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To cite this version:

Dorothée Provost, Marie-Christine Delmas, Laetitia Bénézet, Céline Ribet, Julie Chesneau, et al.. Impact of asthma on working life: an analysis of the French CONSTANCES cohort. Occupational and Environmental Medicine, 2023, pp.oemed-2022-108671. 10.1136/oemed-2022-108671 . hal-04109646

HAL Id: hal-04109646

https://hal.science/hal-04109646v1

Submitted on 19 Dec 2023

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Original research

Impact of asthma on working life: an analysis of the French CONSTANCES cohort

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► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/oemed-2022-108671).

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Received 29 September 2022
Accepted 21 April 2023

Check for updates

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To cite: Provost D, Delmas M-C, Bénézet L, *et al*. *Occup Environ Med* Epub ahead of print: [please include Day Month Year]. doi:10.1136/oemed-2022-108671

ABSTRACT

Objectives Asthma has significant occupational consequences. The objective of our study was to investigate the links between asthma and the career path, taking into account gender and age at asthma onset.

Methods Using cross-sectional data collected at inclusion in the French CONSTANCES cohort in 2013–2014, we studied the links between each career path indicator (number of job periods, total duration of employment, numbers of part-time jobs and work interruptions due to unemployment or health issues, employment status at inclusion) on the one hand, and current asthma and asthma symptom score in the last 12 months on the other hand, as reported by the participants. Multivariate analyses were performed separately for men and women using logistic and negative binomial regression models adjusted for age, smoking status, body mass index and educational level.

Results When the asthma symptom score was used, significant associations were observed with all of the career path indicators studied: a high symptom score was associated with a shorter total duration of employment as well as a greater number of job periods, part-time jobs and work interruptions due to unemployment or health issues. These associations were of similar magnitude in men and women. When current asthma was used, the associations were more pronounced in women for some career path indicators.

Conclusion The career path of asthmatic adults is more often unfavourable than that of those without asthma. Efforts should be made to support people with asthma in the workplace, in order to maintain employment and facilitate the return to work.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Asthma has a significant socioeconomic impact (decreased income, loss of employment, transfer to non-exposed positions). The consequences of asthma on the career path are still poorly documented in France.

WHAT THIS STUDY ADDS

⇒ Asthma is associated with an unfavourable career path in France. The impact of asthma on the career path was similar in magnitude in men and women when asthma was assessed by an asthma symptom score. When asthma was assessed dichotomously, the impact was stronger for women.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Prevention actions need to be strengthened, especially those aimed at identifying asthma early and ensuring appropriate management of the disease, as well as helping people with asthma to stay in work and return to work.

INTRODUCTION

Asthma is a common chronic respiratory disease, with large differences in prevalence between countries.[1] In France, the prevalence of current asthma varies from 6% to 9% according to the definition used.[2] Several studies have documented gender differences in asthma prevalence and incidence, and these differences change considerably over the course of life, with a predominance of severe and non-atopic adult-onset asthma among women.[3–5] Asthma has significant consequences for individuals' careers. Several studies have highlighted the impact of asthma on long-term leave, or periods of work disability.[6–9] A review of studies focusing on the 'healthy worker effect' and asthma suggested that people with asthma are twice as likely to change or leave jobs as those without asthma.[10] In contrast, an association between asthma and unemployment has been inconsistently found.[7 9 11]

Several studies have found a differential association between asthma and employment according to age at diagnosis: individuals with adult-onset asthma were more likely to be at a higher risk of work disability than those with childhood-onset asthma.[7 9 12] Few studies have examined the potential gender difference in the impact of asthma on employment.[13 14] In France, analyses of the longitudinal data of the 'Santé et Itinéraire Professionnel' (SIP) survey showed a greater impact of asthma in women than in men, with more frequent periods of unemployment and sick leave.[13] Men and women experience differential exposures in the workplace, even for the same jobs.[15] Healthy worker effect (hire/survivor) might be different according to gender.[10 14 16] However, to our knowledge, no study has investigated the links between asthma and the career path according to gender and age at asthma onset.

