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Factors influencing duration of exposure with symptoms and costs of occupational asthma

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ABSTRACT: The most important factor for the prognosis of occupational asthma is the length of exposure with symptoms prior to removal from exposure. We wanted to identify factors, including socioeconomic status, that can influence the delay in submitting a claim to a medicolegal agency after the onset of asthmatic symptoms, and to confirm that this delay is associated with worse respiratory prognosis and higher direct costs.

This is a cross-sectional study of subjects who claimed compensation for occupational asthma at the Workers' Compensation Board of Quebec, Canada. Data were collected at re-evaluation ~2.5 yrs after diagnosis. Information on the number of years with symptoms and removal from exposure was obtained from the medicolegal file.

60 subjects were included in the study. Being older, having a revenue of >30,000 Canadian dollars and having occupational asthma due to high molecular weight agents were all positively associated with the number of years of exposure with symptoms before removal from exposure. Subjects with persistent airway hyperresponsiveness at follow-up had a higher number of years with symptoms. Experiencing symptoms in the workplace for <1 yr generated lower direct costs.

These findings might help in surveillance programmes that could be preferentially targeted for these subgroups of workers.

KEYWORDS: Costs and cost analysis, diagnosis delay, economics, Quebec, socioeconomic factors

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The majority of subjects with occupational asthma (OA) continue having symptoms despite leaving the causal workplace and having medication to treat the underlying airway inflammation [1]. The single most important factor that determines the prognosis of OA is the duration of time that an individual is exposed to the offending agent while experiencing symptoms prior to diagnosis and subsequent removal from exposure [2]. Socioeconomic factors are important determinants of health, and influence the frequency, severity and progression of most known diseases [3]. In Europe, an individual's low socioeconomic status has been shown to be a risk factor for asthma as well as living in an underprivileged area, regardless of the individual's educational level or social class [4]. Work-related asthma is associated with lower educational levels as shown in a population of young adults in Brazil, most likely because those individuals with a shorter period spent at school start working earlier and, therefore, experience longer exposure to potentially offending agents at work. Moreover, due to their low educational level, they have limited working options and are prone to work in manual professions with a higher risk of exposure [5].

Besides the obvious physical deterioration in health, having OA has a significant socioeconomic impact on the individuals since 25–38% of them suffer prolonged work disruption and 42–78% report a loss of income [6]. Compensating for OA generates high costs for the medicolegal agency as reported for QC, Canada: the median total cost for a case of OA was reported to be 61,300 Canadian dollars (CAD) and was higher for subjects >40 yrs of age, males and those requiring retraining or taking an early retirement [7].

The aim of this study was to identify socioeconomic factors that can influence the delay in submitting a claim to a medicolegal agency, with

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removal from exposure after the onset of asthmatic symptoms. We wanted to confirm that this delay was associated with worse respiratory prognosis and to examine whether this delay generates higher direct costs when combined with other costs.

METHODS

This is a cross-sectional study investigating subjects who claimed compensation for OA at the Workers' Compensation Board of Quebec (Canada) in 2004–2006 and were evaluated for permanent disability indemnity in the Montreal area. All study subjects gave written consent for their participation. The research protocol was approved by the ethics committee of our hospital.

Subjects were investigated at the time of re-evaluation by Workers' Compensation Board for permanent disability indemnity and answered a questionnaire on medication, tobacco consumption, the type of agent causing the OA, information about the workplace, sociodemographic and socioeconomic outcomes, as well as information about the Workers' Compensation Board's Social Rehabilitation Program. The Workers' Compensation Board records were consulted to obtain information concerning costs for compensation for loss of income and compensation for functional impairment. Compensation for loss of income corresponds mainly to compensation for lost salary during the rehabilitation period ($\leqslant$2 yrs) after a worker is removed from the workplace harbouring the offending work agent. Compensation for functional impairment is allocated at the time of re-evaluation by the Workers' Compensation Board, ~2 yrs after diagnosis and after subsequent removal from the workplace, and is calculated according to the Workers' Compensation Board Scale for OA.

