



Physical Activity and Health Related Quality of Life in Relation to Allergic Disease among Adolescents: Results from a Crosssectional Study

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Abstract

Aim: The overall aim was to investigate the impact of self-reported allergic disease on physical activity (PA) and health-related quality of life (HRQoL) among adolescents.

Methods: A cross-sectional analysis of 1 181 adolescents aged 13-14 years (251 with current allergic disease), participating in the baseline investigation of the Southern Sweden allergy cohort, including a survey with questions on wheeze, rhinoconjunctivitis, eczema, PA and HRQoL.

Results: Boys were more physically active than girls (mean total PA score 6.47 vs. 5.98, possible range 3-9). There were no noticeable differences in PA among adolescents with and without allergic disease ($p \geq 0.3$ in all comparisons). Clear differences in HRQoL were observed depending on current or previous symptoms. In particular, adolescents with both current asthma and rhinoconjunctivitis scored lower HRQoL than the others.

Conclusions: Our results support the importance of having health care measures directed towards promoting PA among adolescents with allergic disease as part of their treatment. The noticeable impaired HRQoL during pollen season in relation to self-reported symptoms observed in the present study warrants further attention by health care.

Keywords: Adolescent health; Allergy; Asthma; Physical activity; Health-related quality of life

Abbreviations: The International Study of Asthma and Allergies in Childhood (ISAAC); The international Physical Activity Questionnaire (IPAQ); Health Related Quality of Life (HRQoL); Pediatric Allergic Disease Quality of Life Questionnaire (PADQLQ); Physical Activity (PA); Rhinoconjunctivitis (RC).

Introduction

Physical activity (PA) includes varying forms of activities such as sports, playing, gymnastics, exercise or outdoor activities during school-hours and leisure time [1]. The World Health Organization [1] and the Swedish National Board of Health and Welfare, Guidelines for Prevention and Treatment in Unhealthy Living [2] recommend that children and

adolescents should accumulate at least 60 min of moderate to vigorous physical activity (PA) every day to achieve positive effects on their health and health-related quality of life (HRQoL). However, it has been reported in several studies that the vast majority (80%) of adolescents worldwide do not meet this recommendation [1,3]. It is known that PA is associated with health and improved psychological well-being among children [4,5]. It is also known that asthma, conjunctivitis and rhinitis are some of the most common allergic diseases worldwide, placing considerable burdens on the individuals and their families [6-8]. Studies have reported that childhood asthma may have negative impact on PA [9-12]. On the other hand, there is also empirical evidence suggesting that PA may protect against asthma symptoms due to the increase of aerobic capacity [13]. However there are little research in associations between PA, HRQoL and allergic disease [14]. HRQoL defines the perceived physical and mental health over time at individual or group level, and is commonly used to investigate the impact of health status on quality of life [14,15]. A general finding from previous research in this area is that allergic disease may have marked consequences in terms of HRQoL among children and adolescents [7,16]. Several studies have shown significantly reduced HRQoL in children and adolescents with grass pollen allergy during the pollen season [17,18]. However, research in this field has mainly been focused on individuals with verified allergy-diagnosis, excluding those with self-reported allergic conditions [12]. Thus the overall aim of this study was to investigate the impact of self-reported allergic disease on PA and HRQoL among adolescents.

Methods

Study design

The present study was approved by the Regional Ethics Board in Lund, Sweden (No. 2011/753). It is a cross-sectional analysis of adolescents aged 13-14 years, participating in the baseline investigation of the Southern Sweden allergy cohort, which has been described in detail previously [19]. The cohort was established from a random sample of schools in 13 of 52 municipalities (300 schools for the selected age group) in four counties in southern Sweden. Stratified sampling was done in order to obtain data from both small and large municipalities and from coastal as well as rural counties. The location of the school was used as a proxy for the living area (large city, city and countryside), since most children live close to their elementary school in Sweden. Information on the study was sent to the heads and school nurses of 104 schools in 2012. Each head was contacted personally by telephone in order to elicit the school's participation in the study, resulting in the participation of 51 schools (230 classes in grade 7 and 8). Written information about the study was delivered to the adolescents at school and sent home to their parents. The web-based survey used in this study was completed during school hour in the fall semester (September-November) under the supervision of the school nurse or a teacher. Written informed consent from their guardians were required in order to participate, which was obtained for 2 568 (46%) of the 5622 eligible adolescents attending the participating schools. A

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flow chart describing recruitment and participation with a total of 1 181 participating adolescents is presented in Figure 1.

