https://doi.org/10.48047/AFJBS.7.5.2025.472-483

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Epidemiological Insights into Lung Cancer in Western Algeria: A Cross-Sectional Study of Patient Characteristics and Risk Factors

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Volume 7, Issue 5,May 2025

Received: 15 Mar 2025

Accepted: 05 Apr 2025

Published: 09 May2025

doi:10.48047/AFJBS.7.5.2025.472-483

Abstract:

Background:

In Algeria, there is a need for more epidemiological data on lung cancer as lung cancer is a major public health concern. By this study, we seek to provide valuable statistics to improve prevention and promote screening strategies in the country.

Methods:

A cross-sectional observational study was conducted at the University Hospital Centre of Oran over three years (2020-2022) on lung cancer patients by retrospectively reviewing their medical records using a structured survey form, focusing on demographics, lifestyle habits, and clinical and histopathological characteristics.

Results:

We collected 312 lung cancer cases. A 6.8 sex ratio and a high smoking prevalence of 83% were observed. The patient's median age was 63 years [35-89]. Cannabis use was reported in 16% cases. Alcohol consumption was found in 49% of patients. Adenocarcinoma was the predominant subtype (69%), often diagnosed at advanced stages (III and IV). The most common comorbidities were hypertension (41%) and diabetes (23%). Additionally, 25% of patients had a family history of cancer.

Conclusion:

These findings will aid in implementing early lung cancer detection in Algeria, ultimately improving survival rates. Further research into non-smoking risk factors is necessary to deepen our understanding of the disease in Algeria and improve prevention measures.

Key words: Lung cancer, Screening, Epidemiology, Cannabis, Tobacco

1. Introduction:

Lung cancer is a significant public health concern, representing the first most diagnosed cancer with more than 2 million new cases (12.4%) and the leading cause of cancer related deaths with more than 1.8 million deaths (18.7%) worldwide, in 2022. In men, it is both the most frequent and the deadliest cancer with 15.2% and 22.7% rates respectively. In women, it is the second most frequent cancer after breast cancer with 9.4% new cases and the second cause of death after breast cancer with 13.5% death cases **[1].**

In Algeria, lung cancer represents the 3rd most common form of cancer after breast and colorectal cancers with 5 040 (7.8%) new cases and the 2nd cause of death after breast cancer with 4 599 (12.9%) deaths in 2022 **[1].**

Smoking stands out as the leading risk factor for lung cancer. Other factors, such as age, radon exposure, environmental pollution, occupational exposures, gender, ethnicity, and pre-existing lung diseases are also important contributors **[2]**. Lung cancer is divided into two main histological types: small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC) **[3].** NSCLC is subdivided into adenocarcinoma (ADC), squamous cell carcinoma (SqCC), and large cell carcinoma (LCC) **[4].** Most patients with lung cancer are diagnosed at advanced stages (III and IV). At present, thanks to the development of medical practice related to cancer screening and/or treatment, localized stage rates suddenly increased by 4.5% per year from 2004 to 2018, while the incidence of lung cancer for advanced stages continued to decline **[5].**

The objective of this study was to draw-up a profile of lung cancer patients admitted to the University Hospital Centre of Oran (UHCO) at the Oncology Service over a three-year period (2020-2022). This was done in order to enhance understanding of the clinico-epidemiological characteristics of these patients, identify prevalent risk factors, and ultimately inform targeted prevention and screening strategies to improve patient outcomes in Algeria.

In Algeria, the absence of screening programs for lung cancer presents a significant public health challenge. This study advocates for the urgent implementation of early detection initiatives, as lung cancer constitutes one of the foremost health concerns in the nation. Additionally, there is a critical need to gather comprehensive data regarding the characteristics of lung cancer patients across various regions of Algeria. Such data collection is essential for enhancing prevention strategies and establishing effective lung cancer screening protocols. By addressing these gaps, Algeria can improve its response to lung cancer and ultimately reduce morbidity and mortality associated with this disease.

