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Epidemiology of smoking habits among healthcare workers employed in a regional reference teaching hospital in Northern Italy: a cross-sectional study

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Keywords

Tobacco-based products • Occupational health • Health promotion

Summary

Introduction. *Tobacco consumption is one of the most significant avoidable health risks and cause of premature death globally. Smoking in the workplace represents a potential combination of health risks due to the interactions of tobacco use and professional exposure. Occupational Health Professionals can aid in health promotion of workers and improvement of workplace environment. This study aims to analyze the prevalence of smoking and its determinants among healthcare workers and equated subjects at the Ospedale Policlinico San Martino IRCCS of Genoa, Italy.*

Methods. *An observational, cross-sectional study was performed using demographic and clinical data. It involved a total workforce of 1561 Health Care Workers (HCW), medical residents and healthcare students. We focused on the medical visits performed from July 1 to December 31, 2023. All statistical analyses were performed using SPSS statistical software vers. 26.0 (IBM Corp.).*

Results. *In the studied population, 24.7% of participants reported being current smokers. The univariate analysis showed an association between smoking and several demographic and occupational variables such as different professional categories and occupational risks. At the multivariate analysis physicians (OR 0.39, 95 CI 0.24-0.61, p < 0.001) and professions with exposure to chemical hazards (OR 0.26, 95 CI 0.09-0.80, p = 0.018) showed reduced odds of smoking, while increases in alcohol consumption were associated with increased probability of smoking (OR 1.79, 95 CI 1.19-2.71, p = 0.006).*

Conclusions. *These results highlight a concerning prevalence of smokers among HCW. An up-to-date epidemiological picture on health habits and behaviors may provide a baseline on which targeted interventions can be implemented, considering not only modifiable lifestyle factors but also work-related risk factors to effectively tackle the magnitude of the phenomenon.*

Introduction

Tobacco consumption is one of the most significant avoidable health risks and cause of premature death globally, causing 8 million deaths each year, including close to 1.3 million people exposed to second-hand smoke [1]. Smoking is a well-known risk factor for preventable disease and disability, including respiratory illness, heart disease, and cancer. Although the vast majority of smokers live in low- and middle-income countries, in highly developed regions such as the European Union, annual mortality due to tobacco still reaches nearly 700,000, with an average reduction in lifespan of 14 years [2].

Although considerable progress has been made, one fourth of the overall population in Europe is still a consumer of tobacco products, particularly among the young working age population [3, 4].

Moreover, passive smoking is recognized as an increasing source of indoor air pollution. This is particularly relevant in the occupational setting, where the National Institute for Occupational Safety and Health (NIOSH) determined environmental tobacco smoke (ETS) as potentially carcinogenic to occupationally exposed workers. Epidemiologic studies estimated the relative risk of lung cancer to be increased by 30% for a non-smoker exposed to second-hand smoke [5].

Smoking in the workplace represents a potential combination of health risks due to the interactions of tobacco use and professional exposure, such as to chemical and physical agents, contributing to the development of adverse health effects in the workplace [6].

In this perspective, evidence shows that smoke-free workplaces not only prevent ETS but also reduce total cigarette consumption per smoker by nearly 30%, contributing to the overall health promotion of workers [7]. For this reason, in many developed countries specific legislation has been introduced to reduce or outright ban smoking in workplaces [8].

In Italy, the legislative framework prohibits smoking in all indoor workplaces, extending this ban to outdoor areas for hospitals [9]. Indeed, healthcare professionals represent key actors in the promotion of smoke reduction in patients and the general public in order to achieve

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public health goals. Recent studies performed on this population, within the framework of the "*Progressi delle Aziende Sanitarie per la Salute in Italia* (PASSI)" project, showed a prevalence of current tobacco smoking between 2014 and 2018 of 23.0%, with an average declining trend from 2014 to 2018 [10].

Occupational Health Professionals can aid in health promotion of workers and improvement of workplace environment, as stated by the objectives put forward by ILO and WHO defined as the maintenance and promotion of health and work capacity, as well as the improvement of the work environment and the work itself to make them compatible with safety and health requirements [11]. Moreover, in the Italian context, the Occupational Physician acts in compliance with the obligations mentioned in Article 25 of the Italian Legislative Decree 81/2008, collaborates with the employer in the assessment of risks, for the purpose of planning health surveillance, but also collaborates in the implementation and enhancement of voluntary health promotion programs [12].

