

Childhood asthma, behavior problems, and family functioning

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Background: Studies of families of asthmatic children indicate associations between psychological factors and asthma symptoms. **Objective:** We investigated relations between psychosocial factors and the development of respiratory symptoms within a large prospective cohort study.

Methods: The children were prenatally assigned to high, medium, or low risk for asthma development on the basis of parental atopy and family history of allergic disease. When the children were 3 years of age, parents completed the Eyberg Child Behavior Inventory (ECBI), Family Relationships Index (FRI), Hospital Anxiety and Depression Scale (HAD), and General Health Questionnaire (GHQ).

Results: Data from 663 participants were analyzed. ECBI intensity scores were significantly higher for children with parentally reported respiratory symptoms. Symptomatic low-risk children (both parents nonatopic, no family history of allergic disease) were particularly likely to have elevated behavior problem ratings. None of the other family psychosocial variables showed this pattern. Child behavior problems were, however, significantly positively correlated with the other family psychosocial variables. Logistic regression indicated that behavior problem scores were associated with 3 or more attacks of wheeze ($P = .03$, OR = 1.023), irrespective of risk group.

Conclusions: Children at 3 years of age with symptoms suggestive of asthma are at elevated risk of behavior problems. Children from families without a history of asthma and allergic diseases may be particularly vulnerable to behavioral disturbance. Families may benefit from additional advice on management of their child's behavior, particularly if parents do not have the experience of having the illness themselves. (*J Allergy Clin Immunol* 2003;112:499-504.)

Key words: Asthma, child behavior, family relations

Studies of the families of children and adolescents with asthma have indicated associations between psychological factors and exacerbation of symptoms; the relative contribution of biological and psychological factors to asthma

Abbreviations used

ECBI: Eyberg Child Behavior Inventory
FRI: Family Relationships Index
GHQ: General Health Questionnaire
HAD: Hospital Anxiety and Depression Scale
NACMAAS: National Asthma Campaign Manchester Asthma and Allergy Study

varies across families.¹ Since the majority of studies include patients who are already receiving asthma treatment, the direction of relations between illness and psychological factors is unclear. Having an asthmatic child may lead to difficulties managing behavior or to emotional problems in the parent, and psychosocial stress may exacerbate vulnerability to asthma symptoms. Meta-analysis of adjustment of ~5000 children with asthma indicates that the level of behavioral difficulties is higher in asthmatic than in healthy children.² In asthmatic children, clinically significant behavioral problems are associated with greater frequency of wheeze.³ Moreover, parenting difficulties or stress in early life may be associated with the early development of asthma,^{4,5} which in turn may lead to higher level of behavior problems in children.^{5,6}

Negativity in the family environment can contribute to asthma severity.⁷⁻⁹ Mental health problems in the parent relate to elevated levels of hospitalization for children with asthma³ and lead to increased effects of asthma on the family.¹⁰ There is clear evidence that relations between child behavior problems and maternal depression are circular and enduring.¹¹ Data on family factors including difficulty managing child behavior, conflict, and mental health difficulties would clarify the extent to which these factors influence illness and enable the identification of subgroups in which psychosocial factors are particularly salient. Elucidation of these relations should lead to major benefits in physical and mental health at the public health level.

The current study investigated relations between the development of asthma and family psychological factors within a prospective birth cohort (NAC Manchester Asthma and Allergy Study, NACMAAS¹²⁻¹⁵). The aim was to gather data on psychosocial factors, including child behavior problems, family relationships, and parental mental health to investigate the associations between psychosocial factors and the development of symptoms suggestive of asthma. We tested whether scores on mea-

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tures of psychosocial factors were higher for children with respiratory symptoms and then conducted more exploratory analyses to assess whether the child's level of biological and environmental risk of asthma was related to outcome. Finally, we tested the specific hypothesis that parental report of behavior problems would be associated with reports of recurrent wheeze.

