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TOBACCO SMOKING, OCCUPATIONAL EXPOSURES AND SOCIO-DEMOGRAPHIC CHARACTERISTICS AMONG MALE PATIENTS WITH LUNG CANCER AT APEKSHA HOSPITAL, SRI LANKA: A CROSS-SECTIONAL STUDY

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ABSTRACT

Lung cancer is a major public health concern, and tobacco smoking, second hand smoke, and occupational exposures are important modifiable exposure factors. This study aimed to describe tobacco smoking, second-hand smoke exposure, selected occupational exposures, personal protective equipment use, and socio-demographic characteristics among male patients with lung cancer at Apeksha Hospital, Sri Lanka, and to examine associations between smoking exposure and selected occupational and socio-demographic variables. A descriptive crossectional study was conducted among 120 male patients with primary lung cancer using purposive sampling. Data were collected using an interviewer-administered questionnaire. The questionnaire assessed socio demographic characteristics, active smoking, second hand smoke exposure, working hours, and PPE use. Data were analysed using descriptive statistics and chi square tests with SPSS version 20. The mean age of participants was 57.85 years. Most participants were current or former cigarette smokers. Second-hand smoke exposure was reported at home and at the workplace. More than half of the participants reported at least one selected occupational exposure, with cement related exposure being the most common. A statistically significant association was observed between pack-years of smoking and age at diagnosis, and between educational level and pack-years of smoking. PPE utilization was low among participants with occupational exposures. These findings highlight the need for targeted smoking cessation, reduction of second hand smoke exposure, and strengthened occupational safety practices among high-risk occupational groups.

KEYWORDS: Tobacco Smoking, Lung Cancer, Asbestos, Paint, Wood, Cement Industry

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1. INTRODUCTION

Cancer remains one of the most significant global public health challenges. It is characterized by the uncontrolled growth and proliferation of abnormal cells, which can invade surrounding tissues and metastasize to distant organs. Despite the substantial advances in cancer diagnosis, treatment, and prevention, cancer continues to be a leading cause of morbidity and mortality worldwide. Among all malignancies, lung cancer remains the foremost cause of cancer-related deaths globally. According to the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC), approximately 2.5 million new lung cancer cases were diagnosed worldwide in 2022, making it one of the most frequently diagnosed cancers to distant organs. (IARC, 2025; WHO, 2025). The high mortality associated with lung cancer is largely attributable to late-stage diagnosis, when treatment options are limited and prognosis is poor.

Importantly, a significant proportion of cancer cases are preventable. Evidence suggests that more than 30% of cancers could be avoided through the modification of known risk factors, particularly tobacco use and exposure to environmental carcinogens (American Cancer Society, 2025; CDC, 2025; Winship Cancer Institute of EMory University, 2022). Consequently, understanding and addressing these risk factors remains a critical component of global cancer prevention strategies.

Lung cancer is often asymptomatic during its early stages and may not present with noticeable clinical manifestations until the disease has progressed or metastasized. Common symptoms include persistent cough, heamoptysis, chest pain, hoarseness of voice, unexplained weight loss, and dyspnea. Tobacco smoking has long been recognized as the primary risk factor for lung cancer, accounting for approximately 85% of cases worldwide (IARC, 2025; Prado et al., 2023). The risk of developing lung cancer increases with both the duration and intensity of smoking exposure, commonly quantified using the pack-year index. However, lung cancer among never smokers has emerged as an important public health concern and is currently recognized as the fifth leading cause of cancer-related mortality globally (CDC, 2025; Pleasants et al., 2020). Exposure to ambient air pollution has been identified as a major contributing factor in these cases (IARC, 2025). Furthermore, adenocarcinoma, currently the most prevalent histological subtype of lung cancer, is increasingly observed among both smokers and never smokers, reflecting evolving patterns of environmental and behavioral risk factors (Gregory, 2025; Samet et al., 2009).

