La Medicina del Lavoro

Original article

Med. Lav. 2025; 116 (2): 16173
DOI: 10.23749/mdl.v116i2.16173

A 7-Year Active Surveillance Experience for Occupational Lung Cancer in Bologna, Italy (2017-2023)

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Keywords: Occupational Lung Cancer; Occupational Carcinogens; Active Systematic Search

Abstract

Background: *In Italy, lung cancer is the second most frequent neoplasm in men and the third in women. Exposure to carcinogens in workplaces plays a significant role. Still, cases attributable to occupational exposure are currently under-reported as occupational diseases: the current National Prevention Plan also encourages active research projects for the detection of cancers attributable to occupational exposure.* **Methods:** *The Unit of Prevention and Safety in the Workplace of Bologna Local Health Authority (Azienda Unità Sanitaria Locale-AUSL-)created a network for active surveillance of occupational lung cancer cases with the dedicated Diagnostic and Therapeutic Care Pathways (PDTA). Possible occupational exposure cases were selected within all incident PDTA cases using a self-completed patient filter form. Only patients selected through the form were interviewed; occupational physicians collected personal, occupational, and clinical history. Definition of a cooperation system with the local office of the National Institute for Insurance(INAIL)for monitoring the process during the medico-legal assessments conducted by the insurance institute up to resolution.* **Results:** *453 cases completed the filter form, 177 had a potential occupational exposure. Of these, 140 accepted the direct interview with occupational physicians. One hundred eleven cases interviewed were assessed with sure or suspect occupational origin: for 82, a claim for recognition was sent to INAIL, while for the other 29 was sent to INAIL a report for epidemiological purposes. Out of 82 compensation claims, 18 individuals (4 females and 14 males) received compensation, while 4 cases remain under investigation. A total of 53 claims were rejected: 54.7% for lack of exposure to risk factors, 24.5% for insufficient exposure, 9.4% due to inadequate administrative documentation, 7.5% because of insufficient clinical documentation, and 3.8% for the absence of causal association.* **Conclusions:** *Several occupational lung cancers were found that otherwise would have been unrecognized. Asbestos was the most frequent agent occurring in the most widespread work sectors—construction and manufacture of metal-working products—and in the period of exposure from 1970 to 1980. Other relevant agents were welding fumes and polycyclic aromatic hydrocarbons. Active surveillance, direct patient interviews, and claims for recognition integrated by a complementary report are essential to increase the INAIL compensation rate.*

1. Introduction

According to the latest estimates, lung cancer in Italy ranks as the second most common neoplasm among men (15%, 30,000 new cases in 2023) and the third among women (6%, 14,000 new cases in 2023); mortality remains significant, though decreasing [1]. The primary risk factor is tobacco

Received: 04.11.2024 – Accepted 26.03.2025
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smoking, which is attributed to approximately 80% of lung cancer cases in the Western population [2].

The proportion of cases linked to environmental and occupational factors varies over time and by location. An early estimate from 1981 [3] in the United States assigned 15% of men's cases to occupational exposure. Since then, several studies have sought to estimate the percentage of cancer cases attributable to such exposures. These studies indicate that for individuals who have historically worked in occupations involving multiple carcinogens, the percentage of lung cancer cases ranged from 2.8% to 17.3% for males and from 2% to 4% for females [4-10]. However, a consistent figure is not currently available due to variations in the types and number of carcinogens considered or known at different times, as well as difficulties in obtaining data on occupational exposure to these substances and changes in exposure conditions over time (both mode and extent) [11-16].

The most significant risks have been noted among construction and transport workers [7, 8, 11, 17, 18-19]. Construction workers are engaged in various activities and work environments that expose them to numerous carcinogens, including diesel engine exhaust, crystalline silica dust, and asbestos-containing materials. In contrast, transport workers primarily face exposure to diesel engine exhaust. This is followed by workers involved in painting activities across various sectors and by those in metal production who are exposed to multiple agents (aluminum, arsenic, beryllium, cadmium, chromium, nickel compounds, silica, and polycyclic aromatic hydrocarbons).