2. Methods:

2.1. Study Population and Data Collection:

This cross-sectional observational study was conducted at the UHCO, within the Medical Oncology Department, the Oncological Emergency Department and the Day Hospital. We retrospectively analysed the epidemiological profile of patients with lung cancer using their medical records registered from January 2020 to December 2022. Data on age, gender, occupation, smoking status, cannabis status, alcohol status, personal comorbidities, family history of cancer, histological type and stage of the disease were collected using a survey form. All patients' records with a confirmed lung cancer diagnosis through rigorous histological or clinico-radiological methods were included in the study. Patients with incomplete records or uncertain diagnosis were excluded.
Data were collected anonymously and confidentially to protect patient's privacy.

2.2. Statistical Analyses

Statistical analyses were conducted using the R software 4.4.2 version. The Excel software (Microsoft Office 2019) was used to organise and classify the variables. A p-value ≤ 0.05 was considered as statistically significant. Categorical variables were analysed using Pearson Chi-square or Fisher's exact tests. Numerical data normality was assessed to choose between ANOVA (Analyses of Variance) or Kruskall-Wallis tests for associations between numerical data and categorical variables.

Data presentation included the number of cases and percentage of total for categorical variables, while quantitative variables were reported as mean ± standard deviation of mean and median with quartiles.

Analyses were performed only with available data, missing data were not imputed.

3. Results:

3.1. Clinical Characteristics:

During this three years period, 312 patients with lung cancer were registered, 272 (87%) were men and 40 (13%) were women with a sex ratio of 6.8 showing a significant association between lung cancer and gender **(Table 1)**. The median age was 63 years [35-89]. Age distribution indicated that 16% of patients were under 50 years and 22% were aged between 65 and 71 years old. Notably, patients aged over 77 years old represented 7% of the total cases **(Fig 1)**.

The clinical stage of disease was reported for 292 patients and was missing for 20 patients, and 71% diagnosed at metastatic stage IV. Advanced stages (III, IV) accounted for 95% of cases.

Table 1: Frequency Distribution of Demographic, Clinical, Histopathological, and Lifestyle Characteristics of the Lung Cancer Patients Enrolled in our Study. This table summarizes key patient characteristics, including age distribution, smoking status, and histological types of lung cancer.

Variable	Patients (N)	Patients (%)	p-value
Age at diagnosis	312	100	/
Mean	62.43±11,2	/	
Median	63 [35-89]	/	
Gender	312	100	<0.0001
Males	272	87	
Females	40	13	
Smoking status	312	100	<0.0001
Smoker	259	83	
Non-smoker	53	17	
Pack-Year	255	82	/
Mean	47.15	/	
Median	40 [4-200]	/	
Age at initiation	126	40	/
Mean	18.87	/	
Median	18 [9-61]	/	

Cannabis status	183	59	<0.0001
Consumer	30	16	
Non-consumer	153	84	
Unknown	129	41	
Alcohol Status	185	59	0.71
Consumer	95	51	
Non-consumer	90	49	
Unknown	127	41	
Comorbidities	175	56	<0.0001
Hypertension	71	41	
Diabetes	40	23	
Tuberculosis	17	10	
COPD	15	9	
Asthma	9	5	
Other	23	13	
Comorbidities free	137	44	
Histological types	312	100	<0.0001
NSCLC ADC	281	90	
SqCC SCLC	214	69	
Others	47	15	
	19	6	
	12	4	

COPD= Chronic Obstructive Pulmonary Disease, **NSCLC**= Non-Small Cell Lung Cancer, **ADC**= Adenocarcinoma, **SqCC**= Squamous Cell Carcinoma, **SCLC**= Small Cell Lung Cancer.