In addition to tobacco exposure, occupational carcinogens contribute significantly to lung cancer risk. Exposure to asbestos, a naturally occurring mineral historically used in construction and manufacturing industries, is strongly associated with increased lung cancer incidence. Evidence indicates that even low-level asbestos exposure can elevate lung cancer risk, particularly among individuals who smoke. Other occupational exposures, including silica dust, diesel exhaust, paints and various industrial chemicals, have also been linked to an increased risk of lung cancer, independent of smoking status (Huang et al., 2025; van Loon et al., 1997). Although evidence regarding wood dust exposure remains inconclusive, recent meta analyses suggest a potential association with lung cancer, particularly small cell lung carcinoma among heavily exposed workers. Evidence about wood dust exposure is mixed, but recent meta analyses suggest an increased risk, particularly for small cell lung cancer among heavily exposed workers (Russell et al., 2025; Tse et al., 2011). These findings underscore the importance of implementing effective occupational health and safety measures, particularly within woodworking, construction, and manufacturing industries. This highlights the need for effective safety measures in woodworking and construction environments (Bhatti et al., 2011).

Given that many risk factors for lung cancer are modifiable, comprehensive public health interventions are essential for disease prevention. Tobacco control policies, smoking cessation programmes, and measures aimed at reducing exposure to second hand smoke have demonstrated significant effectiveness in lowering lung cancer incidence and mortality (Weinstein, 2024; Zhang et al., 2025). Additionally, strategies to reduce ambient air pollution, strengthen occupational safety regulations promote the use of personal protective equipment (PPE), and limit exposure to established carcinogens such as asbestos and silica are critical components of comprehensive lung cancer prevention efforts (Laumbach et al., 2021).

In low- and middle-income countries, including Sri Lanka, evidence regarding occupational and environmental determinants of lung cancer remains limited. Therefore, such research is essential for informing targeted prevention, screening, and early detection initiatives. These measures have the potential to reduce the burden of lung cancer and improve population health outcomes.

Although tobacco smoking is a well-established risk factor for lung cancer, there is limited published evidence from Sri Lanka describing the combined profile of smoking exposure, second-hand smoke exposure, occupational exposures, socio-demographic characteristics, and PPE use among male patients with lung cancer. Male participants were selected because lung cancer attributable to tobacco smoking and occupational exposures is significantly more prevalent among men in Sri Lanka, whereas corresponding evidence among females remains comparatively limited. In particular, evidence from cancer treatment settings in Sri Lanka regarding exposure to cement dust, sawdust, painting materials, and asbestos-related work remains limited. Identifying these exposure patterns is important for strengthening tobacco-control strategies, workplace safety practices, and targeted health education among high-risk occupational groups.

2. METHODOLOGY

Aims and objectives

The main objective of this study was to describe tobacco smoking, selected occupational exposures, and socio-demographic characteristics among male patients with lung cancer at Apeksha Hospital, Sri Lanka.

The specific objectives were:

To describe socio-demographic characteristics of male patients with lung cancer.

To assess tobacco smoking status, pack-years of smoking, and second-hand smoke exposure.

To describe selected occupational exposures, including cement dust, sawdust, painting materials, and asbestos-related work.

To assess PPE use among participants with occupational exposures.

To examine associations between smoking exposure, occupational category, age at diagnosis, education, and income.

Study design & setting

This was a descriptive cross-sectional study conducted among male patients diagnosed with lung cancer. The study was carried out at the Apeksha Hospital, Maharagama, Sri Lanka, the national tertiary referral center for cancer care, which receives patients from across the country. According to hospital records, approximately 14,000 outpatient visits and 6,000 inpatient admissions are recorded annually.

Data Collection

Data collection was conducted from September 2018 to January 2019. Male patients with a primary diagnosis of lung cancer, confirmed by a consultant oncologist and documented in medical records and patients who provided written informed consent were included for the study while male patients with lung cancer who were critically ill and unable to participate in an interview were excluded.

A purposive sampling method was used to recruit eligible participants during the study period. The minimum sample size was calculated using the formula for estimating a population proportion (Lwanga and Lemeshow, 1991). $n=p(1-p)z^2/d^2$; where p was the estimated prevalence of lung cancer in Sri Lanka (0.10), z was the standard normal deviate at the 95% confidence level (1.96), and d was the acceptable margin of error (0.05). the calculated minimum sample size was 138. After allowing for a 20% non-response rate, the required sample size was 166. Due to time and resource constraints, data were collected from 120 participants.