Within this framework, and as highlighted by the Italian National Prevention Plan 2020-2025 [13], it is necessary to continue to implement a comprehensive and interdisciplinary approach to promote smoking cessation and smoke-free environments, integrating effective policies and actions to monitor consumption habits, as well as to prevent and protect the population, such as providing support for cessation, updated information on the dangers of tobacco, as well as strengthening the ban of tobacco.

In this context, *Ospedale Policlinico San Martino* IRCCS of Genoa, Italy, is a full member of the Organization of European Cancer Institutes (OECI) as a "Comprehensive cancer centre". The Occupational Health Unit, as part of the Improvement Action Plan, promotes activities to prevent cancer through early detection and counseling, aiming to a reduction of active and passive smoking among the working population.

Despite the growing recognition that both smoking and workplace exposures are associated with the development of several morbidities, few investigators have explored the potential interactions between these two factors and their impact on disease in workers.

In line with these objectives, this study aims to analyze the prevalence of smoking and its determinants among healthcare workers and equated subjects at the *Ospedale Policlinico San Martino* IRCCS of Genoa, Italy.

Materials and methods

The present study was developed according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline [14].

Study design and population

An observational, cross-sectional study was performed using demographic and clinical data.

The study was carried out on March 14-May 14, 2024. It involved a total workforce of 1561 Health Care Workers (HCW), medical residents and healthcare students attending at the *Ospedale Policlinico San Martino* IRCCS of Genoa, Italy, the regional tertiary adult acute care reference hospital. This population routinely undergoes occupational health surveillance programs performed by the Occupational Health Service (OHS) in accordance with Italian Law. We focused on the medical visits performed from July 1 to December 31, 2023.

Trained occupational physicians and medical residents of the OHS collected data and information from the examinations during the study period. All the information were obtained with a retrospective review of the electronic medical records routinely registered on Canopo–HSE Software (vers. 23.12) during medical visits performed for health surveillance of workers and equated subjects exposed to professional risks. All data for each person, were collected at one point in time, and were extracted in an *ad hoc* Microsoft Excel (version 2402) dataset created for the statistical analysis.

Information concerning the following variables were extracted:

- demographic information (age, gender);
- occupational category (physicians, nurses, administrative healthcare technicians, non-healthcare technicians, coordinators);
- department (clinical areas, surgical areas, technical areas, service areas);
- professional risk factors (biological agents, manual handling of loads/patients, visual display unit, night shift work, anesthetic gases, chemical agents, cancerogenic/mutagenic agents, animal allergens, electromagnetic fields, ionizing radiation, laser);
- smoking habits (including typology, quantity per day and duration);
- alcohol consumption (regular consumption, AUDIT <Alcohol Use Disorders Identification Test>);
- coffee consumption (regular consumption, quantity per day);
- sleep quality;
- physical activity;
- allergies.

The study was approved by the Ethics Committee of the Liguria Region (administrative reference number: N. 111/2024 - DB id 13697). All the activities were performed in compliance with the Declaration of Helsinki and current healthcare standards, according to the recommendations of the Italian Ministry of Health and World Health Organization. All HCWs included in the study signed written informed consent for data collection according to routine healthcare procedures of the Occupational Health Surveillance Program at *Ospedale Policlinico San Martino* IRCCS of Genoa, Italy. Data were anonymized before the analysis. Personal information regarding all the subjects included in the investigation was protected according to Italian law.

Statistical analysis

Continuous numerical variables were summarized as means and standard deviations (SDs) or, when

appropriate, medians and interquartile ranges (IQRs). Nominal and ordinal categorical variables were summarized and described as frequency and percentages. The Mann-Whitney U test, the χ_2 test, and Fisher's exact test were used, according to the variable type, for a univariate analysis of the association between professional and clinical characteristics and smoke, the main outcome of interest. Multivariate analyses were performed for variables with probability (p) values of < 0.20 in the univariate analysis. Differences were considered significant when $p < 0.05$. A backward stepwise logistic regression was used to calculate the odds ratio (OR) and the 95% confidence intervals (CI). A 2-tailed $p < 0.05$ was considered statistically significant. All analyses were performed using SPSS statistical software vers. 26.0 (IBM Corp.).