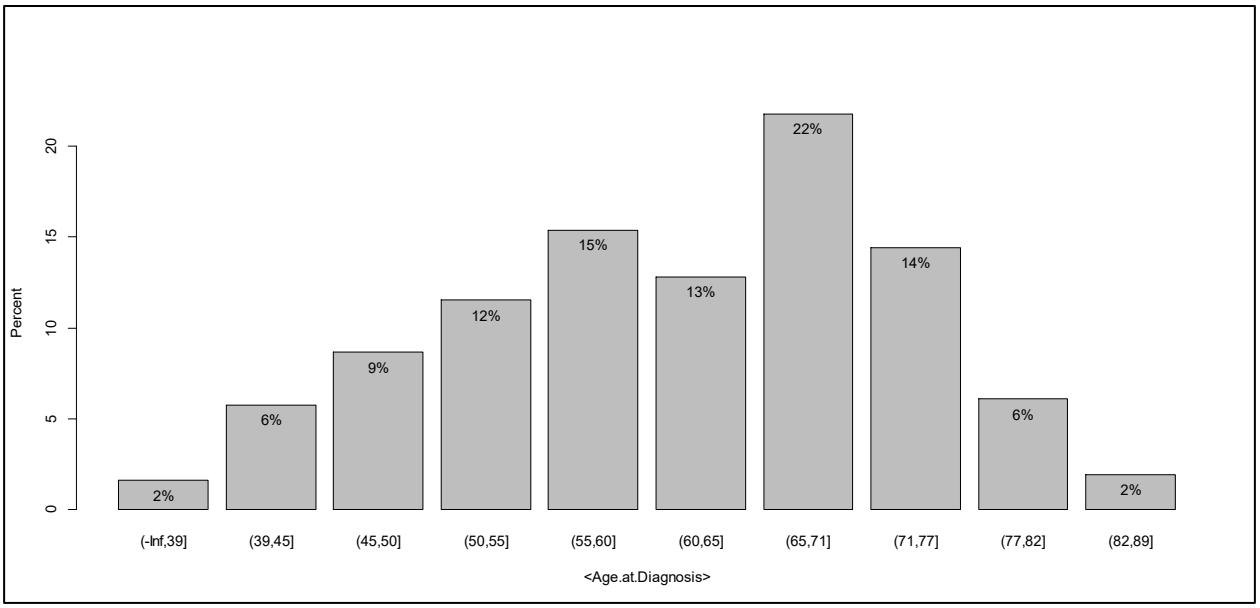

Fig 1: Distribution of Age Groups at Diagnosis Among Patients in our Cohort. The figure clearly shows that the age group between 65 and 71 significantly displays a higher distribution of lung cancer cases.

3.2. Pathological Characteristics:

Non-small cell lung cancer (NSCLC) Histopathological type represented 84% of the cases, followed by 6% of small cell lung cancer (SCLC) and 10% categorized as "Others" not belonging to either of these two categories. Adenocarcinoma (ADC) and squamous cell carcinoma (SqCC) rates were 69% and 15%, respectively **(Table 1).** Furthermore, 98% of SqCC, 95% of SCLC and 78.9% of ADC were found in smokers highlighting an association between smoking and histological types of lung cancer **(Table 2)**.

Table 2: Frequency Distribution of Gender, Smoking Status, Alcohol Status and Cannabis Status of Lung Cancer Patients According to their Histological Types During the Three Years Period (2020-2022). This table describes the associations between histological types of lung cancer and the four characteristics of patients of our cohort: gender, smoking status, alcohol status and cannabis status with a calculated p-value.