METHODS

The NACMAAS is a prospective cohort study, described in detail elsewhere.¹²⁻¹⁵ Briefly, all mothers were screened for eligibility before the birth of the child (8th to 10th week of pregnancy). Both parents were given a skin test and were interviewed for history of asthma and allergy.¹³ Children were assigned to different risk groups for development of asthma according to parental skin prick test (SPT) results and questionnaire data with the following criteria: High risk, both parents have positive results to SPT; medium risk, one parent has positive results to SPT; and low risk, both parents have negative results to SPT with no family history of allergic disease.

Clinical assessment

During the first 3 years of the child's life, parents were asked to keep diary cards regarding their child's health. These captured parentally reported symptoms, physician-diagnosed illnesses, and any medication received. All participants were invited to attend a review clinic at age 3 years (± 4 weeks). A standard respiratory questionnaire¹⁶ was interviewer-administered, and children were given the SPT (*D pteronyssinus*, cat, dog, mixed grasses, egg, milk). The skin test result was regarded as positive if the wheal was at least 3 mm greater than the negative control.

Psychological assessment

Ethical approval was obtained from the local research ethics committee. Study participants were visited at home 2 weeks before the clinical follow-up to assess environmental exposures. Questionnaires on standardized measures of child behavior problems, family functioning, and parental mental health were distributed at the home visit. The research assistant gave written information to mothers, asking them to complete four questionnaires at home in their own time and return them in a sealed envelope at the clinical follow-up appointment. Questionnaires were selected for brevity and acceptability for large-scale screening and included the following tests.

Eyberg Child Behavior Inventory. The Eyberg Child Behavior Inventory (ECBI)¹⁷ lists 36 common behavioral problems, for example, "refuses to eat food presented," "has temper tantrums," "constantly seeks attention," and "is easily distracted." Parents respond yes or no, recording whether each of these is currently a problem with their child (problem score) and how often the behavior currently occurs (1, never, to 7, always; intensity score); scores are totaled. Reliability and validity were established on 2- to 12-year-olds¹⁷ and confirmed on combined random/pediatric outpatient samples.¹⁸

Family Relationships Index. The Family Relationships Index (FRI)¹⁹ is a 27-item measure derived from the Family Environment Scale¹⁹ and measures (1) expressiveness: how much family members express feelings directly; (2) cohesion: degree of help, commitment, and support family members provide, and (3) conflict, including open conflict, anger, and aggression within the family.

Hospital Anxiety and Depression Scale. The Hospital Anxiety and Depression Scale (HAD)²⁰ is a 10-item questionnaire frequently used in screening to provide an indication of anxiety and depression.

General Health Questionnaire. The General Health Questionnaire (GHQ)²¹ is a 12-item questionnaire that is widely used to identify psychiatric disorder in community settings and was used to indicate level of disturbance in the parent.

Statistical analysis

Data were analyzed with the use of SPSS 10.1. Data were checked for normality by consideration of skewness and kurtosis statistics. Univariate tests (2-sample *t* tests, analyses of variance [ANOVA] for normally distributed data and Kruskal-Wallis for non-normal data) were used to assess relations between risk groups, ECBI scores, demographic factors, child behavior, and health variables. Statistical predictors of respiratory symptoms were assessed by using multiple logistic regression analyses.

RESULTS

Fig 1 shows the trial profile. Of 946 questionnaires distributed, 754 were returned (79.7% response rate); 91 children had been randomly assigned to a stringent environmental control before birth¹² and were removed from subsequent analysis. Of the 663 families whose data are reported, 180 (27.1%) were at high risk, 350 (52.8%) at medium risk, and 133 (20.1%) at low risk.

Demographic data

A total of 625 questionnaires (95.1%) were completed by the child's mother, 31 (4.7%) by the father, and 1 (0.2%) by both parents (data missing in 6 cases). Family income ranged between "no income" (2.1%) and ">£30,000" (48.3%), with a median of £20,000 to £30,000 per annum. Socioeconomic group of the mother and father was derived by means of the National Statistics Socio-Economic Classification; the highest grouping in the household was assumed to be indicative of the familial socioeconomic group. For analyses, the groups were reduced to 3 categories (Table I).

