Published in final edited form as:
Allergy. 2011 December ; 66(12): 1598–1603. doi:10.1111/j.1398-9995.2011.02729.x.

Persistent asthma, co-morbid conditions and the risk of work disability: a prospective cohort study

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Abstract

Backround—This study examined whether asthma alone or together with chronic co-morbidity is associated with increased risk of long-term work disability.

Methods—We examined data from 2,332 asthmatic and 66,354 non-asthmatic public sector employees in Finland who responded to a survey between 1997 and 2004. Respondents were coded as persistent asthmatics based on the special reimbursement for continuous asthma medication by the Social Insurance Institution. Data on long-term work disability (sickness absences or disability pensions >90 days) were obtained from national registers. The risk of work disability was examined by Cox proportional hazard models adjusted for age, gender, socioeconomic status, type of employment contract and type of employer.

Results—Asthma increased the risk of all-cause long-term work disability, hazard ratio (HR) 1.8 (95 % CI 1.62–2.09) compared to controls (no asthma). Asthma and one other chronic co-morbidity increased the risk for long-term all-cause work disability with HR 2.2 (95% CI 1.78–2.83). Asthma together with two or more other chronic conditions increased the risk with HR 4.5 (95% CI 2.98–6.78). Asthma and depression increased the risk with HR 3.6 and the risk was especially high for permanent work-disability (HR 6.8). Among those with asthma there were more women, obesity (BMI ≥30), ex-smokers and lower-grade non-manual workers.

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All the authors have approved the final version to be published.

Conflict of interest statement
Riina Hakola is taking part in the research training programme of the Finnish Institute of Occupational Health and is working for the ALK Abelló. The ALK Abelló has not supported the manuscript or research work financially. The other authors of the manuscript have no conflict of intrests (Paula Kauppi, Timo Leino, Anneli Ojajärvi, Jaana Pentti, Tuula Oksanen, Tari Haahtela, Mika Kivimäki, Jussi Vahtera).

Conclusions—Asthma is associated with increased risk of long-term all-cause work disability. The risk increases further with chronic co-morbidities, and is especially high in patients with asthma and depression.

Keywords

Asthma; co-morbidity; sickness absence; work disability

Introduction

Asthma is a common chronic inflammatory disease of the airways characterized by variable and recurring symptoms, reversible airflow obstruction and bronchial hyperreactivity. It may decrease quality of life and is associated with adverse behavioural and psychosocial effects (1). Although direct costs related to asthma in terms of physician consultation and medical treatment are substantial (2, 3), it is now clear that indirect costs are a great part of total costs in asthma (4). For example, asthma is one of the leading non-musculoskeletal causes of work limitations and has major quality-of-life and economic impacts through occupational disability (5, 6, 7).

Occupational disability can take many forms, including decreased labour force participation rates, change of job or job responsibilities due to health reasons, lost work days, or decreased effectiveness on the job because of illness (5, 8, 9). Previous studies suggest that asthma negatively affects work productivity (10, 11, 12, 13). Those with asthma are also less likely to be employed in the first place. We have previously shown that asthma and rhinitis, and both these conditions combined increased the risk of short-term sickness absences (12). In a Swedish study, the mean productivity loss was estimated to be 5.1 days as a result of both allergic rhinitis and common cold in the working population (13).

Association of asthma with allergic rhinitis and gastroesophageal reflux disease are well known. A weak association of asthma has also been reported with hyperlipidemia, depression, diabetes mellitus and osteoporosis (14). However, the role of the comorbidity in asthma has rarely been taken into consideration in sickness absence studies (12).

Health-related work disability has been increasingly recognized as an important component of the economic and societal burden of diseases. In this study, we evaluated if asthma alone or together with co-morbidities in general and specifically with depression increases the risk for long-term all-cause work disability.

Material and methods

This study is part of the Finnish Public Sector Study of public sector employees in 10 towns and 21 public hospitals in Finland (15, 16). The cohort consisted of 151,618 employees who were employed in the target organisation for at least 6 months in any year between 1991 and 2005. Of them, 70,376 participants responded to a survey in 1997–98, 2000–2002, and/or 2004 (74% of the eligible population responded at least once). In case of repeat responses, the earliest was used in the analyses. Using personal identification codes assigned to all residents in Finland, we linked the participants to their records in national health and pension registers. The linkage was 100% complete with practically no loss to follow-up. Information on asthma and other chronic conditions were derived from the Drug Reimbursement and Prescription Registers maintained by the Social Insurance Institution of Finland (SII) and from the Finnish Cancer Registry. We excluded 1690 (2.4%) participants who were on a long-term work disability during the survey year, or had retired or died before the follow-up began. Thus, the final cohort comprised 68686 employees.

The study was approved by the ethics committee of the Finnish Institute of Occupational Health.