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Table 1 Description of the study population, separately in men and women

	Men N=16 149		Women N=17 847		P value
Age (mean, SD)	45.5	13.1	43.6	13.4	<0.001
ISCED educational level (n, %)					<0.001
0–2 (≤lower secondary)	5142	36.0	4300	28.0	
3–4 (upper secondary)	2361	16.1	3059	19.3	
≥5 (tertiary)	8322	47.9	10 163	52.7	
Employment status (n, %)					<0.001
Employed	10 779	67.1	12 204	67.9	
Unemployed	1014	11.1	1178	10.5	
Retired	3521	16.2	3264	13.6	
Not working for health issues	175	1.9	223	1.9	
Other (in training, no activity)	333	3.7	649	6.1	
Smoking status (n, %)					<0.001
Never smoker	6113	39.1	8576	50.3	
Smoker	3222	26.2	3206	22.5	
Ex-smoker	6021	34.7	5230	27.2	
BMI (kg/m^2) (n, %)					<0.001
<18.5	140	1.3	651	4.2	
(18.5–25)	7284	47.5	10 625	58.1	
(25–30)	6281	37.3	4064	23.1	
≥30	2095	13.9	2160	14.6	
Current asthma (n, %)	1185	8.4	1505	10.3	<0.001
Asthma symptom score (n, %)					0.04
0	11 244	66.3	11 842	63.6	
1	2977	19.5	3641	21.2	
≥2	1887	14.2	2341	15.2	

Data are presented as number observed in the sample (n), and weighted proportion (%) or mean.
BMI, body mass index; ISCED, International Standard Classification of Education.

The objective of our study was to examine the links between asthma and the career path in France, and to assess whether the associations differed according to gender and age at asthma onset.

METHODS

The CONSTANCES cohort

The methodology of the CONSTANCES cohort study has already been described.[17] Briefly, CONSTANCES is a French cohort of individuals aged 18–69 years at inclusion, affiliated to the main national health insurance covering around 85% of the population, and living in one of the French administrative areas (called 'départements') participating in the cohort. For each year of inclusion, individuals were randomly selected according to an unequal probability sampling design stratified by gender, age, social category and area. About 220 000 individuals were included between 2012 and 2019. At inclusion, the individuals who had agreed to participate completed a self-administered questionnaire and underwent a health examination (medical questionnaire, anthropometry, etc) at one of the health prevention centres ('Centres d'examens de santé') in the participating areas. Data were also individually linked to two national databases: the National Health Database (SNDS) that covers all reimbursements for outpatient and hospital healthcare, and the National Retirement Insurance Database (CNAV) that gathers occupational data throughout life. Longitudinal follow-up of the participants is ongoing. It is based on an annual self-administered questionnaire, a health examination every 3–5 years and passive data collection by linkage to the two national databases.

Study population

This study was conducted on data collected at baseline from participants in the CONSTANCES cohort. The study population was limited to participants who had a period of employment of at least 6 months during their working life, and had been invited to participate in 2013 and 2014 since, at the time of the analysis, annual sample weights were only provided for these two inclusion years.

Data collected at inclusion

The self-administered questionnaire included data on sociodemographic characteristics, employment status at inclusion, occupational history, lifestyle (smoking status, physical activity, etc) and health. Questions on respiratory health were taken from the European Community Respiratory Health Survey (ECRHS) questionnaire.[18] The questionnaire included a detailed lifetime job history that covered all jobs held by the individual for at least 6 months up to inclusion. A job period was defined as a period of employment with start and end dates during which the participant held a given occupation in a given industry. Occupational history data contained detailed information on each job period held for more than 6 months: start and end dates, working time, industry and occupation. For each work interruption of more than 6 months, the start and end dates and the reason (health issues, unemployment or another reason) were requested.

Definition of asthma

We defined current asthma by the report of a physician's diagnosis of asthma, and asthma symptoms (asthma attack,

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Table 2 Career path and current asthma, separately in men and women (univariate analysis)

	Men			Women		
	With asthma	Without asthma	P value	With asthma	Without asthma	P value
No of job periods (%)			0.3			0.3
1–2	36.4	39.6		39.3	42.4	
3–4	33.7	32.7		33.3	32.5	
≥5	29.9	27.7		27.4	25.1	
Total duration of employment (%)			0.01			<0.001
1–9 years	25.8	21.7		32.3	26.7	
10–19 years	30.2	24.9		32.6	29.1	
20–29 years	19.3	19.0		15.2	19.9	
≥30 years	24.7	34.4		19.9	24.3	
No of part-time jobs (%)			0.1			0.4
0	83.2	86.1		62.3	63.9	
≥1	16.8	13.9		37.7	36.1	
No of unemployment-related periods of work interruption (%)			0.6			0.6
0	83.7	84.5		81.8	81.1	
≥1	16.3	15.5		18.2	18.9	
No of health-related periods of work interruption (%)			0.06			<0.001
0	93.6	95.6		90.2	94.3	
≥1	6.4	4.4		9.8	5.7	
Employment status at inclusion (%)			0.01			<0.001
Employed	69.1	66.8		64.4	68.2	
Unemployed	14.1	10.8		13.5	10.2	
Retired	9.8	17.1		11.3	13.9	
Not working for health issues	3.5	1.7		3.6	1.7	
Other (in training, no activity)	3.5	3.6		7.2	6.0	