Risk group and differences on psychological measures

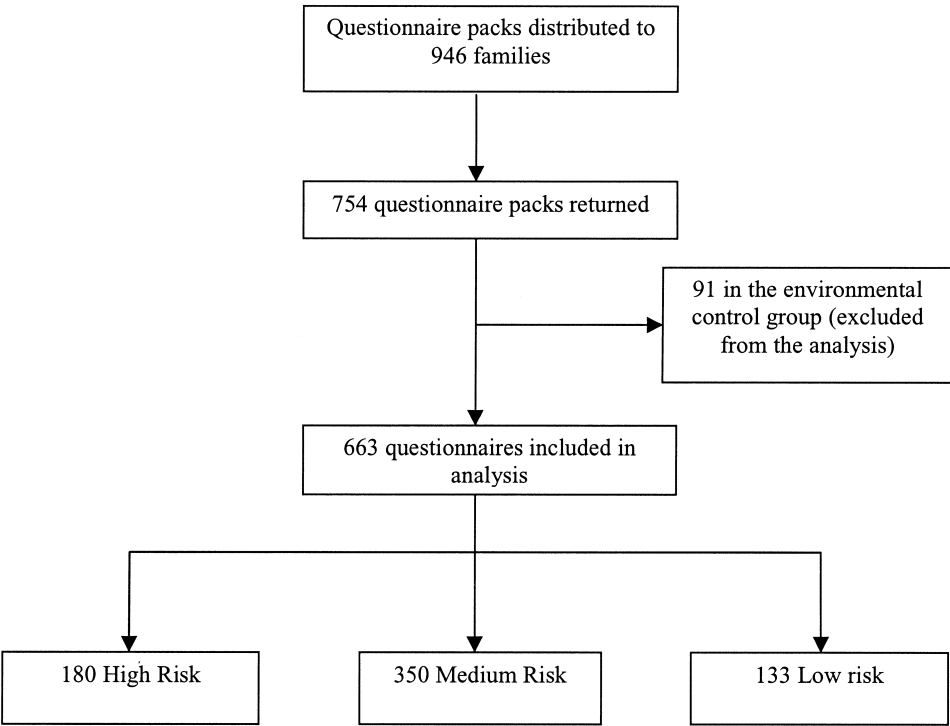
Preliminary 1-way ANOVA and Kruskal-Wallis tests revealed no differences between overall scores for the risk groups for the child behavior or family variables. Similarly, atopic children (at least one skin test with positive results, $n = 73$) did not differ from those who were nonatopic on any psychosocial variables. Data were pooled for initial analysis of the health and psychosocial variables.

Child behavior problems

Independent-sample *t* tests and 1-way ANOVAs on ECBI intensity scores showed no effect of child's sex, parent completing the questionnaire, or socioeconomic grouping, allowing pooling of data. Intensity scores were normally distributed, with a mean score of 99.21 (range, 36 to 186). By using the established clinical cutoff,¹⁹ 88 children (13.3%; 61 boys) fell within the clinically significant range on the ECBI intensity scale (ie, score >127). Problem scores were relatively low and not normally distributed, so only intensity scores were used in subsequent analyses.

Relation between symptoms and child behavior

ECBI intensity scores were compared for the sample as a whole on the basis of positive or negative responses to the respiratory questions through the use of *t* tests. As



Asthma, rhinitis, other
respiratory diseases

FIG 1. Audit trail from study population to analyzed sample.

TABLE I. Demographic characteristics of the sample

		Number	Percentage
Sex	Male	368	55.5
	Female	295	44.5
Number of siblings living at home*	0	156	23.7
	1	360	54.8
	2	117	17.8
	3	19	2.9
	4	5	0.8
Socioeconomic group†	Managerial and professional	408	64.3
	Intermediate	143	22.5
	Routine and manual	84	13.2

*Six parents did not answer on number of siblings; †28 parents did not answer on socioeconomic group.

demonstrated in Table II, ECBI intensity scores were significantly higher for children with parentally reported respiratory symptoms but not for current physician diagnosis of asthma or being prescribed asthma medication.

