

## WORK-RELATED ASTHMA

# Respiratory Symptoms and Respiratory-Related Absence from Work among Health Care Workers in Sweden

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**Objective.** To investigate respiratory symptoms and respiratory-related absence from work among Swedish health care workers (HCWs). **Methods.** From a postal questionnaire study among a general Swedish working population ( $n = 12,186$ ), we identified 2156 HCW (555 assistant nurses, 377 nurses, 109 physicians, and 1115 others), including 429 with mainly cleaning tasks (HCW-cleaning). The remaining respondents were classified as non-HCW. Multiple logistic regressions with 95% confidence intervals (CIs) were used to compare respiratory symptoms and respiratory-related absence from work between HCW and non-HCW, adjusting for potential confounders. **Results.** The prevalence of adult onset asthma was 4.3% in HCW and 3.0% in non-HCW ( $p = .003$ ). Asthmatic symptoms during the past year were reported mainly by HCW-cleaning, 14.7%, in comparison to 8.3% among non-HCW ( $p < .0001$ ). HCW had an increased odds ratio (OR) for asthmatic symptoms during the past year (OR 1.3, 95% CI (1.1–1.5)) and more prominent among assistant nurses (OR 1.5, 95% CI (1.1–2.0)) and HCW-cleaning (OR 1.9, 95% CI (1.4–2.5)). Respiratory-related absence from work in the past year was reported by 1.4% of non-HCW, 3.0% of HCW-cleaning, 2.9% of nurses, and 1.6% of assistant nurses. Taking smoking and age into account, there was still significantly increased respiratory-related absence from work in nurses (OR 2.0, 95% CI (1.1–3.8)) and in HCW-cleaning (OR 2.1, 95% CI (1.2–3.7)). **Conclusions.** HCW in Sweden, especially those with cleaning tasks, reported more respiratory symptoms and respiratory-related absence from work than the general working population. There is a need for longitudinal studies with detailed information on both occupational exposures and socioeconomic factors to explore what influences respiratory-related absence from work among HCW.

**Keywords** asthmatic symptom, cleaning task, nurse, respiratory work disability, sick-listing, sickness absence, work exposure

## INTRODUCTION

Previous studies have shown an increased risk for asthma among health care workers (HCWs), especially among those with chemical or cleaning-related tasks (1–7).

The large, multicenter European Community Respiratory Health Survey II (ECRHS II) study showed that the occupation groups nurses and cleaners had the highest relative risks for new-onset asthma (8). Delclos and co-workers (2007) also reported an approximately twofold increased likelihood of new-onset asthma after the entry into a health care profession with cleaning tasks. Moreover, surveillance programs indicate that work-related asthma is reported more often for HCW than for most other occupations such as hairdressers, painters, and farmers (9, 10). Well-known causes of work-related asthma such as latex and disinfectants (e.g., glutaraldehyde) are occasionally still used and frequently appear in reports of surveillance programs (9–12).

Nordic countries are no exception, with HCWs having an increased risk of work-related asthma. A prospective study of a Finnish population showed an increased incidence of asthma among subjects in medical and nursing work compared with subjects in administrative, managerial, and cle-

rical work (relative risk (RR) 1.2, 95% confidence interval (CI) 1.03–1.4 for men; RR 1.1, 95% CI 1.1–1.2 for women) (13). One Norwegian study presented that occupational asthma was frequently reported by nurses, and the incidence rate was 0.10 per 1000 person years (14). A registry study by Li and co-workers showed that Swedish female assistant nurses had a higher risk of hospitalization for asthma compared with female workers in general (standardized incidence ratio 1.2, 95% CI 1.1–1.4) (15). Annual self-reporting rate of occupational asthma in 1990–92 in Sweden was 100 cases per million (95% CI 59–147) in male HCWs and was 52 cases per million (95% CI 42–70) in female HCWs, while it was 10 cases per million (95% CI 3–19) in male administrative, managerial, and clerical workers and was 30 cases per million (CI 22–42) in corresponding females (16).

Previously, few studies have shown an increased sickness absence in HCWs, in which the majority are women (17), especially due to neck, shoulder, and back disorders (18). However, studies on absence from work with focus on respiratory symptoms are, according to our knowledge, still scarce. The prevalence of respiratory-related work disability in the general Swedish adult population has previously been reported as approximately 5%, with the prevalence rising to 13% in those with asthma (19). Moreover, the impact on such disability of occupational exposure to biological or mineral dust, gases, or fumes has previously been highlighted (20, 21). Health care is one

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area in which there is substantial variation in occupational exposure to these potential hazards. To date, there is only limited knowledge on the actual work exposure in health care and its consequences for workers' respiratory health and respiratory-related work disability.

