

BMJ Open Association of allergic diseases with children's life satisfaction: population-based study in Finland

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ABSTRACT

Objective To assess the impact of allergic diseases on the subjective well-being and life satisfaction of primary-school children.

Design Population-based cohort.

Setting Finnish sample of children ages 10 and 12 from the International Survey of Children's Well-Being.

Participants Nationally representative sample of 1947 school children.

Main outcome measure Two different instruments to assess the child's own perception of well-being, the short version of the Student Life Satisfaction Scale (SLSS) and the Brief Multidimensional Student Life Satisfaction Scale (BMSLSS).

Results Altogether, 51.4% of children reported having at least one allergic condition (10.1% asthma, 23.8% eczema and 40.3% seasonal allergic rhinitis). A statistically significant distinction in life satisfaction emerged between non-allergic and allergic children (inferior in the latter). In particular, children with eczema were more likely to report a reduction in life satisfaction compared with non-allergic children (SLSS $\beta=-128.220$; BMSLSS $\beta=-90.694$; $p<0.01$). Apart from freedom from eczema, good life satisfaction was associated with a physically active lifestyle.

Conclusions Active allergic disease reduces the child's own perception of well-being. During clinical visits, more attention should be paid to the child's psychosocial status and impairments, which may differ substantially from those of parents or medical authorities.

INTRODUCTION

Societies worldwide are faced with a progressively increasing risk of immune-mediated health problems such as allergic, autoimmune and inflammatory diseases, and the velocity of propagation is highest in children.^{1,2} Allergic diseases, the first manifestation of these conditions, comprise the most common chronic disease among children, with a prevalence ranging from 7% (eczema) to 14.6% (asthma and rhinitis) in 13 to 14-year-old children.³ Thus, allergic diseases represent a significant burden for society and the family and for the affected individual.

The severity of allergic disease is assessed by the extent of symptoms in daily life. A vicious

Strengths and limitations of this study

- The first nationally representative survey on subjective life satisfaction in primary-school children in Finland.
- The first national study that observed allergic diseases with relation to children's life satisfaction.
- The study did not directly and objectively assess the allergy symptoms in question. The research focus was on children's own perception of life satisfaction rather than on disease severity.
- The data used in the present study are cross-sectional, and any causal relationship between the predictors and outcome variables thus remains obscure.

circle of symptoms of allergic disease such as allergy flares and emotional stress has been documented, and these symptoms can potentially contribute to the experienced burden of the disease.⁴ Despite a growing interest in life satisfaction during childhood, little is known about how chronic diseases such as asthma or eczema affect children's subjective well-being, that is, psychosocial contentment. In fact, the burden of allergic disorders may extend well beyond mere physical functioning.

Youth with a chronic illness are at increased risk for poor self-concept⁵ and show significantly higher rates of emotional and behavioural problems.⁶ Self-concept, as a fundamental part of a child's psychological function, is strongly affected by parental and peer approval, physical appearance and perceived competence in domains of importance, such as athletics.⁷ For example, for children with asthma, a decreased quality of life has been found to be related to limited activities and participation in sports.⁸

The importance of the disease burden may culminate in children, whose recognition of self and self-esteem are still evolving, and thus disease may have a long-term impact on personal well-being and quality of life.⁹⁻¹¹ In the medical literature, quality of life refers to a 'uniquely personal perception, denoting the

way that individual patients feel about their health status and/or non-medical aspects of their lives'.¹² On one hand, health is considered a major component affecting one's quality of life and on the other hand, good quality of life is an important outcome of successful treatment of diseases.⁸

The objective of the study presented here was to assess the impact of allergic diseases on subjective well-being and life satisfaction among primary-school children. Conventionally, children's well-being has been determined indirectly, using proxies such as household income, mortality or life expectancy or using parental reports on child well-being,^{13,14} thus ignoring the child's own point of view. However, children's and parents' perceptions of a child's quality of life often differ; thus, obtaining information directly from the child is advisable.^{9,12} Another gap in the research literature regards the lack of attention to ethnically and racially diverse samples.^{10, 15, 16} Research on racially diverse groups of children with allergic diseases would increase our knowledge of the association between allergy and childhood quality of life in populations of children who may already be at increased risk of impaired well-being.¹⁰