Relations between psychosocial factors

Depending on the scaling of questionnaires, Pearson or Spearman correlation was used to assess the extent to which the child behavior measure (ECBI intensity) and family variables (FRI, HAD, GHQ) were related. All family functioning and parental health variables were significantly correlated with one another and with ECBI intensity at or beyond the .001 level of significance.

Psychosocial factors and asthma symptoms

The *t* tests and Mann-Whitney *U* tests were used to assess the extent to which the family functioning and

parental mental health scores varied according to asthma symptoms for the sample as a whole. These analyses showed very few significant differences. Levels of family functioning and parental mental health were not significantly different, depending on asthma status. Overall, whereas ECBI intensity scores showed significant elevation for most categories of symptoms, this was not matched by elevation of scores on other psychosocial variables.

Risk group, symptoms of asthma, and child behavior

We then explored the possibility that the risk group might influence scores on the psychosocial variables. One-way ANOVAs or Kruskal-Wallis tests were used to test for significant differences in any of the child behavior or family variables according to whether the child

TABLE II. Respiratory symptoms and behavior ratings (ECBI)

	Reported symptoms		ECBI intensity score Mean (SD)		P value
	Frequency	Percent	Yes	No	
Current physician-diagnosed asthma	56	8.5	102.2 (29.9)	98.9 (24.1)	.344
Taking asthma medication	56	8.5	102.3 (31.6)	98.9 (23.9)	.333
Attacks of wheeze with shortness of breath	91	13.7	105.8 (26.6)	98.1 (24.2)	.006
≥3 episodes of wheeze with shortness of breath	38	5.7	112.6 (23.6)	98.4 (24.5)	.001
Prescribed medication for wheezy attacks	171	25.8	100.8 (27.4)	98.7 (23.6)	.332
Wheeze after playing or exertion	34	5.1	108.0 (29.0)	98.7 (24.4)	.033
Cough apart from with colds	77	11.6	104.3 (29.0)	98.5 (24.0)	.053
Cough after exertion	83	12.5	105.3 (27.6)	98.3 (24.1)	.015

TABLE III. ECBI intensity scores and respiratory symptoms (present or absent) by risk group

		High-risk group (n = 180)		Medium-risk group (n = 350)		Low-risk group (n = 133)	
		ECBI score Mean (SD)	P value	ECBI Score Mean (SD)	P value	ECBI Score Mean (SD)	P value
Current physician-diagnosed asthma	Yes	93.87 (27.0)	.436	101.0 (28.4)	.504	135.80 (34.1)	.002
	No	99.54 (26.2)		98.29 (22.3)		99.73 (24.8)	
Treatment for asthma	Yes	95.29 (31.5)	.516	100.5 (28.8)	.609	147.8 (24.5)	.000
	No	99.46 (26.4)		98.36 (22.3)		99.63 (24.7)	
Attacks of wheeze and shortness of breath	Yes	110.8 (29.2)	.050	101.4 (24.1)	.280	122.2 (30.0)	.005
	No	97.75 (26.4)		97.95 (22.7)		99.17 (24.8)	
≥3 episodes of wheeze and shortness of breath	Yes	116.6 (26.2)	.025	107.55 (23.3)	.058	126.0 (13.6)	.028
	No	97.91 (26.6)		97.97 (22.9)		100.1 (25.9)	
Prescribed medication for wheezy attacks	Yes	103.0 (30.1)	.228	98.03 (25.2)	.795	105.5 (29.4)	.294
	No	97.55 (25.5)		98.76 (22.2)		99.80 (24.9)	
Wheeze after exertion	Yes	102.1 (39.9)	.728	107.7 (25.5)	.052	127.3 (0.58)	.077
	No	98.90 (26.2)		97.95 (22.7)		100.5 (26.0)	
Cough apart from with colds	Yes	102.11 (31.3)	.516	103.3 (26.1)	.154	122.2 (37.0)	.042
	No	98.50 (26.07)		97.91 (22.5)		100.1 (25.1)	
Cough after playing or exertion	Yes	97.50 (31.3)	.772	106.6 (24.1)	.007	116.0 (33.9)	.059
	No	99.28 (26.3)		97.19 (24.1)		99.88 (25.0)	

was at high, medium, or low risk of development of asthma. No significant differences were found.