	ADC (N= 214)	**SqCC (N= 47)**	**SCLC (N= 19)**	**Others (N= 32)**	**p-value**
Gender					0.027
Males	179 (84%)	46 (98%)	18 (98%)	29 (91%)	
Females	35 (16%)	1(2%)	1(2%)	3 (9%)	
Smoking Status					0.002
Smokers	169 (79%)	46 (98%)	18 (98%)	26 (81%)	
Non-smokers	45 (21%)	1(2%)	1(2%)	6 (19%)	
Alcohol Status	N=128	N=31	N=8	N=18	0.8
Consumer	60 (47%)	16 (52%)	5 (62%)	9 (50%)	
Non-consumer	68 (53%)	15 (48%)	3 (38%)	9 (50%)	
Cannabis Status	N=183				0.16
Consumer	17 (13%)	6 (20%)	1 (12%)	6 (33%)	
Non-consumer	110 (87%)	24 (80%)	7 (88%)	12 (67%)	

ADC= Adenocarcinoma, **SqCC**= Squamous Cell Carcinoma, **SCLC**= Small Cell Lung Cancer.

3.3. Risk Factors:

3.3.1. Smoking, Cannabis and Alcohol Statuses:

Smoking status included smokers (current and former) and non-smokers. It was reported in all patients enrolled in the study. A rate of 83% of cases were smokers showing a strong association between lung cancer and smoking **(Table 1)**. In addition, 95% of males were smokers, while 98% of women were nonsmokers. Moreover, the higher mean of 55 PY was found in patients with SqCC. However, no significant association was found between the PY mean and lung cancer histological types (p=0.48) **(Fig 2)**. Former smokers had an average smoking cessation period of 12 years. Additionally, cannabis status was reported in 183 patients and missing in 129 patients, and 16% were consumers **(Table 2).** Furthermore, alcohol status was available for 185 patients and missing for 127, and 49% were consumers. However, no significant association was found between lung cancer and alcohol (p=0.71), nor between alcohol consumption and the histological types of lung cancer (p=0.81). Nevertheless, when combining data of smoking and alcohol statuses, 185 had both data combined and statistically showed a highly significant association of alcohol combined to smoking with lung cancer risk (p= 0.000001427).

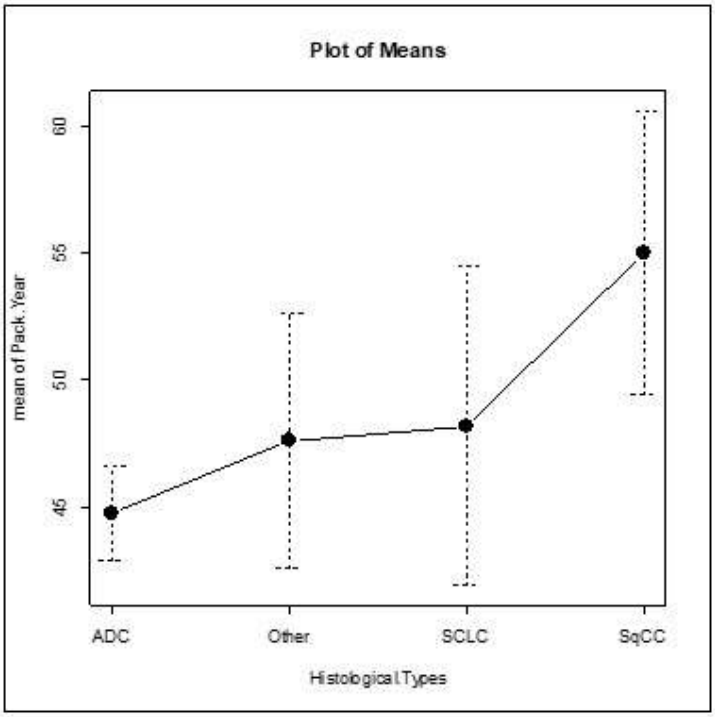

Fig 2: Distribution of Pack-Year Among Histological Types of Lung Cancer in the Studied Population. **ADC:** Adenocarcinoma, **SCLC:** Small Cell Lung Cancer, **SqCC:** Squamous Cell Carcinoma. The figure displays the lower PY mean of 45 found in ADC cases and the higher PY mean found in SqCC along with 95% confidence intervals.