The number of years of exposure in the workplace with symptoms before removal from exposure (YWS) was determined by consulting the Workers' Compensation Board file. We recorded the time period as noted by the local medical committee in the initial official report.

Skin prick tests were performed and subjects underwent spirometry, methacholine challenge testing and analysis of induced sputum at diagnosis and at re-evaluation.

At diagnosis, specific inhalation testing was performed in all study participants and a positive test was a pre-requisite for the diagnosis being assigned. The asthma severity at diagnosis and at re-evaluation and the proportion of permanent disability that was allocated were calculated according to the Workers' Compensation Board Scale for OA (0%: low severity; 100%: maximum severity) [8]. This scale incorporates three factors in the same way as the one proposed by the American Medical Association (AMA) [9]: level of bronchial calibre, degree of bronchial responsiveness and need for medication to control asthma [10]. We estimated the change in asthma severity by subtracting the score at re-evaluation from that at diagnosis. For some analyses, we dichotomised the data by using a cut-off of 18%. This severity reflects mild obstruction (forced expiratory volume in 1 s (FEV_1) 71–85% predicted), mild bronchial hyperresponsiveness (provocative dose of methacholine causing fall in FEV_1 $\geqslant$20% (PC_{20}) 2–16 $mg \cdot mL^{-1}$) and regular use of a bronchodilatator if needed.

Continuous data are reported as a mean$\pm$SD or median (interquartile range). Proportions were compared by using Chi-squared or Fisher's exact test. Continuous variables were compared by using the t-test or Mann–Whitney U test. We used Spearman's ρ for correlation analysis. After performing univariate analysis, a multiple linear regression with staggered inclusion of predictors was performed to evaluate the effects of sociodemographic (age, sex, immigration status, marital status, education), economic (revenue, children to support), workplace (size of the employing company at diagnosis, duration of work with the current employer) and asthma-related (type of agent causing OA according to molecular weight and asthma severity) variables on the YWS. Statistical analysis was performed by means of a software package (SPSS V16, SPSS Inc., Chicago, IL, USA). We considered a p-value of <0.05 as statistically significant.

A more extensive description of the methods can be found in the online supplementary material.

RESULTS

During the study period, 73 subjects were eligible to participate. We were unable to contact five subjects and eight subjects refused to participate, leaving a participation rate of 82%. Nonparticipants did not differ significantly from participants regarding sex, age at diagnosis, atopy, smoking status, lung function and hyperreactivity to methacholine, proportion of subjects with OA to low molecular weight (LMW) allergens and number of years in the workplace with symptoms prior to submitting a claim.

Selected baseline characteristics of participants can be seen in table 1. Nine (15%) subjects were born outside of Canada. Agents causing OA identified at diagnosis were isocyanates (n=15), flour (n=8), wood dust (n=2), metals (n=4), resins and glues (n=5), cereals (n=2), animal dander (n=4), chemical products (n=8), latex (n=5), persulfates (n=1), other proteins (n=5) and unknown (n=1).

The median (interquartile range) time between diagnosis and re-evaluation was 33 (30–51) months. At re-evaluation, six (10%) subjects reported still being exposed to the offending agent, but very occasionally and to a significantly lesser extent. The six subjects had left their workplace but continued to work for the same employer in another workshop. They admitted in the questionnaire to have very occasional exposure when passing near their old workplaces. 13 (22%) subjects continued to work for the same employer as prior to diagnosis but were no longer exposed at all to the causal agent, 20 (33%) had changed their workplace, 3 (5%) were in training programmes for new jobs, 12 (20%) were unemployed and 12 (20%) had taken early retirement. After diagnosis of OA, two (3%) subjects received assistance from the Workers' Compensation Board in finding a new job, nine (15%) subjects underwent a retraining programme with studies and seven (12%), a retraining programme without studies, whereas 42 (70%) received neither retraining nor assistance in finding a new job. 26 (43%) subjects reported having a lower income, 18 (30%) subjects a higher income compared with the income prior to diagnosis and in 16 (27%) subjects, the income remained the same. Even after taking into account inflation and calculating predicted income by using the Canadian Consumer Price Index, 44 (73%) were still receiving a lower salary at re-evaluation than predicted and 16 (27%), a higher salary at re-evaluation. Those