Results

Overall, health surveillance data on 1561 workers were included. The mean age was 36.9 (14.1) years, 72.6% of participants were female, and the most frequent work categories were physicians (35.5%), nurses (33.4%) and administrative employees (12.8%). Concerning the type of ward or department, 44.0% comprised clinical areas, 26.6% surgical areas and 16.7% technical department. Most common professional risk factors were biological agents (89.6%), manual handling of loads/patients (31.7%) and night shift work (14.5%).

Concerning relevant healthy behaviors and habits, 65.6% reported performing regular physical activities, whereas regarding unhealthy habits, 55.7% reported regularly drinking alcohol, with an average AUDIT-C score of 1.7 (0.6), 84.3% reported commonly drinking coffee an average of 2.0 (1.1) cups a day, with 8.6% of individuals reporting sleep disturbance.

Regarding smoking habits, 24.7% of participants (n=385) reported being current smokers, of whom 77.9% reported using traditional cigarettes, 21.0% reported using e-cigarettes, and only 4 (1.0%) reported smoking cigars. Among users of traditional cigarettes, an average smoking history of 11.9 (12.1) years and an average daily consumption of 8.0 (6.4) cigarettes was reported.

The comprehensive demographic characteristics of the included sample are summarized in Table I.

Univariate and multivariate analyses of the variables associated with smoking are outlined in Table II. As revealed by the univariate analysis, the probability of being a smoker was associated with several demographic and occupational variables such as different professional categories (*e.g.,* physicians OR 0.62, 95 CI 0.45-0.86; nurses OR 1.73, 95 CI 1.28-2.34), occupational risks (*e.g.,* manual handling of loads/patients OR 1.68, 95 CI 1.32-2.14; night shift work OR 1.94, 95 CI 1.44-2.62), while concerning workers' behaviors and habits, alcohol (regular alcohol use OR 1.57, 95 CI 1.24-1.99; AUDIT-C OR 1.88, 95 CI 1.43-2.45) and coffee consumption (regular coffee use OR 2.50, 95 CI 1.67-3.74; number of cups per day OR 1.19, 95 CI 1.07-1.33) showed increased probability of smoking, with physical activity demonstrating reduced odds of smoking (OR 0.76, 95 CI 0.60-0.97).

Assessing factors independently associated with the outcome of interest, the multivariate logistic regression model resulted in physicians and professions with exposure to chemical hazards showing reduced odds of smoking, while increases in alcohol consumption were associated with increased probability of this habit.

Tab. I. Demographic characteristics of the included sample of workers at IRCCS Ospedale Policlinico San Martino of Genoa, Italy, stratified by smoking status.