3.3.2. Occupational Exposure

Professional status was documented for 218 patients, of whom 33 (15%) unemployed, 24 (11%) drivers (trucks, buses or cars), 22 (10%) manual workers (welders, torch workers, carpenters, road construction workers, railway workers), 21 (10%) employed in a construction industry (masons, painters or workers in the cement industry), 19 (9%) traders, 15 (7%) security agents, 13 (6%) worked in an energy industry, and the remaining 71 patients (33%) were in other occupation fields, which we referred to as "workers". Of the patients with occupations, 8 were women (4%) and 177 were men (81%).

3.3.3. Personal Comorbidities:

In our population, 175 (56%) had personal comorbidities, predominantly hypertension and diabetes, at rates of 40% and 23%, respectively. Among these patients, 43 (25%) had respiratory comorbidities **(Table 1)**. Other respiratory comorbidities such as respiratory allergy, pneumonia, pneumothorax, and pulmonary embolism were less common. Five of these patients had two respiratory comorbidities at the same time. COVID 19 test result was available for 101 patients, of whom 42% tested positive for the virus.

3.3.4. Family History of Cancer:

A family history of cancer was noted in 25% of patients, specifically, 27 cases (9%) had a family history of lung cancer. Among these, 17 patients had a first-degree family member with lung cancer and 3 had two first-degree family members with lung cancer. The median age of patients with a family history of cancer was 59 [35-86] years, while that of patients without a family history of cancer was 65 [36-89] years with a p-value of 0.0007254 which highlights a statistically significant difference in age between these two groups.

4. Discussion:

The aim of this study was to establish a descriptive clinico-epidemiologic profile of lung cancer in Western Algeria through a retrospective analysis of the medical records of patients registered from January 2020 to December 2022 and collected at the UHCO. This study provides valuable statistics to improve prevention and promote screening strategies in Algeria.

In our population of patients, the gender distribution showed a significant difference, with a male predominance. This finding aligns with other studies conducted in Algeria reporting sex ratios between 6.06 and 11.8 **[6,7,8]** and globally **[1].** However, notable exceptions exist, a study from Uganda indicated a higher rate of lung cancer among women **[9]**. Similarly, another study reported that lung cancer is the most prevalent cancer among women in North Korea **[10].** These discrepancies in gender distribution can be attributed to varying risk factors and population characteristics across regions.

In our study, a significant proportion of patients were smokers, demonstrating a strong association between smoking and lung cancer, particularly among males. This correlation underscores smoking as the primary risk factor for lung cancer. Consistent with findings from various studies that highlight its role in gender disparities regarding incidence rates **[11]**. Globally, the male-to-female ratio is decreasing in some regions due to rising smoking rates among women. Indeed, there has been a considerable increase in the incidence of lung cancer among women in recent years, which is likely related to the increase in smoking rates as reported in the literature **[12].** However, a subset of analyses stratified by the ratio of women to men of active smokers reported no difference between men and women in smoking-related lung cancer risk **[11].**

The data collected in this study on the number of pack-years, age of smoking initiation, duration of smoking, and duration of smoking cessation in patients with a history of smoking correlates with a study from Algeria **[8].** However, there are currently no other studies reporting these parameters for Algerian patients; therefore, further research on these parameters in both active and former Algerian smokers would enhance the implementation of lung cancer prevention and screening measures.