A problem of under-reporting is evident when comparing current estimates to the number of cancers recognized as occupational diseases by the INAIL. A significant cause for this disparity is that occupational cancers are often clinically indistinguishable from those caused by other factors. Additionally, there remains insufficient emphasis on the role of occupational hazards, and a patient's occupational history is typically not thoroughly investigated at the initial diagnosis stage. In Italy, most diagnoses of work-related illnesses are performed by occupational physicians or equivalent practitioners (i.e., labor patronage physicians) and rarely by other types of physicians (specialists or general practitioners). Consequently, the diagnosis of work-related illnesses that arise during employment is more likely to occur with active occupational health surveillance. In the case of neoplasms, where clinical diagnoses are generally made when the patient is retired, the correlation to occupational exposure is less frequent [20-25].

Furthermore, since these conditions have a multifactorial etiology, the impact of non-work-related factors common in the population, such as smoking habits, is often overestimated at the expense of risk factors present in occupational settings. This phenomenon of under-reporting is also prevalent and studied at an international level [23-24].

To address the issue of under-reporting, the reference legislation (Article 244 of Decreto Legislativo 81/08) mandates the establishment of a registration system for cancers of occupational origin, including those with a low etiological fraction like lung cancer [18, 26-29].

The previous National Prevention Plan for 2015-2018 had already suggested the need for active regional research projects on cancers with a low etiological fraction. In this context, in 2017, Prevention and Safety in the Workplace Unit (Prevenzione e Sicurezza Ambienti di Lavoro-PSAL-) of the Bologna Local Health Authority (Azienda Unità Sanitaria Locale-AUSL-), launched a project to actively search for lung cancers due to occupational exposure by creating a collaborative network among different diagnosis and treatment hospital units, including Radiotherapy, Oncology, Pneumology, and Thoracic Surgery. This choice was driven not only by the epidemiological context (high incidence in the general population and diffusion across sectors with known lung carcinogen exposure) but also by the existence of a Diagnostic and Therapeutic Care Pathway (Percorso Diagnostico Terapeutico Assistenziale –PDTA-) for lung cancer in Bologna ASL. This project aims to outline a systematic method for identifying occupational lung cancers, improve etiological diagnosis, and increase both the quantity and quality of lung cancer cases notifications.

2. METHODS

According to the specific regional prevention plan, an initial pilot phase started in 2017, involving the PDTA staff (Radiotherapy, Oncology, Pneumology, and Thoracic Surgery Operational Units) in training on the project's purpose and methods to secure active collaboration. Several meetings with PDTA staff (physicians and nurses) supported the creation of a network that defined a practical, "low-effort" and "low-cost" reporting system.

A filter form to select cases with possible occupational exposures was developed and tested for completion by patients with the help of the trained PDTA staff. Eligible patients were identified as those diagnosed with primary lung cancer and residing in the Bologna AUSL area. The filter form consists of a list of occupational sectors, activities, or agents, from which the patient selects one or more items based on their work history, considering at least one year of work/exposure. This instrument, completed by the patients and then submitted to the PSAL occupational physicians, facilitates the selection of cases with potential occupational exposure to known or suspected lung cancer risk factors.

These selected patients are offered a direct interview to reconstruct their detailed lifetime work history, covering every job task and occupational sector, and focusing on exposure to all known or suspected lung carcinogens. Several instruments were developed for this purpose, including a general questionnaire for collecting anamnestic data, modeled after the standard questionnaires used by national surveillance systems for Mesothelioma (RENAM) and sinonasal cancer (RENATUNS), along with additional work-sector-specific sections (i.e., metalworking industry welding activities, construction, transportation, agriculture, painting activities, manufacturing of rubber and plastics products, foundries, etc.).

In cases of incomplete or questionable filter forms, it was decided to contact the patient by telephone to confirm whether the case should be excluded. For all enrolled cases with occupational exposure at companies within the Bologna ASL area, a thorough search for documentation in the PSAL archives was conducted. Available industrial hygiene data, safety data sheets, risk assessment documents, and environmental surveys were utilized to evaluate exposure. During the interview, particular emphasis was placed on smoking habits, reconstructed according to the WHO definition.