wheezing, woken up with a feeling of chest tightness, attack of shortness of breath at rest, attack of shortness of breath after exercise, woken by attack of shortness of breath) in the previous 12 months or current treatment for asthma.[19] Individuals with current asthma were classified according to their age at asthma onset: childhood-onset asthma if the first asthma attack occurred before the age of 16 years and adult-onset asthma if age at the first asthma attack was 16 years or over. A second definition of current asthma, based on the criteria listed above but without confirmation of the diagnosis of asthma by a physician, was also used.

We also calculated an asthma symptom score, defined by the sum of the positive answers to five items, that is, the score ranges from 0 to 5.[20 21] The items were: (1) breathless while wheezing in the last 12 months, (2) woken up with a feeling of chest tightness in the last 12 months, (3) attack of shortness of breath at rest in the last 12 months, (4) attack of shortness of breath after exercise in the last 12 months and (5) woken by attack of shortness of breath in the last 12 months.

Definition of the career path indicators

Using the data from the occupational history questionnaire, we calculated the number of job periods (in three categories: 1–2, 3–4 and ≥5), the total duration of employment periods (in four groups: 1–9, 10–19, 20–29 and ≥30 years), as well as the numbers of part-time jobs, and work interruptions due to unemployment or health issues (as binary variables: 0 and ≥1). Employment status at inclusion was categorised as: employed, unemployed, retired, not working for health issues, other (in training, no activity).

Statistical analysis

The associations between each of the six career path indicators and current asthma were estimated by logistic regression models. Multinomial logistic regression models were used to study the associations with current childhood-onset and adult-onset asthma. Negative binomial regression models were used to study the links with the asthma symptom score. All models were adjusted for potential confounding factors: age (in five groups: (18–24), (25–34), (35–44), (45–54), ≥55 years), body mass index (BMI) (in four categories <18.5, (18.5–<25), (25–<30), ≥30 kg/m^2), smoking status (current smoker, ex-smoker, never smoker) and educational level coded with the International Standard Classification of Education.[22] All analyses were stratified by gender. In addition, the interactions between gender and the career path indicators were tested. In order to assess the potential impact of including patients with chronic obstructive pulmonary disease (COPD) in the analysis of the asthma symptom score, we performed sensitivity analyses with stratification by age (<40 years vs ≥40 years) and smoking status (current smoker/ex-smoker vs never smoker).

All analyses incorporated appropriate weights. Annual weights were calculated taking into account the sampling design and the correction for non-participation based on SNDS and CNAV data gathered from participants and a sample of non-participants, and were calibrated using the target population margins. Then the annual weights were rescaled in order to analyse the data in a combined approach as a single sample from the target population.[23] Statistical analyses were performed using the svy procedure in Stata V.14.2.

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Table 3 Career path and current asthma, separately in men and women (multivariate analysis)

	Men	Women	
	OR (95% CI)	OR (95% CI)	P inter
No of job periods			0.7
1–2	1	1	
3–4	1.29 (1.04 to 1.59)	1.17 (0.92 to 1.37)	
≥5	1.40 (1.11 to 1.78)	1.31 (1.02 to 1.62)	
Total duration of employment			0.03
1–9 years	1	1	
10–19 years	1.09 (0.81 to 1.49)	0.91 (0.71 to 1.17)	
20–29 years	1.03 (0.69 to 1.56)	0.58 (0.42 to 0.80)	
≥30 years	0.79 (0.46 to 1.35)	0.70 (0.47 to 0.99)	
No of part-time jobs			0.6
0	1	1	
≥1	1.14 (0.86 to 1.52)	1.04 (0.86 to 1.27)	
No of unemployment-related periods of work interruption			0.5
0	1	1	
≥1	1.12 (0.87 to 1.44)	0.94 (0.75 to 1.16)	
No of health-related periods of work interruption			0.2
0	1	1	
≥1	1.57 (0.99 to 2.30)	1.86 (1.32 to 2.62)	
Employment status at inclusion			0.04
Employed	1	1	
Unemployed	1.08 (0.78 to 1.50)	1.19 (0.88 to 1.61)	
Retired	0.68 (0.49 to 0.94)	1.20 (0.89 to 1.64)	
Not working for health issues	1.86 (0.85 to 4.08)	2.29 (1.31 to 3.97)	
Other (in training, no activity)	0.86 (0.47 to 1.58)	1.16 (0.78 to 1.74)	