Variable	Smoker	Non-smoker	Total
Demographic characteristics			
Age [years] M (SD)	37.6 (14.1)	36.8 (14.1)	37.0 (14.1)
Female [n (%)]	265 (23.4)	868 (76.6)	1133 (100.0)
Male [n (%)]	120 (28.0)	308 (72.0)	428 (100.0)
Work category [n (%)]			
Physician	64 (17.8)	295 (82.2)	359 (100.0)
Nurse	100 (29.7)	237 (70.3)	337 (100.0)
Administrative	25 (19.4)	104 (80.6)	129 (100.0)
Healthcare technician	6 (11.3)	47 (88.7)	53 (100.0)
Non-healthcare technician	21 (33.3)	42 (66.7)	63 (100.0)
Coordinator	5 (25.0)	15 (75.0)	20 (100.0)
Occupational setting [n (%)]			
Clinical area	130 (25.2)	385 (74.8)	515 (100.0)
Surgical area	78 (25.1)	233 (74.9)	311 (100.0)
Technical area	54 (27.6)	142 (72.4)	196 (100.0)
Services	31 (20.8)	118 (79.2)	149 (100.0)
Exposure to occupational risks [n (%)]			
Biological	344 (24.6)	1055 (75.4)	1399 (100.0)
Manual handling of loads/patients	156 (31.5)	339 (68.5)	495 (100.0)
Visual Display Unit	49 (25.1)	146 (74.9)	195 (100.0)
Night shift	82 (36.3)	144 (63.7)	226 (100.0)
Anesthetic gases	24 (18.6)	105 (81.4)	129 (100.0)
Chemical	12 (14.6)	70 (85.4)	82 (100.0)
Cancerogenic/ mutagenic	7 (17.9)	32 (82.1)	39 (100.0)
Animal allergens	1 (16.7)	5 (83.3)	6 (100.0)
Electromagnetic fields	0 (0.0)	5 (100.0)	5 (100.0)
Ionizing radiation	6 (22.2)	21 (77.8)	27 (100.0)
Laser	3 (23.1)	10 (76.9)	13 (100.0)
Healthy and unhealthy behaviors and habits			
Regular alcohol consumption [n (%)]	246 (28.3)	623 (71.7)	869 (100.0)
AUDIT-C [M (SD)]	1.8 (0.6)	1.6 (0.3)	1.7 (0.6)
Impaired sleep [n (%)]	25 (20.2)	99 (79.8)	124 (100.0)
Regular physical activity [n (%)]	227 (22.6)	777 (77.4)	1004 (100.0)
Coffee consumption [n (%)]	339 (26.6)	935 (73.4)	1274 (100.0)
Daily cups of coffee [M (SD)]	2.2 (1.3)	1.9 (1.1)	2.0 (1.1)

Tab. II. Univariate and multivariate analyses of demographic, professional and health habits characteristics associated with smoking in the included sample of workers at IRCCS Ospedale Policlinico San Martino of Genoa, Italy.

Variable	Univariate analysis		Multivariate analysis	
	OR (95% CI)	p	OR (95% CI)	p
Demographic characteristics				
Age (per 1 year increase)	1.00 (0.99-1.01)	0.328		
Gender	0.78 (0.61-1.01)	0.058		
Work category				
Physician	0.62 (0.45-0.86)	0.004	0.39 (0.24-0.61)	< 0.001
Nurse	1.73 (1.28-2.34)	< 0.001		
Administrative	0.78 (0.49-1.24)	0.300		
Healthcare technician	0.41 (0.17-0.98)	0.044		
Non-healthcare technician	1.74 (1.01-3.01)	0.046		
Coordinator	1.12 (0.40-3.12)	0.828		
Occupational setting				
Clinical area	1.02 (0.78-1.33)	0.877		
Surgical area	1.00 (0.75-1.36)	0.978		
Technical area	1.17 (0.83-1.66)	0.371		
Services	0.76 (0.50-1.16)	0.205		
Exposure to occupational risks				
Biological	0.96 (0.66-1.40)	0.841		
Manual handling of loads/patients	1.68 (1.32-2.14)	< 0.001		
Visual Display Unit	1.03 (0.73-1.45)	0.872		
Night shift	1.94 (1.44-2.62)	< 0.001		
Anesthetic gases	0.68 (0.43-1.07)	0.097		
Chemical	0.51 (0.27-0.95)	0.033	0.26 (0.09-0.80)	0.018
Cancerogenic/mutagenic	0.66 (0.29-1.51)	0.328		
Animal allergens	0.61 (0.07-5.24)	0.652		
Ionizing radiation	0.87 (0.35-2.17)	0.767		
Laser	0.92 (0.25-3.34)	0.894		
Healthy and unhealthy behaviors and habits				
Regular alcohol consumption	1.57 (1.24-1.99)	< 0.001		
AUDIT-C (per 1 score increase)	1.88 (1.43-2.45)	< 0.001	1.79 (1.19-2.71)	0.006
Impaired sleep	0.75 (0.47-1.18)	0.208		
Regular physical activity	0.76 (0.60-0.97)	0.026		
Coffee consumption	2.50 (1.67-3.74)	< 0.001		
Daily cups of coffee (per 1 cup increase)	1.19 (1.07-1.33)	0.002		

Discussion

The present study suggests the existence of an association between occupational factors and smoking habits.