Recent research has provided tools that can be used to evaluate self-reported perceptions of quality of life, satisfaction or other emotional and behavioural elements of children's lives.¹⁷ In the context of allergic diseases, we applied for the first time two summary measures of life satisfaction: the Student Life Satisfaction Scale (SLSS; measuring children's overall life satisfaction) and the Brief Multidimensional Student Life Satisfaction Scale (BMSLSS; measuring children's overall life satisfaction).^{17–19}

METHODS

Study population and setting

This study is part of an International Children's Worlds survey (<http://www.isciweb.org>),²⁰ which is an international survey on school-aged children's subjective well-being. The purpose of the study is to improve children's well-being by creating awareness among children, their parents and their communities, as well as among other parties involved in children's lives, such as policy decision-makers or teachers. The study was approved by the Ethics Committee of the University of Turku (statement obtained 15 February 2016). Cross-sectional data collected in Finland were used, comprising a random selection of nationally representative data from 43 primary schools (35 classes of fourth graders, 39 classes of sixth graders). Informed consent was obtained from the participants and their parents prior to administering the survey. Finally, in each school at least 40 pupils in each of grades 4 and 6 were recruited. In total, 1947 pupils (67.6% response rate; 48.7% boys; mean age, 11 years) completed an online anonymous questionnaire.

Outcome variables

Global life satisfaction

A reduced version of Diener *et al's*¹⁷ SLSS was expanded by one item assessing children's overall life satisfaction

('the things in my life are excellent'), adapted from Huebner.¹⁸ The SLSS hypothesises that children are able to formulate judgements of their overall life satisfaction over and above judgements concerning specific domains (eg, family, friends, community).¹⁷ Instead of asking about dissatisfaction and negative life judgements, the SLSS focuses on positive, affective conceptualisations of the child's life. This provides information that is complementary to children's own perceptions of their optimal development. The internal consistency of the SLSS items was tested via Cronbach's alpha, resulting in $\alpha=0.94$, indicating internal consistency and reliability.

Domain-specific life satisfaction

The BMSLSS¹⁹ measures satisfaction in life in more general terms than the SLSS. The evaluation covers five important life domains, using one item per domain: family life, friendships, school experience, body image, and child's living environment ($\alpha=0.78$).

Scoring and validity

In both scales, the scoring system was modified from the original version (1='strongly disagree' to 6='strongly agree') to an 11-point scale (0–10). A higher score reflects higher life satisfaction. After calculating the mean of all five items, the subscales were summed and transformed into a scale of 0–100.

SLSS and BMSLSS are validated measures of children's experiences of life satisfaction including psychometric properties, targeted to age groups from 8 to 18 years. These measures have been successfully used in other experience sampling studies; however, to date only a few studies have used them in the context of chronic conditions.^{21, 22}

Characterisation of the allergic conditions

Three questions, modified from the International Study of Asthma and Allergies in Childhood (ISAAC) Phase One core questionnaires investigating the prevalence of doctor-diagnosed asthma, allergic rhinitis and eczema in children worldwide²³ were used to characterise allergic disease among the study population. In Finland, the ISAAC core questions on asthma have been validated against antiasthmatic medication reimbursement data from the Finnish Social Insurance Institution and were found to be highly valid.²⁴ The participants were asked whether they used inhaled asthma medication (no/yes) prescribed by a doctor. In like manner, children were asked about the presence of itchy rash sometimes appearing and disappearing (no/yes), which was interpreted to represent atopic eczema. Although ISAAC questions on eczema have not been specifically validated in the Finnish language, it has been shown that, in general, ISAAC questionnaire-derived symptom prevalence is sufficiently precise at the population level.²⁵ Runny or blocked nose and sneezing in seasons of birch pollen or hay (no/yes) was considered to represent seasonal allergic rhinitis in Finland.

Data on background variables

Self-reported sex, age, ethnic background and parent's employment status were used as sociodemographic background variables. Children were asked for the employment status of both parents (mother and father working: yes, no, do not know) and a recoded variable was formed (parents working: no, yes). Ethnic background was determined based on three items: were you/your mother/your father born in Finland (yes, no, I am not sure). Additionally, we used data on pets (a pet in the family when the child was born or currently in the household; yes, no, I do not know). After-school physical activity (sports or exercising) was self-reported.