Data collection tool

Data were collected using interviewer administered questionnaire. The questionnaire was developed by the investigators following an extensive review of relevant literature and consisted of both closed ended and open ended questions. It comprised three sections;

1. Socio-demographic characteristics: age, place of residence, religion, ethnicity, marital status, educational level, and economic status
2. Tobacco use and smoking exposure: duration of smoking, age at initiation, quantity and type of tobacco products used, and exposure to second-hand smoke
3. Occupational exposure history: current and past occupations, with specific emphasis on exposure to cement dust, sawdust, painting materials, and asbestos related work, including duration and working hours

The questionnaire was pre tested among 10 male lung cancer patients at Apeksha Hospital who met the same eligibility criteria. Pre testing was conducted one day prior to the main data collection. The purpose was to assess clarity, relevance, acceptability, and time required to complete the questionnaire. Minor modifications were made based on feedback obtained during the pre test.

Data analysis

Data were entered and analysed using the Statistical Package for Social Sciences (SPSS), version 20. Descriptive statistics were used to summarize socio demographic characteristics, smoking behaviors, and occupational exposures. Associations between categorical variables were assessed using the chi-square test, with a p-value <0.05 considered statistically significant and a 95% confidence interval applied. Smoking exposure was quantified using pack -years, calculated using a standardized equation obtained from an online smoking pack-years calculator (De Vita et al., 2019).

Occupational exposure was assessed using self-reported current and previous occupational history. Participants were asked about their main occupation, duration of employment, average working hours per day, and whether they had been exposed to selected occupational agents, including cement dust, sawdust, painting materials, and asbestos-related work. Exposure was recorded as present if the participant reported regular involvement in work related to any of these agents. Participants were further categorized into occupational exposure groups based on their main reported exposure: cement-related work, sawdust/wood-related work, painting-related work, asbestos-related work, or non-related occupations. Information on duration of exposure and use of personal protective equipment was also obtained.

Ethical considerations

Ethical approval was obtained from the Ethics Review Committee of the Faculty of Medicine, General Sir John Kotelawala Defence University (RP/S/2018/23). Administrative permission was obtained from Apeksha Hospital, Maharagama. Written informed consent was obtained from all participants before data collection. Participants were informed about the purpose of the study, voluntary participation, confidentiality, and their right to withdraw from the study at any time without affecting their treatment or care.

Study limitations

Data collection was conducted over a limited period, and the final sample size was smaller than the calculated sample size due to constraints related to time and resources.

3. RESULTS

Socio-demographic characteristics of participants

The mean age of participants was 57.85 years (SD = 11.41), and the mean age at lung cancer diagnosis was 57.64 years (SD = 11.42). Over half of the participants had completed primary education (57.5%), while 27.5% had studied up to the Ordinary Level and 15.0% had completed Advanced Level education. Most participants reported a monthly family income of

LKR 10,000–40,000 (61.7%). The majority of the study population was married (93.3%) (Table 1).

Table 1 - Socio-demographic characteristics

Characteristics		Frequency	Percent %
Educational status	Primary education	69	57.5
	O/L	33	27.5
	A/L and above	18	15.0
Monthly income	<10000	14	11.7
	10000 - 40000	74	61.7
	>40000	32	26.6
Marital status	Married	112	93.3
	Unmarried	6	5.0
	Divorced	2	1.7

Smoking status & selected occupation of participants

The majority are smokers (92.5%). Lung cancer patients who are mostly exposed to secondary smoking in the family and at work show 55% and 62.5%, respectively (Table 2).

Table 2 - Smoking status of the participants

Characteristics		**Frequency**	**Percent %**
Smoker		111	92.5
Non-smoker		9	7.5
Secondary smoking (exposed in family)	Yes	66	55.0
	No	54	45.0
Secondary smoking (exposed in work place)	Yes	75	62.5
	No	45	37.5

28.3% of participants are having an occupation related to cement- related industry (Table 3).