TABLE 1 Selected baseline characteristics of participants at diagnosis

Subjects n	60
Sex	
Male	45 (75)
Female	15 (25)
Age yrs	42.9±11.0
Atopy[#]	42 (70)
Smoking habit	
Nonsmoker	10 (16)
Ex-smoker	25 (42)
Smoker	25 (42)
Duration of exposure to causal agent yrs	10.5 (3.1–22.8)
Years of exposure with symptoms before removal from exposure	1.4 (0.1–7.5)
Married	32 (53)
Having children to support	40 (67)
Nature of causal agent	
High molecular weight	26 (43)
Low molecular weight	33 (55)
Salary (<30,000 CAD)	24 (40)
Low income[¶]	9 (15)
Only primary and secondary level education	33 (55)
Working for a company with <20 employees at diagnosis	20 (33)
Working ⩾5 yrs for same employer	34 (57)
Member of a labour union	28 (47)
Professional group	
Shopkeepers, craftsmen	23 (38)
Professionals, managers, intermediate white collars, office and sales employees	11 (18)
Skilled and unskilled workers	26 (43)

Data are presented as n (%), mean±SD or median (interquartile range), unless otherwise stated. [#]: atopy was defined by at least one immediate skin reaction to 15 ubiquitous aeroallergens; [¶]: low income was defined as having an income at diagnosis that was <110% of the cut-off value for low income according to the definition adopted by Statistics Canada (Ottawa, ON, Canada).

TABLE 2 Univariate analysis of years of exposure with symptoms before removal from exposure

	Subjects n	YWS	p-value
Sex			0.179
Male	45	1.8 (0.1–8.3)	
Female	15	0.7 (0.2–2.7)	
Age yrs			0.008
>40	38	2.4 (0.6–11.9)	
⩽40	22	0.6 (0.0–2.9)	
Asthma severity[#] **%**			0.003
<18	41	0.1 (0.0–1.4)	
⩾18	19	2.6 (1.0–8.2)	
Marital status			0.112
Married	32	2.1 (0.6–10.0)	
Not married	28	1.0 (0.0–4.5)	
Children to support			0.019
Yes	40	2.4 (0.0–11.8)	
No	20	0.6 (0.0–2.4)	
Agent			0.083
High molecular weight	27	2.4 (0.9–7.0)	
Low molecular weight	32	0.8 (0.0–7.0)	
Revenue CAD			0.002
<30,000	24	0.2 (0.0–2.1)	
⩾30,000	36	2.6 (0.9–10.0)	
Education			0.080
Primary and secondary level only	33	1.1 (0.1–3.7)	
Higher level	27	3.0 (0.6–12.4)	
Time with current employer yrs			0.131
⩾5	34	2.6 (0.6–8.2)	
<5	26	0.9 (0.1–5.3)	

Data are presented as median (interquartile range), unless otherwise stated. [#]: asthma severity was defined according to the Quebec Workers' Compensation Board's definition (0%: low severity; 100%: maximum severity). YWS: years of exposure with symptoms before removal from exposure.

with a lower salary had a median decrease of 16 (7–46)% while those with a higher salary had a median increase of 16 (7–55)%.