At the end of the assessment and reconstruction, a compensation claim was sent to INAIL, accompanied by an additional report written by PSAL occupational physicians for cases identified as possibly occupational in origin. According to national legislation, the directly interested party must sign the compensation claim. If a patient refuses, only the epidemiological report is sent in accordance with the relevant legislation (Article 139 of DPR 1124/65).

A useful collaboration was then established with the INAIL local office through periodic meetings between ASL and INAIL physicians to discuss cases, monitor the outcomes of the claims, and analyze the causes of positive or negative INAIL responses.

3. Results

A total of 507 completed filter forms were received between 2017 and 2023. At an initial check, 54 forms were directly excluded due to sending errors (subjects not resident in the ASL area or an unconfirmed diagnosis) and were not enrolled. The remaining 453 reports of lung cancer (206 women and 247 men) were then assessed, representing approximately 28% of the cases occurring in the region and under the care of the PDTA.

An analysis of the filter forms revealed that 177 patients had a potential occupational origin to be investigated, of whom 147 were men and 30 were women. Of these, 79% (140 patients) accepted the direct interview.

Table 1 describes the demographic profile, smoking habits, and histotypes found for the total number of patients interviewed (Group 1) and for the group of subjects for whom occupational origin was confirmed by PSAL occupational physicians (Group 2).

The 60-69 and 70-79 age groups represent 70% of both Group 1 and Group 2, with a prevalence

Table 1. Cases Distribution: interviewed and work correlated by gender, age, cigarette smoking, cigarette pack-years, lung cancer morphology.

	Interviewed participants						Work Related Cases					
	women		men		total		women		men		total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Characteristic	24	100	116	100	140	100	11	100	100	100	111	100
Age												
40-49	1	4.2	2	1.7	3	2.1	0	0.0	2	2.0	2	1.8
50-59	3	12.5	16	13.8	19	13.6	1	9.1	13	13.0	14	12.6
60-69	11	45.8	28	24.1	39	27.9	7	63.6	25	25.0	32	28.8
70-79	7	29.2	52	44.8	59	42.1	2	18.2	44	44.0	46	41.4
80-89	2	8.3	18	15.5	20	14.3	1	9.1	16	16.0	17	15.3
Cigarette smoking												
never	7	29.2	6	5.2	13	9.3	3	27.3	5	5.0	8	7.2
quit	6	25.0	66	56.9	72	51.4	2	18.2	56	56.0	58	52.3
current	11	45.8	44	37.9	55	39.3	6	54.5	39	39.0	45	40.5
Cigarette pack years												
0 (no smoker)	6	25.0	6	5.2	12	8.6	3	27.3	5	5.0	8	7.2
< 20	2	8.3	11	9.5	13	9.3	1	9.1	10	10.0	11	9.9
21-40	10	41.7	37	31.9	47	33.6	6	54.5	30	30.0	36	32.4
41-60	5	20.8	37	31.9	42	30.0	1	9.1	35	35.0	36	32.4
>60	1	4.2	18	15.5	19	13.6	0	0.0	14	14.0	14	12.6
missing	0	0.0	7	6.0	7	5.0	0	0.0	6	6.0	6	5.4
lung cancer morphology												
adenocarcinoma	15	62.5	66	56.9	81	57.9	7	63.6	56	56.0	63	56.8
squamous cell carcinoma	0	0.0	14	12.1	14	10.0	0	0.0	14	14.0	14	12.6
small cell carcinoma	2	8.3	4	3.4	6	4.3	1	9.1	3	3.0	4	3.6
neuroendocrine carcinoma	4	16.7	13	11.2	17	12.1	1	9.1	11	11.0	12	10.8
others	0	0.0	2	1.7	2	1.4	0	0.0	2	2.0	2	1.8
only imaging	3	12.5	17	14.7	20	14.3	2	18.2	14	14.0	16	14.4

of the 70-79 age group in males and the 60-69 age group in females.

