Association between asthma and work absence in working adults in the United States

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Abstract

The present study aimed to investigate the association between asthma and work absence in a large sample of US working adults, while controlling for several sociodemographic and health characteristics. This study used data from the 2019 Health and Functional Capacity Survey of the RAND American Life Panel (ALP). Work absence corresponded to the number of days of absence from work for health-related reasons in the past 12 months. Current asthma was selfreported and was included in the analyses as a dichotomous variable. Control variables included sex, age, ethnicity, marital status, education, occupation, annual family income, health insurance, and number of chronic physical or psychiatric conditions. Finally, the association between asthma and work absence was analyzed using logistic regression models. This study included 1,323 adults aged 22-65 years (53.1% males; mean [SD] age 43.1 [11.7] years). Individuals with asthma were more likely to report at least one (81.5% versus 56.8%, pvalue<0.001) or three days of absence (56.9% versus 31.3%, p-value=0.003) from work in the past 12 months than those without asthma. These findings were corroborated in the regression analyses, as asthma was positively and significantly associated with work absence after adjusting for all control variables (at least one day of absence: OR=3.24, 95% CI=1.44-7.29; at least three days of absence: OR=2.61, 95% CI=1.26-5.40). This US study of working adults showed that asthma was a risk factor for work absence. Further research is warranted to better understand the factors predisposing to work absence in the asthma population.

Key Words: Asthma; Work Absence; United States; Cross-Sectional Study; Epidemiology

Introduction

Work absence may be defined as non-attendance when work is scheduled (1). Work absence is a relative broad concept including sickness absence leave, various special leaves (e.g., bereavement leave) and days lost to industrial disputes. Sickness absence leave accounts for the majority of work absence (1). It was estimated that in 2021, the US annual average absence rate was 3.2% (2). The rate was 2.3% for illness or injury and 0.9% for other reasons. Such a high level of work absence is a significant economic burden costing US employers around \$226 billion per year (3). In addition to the cost assumed by the employer in relation to work absence, there is also a considerable cost to the employee, impacting the mental health of employees due to financial concerns (4). Owing to this background, it is indeed essential to identify groups who are at risk of work absence. One particular group may be those who suffer from asthma.

The World Health Organization (WHO) defines asthma as a chronic respiratory disorder characterized by repeated breathlessness and wheezing attacks of varying severity and frequency (5). Some literature does suggest that asthma is associated with a higher rate of work absence in Spain (6), Finland (7) and Denmark (8). However, after adjusting for a wide range of factors (e.g., gender, smoking status and the number of chronic conditions), a study carried out in the US found no significant association between asthma and work absence among participants (9). Therefore, it is important to repeat these analyses in other US samples to confirm or invalidate these null findings.

Asthma and work absence are plausibly associated, since asthma attacks may prevent work attendance, or interrupt/curtail the workday to recover from symptoms or receive treatment from health providers. Besides, those who suffer from asthma are also more likely to report mental health complications such as post-traumatic stress disorder and major depressive disorder (10,11), and these complications are associated with work absence (12,13). Finally, asthma is associated with a higher level of fatigue (14), and fatigue per se is associated with work absence (15).

Given this background, the present study aimed to investigate the association between asthma and work absence in a large sample of US working adults, while controlling for several sociodemographic and health factors.

Methods

Study participants

This study used data from participants of the 2019 Health and Functional Capacity Survey of the RAND American Life Panel (ALP) (16). Briefly, the RAND ALP includes approximately 6,000 people aged \geq 18 years from around 4,500 households in the United States, and the reference population is the US adult, civilian and residential population. Participants have been regularly surveyed via the Internet since early 2006. Weights were constructed using data from the CPS Annual Social and Economic Supplement, and these weights allow the generalization of estimates to the reference population. All participants gave informed consent, while the RAND's Human Subjects Protection Committee formally approved these surveys. Finally, **Figure 1** displays the flow chart of the participants of the study.

Work absence (dependent variable)

Work absence was assessed with the question "Over the past 12 months how many days in total were you absent from work for health-related reasons?". Work absence was analyzed as two

dichotomous variables (at least one versus zero day of absence, and at least three versus less than three days of absence). Two cutoffs were used to assess how the definition of work absence would have impacted the results of the study.

Asthma (independent variable)

Current asthma was assessed with the question "Do you suffer from any of the following serious health problems?", and participants answering "asthma" were considered to have asthma. Asthma was included as a dichotomous variable in the analyses.

