

Allergic rhinitis and the common cold – high cost to society

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Keywords

absenteeism; caregiver absenteeism; presenteeism; productivity loss; rhinitis.

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Abstract

Background: The common cold and allergic rhinitis constitute a global health problem that affects social life, sleep, school and work performance and is likely to impose a substantial economic burden on society because of absence from work and reduced working capacity. This study assesses the loss of productivity as a result of both allergic rhinitis and the common cold in the Swedish working population.

Methods: Four thousand questionnaires were sent to a randomized adult population, aged 18–65 years, in Sweden, stratified by gender and area of residence (metropolitan area *vs* rest of the country). The human capital approach was used to assign monetary value to lost productivity in terms of absenteeism (absence from work), presenteeism (reduced working capacity while at work) and caregiver absenteeism (absence from work to take care of a sick child).

Results: Thousand two hundred and thirteen individuals responded, response rate 32%. The mean productivity loss was estimated at 5.1 days or € 653 per worker and year, yielding a total productivity loss in Sweden of € 2.7 billion a year. Of the total costs, absenteeism (44%) was the dominant factor, followed by presenteeism (37%) and caregiver absenteeism (19%). Poisson regression analyses revealed that women, people in the 18–29 year age group, and respondents with 'doctor-diagnosed asthma' reported more lost days than the rest of the group.

Conclusion: In Sweden, the cost of rhinitis is € 2.7 billion a year in terms of lost productivity. A reduction in lost productivity of 1 day per individual and year would potentially save € 528 million.

Background

Rhinitis is a symptomatic disorder of the nose, causing nasal obstruction, secretion and sneezing, most commonly induced by allergen exposure, bacteria or virus, such as allergic rhinitis and the common cold. It constitutes a global health problem that affects social life, sleep, school and work performance, regardless of

gender, age and social and ethnic background (1). In allergic rhinitis and the common cold, the symptoms are transient for the majority of patients, but, even when the symptoms are mild, the high incidence is likely to impose a substantial economic burden on society. Surprisingly, few studies have been designed to assess the indirect costs of allergic rhinitis and the common cold to society, such as reduced working

capacity and absence from work. In a recent review of health-economic studies targeting allergic rhinitis, it was found that, although the indirect costs are high, little is known about rhinitis sufferers who do not seek medical care (2). This patient group is likely to be large and can only be assessed using a study with a population-based design. Most of the data relating to indirect costs associated with the common cold and allergic rhinitis relate to the US situation. US data show that the indirect cost of *allergic rhinitis* varies between USD 0.1 and 9.7 billion a year in 2003 values, and that the average indirect cost per employee was USD 593 a year compared with USD 85 a year for asthma in 2002 values (2, 3). In a retrospective cross-sectional study from Germany involving 63 patients with allergic rhinitis recruited by pulmonologists, the total annual cost was € 1543 (in 2003 values), about 50% of which were indirect costs (4). In the case of the common cold, the data are even more scarce. A US population-based, telephone-administered survey found that the average loss because of absenteeism, on-the-job productivity reduction and caregiver absenteeism was 8.7 working hours with every episode of the *common cold*, yielding a total estimated productivity loss of USD 25 billion a year (5). In a recent article in the *Swedish Medical Journal*, it was concluded that there is a complete lack of Swedish data on the health-economic burden of rhinitis (6). The marked difference in the health care system between the United States of America and Europe makes the generalization of costs across societies highly uncertain and underlines the need for representative population-based studies. The purpose of this study is to estimate the economic burden of rhinitis in terms of lost productivity because of absenteeism, presenteeism and caregiver absenteeism in a European country.

Methods and material

Survey design

This is a cross-sectional observational study, using a postal questionnaire to collect data. A total of 4000 questionnaires were sent to a randomized, stratified, representative selection of the general working population in Sweden. The inclusion criterion was persons aged 18–65 years. The questionnaire was distributed on two occasions, in February ($n = 2000$) and in May ($n = 2000$) 2008 to capture the common cold and allergy seasons, respectively. A reminder was sent out after 2 weeks. The sample was stratified on the basis of residence: one stratum comprised the three largest cities in Sweden (19% of the Swedish population in

age group 18–65 years) and the other the rest of the country. The sample was retrieved from the PAR database containing the addresses of everyone in Sweden above 16 years of age (7).