We determined the impact of different socioeconomic factors on YWS in a univariate analysis (table 2). YWS was significantly longer for subjects >40 yrs of age who had dependent children, who had a salary of ⩾30,000 CAD and who experienced more severe asthma at diagnosis. There was no significant difference in YWS according to immigration status, status of having low income according to the definition adopted by Statistics Canada (Ottawa, ON, Canada), company size and labour union affiliation (all p>0.2 in univariate analysis, data not shown). We initially performed a multivariate linear regression by including socioeconomic variables, as defined *a priori* in our research hypotheses (model 1, table 3). We then included economic variables (model 2) and asthma-related variables (model 3) with a significant relation to YWS in the univariate analysis (table 2). In the best fitting model, having a revenue of <30,000 CAD was negatively associated to YWS, while being older, being sensitised to high molecular weight (HMW) allergens and suffering from greater asthma severity at diagnosis were all positively and, with the exception of type of agent, independently related to YWS. There was a trend for those having dependent children to have a higher YWS. Subjects who were either without a job or on early retirement tended to have a higher YWS compared with those who were still employed or in training for a new job (4.2 (0.5–11.9) *versus* 1.1 (0.1–14.8) yrs: p=0.086).

Costs for compensation for loss of income were related to the YWS (r=0.405, p=0.007), asthma severity at diagnosis (r=0.428, p=0.004) and to the proportion of permanent impairment that was allocated by the Workers' Compensation Board (r=0.389, p=0.049). Compensation for functional impairment costs were related to asthma severity at diagnosis (r=0.577, p<0.001) and to the proportion of permanent impairment that was allocated (r=0.728, p<0.001). The total costs were related to YWS (r=0.38, p=0.006, fig. 1), asthma severity at diagnosis (r=0.510, p=0.001) and to the proportion of permanent impairment that was allocated (r=0.503, p=0.009). The distribution of costs according to selected health and socioeconomic factors in addition to the type of rehabilitation programme and employment status can be

TABLE 3 Multiple linear regression coefficients for the effects of different socioeconomic factors on the years of exposure with symptoms before removal from exposure

Variable	Strata	*A priori* model 1		*A posteriori* model 2		*A posteriori* model 3	
		β	p-value	β	p-value	β	p-value
Age	>40 yrs *versus* ⩽40 yrs (R)	0.499±0.231	0.036	0.539±0.208	0.208	0.489±0.200	0.018
Revenue	<30,000 CAD *versus* ⩾30,000 CAD (R)	-0.585±0.245	0.020	-0.578±0.203	0.203	-0.433±0.203	0.038
Dependent children	⩾1 *versus* none (R)	0.357±0.234	0.133	0.371±0.207	0.078	0.376±0.198	0.063
Agent	High molecular weight *versus* low molecular weight (R)	NI		0.475±0.196	0.019	0.409±0.189	0.036
Asthma severity#	⩾18% *versus* <18% (R)	NI		NI		0.515±0.211	0.018
Adjusted r^2		0.201		0.305		0.364	

Data are presented as mean±SEM, unless otherwise stated. The dependent variable was log (years in the workplace with symptoms prior to claim). We initially performed a multivariate linear regression by including socioeconomic variables, as defined *a priori* in our research hypotheses (*a priori* model 1). We then performed a multivariate linear regression using economic variables (*a posteriori* model 2) and asthma related variables (*a posteriori* model 3) with a significant relation to years of exposure without symptoms before removal from exposure in the univariate analysis (table 2). The covariates sex, immigration status, marital status and education status were included in *a priori* model 1 but are not displayed in the table as the p-values of the multiple linear regression coefficient β were >0.2. R: referent; NI: not included in the model. #: asthma severity was defined according to the Quebec Workers' Compensation Board's definition (0%: low severity; 100%: maximum severity).

seen in table 4. Factors such as immigration status, dependent children, agent, education, number of yrs with employer and labour union affiliation did not significantly change compensation for loss of income, compensation for functional impairment or total costs. In the multivariate linear regression analysis, being exposed for <1 yr exposed with symptoms before removal from exposure was negatively related, whereas being older was positively related to compensation for loss of income costs (table 5, model 1), but when adding the covariate employment status to the model at re-evaluation, the relationship of <1 yr exposure with symptoms before removal from exposure became insignificantly related to compensation for loss of income costs (table 5, model 2). Less than one year exposed with symptoms before removal from exposure and being older were significantly related to total costs (table 5, model 3) in the same manner as for compensation for loss of income, and the relation remained unchanged when adding the covariate employment status to the model at re-evaluation (table 5, model 4).