Further analyses examined independently, for each of the risk groups, the differences in ECBI scores, depending on whether or not particular respiratory symptoms were present (*t* tests; Table III). The results of this analysis showed only two significant differences for the high-risk and one for the medium-risk group. In marked contrast, for the low-risk group, 5 of 8 analyses showed significantly higher ECBI scores for children with symptoms that may be indicative of asthma.

Post hoc power calculation showed that for symptoms with a prevalence of 14%, the study has 80% power to detect differences in ECBI score of 8 or more between those with and those without the symptom (assuming a standard deviation of 25). For symptoms with a prevalence of 6%, the difference detectable is approximately 12 or more.

Behavior problems and recurrent wheeze

Logistic regression was used to test the hypothesis that child behavior problems might be associated with recur-

rent attacks of wheeze with shortness of breath. The risk group was not significantly associated with 3 or more attacks of wheeze ($P = .59$). Strikingly, ECBI score alone was significantly associated with 3 or more attacks of wheeze ($P = .03$, OR = 1.023), that is, the risk of 3 or more attacks of wheeze increases multiplicatively by 1.023 for each unit increase in ECBI. No interaction between ECBI scores and risk group was apparent.

DISCUSSION

Three-year-old children with symptoms indicative of asthma are also rated by their parents as having higher levels of behavioral difficulty. A striking and important finding to emerge was that for the low risk group (no family history of asthma and allergic diseases), there were clear associations between a range of asthma symptoms and behavioral disturbance.

Consistent with the child mental health literature, there were clear correlations between the rating of behavior problems by the parents and all of the other family functioning and parental mental health variables. Ratings of

conflict, anxiety, and depression all contributed to the child's behavior ratings. However, although behavior problems showed clear associations with symptoms, we did not find direct relations between other family variables and symptoms suggestive of asthma. Logistic regression gave some indication that behavior problems were associated with episodes of recurrent wheeze. These data are treated with caution because of the small numbers.

Because of the longitudinal cohort structure, the sample size for the study of psychosocial factors could not be statistically predetermined, and only post hoc power calculations could be made. Similarly, because the study was primarily exploratory and not purporting to be definitive, the risks of misleading results associated with multiple testing are acknowledged. Significance values of $<.05$ are taken as a possible indication of a relation, and those $<.005$ are taken as reasonable evidence. By using the higher significance level, the results for the low-risk group remain. Our findings, taken together, suggest that (1) children at low biological risk of asthma may be particularly vulnerable to behavioral disturbance and (2) irrespective of risk group, there is a link between elevated levels of behavior problems and recurrent attacks of wheeze.

Prospective studies tend to focus on high-risk groups.^{5,6} Our analyses indicated the possibility of different patterns of reporting of behavioral problems according to risk group and might suggest that parents who do not have asthma themselves have greater difficulty in coping with child's symptoms. One major study looking prospectively at relations between parenting, behavior problems, and the development of asthma in a cohort study of 150 children at high risk found that early parenting difficulties in infancy were significantly related to subsequent development of asthma.⁵ Early parenting difficulty was a significant risk factor associated with onset of asthma by age 3 years. Early onset of asthma was associated with a higher level of behavior problems at age 6 years compared with later onset⁵; at age 6, children with asthma showed more psychological difficulties.⁶ However, what emphasizes the importance of the findings in the current study is the fact that the majority of asthma cases at the population level come from low-risk families.²²

In interpreting our findings, it is important to bear in mind that all the data were obtained from parent report. This raises the possibility that some of the findings are due to common method variance and response tendencies in the parent. Furthermore, at this age, we cannot be certain that the respiratory symptoms reflect asthma in all the children. The heterogeneity of wheeze in early life^{23,24} and difficulties in distinguishing between different causes of wheeze are reasons why in the current study we have to be cautious about the specific diagnosis of asthma. However, it is likely that the results are generalizable, as the early transient wheeze and viral associated-wheeze may be characterized by apparently less severe and less frequent symptoms during first few years of life compared with the symptoms observed among children whose recurrent episodes of airway obstruction persist into the school years.²⁵ A further consideration is the small num-

ber of children in the low-risk group, which meant that we had to be cautious in interpreting our regression analyses.

