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SHORT COMMUNICATION

Health-related quality of life in young adults with asthma

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Summary
Background: The aim was to study health-related quality of life, five years after an intervention study among young adults with asthma.
Method: The design was a follow-up study of a cohort of young adults with asthma ($n = 64$) and 248 general population controls. Both groups were investigated at follow-up with a respiratory questionnaire and one generic quality-of-life instrument, and the asthma cohort also completed one-asthma-specific questionnaire. The material was analyzed with multivariate models.
Results: Female gender and low FEV_1 at baseline predicted both a decline during follow-up and a low quality of life at follow-up. The asthma cohort and controls scored similarly regarding generic quality of life. However, in the asthma cohort, females scored significantly lower in the physical dimension of the generic instrument, especially in the domain of general health.
Conclusions: There is an association between low FEV_1 and a decline in quality of life among young adults with asthma, i.e. low FEV_1 predicts a decline in quality of life during a five-year period. Young females with asthma seem to have lower quality of life compared with young males with asthma.

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Introduction

The goal of modern asthma treatment is to achieve and maintain asthma control in a long-term perspective[1] as such control is beneficial not only to the management of clinical manifestations but also to the improvement of health-related quality of life (HRQL).[2] We have, however, limited knowledge of whether young adults with moderate to severe childhood asthma have impaired quality of life or how quality of life changes as young adults grow older. There is a lack of studies of young adults: most of the studies about quality of life are carried out in older or much younger populations. In one review it was concluded that the conventional clinical parameters of lung function, symptoms, and reliever medication use predict the levels of quality of life differently depending on the level of asthma severity under study. Furthermore, these traditional measures of asthma severity and asthma control explain only half of the variance of HROL.[3] There are data which suggest that personality can influence how asthma patients adhere to asthma medication treatment, and report their control and HRQL.[4]

We have previously assessed the effectiveness of a limited asthma education program with the aim of improving asthma control and quality of life in a group of young adults with asthma.[5] We have now, five years later, performed a questionnaire-based follow-up in all 97 subjects and added a randomly selected group of controls from the general population. The aims of the study were to analyze whether quality of life has changed during follow-up and, whether young adults with asthma have impaired quality of life compared with a control group at the same age.

Material and methods

Study population

Between 1997 and 1998, 97 consecutive patients between the ages of 18 and 25 who were referred to the special ''Asthma outpatient clinic for young adults'' from the Children's Hospital at the Sahlgrenska University Hospital in Göteborg participated in a one-year computerized limited asthma education program.[5] The present study population comprised these 97 subjects with asthma (the asthma cohort) and 500 randomly selected controls from the same source population in the same age interval. The controls were selected from the general population at the year of the follow-up, i.e. 2003. The Ethics Committee at the Faculty of Medicine, University of Gothenburg approved the study.

Methods

The study consisted of a postal self-administered questionnaire. Non-responders received two reminders. The questionnaire consisted of two parts. One part was developed from previous questionnaires[6–10] and included items about asthma, rhinitis and eczema, use of medication, smoking, professional experience, physical activity, and family history of asthma and allergy. The second part consisted of two quality of life questionnaires, one generic and one asthma-specific. The asthma-specific questionnaire was sent only to the asthma cohort.

The generic questionnaire was the Short Form 36 Health Survey (SF-36), which consists of 36 items, which refer to eight health scales related to daily life activities.[11] Four of these health scales represent the physical dimension: (1) physical functioning, (2) role-functioning-physical, (3) bodily pain and (4) general health: the remaining four scales represent the mental dimension: (5) vitality, (6) social functioning, (7) role-functioning-emotional; and (8) mental health. All of these health scales score on a range from 0 to 100, with 100 representing the highest level of functioning and well being. The SF-36 questionnaire was used at follow-up only.