Statistical analysis

Continuous non-normally distributed SLSS and BMSLSS outcome variables were characterised using means, SD, medians and mean ranks. Ranks, counted over the total data, were used in analyses because of the extremely left skewed distributions of the outcome variables SLSS and BMSLSS. Student's t-test for independent samples was applied in comparisons between variables. In the second phase of analysis, the significant background variables from both SLSS and BMSLSS and all five asthma variables (a pet when born, a pet now, asthma, eczema, perennial rhinitis) were subjected to linear regression analysis. The interactions were evaluated, but all were excluded as non-significant from the final regression models. Imputation of the data was not applied to statistical analysis. However, the analyses were conducted using weighting coefficients calculated for Finnish data.²⁰ This takes into account non-response, varying probabilities of selection and variations between characteristics of the sample and the population from which the sample was drawn. Statistical analyses were carried out using SAS for Windows V.9.4 and p values below 0.05 were considered statistically significant.

RESULTS

Overall, the Finnish children in this study evaluated their well-being as excellent; more than 80% of 10 and 12-year olds were very satisfied with their lives. Altogether, 51.4% (n=965) reported having at least one allergic disease—10.1% (n=188) doctor-diagnosed asthma, 23.8% (n=452) eczema and 40.3% (n=769) seasonal allergic rhinitis.

A significant difference in life satisfaction emerged between non-allergic and allergic children on both scales (table 1). In particular, eczema was associated with reduced well-being when compared with children not manifesting atopic eczema: the difference on both scales was statistically significant (SLSS, $p<0.001$; BMSLSS, $p<0.01$). In contrast, no associations were detected between asthma or allergic rhinitis and life satisfaction. It is of note that all subjects with an asthma diagnosis were on prescribed inhaled asthma medication. An additional correlation analysis showed that all the domains of BMSLSS were

statistically significantly associated with eczema. The most affected domain was body image ($r=-0.10$, $p<0.001$).

The determinants of good life satisfaction were measured by a multivariable model (table 2). Children not having eczema, aged 10 years (grade 4), with working parents and a physically active lifestyle were found to be more satisfied with their lives than other children. Having pets in early infancy or having pets currently had no impact on life satisfaction.

Taken together, the strongest predictor of good life satisfaction was a physically active lifestyle ($\beta=194.05$, $p<0.001$), while reduced life satisfaction was correlated with eczema ($\beta=-128.22$, $p<0.001$).

DISCUSSION

This study, which is the first nationally representative survey on subjective life satisfaction and allergic diseases in primary-school children, revealed that active allergic disease is a major determinant of children's well-being in various domains. In particular, eczema was seen to reduce both global life satisfaction related to children's moods and feelings (SLSS) and life satisfaction as measured across broader domains of living (BMSLSS). In accord with national²⁶ and international²⁷ reports, half of the children in the studied sample reported having at least one allergic condition, indicating that our results may be generalisable.

Allergic diseases comprise the most common chronic disorder of childhood²⁸; they also represent the first manifestation of the growing epidemic of non-communicable diseases,²⁹ which tend to share environmental risk factors and pathomechanisms and frequently coexist.^{2 30 31} Besides their well-known economic burden, chronic diseases exert a substantial psychosocial impact on children and their families. This notwithstanding, health-related quality of life research has only recently attracted scientific interest.^{22 32 33}

The importance of life satisfaction may be highest in childhood. Children, specifically those on the very edge of puberty, are vulnerable to external influences such as peer acceptance.³⁴ This phase of life is especially important with regards to self-acceptance and relation to self. As also demonstrated in this study, younger children were more content in terms of their life satisfaction than older ones. Hence, our study results tend to substantiate those of previous research⁵ according to which age is related to perceptions of well-being, for example in the context of emotional well-being. However, the lack of interaction between the variables of age, allergies and life satisfaction indicates that the experience of life satisfaction is influenced by the burdens presented by allergies and age individually.

Previous studies mainly on adult populations indicate that active allergic diseases are related to decreased well-being, as manifested in fewer relationships, limited daily functioning and decreased self-acceptance, as well as decreased emotional well-being.^{32 33 35 36} Our results

Table 1 Socioeconomic background variables, pet status and allergy variables affecting children's life satisfaction analysed by t-test for independent samples*