Our findings contribute to a model of the dynamic and circular patterns of influence between genetic, environmental, and psychosocial risk through childhood and have clear implications for intervention. Better treatment compliance is likely in families that are functioning well.²⁶ There is good evidence that behavior problems in children can be substantially reduced through straightforward, brief primary care interventions.²⁷ Parents' approaches to management may vary according to their beliefs and expectations of illness.²⁸

Parents of preschool children have to manage a large number of potentially difficult interactions with the child several times a day. When parents are afraid that a disagreement with the child may lead to crying and potentially to breathing difficulties or feel particular sympathy for a child because of illness, they may back off and concede to the child's wishes in the hopes of avoiding conflict and upsetting the child. This may be particularly true for families with no prior experience of asthma, who may be anxious and uncertain about the best way to manage their young child. In doing so, however, they may inadvertently exacerbate negative cycles of interaction between themselves and the child, with increased negativity, tantrums, and coercive behavior in the child leading to greater conflict. There is the potential for secondary gain, in which the child might obtain increased positive attention from the parents through exaggeration of symptoms.²⁹

Parents need to know how to manage their child calmly and authoritatively and may need professional guidance on the best ways to do this when their child is showing symptoms of asthma. Screening for behavioral problems by questionnaire is quick and easy. A trusted health professional who has been trained in parent management skills and understands the specific problems of parenting children with asthma would be able to offer simple, specific advice on management of the child's behavior; this approach could enhance asthma self-management programs provided for parents.³⁰

Identification of specific aspects of relations between genetic risk, asthma symptoms, and behavior problems emphasizes the need for psychological intervention in early childhood, particularly among young children with recurrent wheeze coming from families with no history of asthma or allergic diseases.

REFERENCES

1. Miller BD, Wood BL. 'Psychophysiologic reactivity' in asthmatic children: a new perspective on emotionally triggered asthma. *Pediatr Asthma Allergy Immunol* 1995;9:133-42.
2. McQuaid EL, Kopel SJ, Nassau JH. Behavioral adjustment in children with asthma: a meta-analysis. *Dev Behav Paediatr* 2001;22:430-9.
3. Weil CM, Wade SL, Bauman LJ, Lynn H, Mitchell H, Lavigne J. The relationship between psychosocial factors and asthma morbidity in inner-city children with asthma. *Pediatrics* 1999;104:1274-9.
4. Wright RJ, Cohen S, Carey V, Weiss ST, Gold DR. Parental stress as a predictor of wheezing in infancy: a prospective birth-cohort study. *Am J Respir Crit Care Med* 2002;165:358-65.
5. Klinnert MD, Nelson HS, Price MR, Addinoff AD, Leung DYM, Mrazek