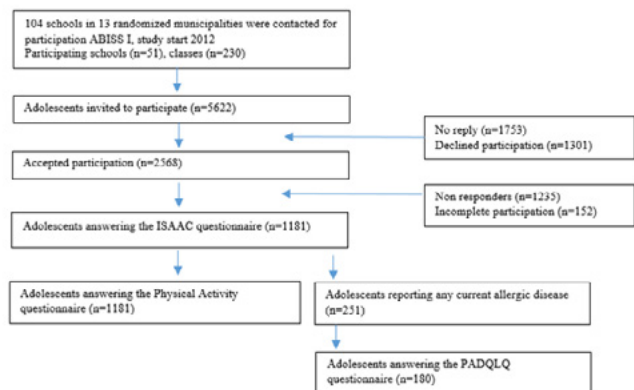


Figure 1: Recruitment of the study population (n=1 181) for the present investigation.

Survey

The web-based survey was constructed and provided by Clinical Studies

Sweden, Forum South, Skane University Hospital, and Lund, Sweden. The survey comprised mainly of questions from international, validated questionnaires, but a few study-specific questions were also included (see further below). The questionnaire modules for asthma, eczema and rhinoconjunctivitis (RC) from the International Study of Asthma and Allergies in Childhood (ISAAC) [20] were used. The ISAAC questionnaire was designed as a tool for epidemiological research in asthma and allergic diseases, and has been widely used during the past decade [7]. In order to assess HRQoL, we used the Swedish version (LILA) of the disease-specific and validated, Pediatric Allergic Disease Quality of Life Questionnaire (PADQLQ) [21]. This questionnaire was only answered by those who reported any pollen related symptoms. PADQLQ has 26 questions in three domains: 1) Practical domain with questions about symptoms that affect concentration, sleep, hearing, breathing and physical activity (question Q1-7, 26). 2) Physical domain with questions about physical allergy symptoms on airways, eyes, nose, skin, tiredness and thirst (Q8-22). 3) Emotional domain with questions about irritation and fear of having an asthma attack (Q23-25). Each question was answered on a 7 point Likert scale where 0 denotes “not troubled at all” and 6 “extremely troubled”. A mean score (with range 0-6) was calculated for each participant in each of the three domains in PADQLQ.

Three questions about PA designed by the research group specifically for

Current RC	Current RC	Previous asthma and/or RC	Current eczema
If the respondent answered yes to rhinitis (sneezing, runny or blocked nose)	If the respondent answered yes to rhinitis (sneezing, runny or blocked nose without a cold) and conjunctivitis (itchy and/or watery eyes) at any time in their life and during the past year	If the respondent answered yes to asthma and orrhinitis/conjunctivitis, at any time in their life but not during the past year.	If the child answered yes to itching, rash/eczema for six months at any time during their life, and during the past year

Table 1: Definitions of current allergic symptoms used in this study

this study were used: I). Think of what you have done during break time at school during the past seven days; how many of these days have you been warm and sweaty after physical activity? Answers were scored as: Low (1)=No day or one day, Medium (2)=Two or three days, High (3)=four or five days. II). Think of what you do after the school day; how many times a week do you exercise and become warm and sweaty? Answers were scored as: Low (1)=Never, more seldom or once a month, Medium (2)=Once a week, High (3)=More than once a week or every day III). Think of the last three days that were not school days; how many of these days did you exercise so that you became warm and sweaty? Answers were scored as: Low (1)=Never, more seldom or once a month, Medium (2)=Once a week, High (3)=More than once a week or every day III). Think of the last three days that were not school days; how many of these days did you exercise so that you became warm and sweaty? Answers were scored as: Low (1)=No day, Medium (2)=One to two days, High (3)=three days. The answers of these three questions were summed up in a total PA score, 3-9. Data on symptoms related to asthma, RC and eczema were obtained from the questionnaire using the definitions given in Table 1.