Control variables

Control variables included sex (male or female), age (in years), ethnicity (White/Caucasian or Other), marital status (single/separated/divorced/widowed or married/in a domestic partnership), education (\leq primary/secondary or \geq tertiary), occupation, annual family income (<\$20,000, \$20,000-<\$40,000, \$40,000-<\$60,000, \$60,000-<\$75,000, and \geq \$75,000), health insurance (private, Medicare/Medicaid/Veterans Affairs Health Care/TRICARE/other, or none), the number of chronic physical conditions, and the number of psychiatric conditions. The definition of occupation relied on the International Standard Classification of Occupations (ISCO-08), and occupation corresponded to a 10-category variable: group 1 – managers; group 2 – professionals; group 3 – technicians and associate professionals; group 4 – clerical support workers; group 5 – service and sales workers; group 6 – skilled agricultural, forestry and fishery workers; group 9 – elementary occupations; and group 0 – armed forced occupations. There was no participant belonging to group 8 or group 0. Chronic physical conditions included abnormal heart rhythm (requiring a pacemaker or defibrillator), Alzheimer's disease, arthritis (including rheumatoid arthritis), back or neck pain, cancer, chronic fatigue syndrome, chronic

kidney disease, coronary artery disease, Crohn's disease, deformity or amputation of limb, diabetes, fibromyalgia, heart failure, heart valve dysfunction, hepatitis C, Human Immunodeficiency Virus (HIV) disease, immune deficiency, liver disease/cirrhosis, lupus, lymphedema, migraine, multiple sclerosis, obesity, Parkinson's disease, peripheral arterial disease, seizure disorder, severe burn, sickle cell anemia, sleep disorder, spinal cord injury, stroke (or effects of a prior stroke), and ulcerative colitis. Finally, chronic psychiatric conditions included alcohol dependence, anxiety, attention-deficit hyperactivity disorder (ADHD), bipolar disorder, depression, opioid dependence, personality disorder, post-traumatic stress disorder (PTSD), and schizophrenia.

Statistical analyses

Differences in the sample characteristics by asthma and work absence status (at least one versus zero day of absence) were assessed using chi-squared tests for categorical variables and Student's t-tests for continuous variables. The proportion of individuals with at least one or three days of absence from work was further compared between the asthma and the no asthma group using chi-squared tests. Finally, two logistic regression model were constructed to assess the association between asthma (independent variable) and work absence (dependent variables; either at least one versus zero day of absence, or at least three versus less than three days of absence). The logistic regression models were adjusted for sex, age, ethnicity, marital status, education, occupation, annual family income, health insurance, the number of chronic physical conditions, and the number of chronic psychiatric conditions. Results of the logistic regression models are presented using odds ratios (ORs) and 95% confidence intervals (CIs). The sampling weight was taken into account in the statistical analyses. P-values lower than 0.050 were considered statistically significant. All analyses were performed with R 4.1.0 (The R Foundation) (17).

Results

This study included 1,323 participants. Males constituted 53.1% of the sample, and the mean (standard deviation) age was 43.1 (11.7) years (**Table 1**). People with asthma were more likely to be married/in a domestic partnership and to have a higher number of chronic physical conditions than those without asthma, while the number of chronic physical and psychiatric conditions was higher in the work absence (at least one day of absence) than in the no work absence group (zero day of absence). In addition, the proportion of individuals reporting at least one or three days of absence at work in the past year was significantly higher in participants with than in their counterparts without asthma (at least one day of absence: 81.5% versus 56.8%, p-value<0.001; at least three days of absence: 56.9% versus 31.3%, p-value=0.003; **Figure 2**). Finally, the results of the logistic regression analyses are displayed in **Table 2**. The adjusted logistic regression models showed that asthma was positively and significantly associated with work absence (at least one day of absence: OR=3.24, 95% CI=1.44-7.29; at least three days of absence: OR=2.61, 95% CI=1.26-5.40).

Discussion

This US study of more than 1,300 working adults showed that, after adjusting for several sociodemographic and health variables, current asthma was positively and significantly associated with work absence in the past 12 months (at least one day of absence: OR=3.24; at least three days of absence: OR=2.61). To the best of the authors' knowledge, this is one of the first asthma-work absence studies to be conducted in the United States.

