RESEARCH ARTICLE OPEN ACCESS

Lung Cancer Landscape in Thailand: Unraveling Trends, Risks, and Urgent Interventions for Thai Teenagers

Napongphop Enguthaiwat
Mahidol Wittayanusorn School, Nakhon Pathom, Thailand
Email : napongphop.c@gmail.com

----------**********----------

Abstract:

Background: Lung cancer presents a formidable global health challenge, with projections indicating a surge in new cases, particularly in developing countries. In Thailand, the prevalence of lung cancer, especially in the northern region, is expected to rise, driven by factors such as smoking rates and seasonal air pollution.

Objective: This review aims to analyze risk factors contributing to lung cancer in Thailand, focusing on the vulnerability of Thai teenagers. The study explores the multifaceted etiology of lung cancer, emphasizing the role of smoking, marijuana use, electronic cigarettes, exposure to asbestos, radon gas, lung-related conditions, air pollution, and gender differences.

Study Methods: A comprehensive analysis of existing literature, national cancer registry data, and substance use studies in Thailand forms the basis of this research. The objective is to provide valuable insights into the risk factors contributing to lung cancer and substance use trends, particularly among Thai teenagers.

Result: The findings underscore the intricate nature of lung cancer development, emphasizing the heightened vulnerability of Thai teenagers. Factors such as the prevalence of smoking, early initiation of risky behaviors, regional disparities, and the impact of cannabis legalization contribute to the concerning landscape. The study calls for targeted interventions, including anti-smoking campaigns, educational programs, and strengthened law enforcement, to mitigate the risks and raise awareness about the critical importance of preventing lung cancer among Thai teenagers.

Conclusion: the study provides valuable insights into the multifaceted nature of lung cancer and substance use in Thailand, emphasizing the importance of a comprehensive approach to healthcare planning and intervention strategies.

Keywords **—lung cancer, risk factors, prevention, Thailand, teenagers**

----------**********----------

Introduction

Lung cancer stands as a formidable global public health challenge, gaining particular prominence within the broader cancer landscape. The World Health Organization (WHO) anticipates a surge in new cancer cases, projecting 24 million by 2030, with lung cancer contributing significantly to the estimated 12.9 million cancer-related deaths worldwide. This upward trend is particularly evident in developing countries, where urbanization-induced lifestyle changes play a role in the rising incidence of lung cancer.[1],[2] In Thailand, lung cancer emerges as the leading cancer among the top five, with projections indicating a 14% increase in new cases for males and 4.8% for females over the next decade, signaling a concerning trajectory.[3] Notably, the prevalence of lung cancer is higher in individuals aged 50-75, especially in the northern region, attributed to elevated smoking rates and seasonal air pollution issues. Despite

advancements in chemotherapy, the 5-year survival rate for lung cancer patients in Thailand is 78%, while only 25% survive beyond five years post-diagnosis.[4]

Cigarette smoking remains the primary risk factor, with a persistent rise in adolescent smoking rates. Beyond smoking, factors such as chronic obstructive pulmonary disease (COPD), family history, and exposure to carcinogenic substances contribute to lung cancer risk. This review aims to analyze factors related to patient mortality and explore preventive measures to enhance public awareness and curb the escalating incidence and mortality rates associated with lung cancer.[5]

Lung Cancer

Lung cancer refers to the uncontrolled abnormal growth of lung cells, often leading to the potential spread of the disease to other regions. This condition is generally classified into two main types: Small Cell Lung Cancer (SCLC) and Non-Small Cell Lung Cancer (NSCLC), with the latter being more prevalent.[6],[7],[8]

Risk Factors

The development of lung cancer is closely associated with prolonged irritation of the cells lining the bronchial tubes. Various risk factors contribute to this condition, affecting both smokers and non-smokers. The primary factors are as follows.[9]