Statistical analysis

Statistical analysis was conducted using SPSS Statistics 25.0 for Windows (SPSS Inc., Chicago, IL, USA). $P < 0.05$ was regarded as statistically significant. Differences in PA between symptom-groups were tested using Mann-Whitney test. Differences in mean PADQLQ scores between symptom-groups were tested using one-way ANOVA overall and independent t-test for subsequent two group comparisons. The

Spearman's rank-correlation coefficient was calculated as a measure of the association between total PA score and PADQLQ.

Results

The study population of 1181 participating adolescents consisted of 50% girls, mean age was 13.5 years, 96% were born in Sweden and 12% were exposed to smoking within the family. Data on school location, eczema and BMI are presented in Table 2 in four groups with current symptoms (n=251 in total): Current asthma-only (6.9%), current RC-only (10.2%), both current asthma and RC (4.2%) and neither RC nor asthma currently (78.7%). There were no clear differences in symptoms across school locations. The prevalence of eczema was significantly higher in all symptom groups than in the non-symptomatic group ($p < 0.001$ in all three comparisons). The mean BMI [22] of the participants in this study was in the normal range and there were no apparent differences across the symptom groups. Boys were more physically active than girls (mean total PA score 6.47 vs. 5.98, possible range 3-9; Table 3). There were no noticeable differences in PA among adolescents with and without allergic disease ($p \geq 0.3$ in all comparisons). When the analysis was conducted separately for boys and girls, still no differences in PA were apparent across the groups (results not shown). The proportion of participants reporting PA classified as high was 19% for school breaks, 67% after school and 29% for school-free days (Table 3). Only 29% of the boys and 22% of the girls reported PA classified as high both after school and during school free days. There were 180 participants with allergic symptoms during pollen season who answered the PADQLQ about HRQoL. The ANOVA test

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		Current asthma only	Current RC only	Both current asthma and RC	No asthma or RC	All Participants
n		81	120	50	930	1 181
Gender, n(%)	Female 38	-46.9	62 (51.7)	23 (46.0)	469 (50.4)	592 (50.1)
	Male	43 (53.1)	58 (48.3)	27 (54.0)	461 (49.5)	589 (49.9)
BMI* mean (range)		20.48 (14-29)	19.44 (14-28)	19.44 (13-28)	19.77 (12-35)	19.77 (12-35)
School-location, n(%)	Large city)	20 (24.7)	27 (22.5)	10 (20.0)	214 (23.0)	271 (22.9)
	City	39 (48.1)	61 (50.8)	28 (56.0)	448 (48.1)	576 (48.8)
	Countryside	22 (27.2)	32 (26.7)	12 (24.0)	268 (28.8)	334 (28.3)
Eczema, n(%)		22 (27.2)	30 (25.0)	18 (36.0)	145 (15.6)	215 (18.2)

*BMI: age 13 male<21.90, female 22.57, age 14 male<22.61, female<23.33 (limits for overweight)

Table 2: Basic characteristics of the study population (n=1 181 respondents), stratified by self-reported current allergic symptoms

Physical activity		Current asthma only	Current RC only 1 missing	Both current asthma and RC	No current asthma or RC	All participants	p-value
n		81	119	50	925-927	1175-1177	
PA total score, mean (SD) range 3-9	Boys	6.47 (1.50)	6.46 (1.64)	6.44 (1.89)	6.47 (1.67)	6.47 (1.66)	0.3
	Girls	6.00 (1.25)	5.92 (1.57)	5.70 (1.49)	6.00 (1.47)	5.98 (1.47)	0.4
PA during break time at school *n=1177(%) 4 missing	Low	40 (49.3)	72 (60.5)	26 (52.0)	502 (54.2)	640 (54.3)	0.5
	Medium	27 (33.3)	26 (21.8)	14 (28.0)	249 (26.8)	316 (26.8)	
	High	14 (17.2)	21 (17.6)	10 (20.0)	176 (18.9)	221 (18.8)	
PA after school day **n=1176 (%) 5missing	Low	10 (12.3)	23 (19.3)	13 (26.0)	173 (18.6)	219 (18.6)	0.3
	Medium	16 (19.7)	18 (15.1)	7 (14.0)	130 (14.0)	171 (14.5)	
	High	55 (67.9)	78 (65.5)	30 (60.0)	623 (67.2)	786 (66.8)	
PA during the previous 3 schoolfree days *** n=1175 (%) 6 missing	Low	16 (19.7)	21 (17.6)	12 (24.0)	177 (19.1)	226 (19.2)	0.4
	Medium	48 (59.2)	58 (48.7)	22 (44.0)	480 (51.7)	608 (51.7)	
	High	17 (20.9)	40 (33.6)	16 (32.0)	268 (28.0)	341 (29.0)	