Table 3 - Selected occupation of the participants (n=120)

Occupation	Frequency	Percent %
Cement related industry	34	28.3
Saw dust industry	17	14.2
Painting industry	9	7.5
Asbestos industry	3	2.5
Non-related industry	57	47.5

Table 4 - Association between tobacco smoking status and occupational category

Selected occupational category	Pack years of smoking		χ^2	P
	<40 (%)	>=40 (%)		
Cement	11 (32.5)	23 (67.6)	10.758	0.005
Saw dust,paint and asbestose	13 (44.8)	16 (55.2)		
Non related occupation	38 (66.7)	19 (33.3)		

A statistically significant association was observed between tobacco smoking status, measured using pack-years, and occupational category ($\chi^2 = 10.758$, df =2, p = 0.005). Participants employed in cement-related occupations showed a higher prevalence of heavy smoking exposure (≥40 pack years) compared with those engaged in saw dust, paint, and asbestos related occupations and those in non-related occupations. Conversely, participants in non-related occupations were more likely to report lower smoking exposure (≤40 pack years).

Table 5 - Association between age at lung cancer diagnosis and smoking status

Lung cancer diagnostic age	Pack years of smoking/ <40 n = 62 (%)	Pack years of smoking/>=40 n = 58 (%)	χ^2	P
24-54	15 (38.5)	24 (61.5)	6.876	0.032
54-63	20 (48.8)	21 (51.2)		
64-78	27 (67.5)	13 (32.5)		

There was a significant association between age at lung cancer diagnosis and pack-years of smoking ($\chi^2 = 6.876$, df = 2, p = 0.032). Participants diagnosed at younger ages (24–54 years) were more likely to have higher smoking exposure (≥40 pack-years), whereas those diagnosed at older ages (64–78 years) more frequently reported lower smoking exposure (<40 pack-years).

Association between socio-economic characteristics and age at diagnosis

Monthly income and age at diagnosis

A statistically significant association was identified between monthly family income and age at lung cancer diagnosis ($\chi^2 = 10.67$, df = 4, p = 0.031). Participants diagnosed at younger ages were predominantly from the middle-income group (LKR 10,000–40,000), while a higher proportion of older participants reported monthly incomes exceeding LKR 40,000.

Educational status and age at diagnosis

A significant association was observed between educational attainment and age at lung cancer diagnosis (χ^2 = 29.041, df = 4, $p < 0.001$). Most participants diagnosed between 54–63 years had completed primary education, whereas participants with Advanced Level education or higher were more frequently diagnosed at younger or older age extremes.

Association between educational level and smoking exposure

Educational level was significant associated with pack-years of smoking (χ^2 = 20.829, df = 2, p = 0.001). Participants with lower educational attainment were more likely to have ≥40 pack-years of smoking, while those with Advanced level education or higher predominantly reported <40 pack-years of smoking.

Association between educational status and personal protective equipment use

No statistically significant association was found between educational status and use of personal protective equipment (PPE) (χ^2 = 3.290, df = 2, p = 0.070). overall, PPE utilization was low among participants, with the majority reporting non-use during occupational exposure.

4. DISCUSSION

This study examined the relationship between tobacco smoking and selected occupational exposures among male patients with primary lung cancer at Apeksha Hospital, Sri Lanka. The study achieved a 100% response rate from the 120 participants included. Nearly all participants were smokers (92.5%, n = 111), reflecting the dominant role of tobacco use in lung cancer etiology in this setting.

The high prevalence of smoking in this cohort is consistent with previous findings in Sri Lanka; reported that 91.9% of male lung cancer patients were smokers, and lower educational attainment was significantly associated with smoking risk categories (Chulasiri et al., 2017). Similar observations have been reported internationally where lower socioeconomic status and educational level are independently associated with increased smoking prevalence and poorer health outcomes. For example, a pooled Mendelian randomization analysis found that smoking and education were independently associated with overall lung cancer risk, highlighting the role of education as both a socioeconomic determinant and mediator of smoking behaviors (Kyaw et al., 2024).