The *first* section of the questionnaire included questions about general background (gender, age, number of people in the household, income and working situation). The *second* section included questions about lost productivity because of rhinitis (i.e. the common cold or allergic rhinitis). Respondents were asked about absenteeism and presenteeism as a result of allergic rhinitis or the common cold during the last month and during the last year. The two time frames were used to capture absenteeism and presenteeism during the two peak seasons and during a full year, respectively. Presenteeism was assessed by asking for the average output capacity (0–100%) when working during the last episode of allergic rhinitis or the common cold. The symptoms of allergic rhinitis and the common cold both include nasal blockage, secretion, itching and sneezing, and it is therefore difficult for sufferers to distinguish between the two conditions. The questions in this study, based on self-reported data, were accordingly phrased asking for allergic rhinitis *or* the common cold which gives the total burden of the productivity loss but does not allow separate analyses of allergic rhinitis and the common cold. There were also questions regarding the respondents' current and previous smoking habits and conditions diagnosed by a doctor, such as (i) asthma, (ii) allergic rhinitis, (iii) eczema, (iv) chronic obstructive pulmonary disease (COPD) and (v) immune deficiency.

The study was approved by the Ethics Committee at Lund University, Sweden.

Statistics

The human capital approach (HCA) was used to estimate lost productivity from a societal angle (8, 9). Using this approach, the value of time lost from work because of illness or the associated reduction in productivity is directly related to expected or potential earnings lost during that time, i.e. 1 day of lost productivity is equal to 1 day of salary (Table 1). There was no statistically significant difference in response rate between the stratified samples of residence (city *vs* rest of the country, respectively), but the cost calculations have been weighted according to the population size in Table 2 and Fig. 1.

Univariate analyses (means and percentages) with descriptive statistics, as well as bivariate analyses (chi-squared and *t*-test), were performed. We also tested for variables that predict variations in absenteeism,

Table 1 Description of cost calculations

Type of cost	Calculation	Assumptions	Reference
<i>Absenteeism because of rhinitis</i>	<i>Cost per person</i> Number of absent working days during the last month/year multiplied by the cost of productivity (wages + social costs), categorized by gender and age groups	Mean days according to the respondents (= 0, 1, 3, 11, 22 and 32 days) 250 working days per year Social benefits (40%)	Self-reported work productivity (absenteeism) Median wage in Sweden (Swedish Statistics, 2006) Social costs: http://www.ekonomifakta.se
	<i>Total cost in Sweden</i> Cost per person multiplied by the number of employed individuals in Sweden, categorized by gender and age groups		
<i>Presenteeism because of rhinitis</i>	<i>Cost per person</i> Number of days at work with rhinitis and self-reported productivity while at work during the last month/year multiplied by the cost of productivity (wages + social costs), categorized by gender and age groups	Productivity reduced by x% results in productivity loss equivalent to (wage per day multiplied by the reduction in productivity) (REF) See 'Assumptions for absenteeism because of rhinitis'	Self-reported work productivity (presenteeism) See 'Assumptions for absenteeism because of rhinitis'
	<i>Total cost in Sweden</i> See calculation for 'Absenteeism because of rhinitis'		

Table 2 The average cost of lost productivity per year and worker because of absenteeism, presenteeism and caregiver absenteeism (€ = euro, costs from 2008)

	Absenteeism	Presenteeism	Caregiver absenteeism	Summary
<i>All*</i>	€ 286	€ 242	€ 124	€ 653
<i>February**</i>	€ 584	€ 841	€ 137	€ 1563
<i>May**</i>	€ 410	€ 719	€ 102	€ 1232