	SLSS					BMSLSS				
	n	Mean(SD)	Md	Mean rank	P values	n	Mean(SD)	Md	Mean rank	P values
Gender					0.7642					0.0685
Boy	946	90.3 (14.0)	96	824.7		867	88.8 (11.4)	92	807.4	
Girl	998	89.8 (14.8)	96	818.9		938	89.3 (12.1)	92	848.5	
Grade					<0.0001					<0.0001
4	942	91.0 (14.4)	96	864.4		863	90.7 (11.4)	94	924.9	
6	1002	89.2 (14.4)	94	781.6		942	87.5 (11.8)	90	740.7	
Born in Finland					0.6146					0.1949
No	1880	90.1 (14.5)	96	822.6		1743	89.1 (11.7)	92	831.5	
Yes	64	89.8 (12.7)	96	795.4		62	86.7 (13.6)	90	751.3	
Parents working					<0.0295					
No	577	88.8 (16.0)	94	794.5		542	88.2 (12.9)	92	808.0	0.1292
Yes	1342	90.9 (13.4)	96	840.2		1241	89.6 (10.9)	92	845.3	
Doing sports					<0.0020					<0.0001
No	78	83.1 (21.4)	94	678.2		65	79.8 (16.4)	82	511.4	
Yes	1803	90.4 (14.0)	96			1686	89.4 (11.4)	92	843.8	
A pet when born					0.1852					0.3060
No	962	90.4 (13.3)	96	841.4		894	89.6 (11.1)	92	849.6	
Yes	766	89.3 (15.9)	96	814.2		711	88.7 (12.6)	92	824.9	
A pet now					0.3202					0.0102
No	703	90.5 (13.8)	96	835.7		660	89.9 (11.3)	92	867.0	
Yes	1227	89.8 (14.7)	96	815.7		1132	88.5 (12.0)	92	806.7	
Asthma					0.5263					0.8561
No	1678	90 (14.2)	96	817.6		1566	89.0 (11.6)	92	827.2	
Yes	191	89.3 (16.9)	96	838.2		174	88.3 (13.7)	92	820.2	
Eczema					<0.0001					0.0018
No	1446	90.8 (13.7)	96	843.3		1350	89.6 (11.0)	92	848.5	
Yes	452	87.5 (16.6)	92	745.8		414	87.2 (13.4)	90	764.6	
Seasonal rhinitis					0.6494					0.6441
No	1140	89.9 (14.6)	96	816.0		1061	89.0 (11.6)	92	823.5	
Yes	764	90.0 (14.3)	96	825.1		709	89.1 (11.9)	92	834.2	

*By Kruskal-Wallis non-parametric tests.

BMSLSS, Brief Multidimensional Student Life Satisfaction Scale; Md, median; SLSS, Student Life Satisfaction Scale.

further underline that allergic diseases affect separate domains of children's lives and have a holistic effect; the intricacy of the allergic burden is manifested in children's overall life satisfaction. For example, skin conditions distress psychosocial well-being by virtue of the stigma resulting from the visibility of dermatological symptoms.³³ Furthermore, children with persistent or late-onset eczema or with persistent wheeze were demonstrated to have psychosocial problems at school.³³

Our study results show no association between ethnic background, allergic diseases and life satisfaction. This suggests that the impact of allergic diseases does not differ between ethnically Finnish children and children with an

immigrant background. Parental employment status was significantly related to life satisfaction, indicating that children of working parents were more satisfied with their lives than those of non-working parents. This association, however, was not associated with allergic diseases.

In the present study, respiratory allergy seemed to have less influence on children's life satisfaction than eczema. An alternative explanation would be that the absence of effects indicates that the symptoms of these allergies are treatable. Interestingly, previous studies suggest that symptom-free patients report better well-being than the population on average,³⁷ suggesting that it is not the chronic disease per se which impacts the quality of life

Table 2 Children's life satisfaction explained by grade, parental employment status, physical activity, pet status and allergy variables*

	SLSS			BMSLSS		
	β	SE	P values	β	SE	P values
Grade	-60.880	13.799	<0.001	-106.225	13.322	<0.001
Parents working	65.682	30.324	<0.05	70.065	29.141	<0.05
Doing sports	194.053	67.723	<0.001	307.704	68.914	<0.001
A pet when born	-22.414	29.734	0.4511	-7.676	28.794	0.7898
A pet now	-28.816	30.597	0.3464	-47.133	29.577	0.1113
Asthma	60.220	46.539	0.1959	1.662	45.248	0.9707
Eczema	-128.220	32.575	<0.01	-90.694	31.441	<0.01
Seasonal rhinitis	29.331	29.015	0.3122	19.440	27.947	0.4868

*By linear regression analysis.