(1) Smoking is a major cause of lung cancer, accounting for as much as 80-90% of cases. Smoking induces changes in bronchial tube cells, leading to the mutation into cancer cells. Individuals who smoke have a significantly higher risk of lung cancer compared to non-smokers, with the risk increasing by more than 10 times for those who smoke regularly. People in close proximity to regular smokers also face a higher risk, at least twice that of the general population. If individuals quit smoking, the risk of lung cancer gradually decreases, but it takes more than 10 years for the risk to approach that of non-smokers.[10] Cigarettes contain approximately 4000 different compounds, with no fewer than 42 known carcinogens. Some significant hazardous substances include nicotine, a substance that causes addiction directly affecting the brain as a stimulant and a central nervous system depressant. In small amounts, like smoking 1-2 cigarettes, it can stimulate the body, causing alertness. However, smoking multiple cigarettes can depress the central nervous system, leading to dulled sensations. About 95% of nicotine binds to lung tissue, some on the lining of the mouth, and some is absorbed into the bloodstream, directly affecting the adrenal glands, causing the release of epinephrine, leading to increased blood pressure, abnormal heart rate, and vasoconstriction in the arteries of the arms and legs. Smoking one cigarette contains 0.8-1.8 milligrams of nicotine (standardized at 1 milligram). Filtered cigarettes do not significantly reduce nicotine content, and nicotine is a major contributor to smoking addiction, influencing smoking behavior and contributing to the development of lung cancer.[11]

(2) Marijuana smoking has a higher potential to cause cancer than smoking cigarettes. While the smoke from marijuana is similar to cigarette smoke, it contains more than twice the amount of polyaromatic hydrocarbons, which are potent carcinogens. Smoking marijuana is often done without a filter, leading to a higher accumulation of cancer-causing substances in the respiratory tract compared to smoking an equivalent amount of cigarettes. Several studies indicate abnormalities in the respiratory tract cells of individuals who smoke marijuana.[12] Furthermore, marijuana also contains increased levels of benzopyrene and benzo[a]pyrene, approximately 50% and 75% more, respectively, along with phenol, vinyl chloride, nitrosamines, and oxygen-reactive compounds compared to cigarettes. Smoking marijuana tends to result in the accumulation of tar at a higher rate than smoking cigarettes, making it a contributing factor to an elevated risk of lung cancer.[13],[14]

(3) Electronic Cigarettes (E-cigarettes), sometimes referred to as e-cigs, vapes, e-hookahs, vape pens, or electronic nicotine delivery systems (ENDS), are popular among young people, particularly students. The

usage has increased significantly since 2011, with students using e-cigarettes rising from 1.5% in 2011 to 20.8% in 2018. There are several confirmed and potential carcinogens present in e-cigarettes, including nicotine, hydrocarbons, heavy metals, and aldehydes/other organic compounds. These substances are found in the liquid for e-cigarettes and result from combustion within the e-cigarette device (including carcinogens like formaldehyde, which arises from glycerol combustion). Various studies indicate that these substances have the potential to alter and damage cells.[15]

The Food and Drug Administration has not found electronic cigarettes to be safe or effective in helping smokers quit. Quitting smoking should involve consultation with a healthcare professional and the use of methods approved by the Food and Drug Administration.[16]

(4) Tar in cigarette smoke is composed of various substances, appearing as a brown, sticky residue. It contains carcinogens that can lead to various cancers, such as lung cancer, laryngeal cancer, bronchial tubes, esophagus, kidneys, bladder, and more. Approximately 50% of tar inhaled goes to the lungs, contributing to respiratory irritation, persistent coughing, and increased mucus production. Individuals smoking one pack a day receive about 30 milligrams of tar. Tar is a significant factor in the elevated risk of lung cancer associated with cigarette smoking, as it contains hydrocarbons that transform into cigarette smoke components, exposing both smokers and passive smokers to the harmful effects of tar.[17]

(5) Radioactive substance - Cigarette smoke contains Polonium-210, a radioactive substance emitting alpha particles. The smoke from cigarettes contains Polonium-210, emitting alpha radiation. The radioactive nature of this substance is one of the causes of lung cancer. Cigarette smoke is also a significant carrier of Polonium-210, exposing non-smokers to this radioactive substance. Polonium-210, emitting alpha radiation, is considered a toxic substance that contributes to the development of lung cancer due to the stimulation it causes in the respiratory system when inhaled through cigarette smoke.[11],[17]

(6) Asbestos Exposure: Asbestos is a fibrous mineral composed of magnesium, iron, silica, and other elements. It has fine thread-like characteristics with special properties such as fire resistance, heat insulation, electrical resistance, and flexibility. It can be spun into threads and woven into fabric, and it is resistant to acids and bases. Asbestos is used as a component in various products, including construction materials (roofing tiles, flat sheets, ceiling tiles), cement pipe manufacturing, rubber tile production, heat-insulating brake linings, and textile industries. Generally, products made from asbestos are not harmful if they are in good condition. However, they can become hazardous and carcinogenic when the products are damaged, cut, sawed, or improperly handled. Asbestos fibers may be released into the air and, if inhaled, can pose health risks, particularly when products like heat-resistant underroofing sheets, commonly found in buildings, are disturbed. The release of asbestos fibers into the air occurs when products made from asbestos are damaged, cut, or manipulated incorrectly. Consequently, individuals in proximity may breathe in asbestos fibers, leading to potential health risks.[18]