For the quantification of smoking exposure, packs per year were used as a synthetic indicator of duration, number of years, and number of cigarettes smoked over a lifetime. Since packs per year represent a continuous variable, it was decided to divide the smoking habits into four classes, fully aware of the fact that there is no exposure below which the risk of developing a neoplasm can be considered zero.

The most prevalent histological type was adenocarcinoma in both women and men, in line with literature data identifying it as the most common malignancy of the lung, both in the general population and among those of occupational origin. The

Table 2. Cases work-related: distribution of occupational cases by industry sector/activity, gender, and type of medico-legal measure for INAIL.

	Claim for compensation (No.)			Epidemiologic surveillance (No.)			Total
Economic Activity sector	**F**	**M**	**Total**	**F**	**M**	**Total**	
Metalworking industry	2	25	27	0	9	9	36
Construction	0	22	22	0	8	8	30
Transport	0	11	11	0	5	5	16
Services	1	5	6	0	4	4	10
Manufacture of rubber and plastics products	2	2	4	1	0	1	5
Chemistry	0	3	3	0	0	0	3
Manufacture of glass and pottery	2	1	3	0	0	0	3
Agriculture	1	0	1	0	2	2	3
Communications	0	2	2	0	0	0	2
Printing, publishing	0	1	1	0	0	0	1
Wood or wood products	1	0	1	0	0	0	1
Food manufactoring	1	0	1	0	0	0	1
TOTAL	**10**	**72**	**82**	**1**	**28**	**29**	**111**

category "others" includes one atypical carcinoid and one poorly differentiated carcinoma. We defined "only imaging" cases without histological definition due to age and/or clinical condition.

Through the interview and documentary research, 111 of the 140 patients interviewed, corresponding to about 80%, were considered to be occupationally exposed to certain or suspected lung cancer risk factors. Of these cases, 82 (74%) had the INAIL compensation claim drawn up. For the remaining 29 (of whom only one was a woman), a report was sent for epidemiological purposes (Article 139 of DPR).

Table 2 illustrates the distribution of occupational cases by industry sector/activity, gender, and type of medico-legal measure. The majority of cases were found to have worked in several sectors with possible exposure to lung carcinogenic agents; however, it was decided to consider the prevalent work sector using duration (the longest of those exceeding one year), the number of agents, and latency congruity (at least 10 years) according to the type of agent as criteria for the attribution of the causal link.

In calculating the duration, periods of work at different companies were also added if they belonged to the same work sector. Considering the total number of cases, the most frequently represented sector is metalworking, followed by construction and transport. The patients in the latter two sectors are all male. Only one apparently anomalous case from the food sector emerged: it is represented by a woman who worked in a sugar refinery as an oiler, a job that involved activities in all departments, resulting in exposure to asbestos.

Table 3 reports the occupational carcinogens to which the group of 82 patients with claims for compensation was exposed. As multiple occupational exposures were found for almost all the patients in this group, data by individual agent have been reported to highlight those that are the most frequent. Asbestos appears to be the most represented agent and is also the most widespread in various sectors, followed by PAHs, silica, and welding fumes. The asbestos exposure was generally detected by documents from PSAL archives or by referring to evidence from the literature for specific work sectors.

Of the 82 cases with claims for compensation, 18 (4 females and 14 males) have been compensated by the Institute; four cases, sent at the end of 2023, are still under investigation. The periodic meeting

Table 3. Cases work correlated: occupational carcinogens by economic activity sector.