Logistic regressions adjusted for age, smoking status, educational level and body mass index.
P inter, p interaction between gender and career path indicator.

RESULTS

Study population

Of the 34 238 participants invited to participate in the CONSTANCES cohort in 2013 and 2014, 34 100 completed the self-administered inclusion questionnaire. Among them, 104 without any period of employment of at least 6 months were excluded. The study population consisted of 33 996 individuals, of which 52.3% were women. Its main characteristics are presented in table 1. The prevalence of current asthma (with a physician-confirmed asthma diagnosis) and the mean asthma symptom score were significantly higher in women than in men (respectively, 10.3% vs 8.4% for current asthma and 0.63 vs 0.59 for the asthma symptom score). Of the 2154 individuals with current asthma for whom the age at asthma onset was known, 1030 (43.9%) had adult-onset asthma (35.3% in men and 50.6% in women, p<0.001).

Associations between the career path and current asthma

Results of univariate analysis are presented in table 2, separately for men and women. After adjustment for age, smoking status, BMI and educational level, three career path indicators were found significantly associated with current asthma in both genders: a higher number of job periods (adjusted OR (95% CI) 1.40 (1.11 to 1.78); and 1.31 (1.02 to 1.62) in men and women, respectively, for more than five job periods), at least one health-related work interruption (1.57 (0.99 to 2.30) in men and 1.86 (1.32 to 2.62) in women) and employment status at inclusion (0.68 (0.49 to 0.94) in retired men and 2.29 (1.31 to 3.97) in women not working due to health issues, compared with employed (reference category)) (table 3). One more career path indicator was found associated with current asthma only in women: a lower total duration of employment (0.70 (0.47 to 0.99) for duration ≥30 years). The interactions with gender were significant for the total duration of employment and employment status at inclusion.

Adult-onset asthma was significantly associated with the career path indicators, except the numbers of part-time jobs and work interruptions due to unemployment in women, and with none of the career path indicators in men (table 4). For childhood-onset asthma, only a significant association with employment status was observed in men, with a lower probability of childhood-onset asthma in retirees. For either childhood-onset or adult-onset asthma, none of the interactions with gender was significant.

Results were similar using the broader definition of current asthma (online supplemental table S1).

Associations between career path and asthma symptom score

Significant associations were observed between all the career path indicators and the asthma symptom score, after adjustment for age, smoking status, BMI and educational level, in both men and women (table 5): a high symptom score was associated with a shorter total duration of employment (adjusted mean score ratio and 95% CI, respectively, in men and women: 0.59 (0.46 to 0.74) and 0.75 (0.62 to 0.90) for a duration ≥30 years) as well as a greater number of job periods (1.33 (1.18 to 1.48) and 1.20 (1.08 to 1.33), respectively, in men and women for at least five job periods), part-time jobs and periods of work interruptions (for health issue (1.55 (1.28 to 1.86) in men and 1.62 (1.41 to 1.85) in women) or unemployment) and the symptom score was higher in individuals not working (unemployed, not working for health issues, in training or without any activity) at inclusion than in employed individuals. A significant interaction between gender and the total duration of employment was observed.

Results remained unchanged when analyses were stratified by age (<40 and ≥40 years) and smoking status (never smokers vs current or ex-smokers) (online supplemental tables S2 and S3).

DISCUSSION

To our knowledge, this study, conducted in a large French cohort, is the first to study the links between the career path on the one hand, and current asthma and asthma symptom score on the other hand, men and women separately. Our results showed that asthma was associated with a disrupted or complex career path. The associations were stronger for women when asthma was studied in a dichotomous way whereas results were similar for both genders when the asthma symptom score was used.