This can significantly increase the risk of lung cancer, up to 5 times more than the general population. Additionally, it can lead to mesothelioma, especially among those who smoke. Individuals who smoke are up to 90 times more likely to develop lung cancer than non-smokers. Other substances that may contribute to lung cancer include radon, nickel, chromium, and air pollution.[19]

When you breathe in, the fibers accumulate and persist in the lung tissue. The embedded fibers cause continuous damage to lung cells and disrupt the ongoing cellular repair mechanism. This leads to inflammation, fibrosis, and can eventually progress to the development of cancerous cells in the lung tissue.[18]

(7) Radon Gas is considered a second-ranking risk factor for lung cancer after smoking, is a radioactive gas originating from the natural decay of uranium-238, thorium-232, and radium-226 in the Earth's crust. It is one of the radioactive progeny in the uranium decay series, produced during the use of Earth's crust resources like rocks and soil in construction materials. Inadequate ventilation in buildings can lead to indoor radon accumulation, posing health risks for inhabitants exposed to higher concentrations of this

colorless, odorless, and tasteless gas. When inhaled, radon undergoes radioactive decay, emitting alpha radiation and transforming into subsequent radioactive elements until it stabilizes into lead. This accumulation of stable lead in lung air sacs cannot be expelled, raising the risk of lung cancer due to both alpha radiation and lead toxicity. The hazardous level for radon gas concentration is 148 Bq/m3 and above, with global indoor concentrations averaging around 40 Bq/m3 and outdoor concentrations around 10 Bq/m3. Measurement methods commonly include CR39 film detectors and RAD7 electronic radon monitors.[20],[21],[22]

(8) Lung-related Conditions: individuals who have experienced lung-related conditions such as pulmonary tuberculosis or emphysema face a higher risk of developing lung cancer compared to the general population. Notably, reports highlight an increased occurrence of lung cancer in patients with specific lung diseases. For example, those with idiopathic interstitial pulmonary fibrosis are more susceptible to adenocarcinoma, and individuals with sarcoidosis exhibit a threefold increased risk of lung cancer. Former tuberculosis patients also demonstrate an elevated likelihood of adenocarcinoma. Moreover, individuals with chronic obstructive pulmonary disease (COPD) face a heightened risk of lung cancer, potentially attributed to changes in airways leading to prolonged exposure to carcinogenic substances in cigarettes. Additionally, diseases caused by inhaling mineral particles into the lungs, such as pulmonary silicosis, can also increase lung cancer risk. Infections, particularly with human papillomavirus (HPV) and mycobacterial infections, are linked to an increased risk of lung cancer. Research from Taiwan indicates that women with a history of HPV infection, particularly HPV 16 and 18, have an elevated likelihood of developing lung cancer. Although infection with Chlamydia pneumonia is not directly associated with cancer, it is a common respiratory infection. The inflammation resulting from this infection can lead to DNA damage, cellular injury, and impaired repair processes, potentially contributing to genetic mutations and cancer development.[17],[22]

(9) Air Pollution: The World Health Organization (WHO) reveals that 14% of lung cancer cases stem from outdoor air pollution, while 17% result from indoor air pollution. Adenocarcinoma lung cancer is often linked to pollutants from external sources. The risk of lung cancer rises with exposure to air pollution, particularly prolonged contact with PM 2.5 particles, particles smaller than 2.5 micrometers. Studies indicate a 1.3 times increased risk when PM 2.5 exposure surpasses 10 micrograms per cubic meter. These tiny particles, comprising black carbon, metals, nitrate, sulfate, and polycyclic aromatic hydrocarbons, can easily infiltrate the smallest airways, contributing to the accumulation of toxins in the lungs. PM 2.5 is associated with heightened mortality rates and the increased spread of lung cancer.