The asthma-specific questionnaire was the Living with Asthma Questionnaire,[12–14] which includes 11 domains: (1) social and leisure activities, (2) sports, (3) holidays, (4) sleep, (5) work and other activities, (6) colds, (7) mobility, (8) effects on others, (9) medication usage, (10) sex and (11) dysphoric states and attitudes. The subjects responded to the questionnaire on a three-point scale: untrue, slightly true and very true. The alternative response ''not applicable'' was also available. Quality of life was calculated according to Hyland as the sum of the points in each item divided by the sum of the points in each area, i.e. the mean scores are calculated and analyzed as continuous variables. This questionnaire was completed both at the start of the study and at follow-up.

Definitions

The following terms used in analysis and discussion were defined as positive responses to the respective yes/no questions and refined as indicated by the accompanying comments.

Physician-diagnosed asthma: ''Have you been diagnosed by a physician as having asthma?''
Prescribed asthma medication: ''Have you used any asthma medication during the last 12 months?'' If the answer was ''yes'', the following questions were asked: ''Have you used rapid-acting inhaled beta$_{2}$- agonist?'' and ''Have you used inhaled corticosteroids?''
Current asthma: affirmative answer to the question, ''Have you been diagnosed by a physician as having asthma?'' and either ''Have you had asthma symptoms during the last 12 months?'', or ''Have you used asthma medication during the last 12 months?''
Body mass index was calculated by weight (kg) divided by the square of the height (m^2) and it was classified by the current WHO classification.
Smoking: subjects were classified as either never smoked or ex-smoker/smoker.
Physical exercise was classified in four categories often, sometimes, seldom or never. The question was ''How often do you exercise until breathlessness or until you are dripping with perspiration in your spare time''.

A sample of non-respondents from the asthma cohort ($n = 32$) and from the control group ($n = 114$) was randomly chosen for a telephone interview based on the short questionnaire. Of these, 70 could be reached for the

interview, 19 from the asthma cohort and 51 from the control group.

Statistical analyses

For the analyses the statistical package SAS, version 8 was used. We used chi square test in the univariate analyses of differences regarding characteristics Student *t*-test for continuous variables, *p*-values < 0.05 were considered significant.

In the multivariate analyses generalized linear multiple regression models (PROC GLM) were used to estimate the associations between dependent and independent variables. We analyzed the change in quality of life in the asthma cohort as the difference in total sum in the Hyland questionnaire between year 1 and follow-up (year 6). Further, at follow-up we analyzed the predictors for total overall scores in the asthma-specific questionnaire and the predictors for the physical and mental dimensions of the generic questionnaire (SF-36). In all models the independent variables included gender, smoking, and educational level. In addition, skin-prick test, lung function at baseline, and current asthma at follow-up were added to some models. When we analyzed change during follow-up the baseline value was also included in the model.

Results

Descriptive results

At follow-up, 66% ($n = 64/97$) of the asthma cohort and 50% ($n = 248/500$) of the control group answered the questionnaire: demographics are shown in Table 1. The prevalence of ever having smoked was higher in the asthma cohort than in the control group (54.7% vs 31.9%). There were no significant gender differences regarding different asthma symptoms in either the cohort or the control group (data not shown).

In the asthma cohort 82.8% ($n = 53$) affirmed and 17.2% ($n = 11$) denied ever regularly using any asthma medication, all 11 ''deniers'' were female. The use of inhaled steroids only was reported by 65.6%.

Health-related quality of life

The overall score at follow-up of quality of life in the asthma cohort assessed with the ''Living with Asthma Questionnaire'' was 162.3 (SE = 3.7). Multiple linear regression modeling analysis showed that female gender ($p = 0.01$) and a low FEV_1 at baseline ($p = 0.002$) predicted a lower quality of life at follow-up. We also analyzed the change in quality of life in the asthma cohort. Quality of life assessed with the specific instrument ''Living with asthma'' did not change significantly during the five years of follow-up (−3.32 [SE = 3.8] with slight differences between males [−2.8] and females [−3.8]). Despite the univariate results, in a multiple linear regression analysis female gender ($p = 0.04$) and low FEV_1 ($p = 0.01$) at baseline predicted a decline in quality of life in the asthma cohort.