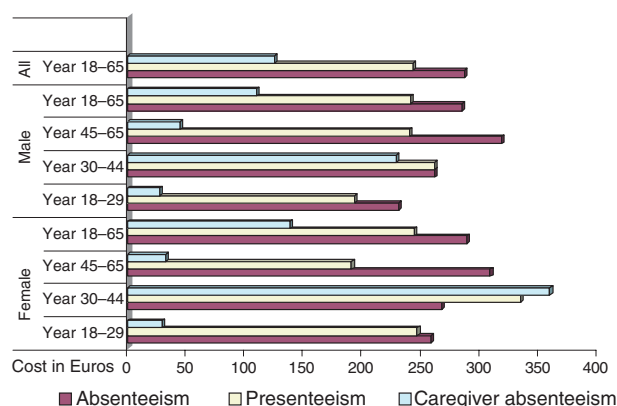
*Based on an estimation of 12 months' absenteeism/presenteeism/caregiver absenteeism.

**Based on an estimation of 1 month of absenteeism/presenteeism/caregiver absenteeism × 12 months.

presenteeism and caregiver absenteeism using a multivariate regression technique. Because the data set was not normally distributed, we applied Poisson regression analyses. In the Poisson regression analyses, only variables with $P < 0.05$ from Table 3 were included. The Poisson regression analyses were performed using STATA, while the univariate and bivariate analyses were performed using SPSS (version 12.0 for Windows).

Results

The basic demographics of the survey participants are presented in Table 4. A total of 1213 individuals responded, corresponding to a response rate of 32%.

**Figure 1** The average cost of productivity lost because of absenteeism, presenteeism and caregiver absenteeism (EURO, costs from 2008).

Of all the respondents, 74% were reported as full-time or part-time workers. According to data from 'Statistics Sweden', 76% in the 16–64 years age group in the Swedish population are working (10). In the nonworking population, the percentage of women was substantially higher than in the working population. As a result, the gender distribution is more equal in the working population of interest. While most of the working respondents were in the oldest age group (45–65 years), most of the nonworking respondents

Table 3 The average number of days of lost productivity per year and worker because of absenteeism, presenteeism or caregiver absenteeism ($n = 888$ workers)

Variable	Absenteeism		Presenteeism		Caregiver absenteeism*		Summary	
	Mean days	<i>P</i> -value†	Mean days	<i>P</i> -value†	Mean days	<i>P</i> -value†	Mean days	<i>P</i> -value†
All	2.3		2.0		0.8 (1.8)		5.1	
Gender								
Male	1.9		1.9		0.7 (2.8)		4.5	
Female	2.6	0.010	2.1	0.343	0.9 (4.6)	0.156 (0.020)	5.7	0.011
Age groups‡								
18–29 years	3.4		3.2		0.2 (1.9)		6.8	
30–44 years	1.9	0.001	2.2	0.034	1.9 (3.9)	0.000 (0.123)	6.1	0.359
45–65 years	2.2	0.007	1.6	0.000	0.2 (2.7)	0.911 (0.522)	4.0	0.000
Household								
No children	2.6		2.0		0.0		4.6	
Children 0–7 years	1.6	0.032	2.4	0.213	3.6 (na)	0.000 (na)	7.7	0.000
Children 8–17 years	2.0	0.127	1.9	0.870	1.1 (na)	0.000 (na)	5.0	0.542
Respondent's share of the household income								
0–25%	2.7		3.4		1.4 (4.8)		7.5	
50%	2.6	0.884	1.9	0.001	1.0 (3.8)	0.316 (0.429)	5.5	0.032
75–100%	1.9	0.106	1.8	0.000	0.5 (2.7)	0.000 (0.073)	4.3	0.000
Smoking status								
Never smoked	2.1		1.9		1.0 (4.0)		5.0	
Former smoker	2.2	0.826	1.9	0.905	0.4 (1.8)	0.046 (0.182)	4.6	0.544
Current smoker	2.8	0.072	2.5	0.038	0.6 (3.0)	0.093 (0.363)	6.0	0.116
Comorbidities								
None of these diagnoses	2.0		1.8		0.8 (3.5)		4.6	
Asthma	4.8	0.000	4.3	0.000	1.0 (4.1)	0.500 (0.695)	10.1	0.000
Nasal allergy	2.5	0.277	2.8	0.000	0.8 (2.6)	0.955 (0.522)	6.2	0.020
Eczema	2.7	0.121	2.4	0.027	1.2 (4.8)	0.182 (0.282)	6.4	0.014