This study was undertaken using a large population-based study of respiratory and allergic diseases (22). The objectives were to investigate the prevalence of asthma, respiratory symptoms, and respiratory-related absence from work among Swedish HCW, taking into consideration different health care occupations and tasks.

## METHODS

### Study Population

In a cross-sectional study implemented to investigate obstructive and allergic diseases in the Swedish region Western Gothia, a postal questionnaire was sent in 2008 to 30,000 randomly selected inhabitants, aged 16–75 years (22). Half of them were chosen from the city of Gothenburg. Three reminders were sent to nonresponders, and a sample of late responders and nonresponders was analyzed for any differences from prompt responders (23). The response rate was 61.9% of the 29,218 traceable subjects and increased with increasing age, among females, and outside the city. Rönmark et al. (23) showed that neither nonresponders nor late responders differed significantly from prompt responders with regard to prevalence of respiratory symptoms, which allows us to make fair risk assessments for respiratory diseases in this study population. The questionnaire included questions on respiratory and allergic symptoms and diseases, occupation, and certain exposures (22).

Among the responders, we identified 12,186 individuals as being part of the working population. Of these, subjects who affirmatively answered to the question of whether they were currently working in the health care sector *and/or* gave their major occupation as assistant nurses, nurses, or physicians were classified as HCW. It was not possible to go into more detail on job descriptions than the three mentioned occupations above, and so the remaining HCWs were classified as "other HCW." That is, four different categories in HCW ( $n = 2156$ ) are consequently assorted: assistant nurses ( $n = 555$ ), nurses ( $n = 377$ ), physicians ( $n = 109$ ), and other HCW ( $n = 1115$ ). One additional question asked whether the respondent mainly worked with cleaning tasks, regardless of the occupational categories they belonged to. HCWs who answered affirmatively to this question were classified as HCW-cleaning ( $n = 429$ ), a new category allowing overlap with the occupational categories. Finally, we classified all the remaining population who were not HCW in their own category of non-HCW ( $n = 10,030$ ).

### Definitions

*Asthma* was defined as self-reported physician-diagnosed asthma, and *adult-onset asthma* was defined as asthma with reported year of onset at the age of 16 or later (24).

*Asthmatic symptoms during the past year (12 months)* were defined as affirmative answers to both of the questions: "Do you presently have, or have you had in the last 10 years, asthma symptoms (intermittent breathlessness or attacks of shortness of breath; the symptoms may exist simultaneously with or without cough or wheezing)?" and "Have you had these symptoms during the last 12 months?". *Allergic rhinitis* was defined as an affirmative answer to either allergic eye or nose symptoms. *Ever-smoking* was defined as daily smoking for at least 1 year during lifetime. There was one general question about absence from work due to all-cause of sickness in the last year and one respiratory-specific question: "Were you sick-listed in the past year due to breathing difficulties?" The latter was defined as *respiratory-related absence from work*.

### Statistical Analyses

Descriptive statistics of the study population are calculated as percentages. For prevalence comparisons, the two-sided chi-square test or *t*-test was used, with  $p < .05$  significance level. Mean age when answering the questionnaire in 2008 was calculated and is presented with standard deviation (SD). Multiple logistic regression models were used to test the association between asthma, asthmatic symptoms, and respiratory-related absence from work according to HCW specification (non-HCW population as reference), adjusting for potential confounders which are restricted to variables that were both biologically closely related to the outcome variables and had a statistical significance level below  $p$ -value of 0.1 in primary simple regression analysis. Odds ratios (ORs) with 95% CI are given. Hosmer–Lemeshow goodness-of-fit statistics were tested to assess the calibration of the models, and only the models which fulfilled the criteria are presented in either text or tables. All statistical analyses were performed with version 9.2 of the SAS statistical software package (SAS Institute, Cary, NC, USA).

### Ethical Approval

The study was approved by the Ethics Committee at the University of Gothenburg.