However, in certain domains there were significantly declines of the scored quality of life outcomes. In the domain of holidays there was a significant decline for the whole group (−0.44, SE = 0.06, $p < 0.0001$), which was most marked in males (−0.51, SE = 0.09, $p < 0.0001$) as compared with females (−0.39, SE = 0.08, $p < 0.0001$).

In the univariate analysis of the generic instrument (SF-36) the asthma cohort scored significantly lower compared to the general population controls regarding the physical dimension (52.7 vs 54.0, $p = 004$), especially in physical functioning (PF) ($p = 0.004$) and general health (GH) ($p = 0.0001$) (Table 2). However, regarding the mental dimension there was an indication of higher scoring for the asthma cohort (47.2 vs 44.8, $p = 0.18$). This was especially seen in social functioning (SF) ($p = 0.04$) and role-functioning-emotional (RE) ($p = 0.01$). In the multiple regression models there were no significant differences between the asthma cohort and the controls in either the physical dimension or the mental dimension. The model was adjusted for gender, education and smoking habits.

Within the asthma cohort females, scored lower in the physical dimension than males ($p = 0.0009$): this was most obvious in the domain of general health ($p = 0.0002$). In the control group, females scored lower in the mental dimension than males ($p = 0.002$), which was most obvious in the domain of role-functioning-emotional (RE) ($p = 0.0009$) (Table 2). We observed similar results in the multiple

Table 1 Study population, young adults with asthma ($n = 64$) and control group ($n = 248$) at the same age.

	Asthma cohort			Control group		
	All, $n = 64$	Males, $n = 28$	Females, $n = 36$	All, $n = 248$	Males, $n = 110$	Females, $n = 138$
Age (yr)	26.3 (0.3)	26.1 (0.3)	26.5 (0.3)	25.7 (0.1)	25.7 (0.1)	25.6 (0.1)
BMI (kg/m^2)	23.5 (SE = 0.4)	24.3 (SE = 0.6)	22.9 (SE = 0.5)	23.1 (SE = 0.2)	24.0 (SE = 0.3)	22.4 (SE = 0.2)
Asthma hereditary	25.0% ($n = 16$)	32.0% ($n = 9$)[a]	19.4% ($n = 7$)	13.7% ($n = 34$)	11.8% ($n = 13$)	15.2% ($n = 21$)
Positive skin-prick test at baseline	87.5% ($n = 56$)	96.4% ($n = 27$)	80.5% ($n = 29$)	n.a.	n.a.	n.a.
Ex-smoker/smoker	54.7% ($n = 35$)	28.6% ($n = 8$)	47.2% ($n = 17$)	31.9% ($n = 79$)	26.4% ($n = 29$)	36.2% ($n = 50$)
Education level — university	54.7% ($n = 35$)	64.3% ($n = 18$)	50.0% ($n = 17$)	55.2% ($n = 137$)	53.6% ($n = 59$)	57.4% ($n = 78$)
Physical exercise — often	48.4% ($n = 31$)	64.3% ($n = 18$)	36.1% ($n = 13$)	54.8% ($n = 136$)	58.2% ($n = 64$)	52.2% ($n = 72$)
Current asthma	87.5% ($n = 56$)	89.2% ($n = 25$)	86.1% ($n = 31$)	5.2% ($n = 13$)	2.7% ($n = 3$)	7.2% ($n = 10$)

n.a. = Not applicable.

[a] Males with astma heriditary in the asthma cohort compared to the control group ($p = 0.007$).

Table 2 SF-36 scores in the whole asthma cohort and in the whole control group. Comparison of SF-36 scores between males and females in the asthma cohort and in the control group.