The current study identified significant exposure to second-hand smoke, with 55% (n=66) reporting exposure at home and 62.5% (n=75) at the workplace. Meta-analytic evidence supports the association between second-hand smoke exposure and lung cancer risk, showing that exposure increases the relative risk of lung cancer by more than 20% and that risks at home and workplace environments are comparable (Possenti et al., 2024). These findings emphasize that, beyond active smoking, environmental tobacco smoke remains an important risk factor in lung cancer development, even among populations where direct smoking prevalence is high.

Occupational exposures to potential lung carcinogens such as cement, sawdust, painting, and asbestos were present in over half of participants (52.5%, n=63). A significant association between pack-years of smoking and occupational category was observed, suggesting potential synergistic effects between smoking and occupational exposures. Evidence from recent pooled case control studies shows that co-exposures to occupational carcinogens (eg; asbestos, crystalline silica) and smoking can have greater than additive effects on lung cancer risk, underscoring the need for workplace interventions and exposure reduction (Kashefi et al., 2025; Xue et al., 2023). Moreover, meta analysis indicates that combined exposure to silica and smoking significantly increase lung cancer risk among industrial workers (Kashefi et al., 2025).

Consistent with prior epidemiological research, this study found a significant association between lung cancer diagnostic age and smoking status (pack-years). Similar patterns were reported in large cohorts by Yoo, who observed that reductions in smoking intensity and cessation were associated with a lower incidence of lung cancer, supporting the dose response relationship between tobacco exposure and cancer risk (Yoo et al., 2022). These findings strengthen evidence that heavier smoking histories are linked to earlier onset and greater severity of disease.

The study also demonstrated significant associations of cancer diagnostic age with education and income status. Lower education levels were associated with higher smoking exposure and earlier diagnostic age, aligning with global public health data that socioeconomic deprivation correlates with both smoking prevalence and worsened cancer outcomes. Recent international evidence from population studies shows that socioeconomic deprivation and limited access to healthcare are associated with higher incidence and mortality of lung cancer, particularly among marginalized communities (Redondo-Sánchez et al., 2022).

Out of 63 participants from the selected occupations PPE use was reported as 15.9% (n = 10). No significant association was found between education and PPE use. Comparable occupational health research in other settings suggests that lower educational attainment may reduce awareness and utilization of PPE, contributing to increased occupational risk for respiratory diseases. However, it is identified that several occupational and behavioural factors remained the strongest risk factor, while occupational exposures, including asbestos, silica dust, diesel exhaust, and other workplace contaminants, were also found to contribute significantly to disease risk. The findings further suggest that educational attainment may influence awareness and utilization of PPE, thereby affecting occupational exposure levels these results highlight the multifactorial nature of lung cancer and the importance of addressing both behavioural and occupational determinants (Larson and Liverman, 2011; Teym and Zeleke, 2025).

Conclusions and recommendations

This study found that most male patients with lung cancer included in the study had a history of cigarette smoking, and second-hand smoke exposure was also commonly reported at home and at the workplace. More than half of the participants reported at least one selected occupational exposure, with cement-related exposure being the most frequent. Pack-years of smoking were significantly associated with occupational category, age at diagnosis, and educational level. PPE utilization among occupationally exposed participants was low.

These findings highlight the importance of strengthening smoking cessation programmes, reducing second-hand smoke exposure, improving occupational safety education, and promoting PPE use among workers exposed to cement dust, sawdust, painting materials, and asbestos-related work. Further analytical studies with comparison groups and objective occupational exposure measurements are recommended to assess causal relationships between smoking, occupational exposures, and lung cancer risk in Sri Lanka.

5. REFERENCES

American Cancer Society, 2025. Lung Cancer Early Detection | Lung Cancer Screening | American Cancer Society [WWW Document]. URL https://www.cancer.org/cancer/types/lung-cancer/detection-diagnosis-staging/detection.html (accessed 12.29.25).

Bhatti, P., Newcomer, L., Onstad, L., Teschke, K., Camp, J., Morgan, M., Vaughan, T.L., 2011. Wood Dust Exposure and Risk of Lung Cancer. Occup. Environ. Med. 68, 599–604. https://doi.org/10.1136/oem.2010.060004

CDC, 2025. Reducing Risk for Lung Cancer | Lung Cancer | CDC [WWW Document]. URL https://www.cdc.gov/lung-cancer/prevention/index.html (accessed 12.29.25).