	Occupational Carcinogens												
Economic activity sectors	**Asbestos**	**PAHs**	**Silica dust**	**Welding fumes**	**Diesel Exhaust**	**Paintings**	**Cr (VI) compounds**	**Rubber**	**Cadmium**	**Nickel**	**Arsenic**	**Coal tar pitch**	**Non-As inscticides**
Construction	19	9	17	10	5	7	6	0	0	0	0	1	0
Metalworking industry	12	13	7	12	6	7	8	0	1	1	0	0	0
Transport	7	2	1	2	9	0	0	0	0	0	0	0	0
Manufacture of rubber and plastics products	2	2	1	1	0	1	0	3	0	0	1	1	0
Agriculture	0	0	0	0	1	0	0	0	0	0	0	0	1
Chemistry	1	1	0	0	1	0	0	0	0	0	1	0	0
Manufacture of glass and pottery	1	1	2	0	1	1	0	0	1	0	0	0	0
Services	4	1	1	1	1	0	1	0	0	1	0	0	0
Communications	1	1	0	2	1	0	0	0	0	0	0	0	0
Food manufactoring	1	1	0	0	0	0	0	0	0	0	0	0	0
Wood or wood products	0	0	0	0	0	1	0	0	0	0	0	0	0
Printing, publishing	1	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**49**	**31**	**29**	**28**	**25**	**17**	**15**	**3**	**2**	**2**	**2**	**2**	**1**

held with INAIL physicians enabled the exchange of information on the compensated cases (Table 4) and the reasons for the rejection of those adversely defined (Table 5). The INAIL compensation scheme follows procedures for causal attribution that differ from ours due to differing INAIL purposes using appraisal systems[23]. INAIL applies medico-legal criteria that require the correlation to be documented with a high degree of certainty. For this reason, when we made a compensation claim, we did not give the patient too many expectations on INAIL recognition, especially in cases without additional evidence.

To evaluate the impact of our active research on the underreporting, it is currently possible to analyze the INAIL data, taking into account the cases of malignant lung cancer (ICDC34) reported, defined, and approved in the 2014-2022 period for the INAIL office in the AUSL Bologna. Comparing the number of reported and defined cases during the project activity period (2018-2022, not considering 2020 influenced by the COVID-19 pandemic) with those of the previous period (2014-2017), there is an increase in reported and defined cases of about 3 times. However, the impact is less significant when considering the percentage of recognized instances, which has increased from 31.6% to 33.8%. Overall, interesting data emerges in relation to the female gender using INAIL open data for the period 2018-2022: out of the total of 14 cases reported and defined at the regional level, 100% were reported by our Operating Unit, and of these, six have been accepted.

However, the main reason for rejection remains the absence of reliable documentation on exposure for each worker (55%). The long latency period between the time of exposure to the risk and the cancer diagnosis results in many companies having been closed or significantly changed. The second reason (25%) concerns the assessment of exposure as "not sufficient." This conclusion is often linked to the absence of exposure measures relating to the reported working periods (not provided for by the legislation in force at the time), or, in the case of companies that still exist, only to the availability of current or recent exposure measures (presumably lower than past exposures).

4. Discussion

Concerning the objective of contributing to knowledge on contexts and activities that expose people to carcinogens in the workplace, it should be borne in mind that in Italy, the majority of occupational carcinogens recognized in the literature as being associated with lung cancer are included in the list of occupational diseases in industry and agriculture (approved by law, the most recent revision is contained in the *DecretoMinisteriale* 10/10/2023), on which the insurance institute relies for the attribution of the percentage of biological damage and possible compensation.

Asbestos was the predominant exposure factor, consistent with the most frequent local work sectors, that is, the manufacture of metalworking products and construction, as well as the periods of exposure between 1970 and 1980. This finding is also consistent with the data in the literature [11, 17, 18, 23-25, 34]. Other relevant agents that have emerged are welding fumes and polycyclic aromatic hydrocarbons. This is in line with several studies currently available in the literature, taking into account the variability of the agents and periods considered by the different authors and, particularly for welding fumes, updates in the evidence of carcinogenicity over the years [8, 11, 12]. In our assessments, exposure to specific agents not included in the list (such as exposure to diesel fumes and gases or crystalline silica) was also identified as a contributory cause of illness in some cases, as it is well established in the literature [12, 35,36] and incorporated into current occupational health and safety legislation.

However, even for agents not included in the list used by INAIL, it is of significant importance to submit certificates or reports for epidemiological purposes to raise awareness of possible effects due to exposure and for these substances to be evaluated by the technical-scientific committees when the tables are revised.