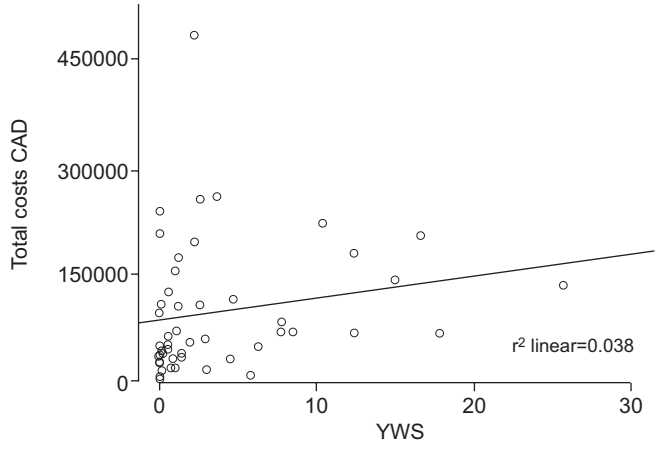

FIGURE 1. Correlation of years of exposure with symptoms before removal from exposure with total costs for rehabilitation programme (r=0.38, p=0.006). YWS: years of exposure with symptoms before removal from exposure.

Further results concerning change of functional measurements between diagnosis and re-evaluation can be found in the online supplementary material.

DISCUSSION

Our study shows that workers who are older, who earn a higher salary and whose asthma is related to HMW allergens, are exposed for a longer time with symptoms prior to removal from exposure. This prolonged exposure is associated with increased asthma severity at diagnosis and persistent bronchial hyperresponsiveness with the need for increased anti-asthma medication at re-evaluation, >2.5 yrs after cessation of exposure and higher direct costs for the medicolegal compensation agency.

Older age was a significant predictor for a higher YWS. Older aged workers generally earn higher salaries, are more likely to have dependent children and may encounter more problems in finding a new job. These factors may render subjects more reluctant to report to a medicolegal agency. In Belgium, the risk of remaining unemployed or having to change employers was also associated with older age in workers with OA [11]. However, in France, AMEILLE *et al.* [12] found the opposite, possibly because retraining programmes are not readily offered to young workers affected with OA. We showed that subjects who had dependent children had a significantly higher YWS. These subjects may hesitate to claim compensation because they fear losing not only their job and income, but also their self-esteem and status as a provider in the family. Additionally, MARABINI *et al.* [13] also showed that workers with OA and dependent family members are more likely to continue working.

TABLE 4 Costs of compensation for loss of income (CLI), compensation for functional impairment (CFI), and total costs (in CAD × 10^3) according to selected health and socioeconomic factors, type of rehabilitation programme and employment status at re-evaluation