Assessment of asthma

Respondents were coded as asthmatics if they were entitled to special reimbursement for asthma medication by the Social Insurance Institution in the beginning of the follow-up.

In Finland, the national sickness insurance scheme covers all permanent residents of the country, regardless of sex, age or occupational title, and provides at present basic reimbursement of 42 % for all filled prescriptions and special reimbursement of 72 % or 100 % for many chronic and severe diseases, including asthma. We extracted data on entitlements of special reimbursements from the Drug Reimbursement Register, kept by the SII of Finland. To be eligible to special reimbursement for asthma medication, the patient's lung function examination should meet criteria for reversibility of bronchial obstruction or moderate to severe bronchial hyperresponsiveness and be confirmed by both the patient's physician and the SII. Among the asthma cases identified for the study, 20 individuals with reimbursement for asthma medication had diagnosis of chronic obstructive pulmonary disease and they were excluded from the study.

Assessment of comorbidities

Six main disease categories were used in this study as comorbidity for asthma: depression, ischemic heart disease, diabetes, rheumatic disease, cancer and hypertension. Respondents were coded as positive for diagnosed disease (other than cancer or depression) based on the reimbursement for disease medication by the Social Insurance Institution. Cases of depression were determined from the Drug Prescription Register as those who had purchased more than 30 DDDs (defined daily dosages) of antidepressants (ATC code N06A) during the survey year. Individuals diagnosed with cancer during the five preceding years before the follow-up were identified from the Finnish Cancer Registry which compiles all cancer notifications in Finland. This information was used to identify those asthma cases who had 1 co-morbidity or at least 2 co-morbidities from those with no co-morbidities, and, separately, those cases who had depression (yes or no).

Assessment of long-term all-cause work disability

Work disability included all-cause long-term sickness absences (≥90 days) and disability pension (permanent or temporary, full- or part-time).

All permanent residents aged 16–67 years in Finland are entitled to daily allowances due to a sick leave based on a medical certificate after a waiting period of nine days, in addition to the first day of illness, for a period of 1 year at the most from the SII of Finland. We identified the date of the beginning of all sickness absences that lasted longer than 90 days. Data on long-term sickness absences were obtained from the SII of Finland. Data on disability pension were obtained from the Finnish Centre for Pensions. The pension data were available for all participants and the linkage was successful for all participants. In Finland disability pension can be granted after 300 reimbursed sickness absence days. This disability pension can be either fixed-term or permanent. We obtained information on the dates of all granted disability pensions. For the follow-up, we noted the date of the first occurrence of any long-term sickness absence or disability pension (all long-term work disability) and separately the date a disability pension was granted between January 1 of the year following the survey (1997–98, 2000–2002, or 2004) and December 31, 2005, irrespective of participants' employment status or workplace at follow-up.

Other predictors of work disability

Sociodemographic characteristics included age, sex, socioeconomic status and marital status. Information on age, sex, and socioeconomic status (SES) of the employees were obtained from the employer-maintained records. SES was categorized according to the occupational-title classification of the 'Statistics Finland' for: upper-grade non-manual workers (e.g., physicians, teachers), lower-grade non-manual workers (e.g., technicians, registered nurses), and manual workers (e.g., cleaners, maintenance workers).

Standard survey questionnaires were used to assess information regarding marital status, body mass index (BMI, kg/m^2) and smoking at the beginning of the follow-up. BMI was dichotomized to indicate obese (≥30) or non-obese (<30). Respondents reported whether they were non-smokers, ex-smokers, or current smokers.

Statistical analysis

The Chi-square test was used to analyze differences in frequency distribution of categorical baseline variables and Student's t-test of continuous variables in those with asthma and those without asthma. Follow-up for work disability began from the 1st January immediately after the year of the survey response and ended to the occurrence of the work disability (sickness absence >90 days or disability pension), official retirement pension (old-age pension), death, or 31 December, 2005, whichever came first. Cox proportional hazard models were used to calculate the risk for long-term work disability and the 95% confidence intervals (CI) for asthmatic participants compared to participants without asthma. The hazard ratios were adjusted for sex, age, socioeconomic status, smoking, obesityand for the presence of co-morbidities. In addition, similarly adjusted hazard ratios were calculated for asthma alone, asthma and one chronic co-morbidity, asthma and two or more chronic co-morbidities. Finally, we calculated the hazard ratios for those with asthma alone, depression alone, and asthma in combination with depression compared to those with neither of these conditions.

All analyses were performed using the SAS statistical software, version 9.2 (SAS Institute, Inc., Cary, North Carolina, USA).

Results

Baseline characteristics of the employees with asthma (n=2 332) and those without asthma (n=66 354) are shown in Table 1. In the group of asthma there were more women, older employees (55–63 years), obese individuals (BMI ≥30), persons with psychological distress, ex-smokers and lower-grade non-manual workers (Table 1). The study groups did not differ in respect of marital status.