*Low=No day or one day, Medium=Two or three days, High=four or five days. ** Low=Never, more seldom or once a month, Medium=Once a week, High=More than once a week or every day. *** Low=No day, Medium=One to two days and High=three days

Table 3: Self-reported physical activity (PA) among the study participants, stratified by self-reported current allergic symptoms.

n=180 *Likert scale 0-6	Current asthma only	Current RC only	Both current asthma and RC	Previous asthma and/or RC	p-value
n	18	62	29	71	
Practical domain mean (range)	1.62 (0.30-4.50)	1.56 (0-4.13)	2.24 (0-4.75)	0.93 (0-5.0)	<0.001
Physical domain mean (range)	2.12 (0-4.40)	2.39 (0.36-4.67)	2.63 (0-4.87)	0.99 (0-4.73)	0.004
Emotional domain mean (range)	1.29 (0-4.00)	1.04 (0.0-4.33)	1.51 (0.0-5.0)	0.47 (0-6.0)	0.001

* 0=“not troubled at all” and 6=“extremely troubled”

Table 4: HRQoL scores obtained from the PADQLQ-questionnaire in relation to selfreported current or previous allergic symptoms

showed strong empirical evidence for differences in all three dimensions of HRQoL depending on current or previous symptoms ($p \leq 0.004$) (Table 4). Likewise, there were strong empirical evidence suggesting that adolescents with both current asthma and RC ($n=29$) had lower HRQoL in all three domains compared to those with only one current or no current symptom ($n=152$; $p \leq 0.005$; not in tables) the differences between the groups in the three domains are further illustrated in Figure 2. The correlation between total PA score and the three domains of HRQoL was consistently low (Spearman’s rank-correlation coefficient -0.14, -0.11 and -0.08, respectively).

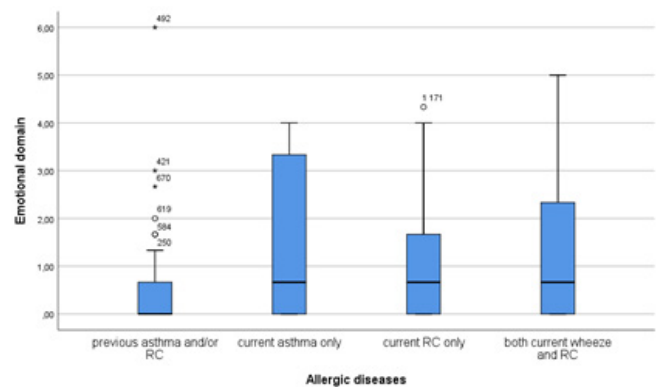
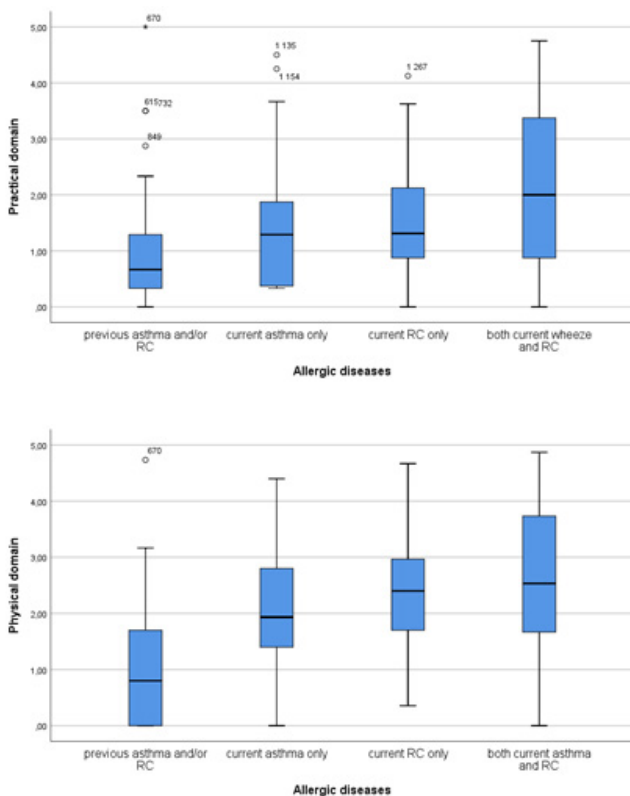