In particular, we found out that being a physician showed an independent association with smoking, demonstrating an almost 10% lower prevalence (17.8%) compared to the overall proportion of smokers. This result is in line with the PASSI surveillance system data from Minardi et al. which considered smoking prevalence among healthcare workers in Italy from 2014 to 2018 [10], in which they observed a prevalence of smokers among physicians between 20.8% in 2014 and 11.5% in 2018, from 10 to 15% lower than the proportion among other healthcare workers.

Moreover, workers exposed to chemical agents demonstrated a significative lower prevalence of smoking compared to other working exposures. This could, at least in part, be explained by strictly regulated no-smoking policies in laboratories. Indeed, Hong et al. suggest that workers with greater concern about their exposure to chemical hazards were less likely to smoke [15]. A further possible explanation could be a positive collateral effect of training and information campaigns enacted for specific inhalatory chemical risk prevention. However, this hypothesis requires additional investigations to better understand and confirm this association.

Other work categories and professional exposures that showed significant, albeit non independent, associations were working as a nurse, manual handling of loads/patients and night shift work. Concerning the first, previous studies in literature have shown similar elevated proportions [16]. Regarding workers who perform manual handling of loads or patients during their occupational activity, epidemiological data from the UK have suggested that nearly one in four employees in routine manual occupations smoke tobacco, over three times more than workers in other roles [17]. The latter

association between night shift work and smoking habit was considered by Peplonska et al. and their results are in accordance with the current study, assessing that the majority of current smokers investigated (40.6%) were night shift workers [18]. Our findings are also confirmed by Knutson et al. who observed a higher proportion of shift workers as current smokers (shift workers, 54% *vs* day workers, 39% - p = 0.001) [19]. Bae et al. assessed that workers may be more prone to smoking during shift work to relieve stress sleepiness [20]. In the present study, this association was particularly relevant as active smokers showed an almost double probability of smoking compared to day workers.

Other modifiable lifestyle factors associated with smoking were coffee and alcohol consumption and physical activity. Health-care workers who regularly consume coffee and alcohol had a higher probability of being smokers. Treolar et al. widely analyzed the relationship between caffeine consumption and smoking habits [21]. The association between smoking and alcohol consumption was also confirmed at the multivariate analysis. This is not surprising since many studies in literature consistently confirm this association. Ho et al. highlighted an almost double prevalence of tobacco and alcohol co-users compared to tobacco-only users [22].

On the other hand, practicing regular physical activity was associated with a protective effect toward smoking. A recently published paper by Tie et al. observed a significant negative association between physical exercise and smoking behavior among residents [23].

The findings of our study are strengthened by the application of a rigorous methodological approach. However, this study presents some limitations, particularly due to the self-reporting of data, with the possible introduction of selection and recall bias, as well as a lack of effective and precise assessment of health habits and behaviors as well as occupational exposures. Furthermore, the limited number and homogeneity among individual cases might include some confounders that could not be factored into the analysis. For these reasons, further quality research is required in order to confirm the validity of these findings.

Conclusions

The results of our study highlight a concerning prevalence of smokers among HCW, a professional category for which European and Italian regulations prohibit extensively smoking in all healthcare facilities and work environments. An up-to-date epidemiological picture on health habits and behaviors may provide a necessary baseline on which targeted *ad-hoc* interventions can be implemented, considering not only modifiable lifestyle factors but also work-related risk factors, and developing information and educational policies, with the aim of effectively tackle the magnitude of the phenomenon.

This preventive approach, from a Total Worker Health perspective, can bring together occupational health and public health goals, paving the way for a Global Health evidence-based practice.

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Conflicts of interest statement

The authors declare no conflicts of interest.

Author's contributions

Conceptualization, L.P., A.Mo. and G.D.; methodology, A.R., A.Ma. and L.P.; software, A.R., A.Ma., C.B. and L.P.; formal analysis, A.R., A.Mo., L.P. and G.D.; data curation, L.P., C.B., A.Ma. and L.M.; writing—original draft preparation, L.P., A.R., A.Mo. and G.D.; writing—review and editing, A.R., A.Mo., G.D., L.M., M.G.M., N.D. and P.D.; supervision, A.R., A.M., G.D. and P.D.; project administration, G.D. and P.D. All authors have read and agreed to the published version of the manuscript.

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