Chulasiri, P.U., Gunawardana, N.S., De Silva, A., 2017. Smoking and lung cancer risk in Sri Lankan men: a case-control study. Ceylon Med. J. 62, 25. https://doi.org/10.4038/cmj.v62i1.8429

De Vita, M.J., Maisto, S.A., Ansell, E.B., Zale, E.L., Ditre, J.W., 2019. Pack-Years of Tobacco Cigarette Smoking as a Predictor of Spontaneous Pain Reporting and Experimental Pain Reactivity. Exp. Clin. Psychopharmacol. 27, 552–560. https://doi.org/10.1037/pha0000258

Gregory, A., 2025. Lung cancer diagnoses on the rise among never-smokers worldwide. The Guardian.

Huang, Q., Cheng, Y., Lei, R., Chen, Z., Gu, W., Hemminki, K., Chen, T., 2025. Global burden of lung cancer attributable to occupational asbestos exposure: 1990 to 2021. Environ. Health 24, 84. https://doi.org/10.1186/s12940-025-01217-z

IARC, T.I.A. for R. on, 2025. Global Cancer Observatory [WWW Document]. URL https://gco.iarc.fr/ (accessed 12.29.25).

Kashefi, T., Soleimani, M., Nayebi, M., Soleimani, Y., Fard, M.S.F., Khalilzade, P., Pirani, M., Jarrahi, A.M., 2025. Crystalline Silica Dust and Lung Cancer: A Systematic Review and Meta-Analysis Protocol. Asian Pac. J. Environ. Cancer 20250927–20250927. https://doi.org/10.31557/apjec.2074.20250927

Kyaw, T.W., Tsai, M.-K., Wen, C.P., Shu, C.-C., Su, T.-C., Wu, X., Gao, W., 2024. Impaired lung function and lung cancer risk in 461 183 healthy individuals: a cohort study. BMJ Open Respir. Res. 11, e001936. https://doi.org/10.1136/bmjresp-2023-001936

Larson, E.L., Liverman, C.T., 2011. Using PPE: Individual and Organizational Issues, in: Preventing Transmission of Pandemic Influenza and Other Viral Respiratory Diseases: Personal Protective Equipment for Healthcare Personnel: Update 2010. National Academies Press (US).

Laumbach, R.J., Cromar, K.R., Adamkiewicz, G., Carlsten, C., Charpin, D., Chan, W.R., de Nazelle, A., Forastiere, F., Goldstein, J., Gumy, S., Hallman, W.K., Jerrett, M., Kipen, H.M., Pirozzi, C.S., Polivka, B.J., Radbel, J., Shaffer, R.E., Sin, D.D., 2021. Personal Interventions for Reducing Exposure and Risk for Outdoor Air Pollution: An Official American Thoracic Society Workshop Report. Ann. Am. Thorac. Soc. 18, 1435–1443. https://doi.org/10.1513/AnnalsATS.202104-421ST

Lwanga, S.K., Lemeshow, S., 1991. Sample size determination in health studies: a practical manual. World Health Organization, Geneva.

Pleasants, R.A., Rivera, M.P., Tilley, S.L., Bhatt, S.P., 2020. Both Duration and Pack-Years of Tobacco Smoking Should Be Used for Clinical Practice and Research. Ann. Am. Thorac. Soc. 17, 804–806. https://doi.org/10.1513/AnnalsATS.202002-133VP

Possenti, I., Romelli, M., Carreras, G., Biffi, A., Bagnardi, V., Specchia, C., Gallus, S., Lugo, A., 2024. Association between second-hand smoke exposure and lung cancer risk in never-smokers: a systematic review and meta-analysis. Eur. Respir. Rev. 33, 240077. https://doi.org/10.1183/16000617.0077-2024