The main strength of our study is that it is based on a large sample, randomly drawn from the French general population. The use of weights, which took into account the survey sampling design and non-participation in the cohort, allow us to extrapolate the results to the target population (population of main national health insurance affiliates living in one of the areas participating in the cohort in 2013–2014). In order to characterise the career path until inclusion, we considered several career path indicators, represented by the numbers of job periods, part-time jobs, work interruptions due to unemployment or health issues and employment status at inclusion. Working life was reconstructed based on reported job periods and work interruptions of more than 6 months, resulting in a global retrospective overview of

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Table 4 Career path and childhood-onset and adult-onset asthma, separately in men and women (multivariate analysis)

	Childhood-onset asthma			Adult-onset asthma		
	Men	Women		Men	Women	
	OR (95% CI)	OR (95% CI)	P inter	OR (95% CI)	OR (95% CI)	P inter
No of job periods			0.3			0.2
1–2	1	1		1	1	
3–4	1.23 (0.91 to 1.66)	1.27 (0.94 to 1.72)		1.29 (0.88 to 1.88)	1.31 (0.99 to 1.77)	
≥5	1.42 (0.99 to 2.00)	1.07 (0.73 to 1.58)		1.08 (0.71 to 1.66)	1.65 (1.21 to 2.26)	
Total duration of employment			0.1			0.2
1–9 years	1	1		1	1	
10–19 years	1.03 (0.69 to 1.52)	0.85 (0.57 to 1.26)		1.64 (0.79 to 3.43)	1.15 (0.77 to 1.71)	
20–29 years	1.35 (0.77 to 2.36)	0.81 (0.48 to 1.36)		1.42 (0.56 to 3.61)	0.64 (0.39 to 1.05)	
≥30 years	0.92 (0.43 to 1.97)	0.79 (0.37 to 1.70)		0.83 (0.27 to 2.63)	0.62 (0.36 to 0.99)	
No of part-time jobs			0.2			0.3
0	1	1		1	1	
≥1	0.97 (0.66 to 1.43)	1.20 (0.87 to 1.64)		0.83 (0.53 to 1.31)	0.91 (0.69 to 1.19)	
No of unemployment-related periods of work interruption			0.3			0.7
0	1	1		1	1	
≥1	1.15 (0.81 to 1.62)	0.91 (0.63 to 1.29)		0.98 (0.63 to 1.54)	1.00 (0.74 to 1.35)	
No of health-related periods of work interruption			0.9			0.4
0	1	1		1	1	
≥1	1.55 (0.87 to 2.74)	1.55 (0.90 to 2.64)		1.53 (0.85 to 2.77)	1.89 (1.18 to 3.01)	
Employment status at inclusion			0.2			0.06
Employed	1	1		1	1	
Unemployed	0.86 (0.53 to 1.38)	1.28 (0.81 to 2.02)		0.64 (0.35 to 1.15)	1.33 (0.85 to 2.07)	
Retired	0.44 (0.26 to 0.73)	1.03 (0.56 to 1.90)		0.77 (0.51 to 1.15)	1.00 (0.69 to 1.46)	
Not working for health issues	1.72 (0.58 to 5.07)	1.65 (0.51 to 5.33)		2.17 (0.58 to 8.05)	2.39 (1.18 to 4.83)	
Other (in training, no activity)	0.82 (0.35 to 1.91)	1.33 (0.75 to 2.36)		0.46 (0.17 to 1.22)	1.45 (0.78 to 2.68)	

Multinomial logistic regressions adjusted for age, smoking status, educational level and body mass index.
P inter, p interaction between gender and career path indicator.

the career path. However, our study has some limitations. Due to the cross-sectional design of our analysis, it was not possible to study causal relationship between asthma and the career path. Since our study is based on self-reported data, we cannot exclude a better recall of job history among individuals with asthma.