The present findings both support and contradict existing literature. These findings support several previous studies that have also identified a positive relationship between asthma and work absence (6-8). For example, a population-based study, including 14,382 participants with asthma or chronic obstructive pulmonary disease from Spain, revealed that these individuals were more likely to report work absence than the general population (15.2% versus 8.9%) (6). Another prospective cohort study of 68,686 employees from Finland further revealed that asthma was a risk factor for long-term work disability (i.e., sickness absence or disability pension for more than three months) (7). Finally, it was observed, using data of 7,141 adults living in Denmark, that the number of annual weeks with welfare, sick leave and disability benefits was significantly higher in those with than in those without asthma (8). However, the present findings contradict one other study carried out in the United States that found no association between asthma and work absence after controlling for numerous sociodemographic and health factors (9). These discrepancies may be explained by the fact that the two studies were conducted approximately 11 years apart (i.e., in 2008 and 2019), and it is possible that the asthma-work absence relationship has evolved in the United States during this decade. That being said, more work needs to be carried out in other samples of US adults to rule out any spurious results in either the present study or the previous study.

There are several plausible pathways that may link asthma to work absence. First, an asthma exacerbation can last anywhere from a few minutes to hours or days (18). Clearly, a prolonged asthma attack will result in work absence. Moreover, recovery from an asthma attack often requires significant rest and approval from a medical doctor to return to work (19). Interestingly, another US study revealed that 11 million workers had current asthma in 2011-2016, and 9.9% of them reported an asthma-related emergency department visit in the last 12 months (20). Next, asthma is associated with poor sleep (21), and poor sleep is associated with

work absence (22). Finally, as previously discussed, fatigue may also contribute to the positive asthma-work absence relationship (14,15).

It should be noted that in the adjusted logistic regression analyses, those in a professional role (i.e., "professionals") had significantly greater odds for at least one day of work absence when compared to "service and sales workers", "craft and related trades workers", "managers", and "elementary occupations", and had a significantly greater odds for at least three days of work absence compared to "craft and related trades workers". The reason why these differences exist is unclear, and further mechanistic research is required. However, those in a professional occupation are likely exposed to higher levels of work-related stress (23), and stress *per se* is a risk factor for asthma exacerbation (24).

Based on the study findings, asthma may negatively impact the ability to work of working-age adults. In this context, general practitioners, occupational physicians and other health professionals should regularly assess the treatment and the management of asthma in this population. One key measure is to reduce the exposition to environmental triggers (e.g., allergens, viruses and irritants), and this may require the adaptation of the occupational environment (25). Another important measure is the promotion of a regular physical activity in employees with asthma, as physical activity has been associated with improved lung function, decreased exacerbation rate and decreased healthcare use (26). In terms of future research, further data should be collected from the United States to confirm or invalidate the results of the present study. Besides, more studies are warranted to identify the factors playing a mediating role in the association between asthma and work absence. Finally, some patients may be affected by work-related asthma, and given that work-related asthma likely varies by type

of occupation (27,28), it is critical to investigate the association between asthma and work absence in different occupational groups.

The large sample of US working adults and controlling for multiple covariates including the number of chronic physical and psychiatric conditions are clear strengths of the present study. However, findings from this study must be interpreted in light of the study limitations. First, exposure, outcome, and covariates were all self-reported, thus introducing self-report and recall biases into the analyses. However, importantly some literature has shown that self-report diagnosis of asthma has a 90% specificity (29). Second, the severity of asthma was not recorded, nor were any information on medication and type of medication. It is plausible that those with severe or uncontrolled asthma are more likely to experience workplace absenteeism. Third, this was a cross-sectional study, and the directionality of the association between asthma and work absence could not be investigated, although it seems unlikely that work absence can favor the occurrence of asthma.

In conclusion, in this large sample of US working adults, while controlling for several covariates including the number of chronic physical and psychiatric conditions, it was found that those with asthma were significantly more likely to experience work absence over the past 12 months than their counterparts without asthma. Future research is now required in other large samples of US adults to confirm or refute the present findings, and more data is also needed on the potential mediators involved in the asthma-work absence relationship.