SF-36 health scales	Asthma cohort				Control group			
	All ($n = 64$)	Males ($n = 28$)	Females ($n = 36$)	p-Value	All ($n = 248$)	Males ($n = 110$)	Females ($n = 138$)	p-value
Physical dimension	*52.7 (0.9)*	*55.8 (0.8)*	*50.2 (1.3)*	*0.0009*	*54.0 (0.5)*	*54.1 (0.6)*	*53.9 (0.7)*	*0.29*
Physical functioning (PF)	93.7 (1.2)	97.6 (0.7)	90.6 (2.0)	0.003	93.4 (1.1)	94.1 (1.7)	92.8 (1.3)	0.02
Role-functioning-physical (RP)	90.5 (3.1)	94.6 (3.9)	87.1 (4.6)	0.04	85.8 (1.8)	85.7 (2.8)	85.9 (2.4)	0.46
Bodily pain (BP)	85.1 (2.4)	91.5 (2.8)	80.0 (3.5)	0.01	81.6 (1.4)	84.9 (1.8)	79.1 (2.1)	0.07
General health (GH)	65.7 (2.9)	77.9 (3.6)	55.9 (3.7)	0.0002	78.2 (1.1)	80.3 (1.6)	76.5 (1.5)	0.05
Mental dimension	*47.2 (1.2)*	*47.5 (1.7)*	*47.0 (1.6)*	*0.38*	*44.8 (0.7)*	*47.5 (0.9)*	*42.7 (1.1)*	*0.002*
Vitality (VT)	62.5 (2.6)	67.4 (3.6)	58.7 (3.6)	0.07	61.7 (1.3)	66.0 (1.8)	58.3 (1.8)	0.00
Social functioning (SF)	86.7 (2.6)	91.5 (3.0)	82.9 (3.9)	0.08	82.1 (1.5)	86.7 (1.8)	78.4 (2.3)	0.004
Role-functioning-emotional (RE)	89.4 (3.3)	90.1 (4.6)	88.9 (4.7)	0.39	80.2 (2.2)	87.6 (2.7)	74.4 (3.2)	0.0009
Mental health (MH)	75.0 (2.2)	76.3 (3.0)	73.9 (3.1)	0.36	74.0 (1.2)	77.3 (1.6)	71.3 (1.6)	0.009

Standard error (SE) within parentheses.
p-Value = differences between males and females in the asthma cohort and in the control group.

regression models. In the asthma cohort, female sex was significantly associated with low scoring on the physical dimension of SF-36 in a model adjusted for current asthma, smoking, and education. This was not seen for the mental dimension. In the control group, female sex was significantly associated with low scoring on the mental dimension of SF-36. This was not seen for the physical dimension.

Non-responders

Non-respondents to the broader study (asthma cohort and controls), who subsequently answered the short telephone survey, gave no different results for ever having had asthma, asthma symptoms or asthma medication than did respondents from the study groups. There were a few more subjects with wheezing among the respondents in the control group 14.1% vs 3.9% of non-respondents in the control group.

Discussion

The most important result from the present study of young adults with asthma is that females seem to a have decreased asthma-related quality of life compared to males, which also is seen in their generic quality of life, where asthmatic females scores lower in the physical dimension.

The study design has some important limitations. The most important is low power; our asthma cohort consisted of 64 subjects and 248 controls, which mainly limits the ability to study categorical variables. Further, the control group was not studied longitudinally, which makes it impossible to study the change of generic quality of life in a prospective manner.

We found that that the overall score of quality of life in the asthma cohort assessed with the Living with Asthma Questionnaire, decreased at five-year follow-up in females. Further, we found that low FEV_1 at baseline also predicted decline in asthma-related quality of life. We did not, however, find that persistent asthma symptoms predicted lower quality of life scores as others have described.[15] Effect size, the ratio of the mean change in the score to the SD of the baseline score was −0.13 in the present study.[16]

The largest sector of decline in asthma-related quality of life was in the domain of holidays ($p = 0.0001$). This corresponds fairly well to the results of a European survey about the limitations of severe asthma: 28% ($n = 1300$) reported, holidays, as an activity affected by asthma. Severe asthma has a major impact on patients — restricting their activities, causing embarrassment, imparting fear— and is a burden on healthcare systems.[17] One explanation could be that the asthma patients associate holidays with ''physical activity'', ''pets'', ''going out with friends'', ''holidays'' activity — known to have impact on their lives. Their multiple regression analysis also showed a statistically significant association between the differences in overall scores between year 6 and year 1. Female gender ($p = 0.04$) and low FEV1 at baseline ($p = 0.01$) were associated with low asthma-related quality of life.