In our case history, the transmission of the claim of recognition has always been advocated, even if this was only for conceivable exposures or for non-listed carcinogens. However, in the latter instances, patients often preferred to forego the INAIL certificate, resulting in a higher frequency of reporting

Table 4. INAIL Compensated cases: occupational carcinogens by economic activity sector.

	Carcinogens												
Economic activity sectors	**Asbestos**	**PAHs**	**Silica dust**	**Welding fumes**	**Diesel Exhaust**	**Paintings**	**Cr (VI) compounds**	**Rubber**	**Cadmium**	**Nickel**	**Arsenic**	**Coal tar pitch**	**Non-As inscticides**
Metalworking industry	1	3		2	1	1	3			2			
Construction	5	1	1	1		2	1						
Transport	1	1			2								
Manufacture of glass and pottery					1								
Manufacture of rubber and plastics products								1					
Services	1												
Total	8	5	1	3	4	4	4	1	0	2	0	0	0

Table 5. INAIL denied case: motivations for rejection.

	N.	%
Lack of exposure to risk	29	54.7
Insufficient exposure to risk	13	24.5
Insufficient administrative documentation	5	9.4
Insufficient clinical documentation*, istological type **	4	7.5
Lack of causal association	2	3.8
Total	53	100

** Cases without histological definition.*
*** Two neuroendocrine tumors that INAIL did not consider related to asbestos exposure.*

for epidemiological purposes (Art. 139 of DPR 1124/1965).

Our estimate of the fraction of lung cancer attributable to occupational exposure over the 2017-2023 period was 6.2%, which is within the range of the most recent estimates for lung cancer [*3-9*]. However, it should be noted that, over the years, the percentage of reported lung cancer cases was not consistent, equivalent to an average of about 28% of the cases treated.

This experience has further confirmed that the region and the period of analysis must always be taken into account when evaluating estimates of the attributable fraction with reference to the various occupational sectors and occupational risk factors compared with the rates of recognition of occupational disease by the INAIL. There are regional specificities in terms of industries.

With regard to the objective of contributing knowledge about contexts and activities that expose people to carcinogens in the workplace, the data must be considered to be strongly influenced by the area's production characteristics.

The metalworking sector is the most represented for occupational male cases, followed by construction and transport. For women, it is more difficult to discern a prevalent sector since the number of cases is low: one or at most two cases (glass-ceramic processing and research) per sector. It should be noted that none of the women worked in the construction sector or in the other prevalent sectors for males.

The job tasks were found to be very diversified. However, among males, welders and machine-tool operators emerged as numerically prevalent in the metalworking sector. In the construction industry, bricklayers were predominant, followed by transport drivers. There is no prevalent distribution by specific job type among females. However, the cases are evenly distributed over various jobs, with just 1 or 2 individuals per type (glass ceramic worker).

Asbestos was the most represented carcinogen identified, which aligns with the occupational sectors that emerged as prevalent (construction and manufacture of metalworking products) and the working periods concerned (mainly the 1970-1980 period). Exposure to silica, the leading agent in the construction sector, followed asbestos in importance. Welding fumes and polycyclic aromatic hydrocarbons, present in numerous industries and occupational exposures, were other numerically relevant agents.

This experience represents an example of an active search for occupational lung cancer, and it seemed to have several strengths and positive effects:

- The construction of a network between PSAL occupational physicians and staff of the oncological treatment hospital units (Radiotherapy, Oncology, Pneumology, and Thoracic Surgery) involved the latter in information/training sessions and in sharing the Pilot Project and survey instruments (selection and enrolment criteria and tools, procedures, and survey questionnaires).
- The methodology employed facilitated the efficient selection of only those cases of suspect occupational origin, avoiding the misuse of resources to contact all cases. After applying the filter, only 35% of the cases were deemed appropriate for further investigation. The occupational origin was subsequently confirmed in 70% of respondent cases.
- The impact on the number of occupational lung cancer reported to INAIL increased by about 3 times.
- The ability to conduct direct interviews with workers and the additional information obtained from the PSAL archives enabled the

generation of supplementary reporting crucial in documenting exposure and facilitating acceptance and compensation by the INAIL.
- Cooperation with INAIL physicians was useful for monitoring the process from the medico-legal assessments conducted by the insurance institute to resolution.