In our population, most non-smoking patients were women. These findings correlate with other studies showing that women are more likely than men to have a non-smoking-related lung cancer **[6,7,13].** Suggesting a clear involvement of factors other than smoking in lung cancer risk as reported in the literature **[14].** Moreover, most women had adenocarcinoma. This may be due to variations in gender hormone expression. Indeed, various studies have reported the role of female sex hormones, particularly oestrogen receptors (ERs), in promoting lung adenocarcinoma cell metastases in women, which has led to the development of anti-oestrogen therapies for NSCLC **[15,16].** In addition, a meta-analysis reported that late menopause may be associated with lung cancer risk in non-smokers, while early menopause was associated with lung cancer in smokers **[17].**

In our study, while a higher prevalence of non-cannabis consumers was noted, literature presents conflicting evidence regarding cannabis' role in lung cancer. Cannabinoids -components of *Cannabis Sativa*- have been recognized for their potential anti-cancer properties especially the cannabidiol (CBD) molecule which is identified as a novel therapeutic agent in NSCLC **[18]**, yet other studies reported that cannabis consumption increases lung cancer risk especially in adolescents and young adults and among long term cannabis consumers **[19].** However, further research is needed to confirm or deny these findings.
In our study, a notable prevalence of alcohol consumers was found. Despite that, no significant association was found between alcohol and lung cancer nor between alcohol and the histological types, these findings align with some existing literature that report no association of alcohol with the risk of lung cancer **[20]**, while other studies have reported that the risk of alcohol consumption for lung cancer differs depending on

histological subtype and type of alcohol **[21]**. For instance, a meta-analysis reported that moderate alcohol consumption does not significantly increase lung cancer risk, particularly when controlling for confounding factors such as smoking history, which is a well-established risk factor for lung cancer **[22].**

Moreover, the lack of significant association in our study reflects the predominant role of smoking. Some studies suggest that alcohol may act as a co-carcinogen with tobacco, enhancing the carcinogenic effects of smoking rather than being an independent risk factor **[23].** In our population, the high prevalence of smoking likely overshadows any potential contribution of alcohol to lung cancer risk.

Occupational exposure emerged as another critical factor, our study identified potential exposure to carcinogens, such as asbestos, radon, silica, diesel engine exhaust, and others, as discussed in the literature **[6, 24]**. In addition, a notable gender disparity was observed, with more male workers exposed. These findings are consistent with studies conducted in Algeria and other countries **[6, 25].** This difference reflects historical gender imbalances in certain occupations and societal factors that predispose men to greater exposure risks.

In our population, the results concerning age strongly indicate a pronounced occurrence of lung cancer in the 65-71 age group. Results comparable to ours have been reported in previous studies **[6,7,13]**. For example, Harir et al. **[6]** showed that the most common age group found was 50-69 years. However, patients over the age of 80 may be underrepresented due to health conditions and comorbidities associated with ageing, which could lead to increased mortality from causes other than lung cancer. Additionally, patients under the age of 50 may be less represented in our study, as lung cancer takes time to develop after initial exposure to carcinogens. This suggests that the risk of lung cancer tends to increase as individuals age, especially around the age of 65, influenced by their level of exposure to specific risk factors. Nevertheless, there could be an implication of genetic factors that could influence the onset of lung cancer at an earlier age than average. As reported in the literature **[26,27]**.

In our study, the predominance of adenocarcinoma (69%) mirrors global trends, where adenocarcinoma has surpassed squamous cell carcinoma as the most common histological subtype, particularly among nonsmokers and women **[6,28].** However, a study conducted in Algeria by Harir et al. **[7]** reported SqCC as the most frequent histological subtype of NSCLC**.** A significant association between gender and histological types of lung cancer was observed, as well as between smoking history and histological types of lung cancer. ADC is the most prevalent histological type in non-smoking patients, with a higher prevalence in females than males. In contrast, SqCC and SCLC are exclusively found in male smokers, except for one case each in non-smoking women. These findings are consistent with previous literature **[6, 8, 10].** However, Wang et al. reported a wide range of prevalence and distribution by gender and geographic location that remains unexplained **[29].**