*The numbers or letters in () response to answers from workers with children 0–6 years ($n = 138$). For the *household* variable, these responses are not applicable (na).

†*t*-test of equality of means, equal variances assumed. The first value for each variable is compared with the other values, e.g. when comparing the mean days of absenteeism in different age groups, the value 18–29 years is compared with the mean days for 30–44 years and the mean days for 45–65 years.

were in the youngest age group. About 37% of both the workers and the nonworkers reported having at least one child younger than 17 years of age in their household, which corresponds to data from Statistics Sweden (37% aged 18–64 years have at least one child between 0–19 years (10)). There was no difference between workers and nonworkers in terms of previous or current smoking habits. About 66% of the population sample had never smoked. Among Swedish males aged 16–84 years, 56% have never have smoked, while the corresponding figure for women is 60%, according to the Swedish National Institute of Public Health (11).

In the working population, 37% (327/888) reported at least 1 day of absenteeism during the last year because of rhinitis, while 72% (637/888) reported presenteeism (Table 4). The average level of productivity

reduction for presenteeism was 22% during the respondents' last episode of allergic rhinitis or the common cold. The average productivity loss for all workers because of absenteeism, presenteeism and caregiver absenteeism during 1 year was 5.1 days, of which 2.3 days were accounted for by absenteeism and 2.0 days by presenteeism (Table 3). If only those with children aged 0–7 years in their household (138) were included in the analyses, the average number of days for caregiver absenteeism was 3.6 days. The mean total cost of productivity loss during 1 year was estimated at € 653 per worker. An attempt to estimate the total cost of productivity losses related to the common cold and allergic rhinitis in the whole Swedish working population, based on the absenteeism and presenteeism reported during the last year, resulted in € 2.7 billion

Table 4 Sample characteristics and demographics

Respondents*	Working											
	Total		Not working		All		Absenteeism		Presenteeism		Caregiver absenteeism	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
All	1213	100	320	100	888	100	327	100	637	100	127	100
'February'		53		51		54		54		53		59
'May'		47		49		46		46		47		41
Gender†	1208	100	320	100	888	100	327	100	637	100	127	100
Female		58		68		55		61		56		60
Male		42		32		45		39		44		40
Age groups‡	1208	100	320	100	888	100	326	100	633	100	127	100
18–29 years		22		43		14		20		16		6
30–44 years		32		23		36		34		40		76
45–65 years		46		33		50		46		45		18
Household§	1211	100	320	100	888	100	327	100	640	100	127	100
No children		63		62		64		68		62		0
Children 0–7 years		17		20		16		14		17		67
Children 8–17 years		20		18		20		18		21		33
Respondent's share of the household income¶	1197	100	318	100	879	100	323	100	632	100	127	100
0–25%		22		50		12		13		13		19
25–50%		37		23		42		45		42		52
75–100%		41		27		46		42		45		29
Smoking status**	1204	100	319	100	885	100	327	100	637	100	127	100
Never smoked		66		64		67		64		67		72
Former smoker		12		12		12		10		12		9
Current smoker		22		24		22		26		21		19
Comorbidities††												
None of these diagnoses	884	73	223	70	659	74	233	71	460	72	95	75
Asthma	117	10	40	12	77	9	43	13	65	10	12	9
Nasal allergy	161	13	51	16	109	12	38	12	84	13	13	10
Eczema	116	10	28	9	88	10	36	11	72	11	16	13
COPD (chronic obstructive pulmonary disease)	10	1	6	2	4	1	2	1	3	1	0	0
Immune deficiency	14	1	4	1	10	1	5	2	7	1	0	0

*There are no differences in the number of respondents between the different surveys ($P > 0.1$).

