoL (11). Our results tend to support this since those with a diagnosis of

asthma but asymptomatic in the previous month were more closer to those without asthma, even though we did not use a disease specific measure of QoL.

In this study we did not exclude the children with other chronic conditions. Instead, the chronic conditions affecting QoL were taken into account in statistical analyses (see text). The effect of allergic rhinoconjunctivitis was minimized, by carrying out the study during the season when the allergic particles and allergic upper airway symptoms are rare or only random. In addition, adjusting the results for atopic dermatitis, the allergic disease that in Finland causes symptoms especially during the wintertime, in the multiple regression slightly decreased the coefficient for asthma, but the significance level of the coefficients remained practically unchanged.

We used three definitions of asthma in our study. In two definitions, a doctor's diagnosis or no diagnosis was required, increasing the specificity of the definition. In the third, only wheezing symptoms were used (22). In addition, different time frames of the symptoms (month/year/ever) were used. The deficits in the QoL were most evident in the most recently symptomatic children with a diagnosed disease. Therefore, our results were clearly feasible in terms of both disease activity and classification, supporting the proposal that asthma decreases the QoL in children (12).

The response rate was relatively low in our study. This may have introduced selection bias to the results, as children suffering from asthma or allergic diseases and their parents may have been more interested in participating. We were unlucky to be conducting this study concurrently with other questionnaire studies, resulting in significant numbers of whole schools (principals) or classes (teachers) deciding against participation. Usually a very high response rate is achieved when relying on taking time from school lessons (15). This fact suggests that the non-participation occurred for the most part at random, reducing the possibility of selection bias. The finding that the prevalence of asthma and allergic symptoms obtained in our study resembles those in the other previous studies in Finland support this suggestion (15, 23).

It is noteworthy that in the healthy population, similar to the asthmatic children, the scores of general health- and mental health-scales were lower than the scores of the other scales (Fig. 1). This could be speculated as being caused by the questionnaire structure, as the same phenomenon was seen in the Australian study (24). In a previous study in Finland among children aged

6–18 yr only the scores of general health scale were lower than the other scales (18), but it must be noted that in our study the children were 11 to 15-yr old, i.e., living in the middle of the puberty.

How should the results be interpreted and what is the clinical significance of the differences in QoL between the asthmatic and healthy children? It seems clear that in overall, asthma does have deleterious effects on the QoL. It is interesting that the most severe impairments are seen in the scales for physical functioning. This at least seems to lend credence to the clinical practice of questioning specifically about the symptoms of asthma on physical exertion. Some of the differences seem relatively minor considering clinical significance, but on the other hand the profile of the asthmatic children is constantly lower than that of the healthy children.

In conclusion, asthma impairs the self-assessed QoL of school-aged children, even when the disease has been relatively asymptomatic recently. The impairment is more marked when there have been recent symptoms.

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Appendix

The parts of the ISAAC-questionnaire of which the background questions were slightly modified (symptoms asked also about the period of previous month).

7.1 Module 1.1: Core questionnaire for wheezing and asthma

7.1.1 Questionnaires

Questionnaire for 13 and 14-yr olds

Lomakkeen yläreuna

1 Have you ever had wheezing or whistling in the chest at any time in the past?	Yes	☐
	No	☐
IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 6		
2 Have you had wheezing or whistling in the chest in the last 12 months?	Yes	☐
	No	☐
IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 6		
3 How many attacks of wheezing have you had in the last 12 months?	None	☐
	1–3	☐
	4–12	☐
	More than 12	☐
4 In the last 12 months, how often, on average, has your sleep been disturbed due to wheezing?	Never woken with wheezing	☐
	Less than one night per week	☐
	One or more nights per week	☐
5 In the last 12 months, has wheezing ever been severe enough to limit your speech to only one or two words at a time between breaths?	Yes	☐
	No	☐
6 Have you ever had asthma?	Yes	☐
	No	☐
7 In the last 12 months, has your chest sounded wheezy during or after exercise?	Yes	☐
	No	☐
8 In the last 12 months, have you had a dry cough at night, apart from a cough associated with a cold or chest infection?	Yes	☐
	No	☐

Questionnaire for 6 and 7-yr olds

1 Has your child ever had wheezing or whistling in the chest at any time in the past?	Yes	☐
	No	☐
IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 6		
2 Has your child had wheezing or whistling in the chest in the last 12 months?	Yes	☐
	No	☐

IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 6

- 3 How many attacks of wheezing has your child had in the last 12 months? None ☐
1-3 ☐
4-12 ☐
More than 12 ☐
- 4 In the last 12 months, how often, on average, has your child's sleep been disturbed due to wheezing? Never woken with wheezing ☐
Less than one night per week ☐
One or more nights per week ☐
- 5 In the last 12 months, has wheezing ever been severe enough to limit your child's speech to only one or two words at a time between breaths? Yes ☐
No ☐
- 6 Has your child ever had asthma? Yes ☐
No ☐
- 7 In the last 12 months, has your child's chest sounded wheezy during or after exercise? Yes ☐
No ☐
- 8 In the last 12 months, has your child had a dry cough at night, apart from a cough associated with a cold or chest infection? Yes ☐
No ☐

7.2 Module 1.2: Core questionnaire for rhinitis

7.2.1 Questionnaires

Questionnaire for 13 and 14-yr olds

All questions are about problems, which occur when you DO NOT have a cold or the flu.

- 1 Have you ever had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or the flu? Yes ☐
No ☐

IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 6

- 2 In the past 12 months, have you had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or the flu? Yes ☐
No ☐

IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 6

- 3 In the past 12 months, has this nose problem been accompanied by itchy-watery eyes? Yes ☐
No ☐

4 In which of the past 12 months did this nose problem occur? (Please tick any which apply)

- January ☐ May ☐ September ☐
February ☐ June ☐ October ☐
March ☐ July ☐ November ☐
April ☐ August ☐ December ☐

- 5 In the past 12 months, how much did this nose problem interfere with your daily activities? Not at all ☐
A little ☐
A moderate amount ☐
A lot ☐
- 6 Have you ever had hayfever? Yes ☐
No ☐

Questionnaire for 6 and 7-yr olds

- 1 Has your child ever had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or the flu? Yes ☐
No ☐

IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 6

- 2 In the past 12 months, has your child had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or the flu? Yes ☐
No ☐

IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 6

- 3 In the past 12 months, was this nose problem accompanied by itchy-watery eyes? Yes ☐
No ☐

4 In which of the past 12 months did this nose problem occur? (Please tick any which apply)

- January ☐ May ☐ September ☐
February ☐ June ☐ October ☐
March ☐ July ☐ November ☐
April ☐ August ☐ December ☐

- 5 In the past 12 months, how much did this nose problem interfere with your child's daily activities? Not at all ☐
A little ☐
A moderate amount ☐
A lot ☐
- 6 Has your child ever had hayfever? Yes ☐
No ☐

7.3 Module 1.3: Core questionnaire for eczema

7.3.1 Questionnaires

Questionnaire for 13 and 14-yr olds

1 Have you ever had an itchy rash, which was coming and going for at least 6 months? Yes ☐
No ☐

IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 6

2 Have you had this itchy rash at any time in the last 12 months? Yes ☐
No ☐

IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 6

3 Has this itchy rash at any time affected any of the following places: Yes ☐
No ☐

The folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes?

4 Has this rash cleared completely at any time during the last 12 months? Yes ☐
No ☐

5 In the last 12 months, how often, on average, have you been kept awake by this itchy rash? Never in the last 12 months ☐
Less than one night per week ☐
One or more nights per week ☐

6 Have you ever had eczema? Yes ☐
No ☐

Questionnaire for 6 and 7-yr olds

1 Has your child ever had an itchy rash, which was coming and going for at least 6 months? Yes ☐
No ☐

IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 7

2 Has your child had this itchy rash at any time in the last 12 months? Yes ☐
No ☐

IF YOU HAVE ANSWERED 'NO' PLEASE SKIP TO QUESTION 7

3 Has this itchy rash at any time affected any of the following places: Yes ☐
No ☐

The folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes?

4 At what age did this itchy rash first occur? Under 2 yr ☐
Age 2–4 yr ☐
Age 5 yr or more ☐

5 Has this rash cleared completely at any time during the last 12 months? Yes ☐
No ☐

6 In the last 12 months, how often, on average, has your child been kept awake by this itchy rash? Never in the last 12 months ☐
Less than one night per week ☐
One or more nights per week ☐

6 Has your child ever had eczema? Yes ☐
No ☐