The results of our study regarding the different stages of lung cancer highlight the common late diagnosis of lung cancer in our population, particularly in the metastatic stage which contributes to reduced survival rates and a focus on palliative care. Therefore, emphasising the importance of implementing lung cancer screening programs among the Algerian population and thus increasing survival rates. These findings align with comparable studies reported from Algeria **[6, 7, 8, 13].** Moreover, it was reported that in the Middle East and North Africa region, the majority of lung cancer patients present at an advanced stage. For example, in Yemen almost 75% of lung cancer patients were presenting with stages III and IV **[30].**

In our patients, the respiratory comorbidities may have increased the risk of lung cancer. Studies conducted in Algeria **[6]** and worldwide **[31, 32]** have reported the impact of various comorbidities on lung cancer emphasizing the need to include them in lung cancer screening programs**.**

In addition, the present study considered the results of tests for the novel coronavirus, SARS-CoV-2. A substantial proportion of our cohort was affected by COVID-19 during the pandemic. The high positivity rate among these patients highlights their vulnerability, as those with pre-existing respiratory conditions like lung cancer face increased risks of severe COVID-19 complications and mortality **[33].**

Furthermore, the fact that only a portion of the total patient population had their COVID-19 status assessed may limit the generalizability of this finding. It is possible that those who were tested represent a specific subset of patients—potentially those with more severe symptoms or those who were more proactive in seeking care—thus skewing the positivity rate. This situation highlights the challenges faced by lung cancer patients during the pandemic, as confinement measures likely restricted access to healthcare services and led to delays in treatment. Future research should aim to understand the long-term implications of COVID-19 on lung cancer outcomes and treatment pathways.

Our study's results on family history emphasise the possibility of a genetic predisposition to developing lung cancer. This suggests a hereditary component or potential genetic link within affected families. Thus, investigating family patterns and genetic profiles of lung cancer in this population could facilitate the development of early detection and prevention strategies. The literature has firmly established a hereditary tendency in lung cancer increasing an individual's susceptibility to this disease **[34].** Moreover, the first proof of familial aggregation of lung cancer among patients was documented in 1963 in research by Tokuhata and Lilienfeld **[35].**

Overall, as reported by Gaafar **[36],** obstacles to the global fight against lung cancer include lack of registry in some parts of Africa, low public awareness of lung cancer and absence of screening for the high-risk cases, overburdened treatment centres and insufficient financial support. In that context, this study aims to provide the necessary data to improve lung cancer prevention and implement strategies for lung cancer screening in the country.

However, our study has some limitations. The sample size in this study was limited by the data collection period, which coincided with the COVID-19 pandemic. During this time, confinement measures and social distancing strategies significantly reduced the number of patients seeking hospital care for cancer treatment. Its cross-sectional doesn’t allow the establishment of causal relationship and prevents assessing patient progress or intervention impacts over time.

5. Conclusion:

In conclusion, this study profiles lung cancer in Western Algeria, identifying high-risk criteria and suggesting future research: tailored screening, longitudinal studies for prevention effectiveness, investigation of non-smoking risk factors (especially in women), and exploration of cannabis's impact.
These efforts aim to implement lung cancer screening and improve prevention and survival rates in Algeria.

Acknowledgments

The researchers express their profound gratitude to the staff of the CHUO medical oncology department for their cooperation.

Authors’ Contribution

Conceptualization: Linda Temimi, Bouras Noria, Abdelkader Bousahba, Ahlem Megaïz, Malika Lechar, Tewfik Sahraoui.

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Data curation: Linda Temimi.

Formal analysis: Linda Temimi.

Software: Linda Temimi.

Supervision: Noria Bouras, Abdelkader Bousahba, Sahraoui Tewfik.

Validation: Linda Temimi, Bouras Noria, Abdelkader Bousahba, Ahlem Megaïz, Malika Lechar, Tewfik Sahraoui.

Writing–original draft: Linda Temimi.

Writing–review & editing: Linda Temimi, Bouras Noria.

Competing Interests: The authors declare that there is no conflict of interests.

Ethical Approval: This non-interventional study did not require approval from an ethic committee for data were collected anonymously from medical records.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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