†There are more female respondents in the survey compared with the Swedish population ($P < 0.000$). In Sweden, 48% of those who work in the 16–64 age group are women (10). In this survey, 55% of those who work in the 18–65 age group are women. In the Swedish population, 76% in the 16–64 age group are working, while the figure for men is 78% and for women 73% (10). In this survey, 82% of the men in the 18–65 age group are working, while the corresponding figure for women is 72%.

‡In Sweden, 30% of the population is in the 18–29 age group, 31% in the 30–44 age group and 38% in the 45–64 age group (10). The number of respondents in this survey compared with the population is too small when it comes to the youngest age group ($P < 0.000$), there is no difference for the intermediate age group ($P = 0.73$), and the number is too large compared with the oldest age group ($P < 0.000$).

§In Sweden, 37% of the population in the 18–64 age group have at least one child between 0–19 years, and 71% of the parents (63% of the mothers and 80% of the fathers) work when they have children aged 0–17 years. In the survey, 73% of the respondents with children 0–18 years work (65% of the mothers and 84% of the fathers) and 74% of the respondents with no children work (72% of the women and 77% of the men).

¶No national data were available for comparison with the data in this survey.

**Among Swedish males in the 16–84 age group, 56% have never smoked, 20% used to smoke and 24% smoke. Among women, 60% have never smoked, 15% used to smoke and 24% smoke (11). In the survey, there is no difference in smoking habits when it comes to whether or not the respondents work ($P > 0.716$).

††There is no difference between the employed/unemployed when it comes to respondents with none of these diagnoses and eczema ($P > 0.100$). However, a larger percentage of unemployed people have asthma ($P = 0.043$) and nasal allergy ($P = 0.09$). The respondents with COPD and immune deficiency are too few to draw any conclusions, and they will not be included in the forthcoming analysis.

during 1 year. The cost of absenteeism and presenteeism and caregiver absenteeism comprised 44%, 37% and 19%, respectively, of the mean total costs/year. Based on the reported productivity losses during the last month only (February and May, respectively), the estimated mean cost per person was twofold out twice as high (Table 2). The cost related to absenteeism was highest for men aged 45–65 years. The cost related to presenteeism and caregiver absenteeism was highest for women aged 30–44 years (Fig. 1). Women reported significantly more days lost than men because of absenteeism, presenteeism and caregiver absenteeism. Further subgroup analyses revealed that the youngest age group (18–29 years) reported a significantly higher level of absenteeism and presenteeism in the univariate analyses. Respondents with diagnosed asthma reported the highest number of absenteeism days (4.8 day) and presenteeism days (4.3 day) in the whole study sample.

The Poisson regression model results suggest that asthma has the largest impact on both absenteeism and presenteeism (Table 5). The analysis also shows that absenteeism was related to factors such as young age and female gender, whereas earning a small part of the total income, young age and smoking were related to presenteeism. Caregiver absenteeism was related to female gender and was inversely related to earning a large part of the total income.

Discussion

This study of the Swedish working population reveals that the common cold and allergic rhinitis cause an average loss of 5.1 working days and a cost of € 653 per person each year because of absence from work, reduced work capacity and caregiver absenteeism. Based on this population sample, we estimate that the total productivity loss in Sweden is € 2.7 billion, which is three to seven times higher than the indirect cost previously reported for asthma in Sweden (12).