The mechanism of PM 2.5 leading to lung cancer involves several key processes. PM 2.5 stimulates oncogenes, triggers gene mutations, and induces cellular changes that result in the production of cytokines, inflammatory processes, and the formation of new blood vessels. These changes are associated with cancer growth and the spread of cancer cells.[23],[24],[25]

(10) Gender Differences: Recent research suggests that females have a higher risk of developing lung cancer than males. Genetic factors, lower DNA repair capabilities, and higher mutations of certain genes contribute to this increased susceptibility.[22],[23]

(11)Other Factors: Increasing age, substance use (such as cocaine), vitamin deficiencies, and genetic factors also play a role in the risk of lung cancer. A family history of lung cancer, especially diagnosed before the age of 65, elevates the risk.[7],[22],[26],[27]

Trend of population affected by cancer and death

The trends in lung cancer incidence and mortality in Thailand reveal significant numbers and regional variations. Annually, there are approximately 17,222 new cases of lung cancer, affecting 10,766 males and 6,456 females. The toll on lives is substantial, with 14,586 individuals succumbing to the disease each year, translating to an average of 40 deaths per day. When considering the distribution across provinces,

certain areas show a higher prevalence of lung cancer cases per 100,000 population. Notably, Lampang leads with 45 cases per 100,000, followed by Chiang Mai with 41, and Nan with 38. In contrast, Pattani exhibits the lowest incidence, with only 6 cases per 100,000, while Bangkok reports 24 cases per 100,000 people. These regional variations highlight the diverse landscape of lung cancer prevalence in different parts of Thailand.[28]

Lung Cancer Prevention

Preventing lung cancer involves adopting a proactive approach and making lifestyle choices that contribute to overall well-being. Here are key measures to reduce the risk of lung cancer:

1. Quit Smoking: The most significant preventive step is to quit smoking, including the use of e-cigarettes. Additionally, minimizing exposure to secondhand smoke is crucial for overall lung health.
2. Avoiding Environmental Hazards: Steer clear of places with high air pollution, such as areas with elevated smoke levels or working in mines without proper personal protective equipment. Being mindful of your environment helps reduce exposure to potential carcinogens.
3. Choose Clean Air Environments: Opt for locations with clean air to minimize respiratory risks. Ensuring the air quality in your surroundings contributes to lung health and overall well-being.
4. Routine Health Check-ups: Regular health check-ups play a pivotal role in early detection and prevention. Timely screenings and medical assessments can identify potential risks and allow for proactive management.
5. Physical Activity and Nutrition: Engage in regular exercise and maintain a balanced, nutritious diet. A healthy lifestyle supports the immune system and helps keep the body strong and resilient.
6. Environmental Safety: Periodically inspect your home environment for toxins or gases that could pose health risks. Identifying and addressing potential hazards contribute to a safer living space.

By incorporating these preventive measures into daily life, individuals can significantly reduce their susceptibility to lung cancer. These strategies, coupled with regular health monitoring, contribute to overall lung health and well-being.[27],[29],[30]

Landscape of substance use in Thailand

This study researched into the intricate landscape of substance use in Thailand, examining diverse facets such as smoking behaviors, the repercussions of cannabis legalization, incidents of substance use among the youth, and growing concerns surrounding electronic cigarette use. Examining data from the National Statistical Office in 2560 BE, the study reveals a smoking prevalence of 19.1% among individuals aged 15 and above, with persistent risky behaviors among adolescents.[31] Regional disparities in smoking rates underscore Kamphaeng Phet's position with the highest smoking rate in the northern region.The study further examines gender-specific patterns, revealing a continuous increase in smoking rates among females from 2007 to 2014, particularly in the adolescent age group.[32] A concerning trend emerges in the average age of smoking initiation, decreasing across all age groups, with adolescents experiencing a significant drop [33]. The study also sheds light on the aftermath of cannabis liberation, expressing concerns about increased accessibility. A real-world incident involving marijuana consumption highlights the societal implications of substance use among the youth.[34] Additionally, the prevalence of electronic cigarette use among Thai youth is explored, with urgent calls for governmental intervention to address inadequacies in enforcing control laws.[35],[36] This comprehensive analysis underscores persistent challenges and provides insights for targeted interventions in various aspects of substance use in Thailand.