Variables	CLI	CFI	Total costs
YWS			
<1	34.9 (11.4–85.9)	4.5 (2.4–16.3)	43.1 (23.5–106.4)
⩾1	64.7 (44.6–159.8)	15.0 (6.2–21.0)	84.1 (55.9–180.7)
p-value	0.008	0.092	0.008
Asthma severity %			
⩾18	71.7 (27.7–149.1)	16.8 (10.5–23.0)	95.6 (51.2–178.9)
<18	34.9 (24.6–43.9)	3.4 (2.4–10.5)	39.6 (29.8–51.4)
p-value	0.009	0.001	0.003
Age yrs			
⩾40	100.4 (34.6–159.8)	15.2 (4.5–21.3)	108.9 (51.7–188.6)
<40	36.0 (11.7–58.9)	11.1 (2.5–17.9)	40.0 (26.2–70.7)
p-value	0.003	0.888	0.001
Marital status			
Married	64.7 (33.2–152.7)	15.2 (4.5–20.0)	91.4 (40.4–175.4)
Not married	39.0 (20.7–84.3)	13.3 (2.4–19.4)	51.4 (29.1–108.7)
p-value	0.046	0.369	0.068
Revenue CAD			
<30,000	37.9 (27.3–64.6)	10.5 (2.5–18.6)	49.5 (36.7–80.3)
⩾30,000	75.5 (20.3–149.1)	15.2 (3.4–19.9)	107.1 (33.6–173.7)
p-value	0.069	0.465	0.086
Income			
Low	58.9 (31.5–145.6)	25.2 (16.0–78.9)	84.1 (37.1–207.3)
Other	55.1 (24.2–117.9)	12.3 (2.5–17.8)	66.8 (34.4–127.4)
p-value	0.852	0.005	0.528
Employees n			
<20	40.9 (16.1–71.7)	16.5 (11.9–20.2)	51.4 (30.1–95.6)
⩾20	63.4 (32.2–144.4)	9.8 (2.5–19.3)	70.7 (36.9–177.2)
p-value	0.053	0.152	0.223
Type of rehabilitation programme			
No programme	26.0 (9.2–54.8)[7,9]	8.2 (2.2–16.1)[2]	36.6 (20.4–62.9)[8,10]
Programme without studies	84.9 (57.5–148.3)[7]	9.6 (5.6–30.7)[2]	89.3 (70.8–171.4)[8]
Programme with studies	64.6 (40.9–130.7)[9]	19.6 (3.5–25.2)	69.2 (55.6–154.6)[10]
Help finding a new job[#]	39.4	6.5	45.9
Employment status at re-evaluation			
Without job	44.5 (25.8–101.6)[12]	14.2 (2.2–20.9)	54.4 (36.7–122.6)[13]
Retraining[#]	105.2[1]	2.4	107.1
Retired	127.5 (96.7–183.7)[3, 5, 11, 12]	15.5 (7.9–31.6)	180.7 (112.3–214.1)[4, 6, 13]
Other employer	40.9 (29.4–61.8)[1, 5, 11]	9.9 (2.5–17.3)	47.5 (36.6–70.8)[6]
Same employer	9.5 (0.9–135.9)[3]	7.7 (2.7–14.7)	20.6 (7.3–146.8)[4]

Data are presented as median (interquartile range). The difference is significant at a $p<0.05$ for the pairs numbered ''1, 2, 3, 4'' and at a $p<0.01$ for the pairs numbered ''5, 6, 7, 8, 9, 10, 11, 12, 13''. YWS: years of exposure with symptoms before removal from exposure. [#]: no interquartile ranges are reported as n⩽3.

We also found that subjects with an educational profile higher than secondary level tended to have a higher YWS, which is different from results published by other researchers. Low educational level has been identified as a risk factor for work-related asthma in the young population [5], because of a delay until a diagnosis of OA was made [14] and as a predictor for unemployment after a diagnosis of OA [11, 12]. In a multivariate analysis of our *a posteriori* model (table 3), we showed that education, probably because of its association with income, was no longer significant.

Higher income was associated with a higher YWS. This is contrary to the findings in ON, Canada in which the time taken to arrive at a definite diagnosis of OA in workers was longer in subjects with a low household income [14]. This difference might be explained by the fact that the outcome of our study was slightly different. We measured the median exposure time with symptoms before removal from exposure; however, in the study by POONAI *et al.* [14], the mean duration of symptoms was determined before the final clinical diagnosis was made. However, in a later study done by the same researchers lower

TABLE 5 Costs of compensation for loss of income (CLI) and total costs (in CAD $\times 10^3$) according to years of exposure with symptoms before removal from exposure (YWS), age and employment status at re-evaluation

Variables	Strata	Log(CLI)^2				Log(total costs)			
		Model 1		Model 2		Model 3		Model 4	
		β	p-value	β	p-value	β	p-value	β	p-value
YWS	<1 yr *versus* ⩾1 yr (R)	-3.248±1.1420	0.027	-2.187±1.308	0.102	-0.263±0.113	0.024	-0.223±0.107	0.043
Age	>40 yrs *versus* <40 yrs (R)	3.511±1.433	0.018	2.953±1.464	0.050	0.342±0.113	0.004	0.260±0.120	0.035
Employment status at re-evaluation	Without job *versus* same employer (R)	NI		4.277±1.946	0.033	NI		0.214±0.159	0.183
	Retraining *versus* same employer (R)			8.740±2.909	0.004			0.595±0.239	0.017
	Retired *versus* same employer (R)			7.633±2.060	0.001			0.562±0.172	0.002
	Other employer *versus* same employer (R)			4.669±1.825	0.014			0.270±0.151	0.081
Adjusted r^2		0.189		0.370		0.246		0.370	