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13

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14

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Characteristics	Category	Overall (N=1,323)	Asthma			Work absence		
			No	Yes	P-	Zero day	At least one	P-
			(N=1,206)	(N=117)	value ^a	(N=509)	day (N=814)	value ^a
Sex	Male	53.1	54.1	42.9	0.221	54.4	52.3	0.654
	Female	46.9	45.9	57.1		45.6	47.7	0.034
Age (years)	Mean (standard deviation)	43.1 (11.7)	43.1 (11.9)	42.8	0.848	42 (110)		0.429
				(10.3)		43.6 (11.8)	42.7 (11.7)	
Ethnicity	White/Caucasian	72.3	73.1	64.6	0.310	71.1	73.1	0.679
	Other	27.7	26.9	35.4		28.9	26.9	
Marital status	Single/separated/divorced/widowed	38.8	40.6	20.2	< 0.001	39.5	38.3	0.799
	Married/in a domestic partnership	61.2	59.4	79.8		60.5	61.7	
Education	≤Primary/secondary	34.5	33.8	41.5	0.445	38.9	31.7	0.184
	≥Tertiary	65.5	66.2	58.5		61.1	68.3	
	Group 2 - Professionals	37.3	37.8	33.1		29.7	42.2	0.029
	Group 5 - Service and sales workers	15.9	16.1	14.0		17.1	15.1	
	Group 7 - Craft and related trades workers	11.2	11.5	8.3		13.1	9.9	
	Group 1 - Managers	10.9	11.0	10.1		13.2	9.4	
O	Group 9 - Elementary occupations	9.4	8.6	17.5	0.500	14.2	6.3	
Occupation	Group 4 - Clerical support workers	8.1	7.4	14.3		6.2	9.2	
	Group 3 - Technicians and associate	<i>C</i> A	6.8	2.7		()	67	
	professionals	6.4				6.0	6.7	
	Group 6 - Skilled agricultural, forestry and	0.0	0.9	0.0		0.4	1 1	
	fishery workers	0.8				0.4	1.1	
Annual family income	<\$20,000	8.5	9.1	2.9	0.482	9.6	7.9	0.188

Table 1. Characteristics of the study participants (overall and by asthma and work absence status)

	\$20,000-<\$40,000	16.6	17.0	12.2		12.6	19.2	
	\$40,000-<\$60,000	15.1	15.1	14.9		13.2	16.4	
	\$60,000-<\$75,000	14.7	14.2	19.4		19.0	11.9	
	≥\$75,000	45.1	44.5	50.6		45.7	44.7	
Health insurance	Private	77.8	77.1	85.5		77.0	78.4	
	Medicare/Medicaid/Veterans Affairs Health	15.3	15.6	12.3	0.140	16.6	144	0.807
	Care/TRICARE/other					10.0	14.4	0.807
	None	6.9	7.3	2.1		6.4	7.2	
Number of chronic		0.9 (1.2)	0.8 (1.2)	1.7(1.5)	< 0.001	0.7 (1.1)	1.1 (1.3)	< 0.001
physical conditions ^c	Mean (standard deviation)			1.7 (1.3)				
Number of chronic		0.5 (0.9)	0.5 (0.9)	0.7 (0.9)	0.068	0.3 (0.7)	0.6 (1.0)	< 0.001
psychiatric conditions ^d	inean (standard deviation)							

Data are percentages unless otherwise stated.

Current asthma was assessed with the question "Do you suffer from any of the following serious health problems?", and participants answering "asthma" were considered to have asthma.

Work absence was assessed with the question "Over the past 12 months how many days in total were you absent from work for health-related reasons?", and work absence corresponded to at least one day of absence in the past year.

^a P-values were based on chi-squared tests for categorical variables and Student's t-tests for continuous variables.

^b The definition of occupation relied on the International Standard Classification of Occupations (ISCO-08). There was no participant belonging to group 8 (plant and machine operators and assemblers) or group 0 (armed forced occupations).

^c Chronic physical conditions included abnormal heart rhythm (requiring a pacemaker or defibrillator), Alzheimer's disease, arthritis (including rheumatoid arthritis), back or neck pain, cancer, chronic fatigue syndrome, chronic kidney disease, coronary artery disease, Crohn's disease, deformity or amputation of limb, diabetes, fibromyalgia, heart failure, heart valve dysfunction, hepatitis C, Human Immunodeficiency Virus (HIV) disease, immune deficiency, liver disease/cirrhosis, lupus, lymphedema, migraine, multiple sclerosis, obesity, Parkinson's disease, peripheral arterial disease, seizure disorder, severe burn, sickle cell anemia, sleep disorder, spinal cord injury, stroke (or effects of a prior stroke), and ulcerative colitis.

^d Chronic psychiatric conditions included alcohol dependence, anxiety, attention-deficit hyperactivity disorder (ADHD), bipolar disorder, depression, opioid dependence, personality disorder, post-traumatic stress disorder (PTSD), and schizophrenia.