The increased frequency of job changes in people with asthma observed in our study is consistent with the literature.[10 14 24–27] This result could reflect the healthy worker effect. Prospective surveys have shown that workers with asthma were more likely to seek jobs less exposed to asthma triggers than workers without asthma, which is in favour of an impact of asthma on work life.[14 25] We also observed more frequent health-related periods of work interruption in people with asthma, which is consistent with previous studies reporting a greater frequency of sick or disability leave in individuals with asthma.[7 9 28 29] Our results on shorter total duration of employment in individuals with asthma are also consistent with previous studies.[13 30] In the literature, the association between asthma and unemployment was inconsistently observed.[9 11 13 31 32] In our study, the impact of asthma on the number of unemployment periods was observed in both men and women when the asthma symptom score was used. Few studies have looked at the impact of asthma on employment by gender. In France, the SIP survey showed an unfavourable impact in terms of sick leave, total duration of employment and unemployment in women only.[13] Longitudinal analysis of the ECRHS survey data has shown that, in people with asthma, the risk of leaving a job due to respiratory issues was higher in women than in men.[14]

Previous studies have shown a greater impact of adult-onset asthma than childhood-onset asthma on employment.[7 9 12] In our study, adult-onset asthma was found associated with an unfavourable career path only in women. As regards childhood-onset asthma, only an association with employment status at inclusion was found in men. However, taking account age at asthma onset, none of the interactions between gender and career path indicators was statistically significant which could be due to a lack of statistical power.[33]

In our analyses, we used two standardised definitions of asthma: current asthma and asthma symptom score. When the symptom score was used, the number of significantly associated career path indicators increased, particularly in men, and associations were of the same magnitude in men and women. Compared with a dichotomous definition of asthma, the continuous symptom score increases the capacity to observe associations.[20 21] Several hypotheses could be set forth to explain the differences between men and women according to the asthma definition used. First, our study population included adults up to the age of 69 years, with a likely higher prevalence of COPD than in the young adult population in which the asthma symptom score was developed and validated.[20 21] However, the analyses stratified by age and smoking status showed similar results regardless of the stratum studied. It is, therefore, unlikely that the results concerning the symptom score would be the consequence of including patients suffering from COPD. A second hypothesis could be a higher level of underdiagnosis of asthma in men than in women, making the definition of current asthma less sensitive in men. It has been

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Table 5 Career path and asthma symptom score, separately in men and women (univariate and multivariate analyses)

	Men		Women		
	Mean score	Mean score ratio (95% CI)	Mean score	Mean score ratio (95% CI)	P inter
No of job periods					0.3
1–2	0.52	1	0.60	1	
3–4	0.59	1.17 (1.05 to 1.31)	0.62	1.09 (0.99 to 1.20)	
≥5	0.69	1.33 (1.18 to 1.48)	0.70	1.20 (1.08 to 1.33)	
Total duration of employment					0.02
1–9 years	0.58	1	0.72	1	
10–19 years	0.62	0.95 (0.81 to 1.10)	0.62	0.84 (0.75 to 0.96)	
20–29 years	0.62	0.83 (0.69 to 1.00)	0.58	0.78 (0.67 to 0.91)	
≥30 years	0.50	0.59 (0.46 to 0.74)	0.55	0.75 (0.62 to 0.90)	
No of part-time jobs					0.7
0	0.57	1	0.59	1	
≥1	0.66	1.18 (1.03 to 1.34)	0.68	1.12 (1.02 to 1.23)	
No of unemployment-related periods of work interruption					0.8
0	0.57	1	0.61	1	
≥1	0.68	1.17 (1.04 to 1.32)	0.75	1.15 (1.04 to 1.27)	
No of health-related periods of work interruption					0.4
0	0.57	1	0.61	1	
≥1	0.97	1.55 (1.28 to 1.86)	1.01	1.62 (1.41 to 1.85)	
Employment status at inclusion					0.09
Employed	0.52	1	0.58	1	
Unemployed	0.88	1.58 (1.37 to 1.83)	0.80	1.21 (1.05 to 1.40)	
Retired	0.51	0.90 (0.78 to 1.04)	0.56	1.06 (0.94 to 1.20)	
Not working for health issues	1.29	2.15 (1.60 to 2.90)	1.37	2.16 (1.71 to 2.73)	
Other (in training, no activity)	0.75	1.38 (1.10 to 1.74)	0.85	1.36 (1.13 to 1.64)	

Binomial negative regressions adjusted for age, smoking status, educational level and body mass index.
P inter, p interaction between gender and career path indicator.

shown that asthma is underdiagnosed but, to our knowledge, no data are available in France regarding the potential differences in the level of asthma underdiagnosis by gender.[34]

CONCLUSION

Our study suggests an unfavourable impact of asthma on the career path of adults in France. Results were similar for both men and women when the asthma symptom score was used, and more pronounced in women for current asthma for some career path indicators. Further analyses will be performed by studying the career paths of individuals with asthma using the cohort follow-up data, including those collected passively from the National Retirement Insurance Database. Since asthma is a condition that compromises job retention and has repercussions on quality of life, prevention clearly plays a crucial role. It is essential to strengthen preventive actions, especially those aimed at identifying asthma early and ensuring optimal care and follow-up of the disease. Appropriate support for workers with asthma or respiratory symptoms, involving both occupational physicians and clinicians, must be encouraged in order to maintain employment and promote the return to work.