Data are presented as mean±SEM, unless otherwise stated. β: multiple linear regression coefficient; R: referent; NI: not included in the model.

household income was no longer related with time to diagnosis in patients with OA [15]. The time it takes to make a final diagnosis depends on many factors, such as the awareness and the availability of information about OA for workers, employers and physicians as well as access to specialised centres. Other important factors might be the severity of symptoms, the nature and extent of work exposures, and the compensation that is offered. We explain the difference in our findings by the fact that the comprehensive system of management and compensation of OA in QC (Canada) does not hinder workers with lower income to claim compensation, but rather, allows them to seek help and investigation without significant loss of income, and the opportunity to retrain in order to get a job with similar or even higher income after retraining. In contrast, workers with higher income and higher education are more likely to be hesitant to claim as they have more to lose in terms of income and retraining opportunities. Part-time workers may fear job loss or refusal of employment insurance eligibility and workers in well-paid jobs face a possible loss in income or social status [16]. OA is a condition which, according to the results of our study, may have more detrimental effects in workers with higher socioeconomic status, a situation that is the reverse to what is found for most health conditions.

Having OA to HMW agents was predictive for a higher YWS. The risk for severe adult onset asthma was not significantly different for low molecular weight (LMW) compared with HMW allergens [17], but it was shown by some that subjects with sensitisation to LMW agents, such as isocyanates, have better disease outcomes, a shorter latency period and a shorter duration of symptoms before diagnosis [18, 19]. We confirmed that asthma severity was related to the YWS. Most follow-up studies of OA have consistently shown that the duration of exposure with symptoms was the principal determinant for the persistence of asthma after cessation of exposure, as reviewed [20]. However, even after adjusting for asthma severity in our model, socioeconomic factors (income and dependent children) as well as age and the nature of the agent, remained significantly associated with YWS (table 3), which demonstrate that these factors play a significant role on their own. Past studies have failed to demonstrate that subjects with more severe asthma are more likely to be unemployed after diagnosis [11–13]. However, none of these studies investigated the direct costs for the medicolegal agency for compensation of lost income and functional impairment. It has been shown that the severity of OA is significantly correlated with quality of life and psychological indices [21].

In sensitiser-induced asthma, the appearance of respiratory symptoms is often gradual and recall bias, for the time of appearance of symptoms and therefore, the time interval a subject reported to be symptomatic at the workplace, is possible. We tried to minimise this by consulting the most reliable documented source of information, the official Workers' Compensation Board report.

Eligibility for compensation and compensation processes often differ depending on the country, province or region influencing the length of time a subject remains in the workplace with symptoms [8]. The main message of our work is to point out that socioeconomic factors are important in these delays, which in turn influence respiratory outcomes and costs. In the current study, the effect of these socioeconomic factors were targeted, examined and quantified in QC, Canada where a broad compensation system is in place. Although it is highly likely that socioeconomic factors also play a role in other parts of the world, their nature and impact would need to be examined in relationship with specific compensation systems in place. We showed that even when compensation systems appear to be effective, not all subjects with a high probability of asthma make the decision to terminate exposure to the causal agent sufficiently rapidly to prevent long-term sequelae [22].

Our study shows that advancing age, having a higher salary and having OA to HMW allergens all seem to predict a prolongation of the interval for which a subject is symptomatic in the workplace and consequently increase the severity of asthma at diagnosis. These findings might help in surveillance programmes by preferentially targeting them for subgroups of workers with these characteristics.

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STATEMENT OF INTEREST

None declared.

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