## RESULTS

Mean age was slightly higher in HCW than non-HCW (45 vs. 43 years,  $p < .001$ ), and gender distribution differed; the HCW group was 78% female, while the non-HCW group was only 48% female ( $p < .0001$ ) (Table 1). In general, HCW, except for physicians (36%), had a higher ever-smoking rate than non-HCW (49% vs. 40%;  $p < .0001$ ). The prevalence of adult-onset asthma was 4.3% among HCW and 3.0% among non-HCW ( $p = .003$ ). Of the HCW subgroups, the assistant nurses had the highest prevalence of adult-onset asthma (5.1%). Asthmatic symptoms during the past year were reported most often by HCW-cleaning (14.7%) followed by assistant nurses; the corresponding figure was 8.3% in non-HCW. Adult-onset asthma and asthmatic

TABLE 1.—Demographic characteristics of the study population and prevalence of asthma, asthmatic symptoms, and respiratory-related absence from work.

|                         | N      | Mean age (SD) <sup>a</sup> | Female % (N) | Ever-smoking % (N) | Allergic rhinitis % (N) | Physician-diagnosed asthma % (N) | Adult-onset asthma % (N) | Asthmatic symptoms in the past year % (N) | Respiratory-related absence from work in the past year % (N) |
|-------------------------|--------|----------------------------|--------------|--------------------|-------------------------|----------------------------------|--------------------------|-------------------------------------------|--------------------------------------------------------------|
| Non-HCW                 | 10,030 | 42.6 (13.1)                | 48 (4802)    | 40 (4011)          | 29 (2883)               | 7.9 (790)                        | 3.0 (296)                | 8.3 (828)                                 | 1.4 (142)                                                    |
| HCW <sup>b</sup>        | 2,156  | 44.8 (12.4)                | 78 (1677)    | 49 (1051)          | 28 (605)                | 8.7 (188)                        | 4.2 (91)                 | 10.9 (234)                                | 1.9 (41)                                                     |
| Assistant nurses        | 555    | 44.5 (11.9)                | 95 (528)     | 55 (307)           | 26 (142)                | 9.2 (51)                         | 5.1 (28)                 | 12.6 (70)                                 | 1.6 (9)                                                      |
| Nurses                  | 377    | 45.1 (11.5)                | 91 (342)     | 43 (163)           | 27 (101)                | 8.2 (31)                         | 4.5 (17)                 | 9.3 (35)                                  | 2.9 (11)                                                     |
| Physicians              | 109    | 45.3 (11.5)                | 43 (47)      | 36 (39)            | 34 (37)                 | 6.4 (7)                          | 1.9 (2)                  | 7.3 (8)                                   | 0 (0)                                                        |
| Other HCW               | 1,115  | 44.8 (12.9)                | 68 (760)     | 49 (542)           | 29 (325)                | 8.9 (99)                         | 4.0 (44)                 | 10.9 (121)                                | 1.9 (21)                                                     |
| HCW: non-cleaning tasks | 1,727  | 45.3 (11.9)                | 76 (1304)    | 48 (837)           | 28 (492)                | 8.9 (153)                        | 4.2 (73)                 | 9.9 (171)                                 | 1.6 (28)                                                     |
| HCW: cleaning tasks     | 429    | 42.7 (13.8)                | 87 (373)     | 50 (214)           | 26 (113)                | 8.2 (35)                         | 4.3 (18)                 | 14.7 (63)                                 | 3.0 (13)                                                     |

<sup>a</sup>SD: standard deviation, <sup>b</sup>HCW: health care worker.

symptoms during the past year were more pronounced among females than among males in both HCW (adult onset asthma: 4.6% vs. 3.2%,  $p = .2$ , asthmatic symptoms: 11.8% vs. 7.7%,  $p = .01$ , respectively) and non-HCW (adult onset asthma: 3.5% vs. 2.5%,  $p = .002$ ; asthmatic symptoms: 9.4% vs. 7.2%,  $p < .001$ , respectively), although no such notable difference was observed regarding ever having had asthma (approximately 8% regardless of gender or HCW/non-HCW).

Absence from work due to all-causes of sickness in the past 12 months was reported by 33% of non-HCW and 40% of HCW ( $p < .0001$ ). Among the HCW, 45% of assistant nurses, 43% of nurses, 30% of physicians, 37% of other HCW, and 39% of HCW non-cleaning and 41% of HCW-cleaning reported that they had absence from work due to all-causes of sickness in the past year. Respiratory-related absence from work during the past year was reported generally much less often than absence from work due to all-causes of sickness. Assistant nurses reported a relatively low prevalence of respiratory-related absence from work (1.6%), even though they reported the highest prevalence of physician-diagnosed asthma, adult-onset asthma, and asthmatic symptoms during the past year (Table 1). However, 2.6% of the subgroup of assistant nurses with cleaning tasks ( $n = 193$ ) reported respiratory-related absence from work. In comparison to male HCW, female HCW reported a higher prevalence of absence from work due to all-causes of sickness (43% vs. 29%,  $p < .0001$ ) and a doubled respiratory-related absence from work (2.2% vs. 1.1%,  $p = .12$ ).