Asthma increased the risk of long-term all-cause work disability 1.8 fold (HR 1.8, 95 % CI 1.6–2.1) when the results were adjusted for age, gender, SES, smoking, and obesity. The risk was 1.7 (95% CI 1.55–1.95) when the results were also adjusted for the presence of comorbidities (Table 2). In analyses restricted to disability pension as an outcome, these hazard ratios were 2.1 (95% CI 1.7–2.5) and 1.9 (95% CI 1.6–2.3), respectively.

The risk of long-term all-cause work disability increased with the number of comorbidities. In this analysis, asthma without any other chronic co-morbid condition increased the risk of work disability 1.6 fold. Asthma accompanied with another chronic co-morbidity increased this risk by 2.2-fold (95% CI 1.8–2.8). Asthma together with two or more other chronic conditions increased the risk by 4.5 fold (HR 4.5, 95% CI 3.0–6.8) (Table 3). For disability pension only, the risk was even higher, HR 5.5 (95% CI 3.2–9.3). Analyses examining

depression as a sole co-morbid condition showed that asthma in combination with depression increased the risk of long-term all-cause work disability 3.6 fold (95% CI 2.6–5.0) (Table 4). For disability pension, the corresponding risk was 6.8-fold.

Discussion

In this large register-based study of Finnish public sector employees, asthma increased the risk of long-term all-cause work disability (≥90 days) nearly 2-fold when compared with employees without asthma. Co-morbid conditions among those with asthma further increased the risk of long-term all-cause work disability. Asthmatic employees with depression had 3.6 times higher risk and those with two or more other chronic conditions had 4.5 times higher risk of work disability than healthy employees. For all-cause disability pension, those with persistent asthma and depression risk was 6.8 higher than for those public-sector employees without either of diseases.

Prospective study design, large sample size and high response rate are important strengths of this study. A large sample size provides statistical power to detect small differences and reduces the likelihood of random error influencing the results. In the present study, hazard ratios were large and clinically significant, and they were estimated with relatively high precision as indicated by the narrow confidence intervals. The data for the outcome as well as asthma and co-morbid conditions were obtained from national registers, which in Finland are reliable and have high coverage. To be eligible for special reimbursement, all cases of asthma had to have asthma diagnosis confirmed both by the physician and the SII. The use of reliable register information minimizes the risks of measurement error and recall bias, often associated with self-reported measures. In addition, we were able to take into account several potentially confounding factors in the analysis, such as socioeconomic status, smoking and obesity.

Some limitations may be considered when interpreting the results of this study. The study population comprised public sector employees and may not be generalized into unselected population sample. The study lacks information on asthma symptoms and a detailed classification of asthma severity. However, the fact that only definite asthma cases that have special reimbursement for asthma medication and thus chronic disease were included in the study, strengthen the results. Those with intermittent mild disease are diluted in the large pool of healthy employees. We assume that if employees with only self-reported asthma (including thus intermittent mild asthma cases) were included in the analysis, the hazard ratios may have been lower. However, probably those with mild or intermittent disease would be more likely to have short-term rather than long-term work-disability periods. The observed prevalence of asthma in our study (3.5%) did not differ from other studies in Finland (3–11%) (17, 18, 19).

In line with previous studies, these results show that asthma is an important cause of occupational disability and related economical costs (5, 8, 9, 20, 21). As in many other chronic conditions, psychosocial factors play a significant role in the outcomes of patients with asthma. Psychiatric disease and psychosocial stress have been demonstrated to contribute to asthma morbidity and mortality. Patients' coping mechanisms for dealing with chronic disease and their attitudes and beliefs about their illness may also impact outcomes (22). In addition, depression and psychological distress, important causes of sickness absence and work disability have been linked to asthma (23, 24, 25). For example, cases with psychological distress had 1.3 to 1.4 times higher incidence of long-term sickness absence than those without distress (25). These are in line with our results which showed that asthma alone increased the risk for long sickness absences by 1.8 but together with depression by 3.6.

Claessen et al. found strong associations between heavy smoking (>=20 cigarettes/day) and occupational disability due to mental and respiratory disease. Smoking was associated with increased risk of occupational disability among construction workers, in particular occupational disability due to respiratory, cardiovascular and mental diseases, cancer and dorsopathy (the major causes of disability in this occupational group) (26). In our study, the number of co-morbid diseases additively increased the risk of long-term work disability among asthmatic employees. Our results could not be explained by smoking as the excess risk of work disability was observed in analyses adjusted for smoking status.

Conclusions

Health-related work disability has been increasingly recognized as an important economic and societal burden of asthma (27). This study found an increased risk of long-term all-cause work disability in employees who have physician-diagnosed asthma, a common chronic condition among public sector employees. The risk was further increased if they had another chronic disease and the risk was especially high with depression as a co-morbidity to asthma. Further studies are needed to show, whether return-to-work or other interventions by clinicians would reduce the risk of permanent work disability in patients with asthma with or without co-morbidities.