Acknowledgements The authors thank the team of the 'Population-based Epidemiologic Cohorts Unit' (Cohortes épidémiologiques en population) that designed and manages the CONSTANCES Cohort Study, in particular A Renuy in charge of weightings in the CONSTANCES cohort for her methodological support on the use of weightings. They also thank the French National Health Insurance Fund ('Caisse nationale d'assurance maladie', CNAM) and its Health Prevention Centres ('centres d'examens de santé'), which are collecting a large part of the data, the French National Retirement Fund ('Caisse nationale d'assurance vieillesse') for its contribution to the constitution of the cohort and ClinSearch, Aqualab and EuroCell, which are conducting the data quality control. The authors also acknowledge the Constances Respiratory Group: MC Delmas, O Dumas, V Giraud, Y Iwatsubo, B Leynaert, N Le Moual, R Nadif, T Perez, N Roche, R Varraso.

Contributors DP performed the statistical analysis, interpreted the results and edited the first draft of the manuscript. JC and LB contributed to the statistical analysis. MG and CRi acquired the data. DP, MCD and YI developed study hypotheses. MCD, YI and LB were involved in the data interpretation and critical revision of the manuscript. NLM and OD contributed to data interpretation. CRa contributed to critical revision of the manuscript. All authors critically revised the manuscript. DP is the guarantor, accepts full responsibility for the work.

Funding The CONSTANCES Cohort Study was supported and funded by the French National Health Insurance Fund ('Caisse nationale d'assurance maladie', CNAM). The CONSTANCES Cohort Study is an 'Infrastructure nationale en biologie et santé' and benefits from a grant from the French National Agency for Research (ANR-11-INBS-002). CONSTANCES is also partly funded by Merck Sharp & Dohme (MSD), AstraZeneca, Lundbeck and L'Oréal.

Competing interests MG reports grants or contracts from ANSES.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and the CONSTANCES cohort was approved by the French Data Protection Agency (CNIL), reference number 910486. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Anonymised data will be shared by request to the CONSTANCES scientific committee.