Figure 2. Differences between the symptom groups; previous asthma and/or RC, current asthma only, current RC only, and current asthma and RC, in the three domains of HRQoL. a) Practical domain, b) Physical domain and c) Emotional domain. HRQoL scores from the 7-point Likert scale used in the PADQLQ-questionnaire are given on the Y-axis were 0 denotes “not troubled at all” and 6 “extremely troubled”.

Discussion

There were two salient findings in the present study. Firstly, there were no noticeable differences in PA among adolescents with or without allergic disease. Secondly, clear differences in HRQoL were observed depending on current or previous symptoms. In particular, adolescents with both current asthma and RC scored lower HRQoL than the others. Our results support the importance of having health care measures directed towards promoting PA among adolescents with allergic disease as part of their treatment [2]. Adherence to such recommendations and guidelines could be one of the reason why adolescents with and without allergic disease were equally active in the present study. Both current and previous asthma were associated with lower PA in a cross-sectional study of adolescents in 2002 in Denmark [23]. This is a finding that could not be confirmed in our study. Our study was smaller and thus more statistically uncertain, but another potential explanation for the differences could be that our study represents more recent birth cohorts where PA among individuals with allergic disease has been promoted. Other studies on PA and asthma control among adolescents reported similar results with no associations

between asthma symptoms and PA in line with the present study [11,24]. Adolescents who participate regularly in physical activities are more likely to have better general health than those who never participate in physical activities [12,25,26]. The finding that adolescents with both current asthma and RC had lower HRQoL in all three domains during the pollen season, compared to those with only one current or no current symptom, is in line with previous studies [7,14,16,27,28]. The newly updated, ARIA (Allergic Rhinitis and its Impact on Asthma) guidelines with the approach to provide an active and healthy life to this patient group and to stress the importance of HRQoL instruments in clinical practice to evaluate and treat symptoms, using mobile technology [29]. PA during the school day may have many positive effects. As an example frequent PA at school was associated with higher final grades for boys in a recent study [30]. Many of the adolescents in our study were not physically active during break time at school that might have been due to short pauses or not enough stimulating environment in the schoolyards. It is thus important to promote PA at school, which could be done by investments in both school and surrounding environments [31].

Strengths and limitations

A major strength of the present study was the population-based design, with a broad range of questions covering previous and current symptoms resulting from respiratory allergy, daily PA and HRQoL during the pollen season. Validated questionnaires, ISAAC and PADQLQ were to a large extent used to ensure that the results of the study were comparable to those from other investigations. The PADQLQ is a disease specific questionnaire used to obtain an overview of the HRQoL among a large population. The questionnaire is not specific to each individual, and important information could therefore be missed [21]. Another limitation was that the questions about PA were study-specific and not validated. On the other hand, the expected higher PA level among boys than among girls was confirmed in our study, and the associations found were in line with other studies [11,24]. The study size made it impossible to assess PA using accelerometers. An additional noteworthy limitation was the low rate of participation regarding both the number of schools that agreed to participate, and the number of adolescents participating from each school. Finally, as this is a cross-sectional study, no firm conclusions about causality can be drawn.

Conclusions

Our results support the importance of having health care measures directed towards promoting PA among adolescents with allergic disease as part of their treatment. The noticeable impaired HRQoL during pollen season in relation to allergic disease observed in the present study warrants further attention by health care. The finding that only a minority of both boys and girls, irrespective of allergic disease, reported PA classified as high both after school and during school-free days also calls for further investigations.

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Conflict of interest

All authors declare no conflicts of interest.

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