SF-36 is a generic, well-validated and reliable instrument for the measurement of health-related quality of life in adults and adolescents from the age of 14, and normative data are available for the Swedish population.[11] The results of SF-36 in the present study did not show any significant difference between the asthma cohort and the control group in the multiple linear regression models, even if there were slight differences in the univariate analyses. There was a gender difference, with, females scoring lower in the physical dimension compared to men most markedly in the domains of physical functioning and general health. General opinion is that, an effect size of 5 points in SF-36 (0—100 scale), represent a clinical significance.[18] We have gender differences in that magnitude regarding physical dimension in the asthma cohort. Statistically significant associations between gender and physical dimensions of SF-36 were also seen in a multiple linear regression adjusted for current asthma, smoking, and university level education ($p = 0.0003$). This accords with other studies, Lee et al. reported that female asthma patients reported

significantly greater healthcare utilization, more unscheduled office contact, more asthma control problems, and lower asthma-related quality of life.[19] We have also identified one recently published study showing that among subjects with asthma, disease-specific quality of life is most associated with perceived stress and disease severity.[20] In the present study was the mental dimension of quality of life not worse in asthmatics than in controls. Ten Brinke et al. have shown in a study of severe asthma, aged 18–75 year, that the morbidity and costs of asthma might be related to the level of psychological dysfunction rather than to asthma severity.[21]

In the control group there was significant difference in the mental dimension in females compared to men and this was found in all four domains: vitality, social functioning, role-functioning-emotional, and mental health. The multiple linear regression model adjusted for smoking and university level education showed a statistically significant association between gender and mental dimension. There was also a clinical significance. We have no explanation for this observation.

Low adherence is associated with use of inhaled steroids[22]: at baseline (year 1) 97% of the asthma cohort used inhaled steroids[5] and in the follow-up only 66% ($n = 42/64$) reported use of inhaled steroids. However, astonishing 11 of 36 women answered that they never had used medication for their asthma, this could contribute to the lower HRQL. Elsewhere, non-adherence to inhaled steroids has been ascribed to various causes including the facts that asthma is a chronic illness requiring prolonged treatment, that the prescribed medications are used as prophylactics, and that the consequences of cessation of treatment are delayed.[23]

Osborne et al. suggest that men and women respond differently to their asthma, and observed gender differences in various measures of asthma such as hospital admissions, quality of life and use of metered dose inhalers, may be related to this difference in response to disease, rather than to real differences such in the disease between men and women.[24]

Conclusion

There is an association between low FEV_1 and a decline in quality of life among young adults with asthma, i.e. low FEV_1 predicts a decline in quality of life during a five-year period. Young females with asthma seem to have lower quality of life compared with young males with asthma.

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Conflict of interest statement

None of the authors have a conflict of interest to declare in relation to this work.