BMSLSS, Brief Multidimensional Student Life Satisfaction Scale; SLSS, Student Life Satisfaction Scale.

of those affected but the manifestations thereof (symptoms). Treating asthma promotes a physically active lifestyle,³⁸ and a physically active lifestyle was strongly associated with life satisfaction in the present survey. Thus, the benefit of balanced asthma treatment may extend far beyond physical health to psychosocial consequences and overall improvements in the quality of life.³⁹

This study was the first to investigate the subjectively measured quality of life focusing on children with or without allergic diseases in a large, nationally representative, sample of 10–12-year-old Finnish children. However, some limitations of this study need to be acknowledged. First, the study did not directly and objectively assess the symptoms in question. Rather, the research focused on children's own perception of disease severity. Similarly, there is a potential for error in children's reports of parental employment status and pet ownership at child's birth. Using objective measures or medical records to verify diagnoses and disease severity and, for instance, parental reports to verify employment status is one way for future studies to improve on the current study assessing self-reported diseases as correlates of children's life satisfaction. Lastly, the data used in the present study are cross-sectional, and any causal relationship between the predictors and outcome variables thus remains obscure.

Taken together, our results suggest a call to monitor the psychological well-being of children affected by allergic diseases, which are the most common chronic diseases in childhood. In medical care, consideration should be given to the children's perceived impairments,³⁷ as these may differ substantially from the perceptions of parents or medical authorities.⁴⁰

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Disclaimer The lead author (LH) affirms that the manuscript is an honest, accurate and transparent account of the study being reported; that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

Competing interests None declared.

Patient consent Not required.

Ethics approval This study was approved by the Ethics Committee of the University of Turku.

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REFERENCES

1. Bach JF. The effect of infections on susceptibility to autoimmune and allergic diseases. *N Engl J Med* 2002;347:911–20.
2. Rautava S, Luoto R, Salminen S, *et al.* Microbial contact during pregnancy, intestinal colonization and human disease. *Nat Rev Gastroenterol Hepatol* 2012;9:565–76.
3. Mallol J, Crane J, von Mutius E, *et al.* The International Study of Asthma and Allergies in Childhood (ISAAC) Phase Three: a global synthesis. *Allergol Immunopathol* 2013;41:73–85.
4. Patterson AM, Yildiz VO, Klatt MD, *et al.* Perceived stress predicts allergy flares. *Ann Allergy Asthma Immunol* 2014;112:317–21.
5. Ferro MA, Boyle MH. Self-concept among youth with a chronic illness: a meta-analytic review. *Health Psychol* 2013;32:839–48.
6. Ferro MA, Van Lieshout RJ, Ohayon J, *et al.* Emotional and behavioral problems in adolescents and young adults with food allergy. *Allergy* 2016;71:532–40.
7. Harter S. *The construction of the self: a developmental perspective*. New York, NY, USA Guilford, 1999.
8. Glazebrook C, McPherson AC, Macdonald IA, *et al.* Asthma as a barrier to children's physical activity: implications for body mass index and mental health. *Pediatrics* 2006;118:2443–9.
9. Merikallio VJ, Mustalahti K, Remes ST, *et al.* Comparison of quality of life between asthmatic and healthy school children. *Pediatric Allergy and Immunology* 2005;16:332–40.
10. Everhart RS, Fiese BH. Asthma severity and child quality of life in pediatric asthma: A systematic review. *Patient Educ Couns* 2009;75:162–8.