Acknowledgments

This study was supported by the Academy of Finland (grants #124322, #124271, #129262 and #132944) and the Social Insurance Institution. Mika Kivimaki is supported by the National Heart, Lung, and Blood Institute (R01HL036310); the National Institute on Aging, NIH (R01AG034454); the BUPA Foundation, UK, and the EU New OSH ERA research programme.

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Table 1

Characteristics of study population.

	Asthma N (%)	No asthma N (%)	p-value
Gender			
Men	345 (14.8)	13 400 (20.2)	<.0001
Women	1 987 (85.2)	52 954 (79.8)	
Age (years, mean+-SD)	44.7 + 9.7	44.1 + 9.7	0.0056
≤44	1 101 (47.2)	32 757 (49.4)	0.012
45–54	796 (34.1)	22 690 (34.2)	
55–63	435 (18.7)	10 907 (16.4)	
BMI (mean+-SD)	25.8 + 4.7	24.9 + 4.1	<0.0001
<30	1 896 (83.4)	57 826 (89.2)	<0.0001
≥30	378 (16.6)	6 977 (10.8)	
Smoking			
Non-smoker	982 (43.6)	29 728 (46.3)	0.0012
Ex-smoker	883 (39.2)	22 731 (35.4)	
Current smoker	390 (17.3)	11 778 (18.3)	
Not married	579 (25.1)	15 891 (24.2)	0.33
Married	1 726 (74.8)	49 693 (75.8)	
Socioeconomic class			
Upper-grade non-manual workers	552 (23.8)	19 289 (29.1)	<0.0001
Lower-grade non-manual workers	1 391 (59.9)	34 602 (52.3)	
Manual workers	381 (16.4)	12 328 (18.6)	

Table 2

Long-term all-cause work disability (≥90 days) quantified by Hazard ratios (HR) and 95% confidence intervals (CI) by asthma status.

	N (%)	No of events	HR[1]	HR[2]
Asthma				
Outcome: All long-term work disability				
No asthma	62 755 (96.6)	5 098	1 (ref.)	1 (ref.)
Asthma	2 196 (3.4)	310	**1.84 (1.64, 2.06)**	**1.74 (1.55, 1.95)**
Outcome: Disability pension				
No asthma	62 755 (96.6)	1 812	1 (ref.)	1 (ref.)
Asthma	2 196 (3.4)	127	**2.05 (1.71, 2.45)**	**1.88 (1.57, 2.25)**

[1] Adjusted for age, sex, socioeconomic status, smoking and obesity

[2] Adjusted for (1) and presence of chronic co-morbidities (depression, ischemic heart disease, diabetes, rheumatic disease, malignancy and hypertension)

Table 3

Risk of long-term all-cause work disability quantified by Hazard Ratios (HR) and 95% confidence intervals (CI) by asthma status.

	N	No of events	HR[1] (95% CI)
Risk of work disability			
Outcome: All long-term work disability			
No asthma	62755	5098	1.00 (ref)
Asthma alone	1787	213	**1.63 (1.42, 1.87)**
Asthma + 1 chronic co-morbidity	347	74	**2.24 (1.78, 2.83)**
Asthma + ≥2 chronic co-morbidities	62	23	**4.49 (2.98, 6.78)**
Outcome: Disability pension			
No asthma	62755	1812	1.00 (ref)
Asthma alone	1787	75	**1.68 (1.33, 2.12)**
Asthma + 1 chronic co-morbidity	347	38	**2.55 (1.85, 3.53)**
Asthma + ≥2 chronic co-morbidities	62	14	**5.50 (3.24, 9.32)**

[1] Adjusted for age, sex, socioeconomic status, smoking, and obesity

Table 4

Risk of long-term all-cause work disability quantified by Hazard Ratios (HR) and 95% confidence intervals (CI) by asthma status.

	N	No of events	HR[1] (95% CI)
Disease status			
Outcome: All long-term work disability			
No asthma, no depression	60449	4685	1.00 (ref)
Asthma, no depression	2042	273	**1.82 (1.61, 2.06)**
No asthma, depression	2306	413	**2.45 (2.22, 2.71)**
Asthma and depression	154	37	**3.58 (2.59, 4.96)**
Outcome: Disability pension			
No asthma, no depression	60449	1611	1.00 (ref)
Asthma, no depression	2042	102	**1.91 (1.56, 2.33)**
No asthma, depression	2306	201	**3.24 (2.79, 3.74)**
Asthma and depression	154	25	**6.83 (4.60, 10.15)**

[1] Adjusted for age, sex, socioeconomic status, smoking, and obesity