A multiple logistic regression model with adjustments for gender, allergic rhinitis, ever-smoking, and age showed that HCW had significantly increased odds of having asthmatic symptoms during the past year compared with non-HCW, OR 1.3 (95% CI 1.1–1.5; Table 2). In the model for HCW-cleaning only, the OR for having asthmatic symptoms was even higher (OR 1.9, 95% CI 1.4–2.5). We did not observe a similar finding among either nurses or physicians. The

TABLE 2.—Adult-onset asthma, asthmatic symptoms in the past year, and respiratory-related absence from work in the past year among HCW compared to non-HCW working population, odds ratio (OR) with 95% confidence interval (CI).

|                         | Adult-onset asthma <sup>a</sup> | Asthmatic symptoms in the past year <sup>a</sup> | Respiratory-related absence from work in the past year <sup>b</sup> |
|-------------------------|---------------------------------|--------------------------------------------------|---------------------------------------------------------------------|
| Non-HCW                 | 1                               | 1                                                | 1                                                                   |
| HCW                     | 1.3 (0.99–1.6)                  | 1.3 (1.1–1.5)                                    | 1.3 (0.9–1.8)                                                       |
| Assistant nurses        | 1.6 (1.0–2.4)                   | 1.5 (1.1–2.0)                                    | 1.1 (0.5–2.1)                                                       |
| Nurses                  | 1.3 (0.8–2.2)                   | 1.1 (0.7–1.5)                                    | 2.0 (1.1–3.8)                                                       |
| Physicians              | NA                              | 0.8 (0.4–1.7)                                    | NA                                                                  |
| Other HCW               | 1.2 (0.9–1.7)                   | 1.3 (1.0–1.6)                                    | 1.3 (0.8–2.0)                                                       |
| HCW: non-cleaning tasks | 1.3 (0.96–1.6)                  | 1.1 (0.9–1.4)                                    | 1.1 (0.7–1.7)                                                       |
| HCW: cleaning tasks     | 1.3 (0.8–2.2)                   | 1.9 (1.4–2.5)                                    | 2.1 (1.2–3.7)                                                       |

Note: NA = not applicable.

<sup>a</sup>Adjusted for gender, allergic rhinitis, ever-smoking, and age > 50 years, <sup>b</sup>Adjusted for smoking and age > 50 years

findings remained the same after gender stratification (data not shown).

HCWs had a tendency toward increased respiratory-related absence from work during the past 12 months (OR 1.3, 95% CI 0.9–1.8). Among nurses and HCW-cleaning, we found significantly increased odds of having respiratory-related absence from work; OR 2.0 (95% CI 1.1–3.8) in nurses and OR 2.1 (95% CI 1.2–3.7) in HCW-cleaning (Table 2). We did not find this increase in any of the other subgroup categories. Following the stratification for gender, female HCW-cleaning had significantly increased respiratory-related absence from work compared to female non-HCW (OR 2.1, 95% CI 1.1–3.9), and there was similar pattern in female nurses (OR 1.6, 95% CI 0.8–3.3).

## DISCUSSION

The main finding of the current study is that asthmatic symptoms during the past year were more pronounced among HCW who perform cleaning tasks and assistant

nurses, whereas respiratory-related absence from work was more prominent among HCW with cleaning tasks and nurses. HCWs who perform cleaning tasks can be exposed to a variety of chemical agents, and so it is not surprising if their respiratory-related absence from work was affected by such occupational exposure.

Respiratory problems during childhood or before entering the current job can influence job selection (25, 26). To minimize such selection bias, we investigated adult-onset asthma and current asthmatic symptoms. We found a distinctly different prevalence of respiratory problems in the different HCW categories, especially in assistant nurses and HCWs with cleaning tasks. In comparison to non-HCW, HCW showed an increased risk of having current asthmatic symptoms as well as a tendency toward an increased risk for adult-onset asthma, after adjusting for potential confounders. A supplementary analysis showed that HCW with asthmatic symptoms during the last 12 months had increased odds of absence from work due to all-causes of sickness compared to corresponding non-HCW (OR 1.5, 95% CI 1.1–2.0). A similar tendency was also observed in HCW with adult-onset asthma compared to corresponding non-HCW (OR 1.5, 95% CI 0.9–2.5). With regard to respiratory-related absence from work, however, we found no such difference between HCW with asthma/symptoms and non-HCW with asthma/symptoms. In other words, subjects with asthma/symptoms had respiratory-related absence from work regardless of whether they are HCW or non-HCW.