Thai Teenagers are at risk

Thai teenagers are at an elevated risk of developing lung cancer, primarily due to a complex interplay of behavioral, societal, and environmental factors. The prevalence of smoking, with a notable 19.1% among

individuals aged 15 and above, sets the stage for increased lung cancer risk. Teenagers, influenced by peer pressure and societal norms, are particularly vulnerable, with regional disparities highlighting areas like Kamphaeng Phet with the highest smoking rates. The continuous rise in smoking rates among females, especially in the adolescent age group, adds to the concerns. Early initiation of smoking, regional variations, and the aftermath of cannabis liberation further compound the risks. Additionally, the prevalence of electronic cigarette use among Thai youth, coupled with inadequacies in control laws, contributes to the overall landscape of substance-related risks. Tackling these issues demands a comprehensive strategy, encompassing anti-smoking campaigns, educational initiatives, strict law enforcement, and increased awareness about the hazards of substance use, including electronic cigarettes.

Conclusion

The increasing incidence of lung cancer poses a significant global public health challenge, with projections indicating a surge in new cases, especially in developing countries. In Thailand, lung cancer is anticipated to rise, particularly in the northern region, emphasizing the role of smoking rates and seasonal air pollution. Despite advancements in chemotherapy, the survival rates for lung cancer patients in Thailand remain a concern. The review identified several risk factors contributing to lung cancer, with cigarette smoking standing as the predominant cause, accounting for 80-90% of cases. Other contributors include marijuana smoking, electronic cigarettes, exposure to asbestos, radon gas, lung-related conditions, air pollution, gender differences, and various environmental and genetic factors. These findings underscore the multifaceted nature of lung cancer etiology, necessitating a comprehensive approach to prevention and intervention. Preventive measures are crucial in mitigating the escalating incidence and mortality rates associated with lung cancer. Key strategies include smoking cessation, avoiding environmental hazards, choosing clean air environments, routine health check-ups, maintaining a healthy lifestyle, and addressing potential toxins in the home environment. The comprehensive analysis of lung cancer trends, risk factors, and preventive measures in Thailand sheds light on the significant challenges faced by the population, with a particular emphasis on the vulnerability of Thai teenagers to developing lung cancer. The prevalence of smoking, both traditional and marijuana, along with the increasing use of electronic cigarettes, underscores the urgent need for targeted interventions. The intricate landscape of substance use, coupled with regional disparities and early initiation of risky behaviors among adolescents, paints a concerning picture for the future health of Thai youth. Efforts to reduce these risks should involve multifaceted strategies, including rigorous anti-smoking campaigns, educational programs addressing the dangers of substance use, and strengthened law enforcement to curb access to harmful substances. Additionally, promoting clean air environments, routine health check-ups, and a focus on physical activity and nutrition can contribute to reducing lung cancer susceptibility among Thai teenagers. It is imperative for policymakers, healthcare professionals, educators, and communities to collaborate in fostering a healthier environment and raising awareness about the critical importance of preventing lung cancer among the vulnerable teenage population in Thailand.

References

[1] Cancer Tomorrow [Internet]. Lyon: International Agency for Research on Cancer; c1965-2024. Estimated number of new cases from 2020 to 2040, Incidence, Both sexes, age [0-85+] All cancers; 2024 [cite 2023 Nov 25]. Available from: https://gco.iarc.fr/tomorrow/en/dataviz/tables?cancers=39&years=2030

[2] Cancer Tomorrow [Internet]. Lyon: International Agency for Research on Cancer; c1965-2024. Estimated number of deaths from 2020 to 2030, Both sexes, age [0-85+] All cancers; 2024 [cite 2023 Nov 25]. Available from: https://gco.iarc.fr/tomorrow/en/dataviz/bubbles?years=2030&types=1&mode=population&group_populations=1&multiple_cancers=0&multiple_populations=1&single_unit=500000

[3] Khuhaprema T, Attasara P, Sriplung H, Wiangnon S, Sangrajrang S, editors. Cancer in Thailand Volume VII, 2007-2009 [Internet]. Bangkok: National Cancer Institute; 2013 [cited 2023 Nov 27]. Available from: https://www.nci.go.th/th/File_download/Nci%20Cancer%20Registry/Cancer%20in%20thailand_VII.pdf

[4] American Lung Association [Internet]. Illinois: American Lung Association; c2024. Lung Cancer Trends Brief: Additional Measures; 2020 [cite 2023 Nov 27]. Available from: https://www.lung.org/research/trends-in-lung-disease/lung-cancer-trends-brief/lung-cancer-additional-measures