Prado, M.G., Kessler, L.G., Au, M.A., Burkhardt, H.A., Zigman Suchsland, M., Kowalski, L., Stephens, K.A., Yetisgen, M., Walter, F.M., Neal, R.D., Lybarger, K., Thompson, C.A., Al Achkar, M., Sarma, E.A., Turner, G., Farjah, F., Thompson, M.J., 2023. Symptoms and signs of lung cancer prior to diagnosis: case–control study using electronic health records from ambulatory care within a large US-based tertiary care centre. BMJ Open 13, e068832. https://doi.org/10.1136/bmjopen-2022-068832

Redondo-Sánchez, D., Petrova, D., Rodríguez-Barranco, M., Fernández-Navarro, P., Jiménez-Moleón, J.J., Sánchez, M.-J., 2022. Socio-Economic Inequalities in Lung Cancer Outcomes: An Overview of Systematic Reviews. Cancers 14, 398. https://doi.org/10.3390/cancers14020398

Russell, A.J., Mundt, K.A., Maier, A., 2025. Risk characterization for silica-related silicosis and lung cancer in communities adjacent to sand and gravel extraction facilities: examining limitations in our current risk methods. Front. Public Health 13, 1558778. https://doi.org/10.3389/fpubh.2025.1558778

Samet, J.M., Avila-Tang, E., Boffetta, P., Hannan, L.M., Olivo-Marston, S., Thun, M.J., Rudin, C.M., 2009. Lung cancer in never smokers: clinical epidemiology and environmental risk factors. Clin. Cancer Res. Off. J. Am. Assoc. Cancer Res. 15, 5626–5645. https://doi.org/10.1158/1078-0432.CCR-09-0376

Teym, A., Zeleke, T.K., 2025. Utilization of personal protective equipment and its key factors among WA oil factory workers in Debre Markos town, Ethiopia. Front. Public Health 13. https://doi.org/10.3389/fpubh.2025.1529436

Tse, L., Yu, I., Au, J., Qiu, H., Wang, X.-R., 2011. Silica dust, diesel exhaust, and painting work are the significant occupational risk factors for lung cancer in nonsmoking Chinese men. Br. J. Cancer 104, 208–13. https://doi.org/10.1038/sj.bjc.6606006

van Loon, A.J., Kant, I.J., Swaen, G.M., Goldbohm, R.A., Kremer, A.M., van den Brandt, P.A., 1997. Occupational exposure to carcinogens and risk of lung cancer: results from The Netherlands cohort study. Occup. Environ. Med. 54, 817–824. https://doi.org/10.1136/oem.54.11.817

Weinstein, D., 2024. Preventing Lung Cancer: Promoting Healthy Lifestyles and Awareness 9.

WHO, 2025. Cancer [WWW Document]. URL https://www.who.int/news-room/fact-sheets/detail/cancer (accessed 1.7.26).

Winship Cancer Institute of EMory University, 2022. Lung Cancer Prevention | Winship Cancer Institute of Emory University [WWW Document]. URL https://winshipcancer.emory.edu/cancer-types-and-treatments/lung-cancer/prevention.php (accessed 12.29.25).

Xue, Y., Miao, L., Xu, P., Yang, X., Qu, M., Lai, H., Xue, Y., Miao, L., Xu, P., Yang, X., Qu, M., Lai, H., 2023. Potential Effect of Combined Exposure of Crystalline Silica Dust and Cigarette Smoking on the Incidence of Silicosis among Chinese Male Stone Processing Workers: A Cross-Sectional Study. Healthcare 11. https://doi.org/10.3390/healthcare11162260

Yoo, J.E., Han, K., Shin, D.W., Jung, W., Kim, D., Lee, C.M., Kwon, H., Jung, K.-W., Song, Y.-M., 2022. Effect of smoking reduction, cessation, and resumption on cancer risk: A nationwide cohort study. Cancer 128, 2126–2137. https://doi.org/10.1002/cncr.34172

Zhang, Y., Wang, W., Dai, K., Huang, Y., Wang, R., He, D., He, J., Liang, H., 2025. Global lung cancer burden attributable to air fine particulate matter and tobacco smoke exposure: spatiotemporal patterns, sociodemographic characteristics, and transnational inequalities from 1990 to 2021. BMC Public Health 25, 1260. https://doi.org/10.1186/s12889-025-22450-8