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REFERENCES

1 Soriano JB, Kendrick PJ, Paulson KR, *et al*. Prevalence and attributable health burden of chronic respiratory diseases, 1990-2017: a systematic analysis for the global burden of disease study 2017. *Lancet Respir Med* 2020;8:585–96.
2 Delmas MC, Bénézet L, Ribet C, *et al*. Prevalence of asthma among adults in France, data from the Constances cohort study. *Rev Mal Respir* 2021;38:797–806.
3 Becklake MR, Kauffmann F. Gender differences in airway behaviour over the human life span. *Thorax* 1999;54:1119–38.
4 Chen Y, Stewart P, Johansen H, *et al*. Sex difference in hospitalization due to asthma in relation to age. *J Clin Epidemiol* 2003;56:180–7.
5 Leynaert B, Sunyer J, Garcia-Esteban R, *et al*. Gender differences in prevalence, diagnosis and incidence of allergic and non-allergic asthma: a population-based cohort. *Thorax* 2012;67:625–31.
6 Hakola R, Kauppi P, Leino T, *et al*. Persistent asthma, comorbid conditions and the risk of work disability: a prospective cohort study. *Allergy* 2011;66:1598–603.
7 Hansen CL, Baelum J, Skadhauge L, *et al*. Consequences of asthma on job absenteeism and job retention. *Scand J Public Health* 2012;40:377–84.
8 Malo JL, Tarlo SM, Sastre J, *et al*. An official American Thoracic Society Workshop Report: presentations and discussion of the fifth Jack Pepys workshop on asthma in the workplace. comparisons between asthma in the workplace and non-work-related asthma. *Ann Am Thorac Soc* 2015;12:S99–110.
9 Thaon I, Wild P, Mouchot L, *et al*. Long-term occupational consequences of asthma in a large French cohort of male workers followed up for 5 years. *Am J Ind Med* 2008;51:317–23.
10 Le Moual N, Kauffmann F, Eisen EA, *et al*. The healthy worker effect in asthma: work may cause asthma, but asthma may also influence work. *Am J Respir Crit Care Med* 2008;177:4–10.
11 Sibbald B, Anderson HR, McGuigan S. Asthma and employment in young adults. *Thorax* 1992;47:19–24.
12 Taponen S, Uitti J, Karvala K, *et al*. Asthma diagnosed in late adulthood is linked to work disability and poor employment status. *Respir Med* 2019;147:76–8.
13 Provost D, Delmas MC, Chastang JF, *et al*. Asthma and career path in the French SIP survey, 2006 and 2010. *Arch Mal Pro Env* 2019;80:241–9.
14 Torén K, Zock JP, Kogevinas M, *et al*. An international prospective general populationbased study of respiratory work disability. *Thorax* 2009;64:339–44.
15 Eng A, 't Mannetje A, McLean D, *et al*. Gender differences in occupational exposure patterns. *Occup Environ Med* 2011;68:888–94.
16 Olivieri M, Mirabelli MC, Plana E, *et al*. Healthy hire effect, job selection and inhalation exposure among young adults with asthma. *Eur Respir J* 2010;36:517–23.
17 ZinsM, Goldberg M, CONSTANCES team. The French CONSTANCES population-based cohort: design, inclusion and follow-up. *Eur J Epidemiol* 2015;30:1317–28.
18 Burney PG, Luczynska C, Chinn S, *et al*. The European Community respiratory health survey. *Eur Respir J* 1994;7:954–60.
19 Cazzoletti L, Marcon A, Janson C, *et al*. Asthma control in Europe: a real-world evaluation based on an international population-based study. *J Allergy Clin Immunol* 2007;120:1360–7.
20 Pekkanen J, Sunyer J, Anto JM, *et al*. Operational definitions of asthma in studies on its aetiology. *Eur Respir J* 2005;26:28–35.
21 Sunyer J, Pekkanen J, Garcia-Esteban R, *et al*. Asthma score: predictive ability and risk factors. *Allergy* 2007;62:142–8.
22 UNESCO Institute for Statistics. *International standard classification of education: ISCED*. 2011.
23 Kish L. Cumulating/combining population surveys. *Surv Methodol* 1999;25:129–38.
24 Blanc PD, Ellbjär S, Janson C, *et al*. Asthma-related work disability in Sweden. The impact of workplace exposures. *Am J Respir Crit Care Med* 1999;160:2028–33.
25 Dumas O, Varraso R, Zock JP, *et al*. Asthma history, job type and job changes among US nurses. *Occup Environ Med* 2015;72:482–8.
26 Fell AK, Abrahamsen R, Henneberger PK, *et al*. Breath-taking jobs: a case-control study of respiratory work disability by occupation in Norway. *Occup Environ Med* 2016;73:600–6.
27 Taponen S, Lehtimäki L, Karvala K, *et al*. Employment status and changes in working career in relation to asthma: a cross-sectional survey. *J Occup Med Toxicol* 2018;13:8.
28 Blanc PD, Trupin L, Eisner M, *et al*. The work impact of asthma and rhinitis: findings from a population-based survey. *J Clin Epidemiol* 2001;54:610–8.
29 Kauppi P, Salo P, Hakola R, *et al*. Allergic rhinitis alone or with asthma is associated with an increased risk of sickness absences. *Respir Med* 2010;104:1654–8.
30 Yelin E, Katz P, Balmes J, *et al*. Work life of persons with asthma, rhinitis, and COPD: a study using a national, population-based sample. *J Occup Med Toxicol* 2006;1.
31 Eisner MD, Yelin EH, Trupin L, *et al*. The influence of chronic respiratory conditions on health status and work disability. *Am J Public Health* 2002;92:1506–13.
32 Ross S, Godden D, McMurray D, *et al*. Social effects of wheeze in childhood: a 25 year follow up. *BMJ* 1992;305:545–8.
33 Rich-Edwards JW, Kaiser UB, Chen GL, *et al*. Sex and gender differences research design for basic, clinical, and population studies: essentials for investigators. *Endocr Rev* 2018;39:424–39.
34 Aaron SD, Boulet LP, Reddel HK, *et al*. Underdiagnosis and overdiagnosis of asthma. *Am J Respir Crit Care Med* 2018;198:1012–20.

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