A criticism is undoubtedly the inconstancy of the reporting flows activated and consolidated over the years and the need to activate further channels to recover, including from other hospital facilities, the totality of cases occurring in our region. In fact, due to staff shortages and/or organizational difficulties, there were some disruptions or reductions in the sending of filter forms, which were dealt with by organizing periodic updates both within the PSAL and with the departments involved.

The assessment of the causes of rejection by INAIL highlights the need to maintain a strong focus on past exposures but, even more so, to document and monitor those currently in progress. Finally, given the overall validity of the project, plans are also being made to extend it to other cancers, particularly bladder cancer.

5. Conclusions

The implementation of active surveillance for occupational lung cancer (LC) has proven to be both effective and efficient; a significant number of cases were identified that would otherwise have been overlooked. Asbestos emerged as the most common exposure factor, followed by welding fumes and polycyclic aromatic hydrocarbons.

A systematic approach, grounded in multidisciplinary collaboration among occupational physicians and hospital departments involved in lung cancer diagnosis and treatment, coupled with direct patient interviews and cooperation with INAIL, highlights a best practice that effectively minimizes the underreporting of occupational lung cancer.

Supplementary Materials: The following are available online: Occupations and exposures of INAIL compensated cases; Filter form and examples of work-sector specific sections questionnaires; table describing INAIL compensated cases.

Funding: This project received funding from Emilia-Romagna Region DGR 2102/2017, DGR 1800/2020, DGR 2145/2021

Institutional Review Board Statement: Not applicable as it is a public health intervention included in the activities of the Public Health Department.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Acknowledgements: The authors wish to thank the colleagues of the Lung Cancer Dedicated Diagnostic and Therapeutic Care Pathways (PDTA): Division of Pneumology, Oncology, and Thoracic Surgery of the AUSL Bologna for their significant contribution. They are also grateful to the colleagues of INAIL for their cooperation. Special thanks go to the colleagues Dr. Venere Pavone and Anna Maria Ferretti, who followed the project and its pilot phase.

Declaration of Interest: The authors declare no conflict of interest.

Declaration on the use of AI: None.

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Supplementary Material

Occupations and exposures of INAIL compensated cases

Work tasks	Exposures defined by INAIL	Availability of documentation in PSAL archive
Welder	Nickel, chromium, welding fumes	Not available (literature data)
Metalworker / machine tool operator	PAHs, Formaldehyde, Nitrites, N-Nitrosylenediamine, Tetrachloroethylene, Beryllium	Not available (literature data)
Water and gas network maintenance worker	Asbestos	Available
Welder and painter	Dust, mineral oils, lead, paints, welding fumes, inorganic compounds, asbestos	Not available (literature data)
Painter in construction	Painting and asbestos	Not available (literature data)
Plastic molding worker	Rubber processing in vulcanization activities	Not available (literature data)
Metalworker / machine tool operator	Toluene and PAHs	Available
Plumber in construction	Asbestos, welding fumes, tar fumes, lead paint, strong acids	Not available (literature data)
Construction worker and transporter	Probable exposure to PAHs, fuels, asbestos exposure not excluded	Available
Wood worker (furniture)	Wood dust, formaldehyde and paints	Available
Warehouse worker	Diesel exhaust	Available
Metalworker / machine tool operator	Nickel, chromium, asbestos, PAHs	Not available (literature data)
Welder	Welding fumes, chromium VI, PAHs	Not available (literature data)
Barman at railway rolling stock repair company	Asbestos (environmental exposure)	Available
Chrome plating worker	Chromium VI	Not available (literature data)
Metalworker /machine tool operator	Diesel exhaust and PAHs	Available
Construction worker	Asbestos, chromium, crystalline silica	Not available (literature data)
Toll booth attendant on the highway	Diesel exhaust (higher exposure than the general population)	Not available (literature data)