This is the first nationwide, population-based study that estimates the production loss because of both allergic rhinitis and the common cold in a European country. It is based on individuals from the general working population and is therefore not focused on any specific population or occupation. The response to the questionnaire was well balanced between town and country and between the answerers given in February and May. Because the questionnaire was answered anonymously, it is not possible to make a detailed analysis of the nonresponders. To evaluate its validity, we compared our data with data derived from well-recognized Swedish databases. In our sample, 82% of the men and 72% of the women aged 18–65 years were working compared with 78% and 73%, respectively, in the 16–64 age group, according to data from Swedish Statistics. Further, our study sample has more women

Table 5 Variables influencing amount of productivity loss – Poisson analysis

Absenteeism*	IRR (Incidence Rate Ratio)	Std. Error	Z	P	95% confidence interval	
Women	1.49	0.075	7.83	0.000	1.35	1.64
18–29 years	1.60	0.090	8.39	0.000	1.43	1.79
Child 0–6 years	0.72	0.052	4.52	0.000	0.63	0.83
Asthma	2.30	0.149	12.84	0.000	2.02	2.61
Nasal allergy	0.77	0.057	–3.59	0.000	0.66	0.89
Eczema	1.10	0.080	1.30	0.192	0.95	1.27
Presenteeism†						
Women	1.01	0.050	0.28	0.779	0.92	1.12
18–29 years	1.41	0.085	5.72	0.000	1.25	1.59
Share of income low	1.70	0.105	8.67	0.000	1.51	1.92
Smoker	1.28	0.071	4.50	0.000	1.15	1.43
Asthma	2.02	0.138	10.36	0.000	1.77	2.31
Nasal allergy	1.13	0.078	1.73	0.083	0.98	1.29
Eczema	1.00	0.076	–0.00	0.999	0.86	1.16
Caregiver absenteeism‡						
Women	1.41	0.11	4.26	0.000	1.20	1.66
Share of income high	0.62	0.06	–5.27	0.000	0.52	0.74

*Number of obs = 830; LR χ^2 (6) = 340.55; Prob > χ^2 = 0.0000; Pseudo R^2 = 0.0597.

†Number of obs = 859; LR χ^2 (7) = 297.18; Prob > χ^2 = 0.0000; Pseudo R^2 = 0.0665.

‡Number of obs = 317; LR χ^2 (2) = 65.59; Prob > χ^2 = 0.0000; Pseudo R^2 = 0.0325.

(58% compared with 50%) and more respondents in the 45–65 age group (46% compared with 38%) than the figures quoted in Swedish National Institute of Public Health data, but the smoking habits were the same, as was the percentage of respondents reporting children in the household.

We defined rhinitis on the basis of self-reported symptoms, and it could be argued that anatomical problems (e.g. septal deviation, turbinate hypertrophy or nasal polyps) or chronic inflammation (e.g. chronic rhinosinusitis) could have affected the outcome of the study. However, the prevalence of these conditions is known to be low in comparison with the common cold and allergic rhinitis, and these conditions seldom constitute a reason for short-term absence by themselves.

In a retrospective study like this, recall bias may be a confounding factor. For this reason, subjects were asked to report absenteeism, presenteeism and caregiver absenteeism during the last year, as well as during the last month. The results show that the costs were 2.4 times higher in February and 1.9 times higher in May compared with the reported cost for the whole year. This is to be expected, as these periods include the common cold and allergy seasons in Sweden, respectively. The higher costs in February compared with May could be attributed to the fact that the common cold affects a larger proportion of the population than allergic rhinitis. It also indicates that the productivity loss attributed to the common cold and allergic rhinitis could be higher than our estimates from the 1-year data.

Costs related to a disease can be measured in several ways. The present study focused on the cost of productivity loss in the short term. Direct costs, such as health care visits, hospitalization, medical treatment and drugs, were excluded. Indirect costs, such as early retirement and mortality, were also excluded. Our study therefore only shows a part of the total economic burden imposed by the common cold and nasal allergy. The annual cost of adult asthma in Sweden has been estimated at € 1643 per patient (12), of which € 509 (31%) were direct costs, and € 1134 (69%) were indirect costs. The total cost of asthma to society amounted to € 382 million in 2008 values (12). Even though the cost is somewhat higher per patient with asthma, the total cost of asthma is still far from the € 2.7 billion attributed to the common cold and allergic rhinitis, highlighting the fact that the prevalence of a disease may be just as important as the severity when assessing the total cost of an illness.