		At least one day of absence			At least three days of absence				
Chamatamatias	Category	Odds	95% confidence	P-	Odds	95% confidence	P-		
Characteristics		ratio	interval	value	ratio	interval	value		
Asthma	No	Reference							
	Yes	3.24	[1.44,7.29]	0.005	2.61	[1.26,5.40]	0.010		
0	Male	Reference							
Sex	Female	0.79	[0.54,1.17]	0.241	0.98	[0.68,1.42]	0.931		
Age (years)	Per one-year increase	1.00	[0.98,1.02]	0.980	1.01	[1.00,1.03]	0.102		
E4	White/Caucasian	Reference							
Ethnicity	Other	0.96	[0.59,1.56]	0.870	1.05	[0.67,1.63]	0.841		
	Single/separated/divorced/widowed	Reference							
Marital status	Married/in a domestic partnership	1.13	[0.75,1.71]	0.551	0.87	[0.58,1.31]	0.509		
Education	≤Primary/secondary	Reference							
Education	≥Tertiary	0.99	[0.62,1.60]	0.977	1.23	[0.76,1.98]	0.400		
	Group 2 - Professionals	Reference	ce						
	Group 5 - Service and sales workers	0.54	[0.32,0.94]	0.029	0.57	[0.31,1.06]	0.076		
	Group 7 - Craft and related trades workers	0.36	[0.16,0.79]	0.011	0.42	[0.19,0.90]	0.027		
	Group 1 – Managers	0.43	[0.24,0.78]	0.005	0.75	[0.41,1.36]	0.342		
	Group 9 - Elementary occupations	0.22	[0.11,0.46]	<0.001	0.62	[0.27,1.40]	0.249		
Occupation	Group 4 - Clerical support workers	0.88	[0.43,1.81]	0.735	1.08	[0.57,2.05]	0.805		
	Group 3 - Technicians and associate professionals	0.58	[0.29,1.17]	0.128	0.82	[0.41,1.66]	0.585		
	Group 6 - Skilled agricultural, forestry and fishery	2.22	[0.31,15.88]	0.428	0.52	[0.09,2.87]	0.452		
	workers	2.22					0.452		
	<\$20,000	Reference							
Annual family income	\$20,000-<\$40,000	1.79	[0.64,5.06]	0.269	2.31	[0.98,5.43]	0.056		

Table 2. Association between asthma and work absence in working adults from the United States

Number of chronic		1 40		0.000			0.000		
conditions	Per one-condition increase	1.29	[1.10,1.52]	0.001	1.32	[1.15,1.55]	<0.001		
Number of chronic physical		1 20	[1 10 1 70]	0.001	1 22		.0.001		
Health insurance	None	1.22	[0.56,2.66]	0.615	1.34	[0.61,2.98]	0.469		
	Care/TRICARE/other	0.70	[0.42,1.59]	0.379	0.88	[0.48,1.60]	0.005		
	Medicare/Medicaid/Veterans Affairs Health	0.76	[0 42 1 20]	0.270			0.665		
	Private	Reference							
	≥\$75,000	0.73	[0.28,1.94]	0.528	0.91	[0.38,2.15]	0.826		
	\$60,000-<\$75,000	0.54	[0.19,1.52]	0.243	1.01	[0.39,2.66]	0.979		
	\$40,000-<\$60,000	1.19	[0.43,3.30]	0.743	1.53	[0.64,3.64]	0.339		

Significant associations are displayed in bold.

Current asthma was assessed with the question "Do you suffer from any of the following serious health problems?", and participants answering "asthma" were considered to have asthma.

Work absence was assessed with the question "Over the past 12 months how many days in total were you absent from work for health-related reasons?", and work absence corresponded to at least one or three days of absence in the past year.

The association between asthma (independent variable) and work absence (dependent variable) was analyzed using a logistic regression model adjusted for sex, age, ethnicity, marital status, education, occupation, annual family income, health insurance, number of chronic physical conditions, and number of chronic psychiatric conditions.



Figure 1. Flow chart of study participants





12 months by asthma status

Current asthma was assessed with the question "Do you suffer from any of the following serious health problems?", and participants answering "asthma" were considered to have asthma.

Work absence was assessed with the question "Over the past 12 months how many days in total were you absent from work for health-related reasons?".

Participants with asthma were significantly more likely to report at least one (p-value<0.001) and three days of absence from work in the past 12 months (p-value=0.003) than their counterparts without asthma (chi-squared tests).