- DA. Onset and persistence of childhood asthma: predictors from infancy. *Pediatrics* 2001;108:1-8.
6. Mrazek DA, Schuman WB, Klinnert MD. Early asthma onset: risk of emotional and behavioral difficulties. *J Child Psychol Psychiatry* 1998;39:247-54.
7. Hermanns J, Florin I, Dietrich M, Rieger C, Halhlweg K. Maternal criticism, mother-child interaction, and bronchial asthma. *J Psychosom Res* 1989;33:469-76.
8. Schobinger R, Florin I, Zimmer C, Lindemann H, Winter H. Childhood asthma: paternal critical attitude and father-child interaction. *J Psychosom Res* 1992;36:743-50.
9. Walmboldt FS, Wamboldt MZ, Gavin LA, Roesler TA, Brugman SM. Parental criticism and treatment outcome in adolescents hospitalized for severe, chronic asthma. *J Psychosom Res* 1995;39:995-1005.
10. Frankel K, Wamboldt MZ. Chronic childhood illness and maternal mental health: why should we care? *J Asthma* 1998;35:621-30.
11. Lovejoy MC, Graczyk PA. Maternal depression and parenting behavior: a meta-analytic review. *Clin Psychol Rev* 2000;20:561-92.
12. Custovic A, Simpson BM, Simpson A, Kissen P, Woodcock A. Effect of environmental manipulation in pregnancy and early life on respiratory symptoms and atopy during the first year of life: a randomised trial. *Lancet* 2001;358:188-93.
13. Simpson BM, Custovic A, Simpson A, Hallam CL, Walsh D, Marolia H, et al. Manchester Asthma and Allergy Study (^{Nac}MAAS): risk factors for asthma and allergic disorders in adults. *Clin Exp Allergy* 2001;31:391-9.
14. Custovic A, Simpson BM, Simpson A, Hallam C, Craven M, Brutsche M, et al. Manchester Asthma And Allergy Study: low allergen environment can be achieved and maintained during pregnancy and in early life. *J Allergy Clin Immunol* 2000;105:252-8.
15. Lowe L, Murray CS, Custovic A, Simpson BM, Kissen PM, Woodcock A. Specific airway resistance in three year-old children. *Lancet* 2002; 359:1904-8.
16. Ferris BG. Epidemiology standardization project, II: recommended respiratory disease questionnaire for use with adults and children in epidemiological research. *Am Rev Respir Dis* 1978;118(Suppl V6):7-53.
17. Robinson EA, Eyberg SM, Ross AW. The standardization of an inventory of child conduct problem behaviors. *J Child Clin Psychol* 1980;9:22-9.
18. Burns GL, Patterson DR. Normative data on the Eyberg Child Behavior Inventory and Sutter-Eyberg Student Behavior Inventory: parent and teacher rating scales of disruptive behavior problems in children and adolescents. *Child Fam Behav Ther* 2001;23:15-28.
19. Moos RH, Moos BS. *Family Environment Scale Manual*. Palo Alto, Calif: Consulting Psychologists Press; 1986.
20. Zigmond AS, Snaith RP. The Hospital Anxiety and Depression Scale. *Acta Psychiatr Scand* 1983;67:361-70.
21. Goldberg D. *The Manual of the General Health Questionnaire*. Windsor, United Kingdom: NFER-Nelson; 1978.
22. Bergmann R, Woodcock A. Whole population or high-risk group? *Eur Respir J* 1998;12(Suppl 27):9S-12S.
23. Martinez FD, Helms PJ. Types of asthma and wheezing. *Eur Respir J* 1998;12(Suppl 27):3S-8S.
24. Martinez FD, Wright AL, Taussing LM, Holberg CJ, Morgan WJ, and the Group Health Medical Associates. Asthma and wheezing in the first six years of life. *N Engl J Med* 1995;332:133-8.
25. Martinez FD. Present and future treatment of asthma in infants and young children. *J Allergy Clin Immunol* 1999;104:S169-74.
26. Weinstein AW, Faust D. Maintaining theophylline compliance/adherence in the severely asthmatic children: the role of psychologic functioning of the child and family. *Ann Allergy Asthma Immunol* 1997;79:311-8.
27. Sanders MR, Markie-Dadds C, Tully L, Bor W. The Triple P-Positive Parenting Program: a comparison of enhanced, standard and self-directed behavioral family intervention for parents of children with early onset conduct problems. *J Consult Clin Psychol* 2000;68:624-40.
28. Walker LS, Garber J, Van Slyke DA. Do parents excuse the misbehavior of children with physical or emotional symptoms? An investigation of the pediatric sick role. *J Pediatr Psychol* 1995;20:329-45.
29. Weinstein AW, Chenkin C, Faust D. Caring for the severely asthmatic child and family, I: the rationale for family systems integrated medical/psychological treatment. *J Asthma* 1997;34:345-52.
30. Bernard-Bonnin AC, Stachenko S, Bonin D, Charetter C, Rousseau E. Self-management teaching programs and morbidity of pediatric asthma: a meta-analysis. *J Allergy Clin Immunol* 1995;95:34-41.