11. Heintz D, Chalmers J, Nankervis H, *et al.* Eczema trials: quality of life instruments used and their relation to patient-reported outcomes. A systematic review. *Acta Derm Venereol* 2016;96:596–601.
12. Gill TM, Feinstein AR. A critical appraisal of the quality of quality-of-life measurements. *JAMA: The Journal of the American Medical Association* 1994;272:619–26.
13. Coffey JK, Warren MT, Gottfried AW. Does infant happiness forecast adult life satisfaction? examining subjective well-being in the first quarter century of life. *J Happiness Stud* 2015;16:1401–21.
14. Sourander A, Helstelä L, Helenius H. Parent-adolescent agreement on emotional and behavioral problems. *Soc Psychiatry Psychiatr Epidemiol* 1999;34:657–63.
15. McQuaid EL, Farrow ML, Esteban CA, *et al.* Topical review: pediatric food allergies among diverse children. *J Pediatr Psychol* 2016;41:391–6.
16. Shaw TE, Currie GP, Koudelka CW, *et al.* Eczema prevalence in the United States: data from the 2003 National Survey of Children's Health. *J Invest Dermatol* 2011;131:67–73.
17. Diener E, Emmons RA, Larsen RJ, *et al.* The satisfaction with life scale. *J Pers Assess* 1985;49:71–5.
18. Huebner ES. Further validation of the students' life satisfaction scale: the independence of satisfaction and affect ratings. *J Psychoeduc Assess* 1991;9:363–8.
19. Seligson JL, Huebner ES, Valois RF. Preliminary validation of the brief multidimensional students' life satisfaction scale (BMSLSS). *Soc Indic Res* 2003;61:121–45.
20. Children's worlds. 2017 <http://www.isciweb.org>.
21. Lippman LH, Anderson Moore K, McIntosh H. *Positive indicators of child well-being: a conceptual framework, measures and methodological issues. Innocenti working paper No. 2009-21.* Florence: UNICEF Innocenti Research Centre, 2009.
22. McDougall J, Wright V, Nichols M, *et al.* Assessing the psychometric properties of both a global and a domain-specific perceived quality of life measure when used with youth who have chronic conditions. *Soc Indic Res* 2013;114:1243–57.
23. Asher MI, Weiland SK on behalf of the ISAAC Steering Committee. The International Study of Asthma and Allergies in Childhood (ISAAC). *Clin Exp Allergy* 1998;28(Suppl 5):52–66.
24. Nwaru BI, Lumia M, Kaila M, *et al.* Validation of the Finnish ISAAC questionnaire on asthma against anti-asthmatic medication reimbursement database in 5-year-old children. *Clin Respir J* 2011;5:211–8.
25. Flohr C, Weinmayr G, Weiland SK, *et al.* How well do questionnaires perform compared with physical examination in detecting flexural eczema? Findings from the International Study of Asthma and Allergies in Childhood (ISAAC) Phase Two. *Br J Dermatol* 2009;161:846–53.
26. Jousilahti P, Haataela T, Laatikainen T, *et al.* Asthma and respiratory allergy prevalence is still increasing among Finnish young adults: table 1. *Eur Respir J* 2016;47:985–7.
27. Asher MI, Montefort S, Björkstén B, *et al.* Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC Phases One and Three repeat multicountry cross-sectional surveys. *The Lancet* 2006;368:733–43.
28. Masoli M, Fabian D, Holt S, *et al.* Global Initiative for Asthma (GINA) Program. The global burden of asthma: executive summary of the GINA Dissemination Committee report. *Allergy* 2004;59:469–78.
29. NCD Risk Factor Collaboration (NCD-RisC). Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *Lancet* 2016;387:1377–96.
30. Campbell DE, Boyle RJ, Thornton CA, *et al.* Mechanisms of allergic disease: environmental and genetic determinants for the development of allergy. *Clin Exp Allergy* 2015;45:844–58.
31. Hersoug L-G, Linneberg A. The link between the epidemics of obesity and allergic diseases: does obesity induce decreased immune tolerance? *Allergy* 2007;62:1205–13.
32. Baiardini I, Braido F, Giardini A, *et al.* Adherence to treatment: assessment of an unmet need in asthma. *J Investig Allergol Clin Immunol* 2006;16:218–23.
33. Teyhan A, Galobardes B, Henderson J. Child allergic symptoms and well-being at school: findings from ALSPAC, a UK cohort study. *PLoS One* 2015;10:e0135271.
34. Rutter M, Rutter M, Monds D. *Challenge and continuity across the life span.* England: Clays Ltd, 1993.
35. Juniper EF. How important is quality of life in pediatric asthma? *Pediatr Pulmonol* 1997;24:17–21.
36. Tuckman A. The potential psychological impact of skin conditions. *Dermatol Ther* 2017;7(S1):53–7.
37. Osman LM, Calder C, Robertson R, *et al.* Symptoms, quality of life, and health service contact among young adults with mild asthma. *Am J Respir Crit Care Med* 2000;161:498–503.
38. Jago R, Searle A, Henderson AJ, *et al.* Designing a physical activity intervention for children with asthma: a qualitative study of the views of healthcare professionals, parents and children with asthma. *BMJ Open* 2017;7:e014020.
39. Cui W, Zack MM, Zahran HS. Health-related quality of life and asthma among United States adolescents. *J Pediatr* 2015;166:358–64.
40. Akeson N, Worth A, Sheikh A. The psychosocial impact of anaphylaxis on young people and their parents. *Clin Exp Allergy* 2007;37:1213–20.