References

1. Global Strategy for Asthma Management and Prevention. Global initiative for asthma (GINA). Available at: www.ginasthma.org; 2007 [accessed 12.22.08].
2. Katz PP, Yelin EH, Eisner MD, Blanc PD. Perceived control of asthma and quality of life among adults with asthma. *Ann Allergy Asthma Immunol* 2002;**89**:251–8.
3. Moy ML, Israel E, Weiss ST, Juniper EF, Dubé L, Drazen JM. NHBLI Asthma Clinical Research Network. Clinical predictors of health-related quality of life depend on asthma severity. *Am J Respir Crit Care Med* 2001;**163**:924–9.
4. Axelsson M, Emilsson M, Brink E, Lundgren J, Torén K, Lötvall J. Personality, adherence, asthma control and health-related quality of life in young adult asthmatics. *Respir Med*; 2009;. doi:10.1016/j.rmed.2009.01.013.
5. Sundberg R, Tunsäter A, Palmqvist M, Ellbjär S, Löwhagen O, Torén K. A randomized controlled study of a computerized limited education program among young adults with asthma. *Respir Med* 2005;**99**:321–8.
6. Torén K, Palmqvist M, Löwhagen O, Balder B, Tunsäter A. Self-reported asthma was biased in relation to disease severity while reported year of onset was accurate. *J Clin Epidemiol* 2006;**59**:90–3.
7. Asher MI, Keil U, Andersen HR, et al. International study of asthma and allergies in childhood (ISAAC): rationale and methods. *Eur Respir J* 1995;**8**:483–91.
8. de Marco R, Zanolin ME, Accordini S, et al. A new questionnaire for repeat of the first stage of the European Community Respiratory Health Survey: a pilot study. *Eur Respir J* 1999;**14**:1044–8.
9. Ekerljung L, Rönmark E, Larsson K, et al. No further increase of incidence of asthma: incidence, remission and relapse of adult asthma in Sweden. *Respir Med* 2008;**102**:1730–6.
10. Rönmark E, Perzanowski M, Platts-Mills T, Lundbäck B. Incidence rates and risk factors for asthma among school children: a 2-year follow up report from the Obstructive Lung Disease in Northern Sweden (OLIN) studies. *Respir Med* 2002;**96**:1006–13.
11. Sullivan M, Karlsson J, Ware Jr JE. The Swedish SF-36 Health survey-1. Evaluation of data quality, scaling assumptions, reliability and construct validity across general populations in Sweden. *Soc Sci Med* 1995;**10**:1349–58.
12. Hyland ME, Finnis S, Irvine SH. A scale for assessing quality of life in adult asthma sufferers. *J Psychosom Res* 1991;**35**:99–110.
13. Hyland ME, Lev A, Fisher DW, Woodward V. Measurement of psychological distress in asthma and asthma management programmes. *Br J Clin Psychol* 1995;**34**:601–11.
14. Tunsäter A, Sundberg R, Lindholm N. A Swedish questionnaire for assessment of quality of life among adults with asthma (in Swedish). *Hygiea Internationalis* 1992;**101**:97.
15. Voll-Aanerud M, Eagan TM, Wentzel-Larsen T, Gulsvik A, Bakke PS. Changes in respiratory symptoms and health-related quality of life. *Chest* 2007;**131**:1890–7.
16. Leynaert B, Soussan D. Monitoring the quality of life in allergic disorders. *Curr Opin Allergy Clin Immunol* 2003;**3**:177–83.
17. Dockrell M, Partridge MR, Valovirta E. The limitations of severe asthma: the results of a European survey. *Allergy* 2007;**62**:134–41.
18. Ware Jr JE, Snow KK, Kosinski M, Gandek B. *SF-36 Health survey manual and interpretation guide*. Boston: New England Medical Center: The Health Institute; 1993.
19. Lee JH, Haselkorn T, Chipps BE, Miller DP, Wenzel SETenor Study Group. Gender differences in IgE-mediated allergic asthma in the epidemiology and natural history of asthma: outcomes and treatment regimens (TENOR) study. *J Asthma* 2006;**43**:179–84.
20. Kimura T, Yokoyama A, Kohno N, Nakamura H, Eboshida A. Perceived stress, severity of asthma, and quality of life in young adults with asthma. *Allergol Int* 2009;**58**:1–9.

21. ten Brinke A, Ouwerkerk ME, Zwinderman AH, Spinhoven P, Bel EH. Psychopathology in patients with severe asthma is associated with increased health care utilization. *Am J Respir Crit Care Med* 2001;**163**:1093—6.
22. Kelly WJW, Hudson I, Phelan PD, Pain MC, Olinsky A. Childhood asthma in adult life: further study at 28 years of age. *Br Med J (Clin Res Ed)* 1987;**294**:1059—62.
23. Griffith S. A review of the factors associated with patient compliance and the taking of prescribed medicines. *Br J Gen Pract* 1990;**40**:114—6.
24. Osborne ML, Vollmer WM, Linton KL, Buist AS. Characteristics of patients with asthma within a large HMO: a comparison by age and gender. *Am J Respir Crit Care Med* 1998;**157**: 123—8.