Previous studies have shown that workplace exacerbation of asthma in HCW is common (27, 28), and also that occupational exposures make a substantial contribution to asthma in HCW (2, 3, 6). An analysis of the European Community Respiratory Health Survey II (ECRHS II) revealed increased relative risks of asthma (RR 2.2, 95% CI 1.03–4.5) among nurses who routinely used ammonia and/or bleach cleaning products (3). Also, Arif and co-workers (6) reported that the prevalence of new-onset asthma was significantly greater among nursing professionals involved in medical instrument cleaning (OR 1.7, 95% CI 1.06–2.6) and when exposed to general cleaning products and disinfectants (OR 1.7, 95% CI 1.0–2.9). Similar findings were observed in Finnish HCWs, showing an increased incidence of asthma among subjects in medical and nursing work than those in administrative work (13). Although we have only limited data on occupational exposure in the HCW categories, our main finding of an increased risk of asthma and asthmatic symptoms in assistant nurses and HCW who perform cleaning tasks is indirectly in line with these previous studies.

In a previous report, no significant increased risk of absence from work due to sickness in HCWs was observed compared with other working population in Nordic countries (29). A registry study of pregnant Danish HCWs showed that sickness absence varied between different occupational groups in HCW: 50% higher sickness absence in assistant nurses than in nurses (30). However,

the two former studies are rather outdated and, thus, it is necessary to carry out a new investigation in this area. Moreover, few studies have investigated the association between respiratory diseases and related absence from work (20, 31). The studies that do exist show that subjects with one or more respiratory symptoms have significantly increased sickness absence. Regarding HCW in particular, we could identify only two studies; one focusing on the association between smoking and sickness absence (32) and the other comparing different occupational categories (33). The latter study reported 47% of sickness-related absence over a period of 1 year, with one of the main known causes being respiratory disorder. The study also reported that the prevalence of sickness-related absence varied with several factors such as tasks, occupation, age, and gender, especially regarding short-term sickness absence. However, the results of this study may not be directly comparable to the Swedish health care environment, since the study was performed in Lebanon, which likely has a different work environment from that of Sweden.

The current study has potential methodological limitations. One main limitation can be that the application of the main results is restricted by the fact that participants without respiratory symptoms are unlikely to be at risk of one of the outcomes being evaluated. Although the current study consists of relatively large HCWs, only limited number of subjects remained in each HCW job, and consequently, we are not possible to perform a main analysis among HCW with symptoms vs. non-HCW with symptoms with regard to the outcome variable (respiratory-related absence from work). Another limitation is that the main outcomes and potential predictor variables are derived only from the self-administered questionnaire. However, this method has commonly been used in epidemiological research, and there is evidence that questions of physician-diagnosed asthma have high specificity but low sensitivity (24). Previously, it has been reported that a substantial proportion of workers do have asthma-like symptoms or other work-related respiratory symptoms without fulfilling the definition of asthma (34–36), especially those with cleaning tasks regularly exposed to a variety of cleaning products containing both irritants and sensitizers (34, 35). In this study, we used a definition of respiratory-related absence from work not solely restricted to asthma, but more generally related to respiratory health, which allowed us to include subjects with not only asthma but also with other respiratory symptoms. This study, however, has limited possibilities to analyze this issue further.

Previously, the self-reported occupational exposures in HCWs were compared to expert occupational exposure assessments (37). The study concluded that there was substantial underestimation of self-reported occupational exposure to disinfecting or cleaning agents, which may result in underreporting of cleaning tasks in our study and, consequently, the estimated rates may even be elevated. Another methodological issue might be related to recall

bias. However, if the questionnaire data were influenced by recall bias, this is unlikely to have happened in a subgroup-specific way, and hence the main findings will probably remain similar. Finally, since the analyses are based on the limited number of HCWs in each job category, our findings should be interpreted with caution for any general HCW population.

One strength of our study is that it not only distinguishes between the general population and HCW, a Swedish occupational group not previously investigated with regard to respiratory health, but also classifies these HCWs into different task categories. Moreover, we investigated not only the prevalence of asthma and respiratory symptoms, but also respiratory-related absence from work. Despite these strengths, it is still not clear why assistant nurses showed no increased risk of respiratory-related absence from work though being among the subgroups reporting high prevalence of asthma and respiratory symptoms. Neither uncertain job security nor socioeconomic conditions can explain this finding, since the general absence from work due to all-causes of sickness among assistant nurses did not differ from that among the other HCW. This question remains to be answered by future studies.

In conclusion, HCWs in Sweden, especially those with cleaning tasks, reported more respiratory symptoms and respiratory-related absence from work than the general population. To increase our understanding of the mechanisms for respiratory-related absence from work among HCW, there is a need for longitudinal studies including more detailed information on both occupational exposures and socioeconomic factors.

# DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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