As indicated by previous US studies, we found that the burden of reduced working capacity, while at work with the common cold and allergic rhinitis, equals the

productivity loss because of absence from work and thus contributes considerably to total costs (5). In a recent population survey assessing the burden of allergic rhinitis in Finland, 36% of allergic rhinitis sufferers reported being frequently affected by their symptoms at work (13). Workers going to work with the common cold may also make things worse if they pass the disease on to other employees, with further productivity loss as a result. Assigning costs because of impaired work performance is known to be difficult, and there is a lack of a standardized approach (3). The present study is based on self-reported assessments of productivity. It could be argued that self-reported productivity is subjective and may differ between individuals. The mean self-reported reduction in work capacity while at work with the common cold or allergic rhinitis in this study, however, was 22%, which corresponds well to the 20–40% work reduction that has previously been reported for intermittent allergic rhinitis and the 21% reduction that has been found in association with the common cold (5, 14).

The cost of productivity loss when taking care of a child with a common cold or allergic rhinitis was just 19% of the total cost, representing 0.8 days/individual and year. Caregiver absenteeism affects the individual during a relatively short period of life, and this is supported by the fact that women aged 30–44 years had the highest productivity loss for caregiver absenteeism. In fact, women reported higher absenteeism, presenteeism and caregiver absenteeism, both in an overall gender comparison and when analysed using a multivariate regression model, compared with men. Further gender analyses will be necessary to explain these interesting findings.

The study reveals that persons aged 18–29 were more prone to stay home from work when they had the common cold/allergic rhinitis and reported significantly more presenteeism than older persons both in the univariate analyses and in the multivariate regression model. It might be that young age is associated with less qualified jobs and higher age with more qualified jobs and more responsibilities, and this may affect the decision of whether to stay at home or go to work when ill.

An evaluation of comorbidity revealed that the highest incidence rate ratio (IRR) for the common cold and allergic rhinitis was found for a positive answer to having *doctor-diagnosed asthma*. This question has previously been carefully validated and exhibits a high specificity for asthma (15). Our prevalence of *doctor-diagnosed asthma* was approximately the same as the prevalence found in another recent survey of the adult Swedish population (9% vs 7%, respectively) (12). Self-reported doctor-diagnosed allergic rhinitis in

this study was 12%, which is roughly in line with the 15% previously reported in another recent Swedish population sample investigation (16). It is well established that allergic rhinitis is present in at least 80% of subjects with asthma (1). It is also well known that common cold episodes can initiate asthma exacerbations. The findings from this study further underline both the medical and economic benefits of a combined approach to rhinitis and asthma.

Smoking was not found to be associated with absenteeism but showed an IRR of 1.28 for presenteeism in the regression model. Tobacco smoking is a risk factor for nasal obstruction and impairs mucociliary clearance, which can initiate or aggravate rhinitis (17).

Indirect costs are not borne by public or private health care; they are instead absorbed by society at large (patients, companies, health insurance, tax-funded schemes). These expenses have to be included when evaluating the economic burden of the disease (9). A profound knowledge of health-economic consequences is crucial when politicians and other decision-makers allocate our health-economic resources and research funding to areas in need. Any type of intervention, preventive or curative, in a disease with high prevalence, that results in even a minor reduction in lost productivity will save large sums for society. Based on the cost of the common cold and allergic rhinitis found in this study, a reduction in 1 day of lost production per individual and year could potentially save € 528 million or 20% of the total cost. This alone is more than the total estimated direct and indirect cost of asthma in Sweden. It can be argued that the symptomatic treatment of the common cold and allergic rhinitis that is currently available is already effective in relieving symptoms. However, the present results show that, even in a society where such treatment is readily available, the cost is still unreasonably high, indicating a potential benefit of increased research in terms of improved health for the population and reduced costs to society.

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