[5] Thai PBS [Internet]. Bangkok: Thai Public Broadcasting Service; c2024. The research center reveals that the smoking rate among 15-18 yearolds increased by 9.2 percent ;2012 [cite 2023 Nov 27]. Available from: https://www.thaipbs.or.th/news/content/120128
[6] Bangpakok Hospital 3 [Internet]. Bangkok: Bangpakok Hospital; c2019. "Lung cancer" is possible if you don't smoke; 2022 [cite 2023 Nov 30]. Available from: https://www.bangpakok3.com/care_blog/view/156
[7] Lung and me [Internet]. Bangkok: Thai Lung Cancer Group; c2020. Lung cancer is caused by what? ; 2020 [cite 2023 Nov 30]. Available from: https://www.lungandme.com/story-from-doctors/5
[8] Centers for Disease Control and Prevention [Internet]. Georgia: Centers for Disease Control and Prevention; 2023. What Is Lung Cancer? ; 2023 [cite 2023 Nov 30]. Available from: https://www.cdc.gov/cancer/lung/basic_info/what-is-lung-cancer.htm
[9] American Lung Association [Internet]. Illinois: American Lung Association; c2024. Lung Cancer Causes & Risk Factors; 2022 [cite 2023 Dec 2]. Available from: https://www.lung.org/lung-health-diseases/lung-disease-lookup/lung-cancer/basics/what-causes-lung-cancer
[10] Thandra KC, BarsoukA, Saginala K, Aluru JS, Barsouk A. Epidemiology of lung cancer. Contemp Oncol (Pozn). 2021; 25(1): 45-52.
[11] Centers for Disease Control and Prevention. How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General [Internet]. Atlanta (GA): Centers for Disease Control and Prevention (US); 2010 [cited 2023 Dec 2]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK53018/
[12] Aldington S, Harwood M, Cox B, Weatherall M, Beckert L, Hansell A, et al. Cannabis use and risk of lung cancer: a case–control study. European Respiratory Journal. 2008; 31: 280-286.
[13] National Institute on Drug Abuse [Internet]. : National Institute on Drug Abuse; 2020. annabis (Marijuana) Research Report What are marijuana's effects on lung health? ; 2020 [cite 2023 Dec 4]. Available from:https://nida.nih.gov/publications/research-reports/marijuana/what-are-marijuanas-effects-lung-health
[14] Mayo Clinic Health System [Internet]. Wisconsin: Mayo Clinic Health System; c2018-2023. Does smoking marijuana increase lung cancer risk? ; 2023 [cite 2023 Dec 4]. Available from: https://www.mayoclinichealthsystem.org/hometown-health/speaking-of-health/marijuana-and-lung-cancer-risk
[15] Bracken-Clarke D, Kapoor D, Baird AM, Buchanan PJ, Gately K, Cuffe S, et al. Vaping and lung cancer - A review of current data and recommendations. Lung Cancer. 2021; 153: 11-20.
[16] American Lung Association [Internet]. Illinois: American Lung Association; c2024. The Impact of E-Cigarettes on the Lung; 2023 [cite 2023 Dec 4]. Available from: https://www.lung.org/quit-smoking/e-cigarettes-vaping/impact-of-e-cigarettes-on-lung
[17] Ragavan M, Patel MI. The evolving landscape of sex-based differences in lung cancer: a distinct disease in women. European Respiratory Review. 2022; 31: 210100.
[18] National Cancer Institute. Indoor air pollution [Internet]. Bangkok: National Cancer Institute; [n.d.] [cite 2023 Dec 10]. Available from: https://www.nci.go.th/en/Knowledge/download/4.pdf
[19] American Cancer Society [Internet]. Georgia: American Cancer Society; c2024. Asbestos and Cancer Risk; 2023 [cite 2023 Dec 10]. Available from: https://www.cancer.org/cancer/risk-prevention/chemicals/asbestos.html
[20] National Cancer Institute [Internet]. Maryland: National Cancer Institute; 2011. Radon and Cancer ; 2011 [cite 2023 Dec 10]. Available from: https://www.cancer.gov/about-cancer/causes-prevention/risk/substances/radon/radon-fact-sheet
[21] Chulalongkorn University [Internet]. Bangkok: Chulalongkorn University; 2023. “Radon gas” is a lung cancer-causing substance nearby. Chula engineering professor suggests ways to prevent it; 2023 [cite 2023 Dec 10]. Available from: https://www.chula.ac.th/highlight/97284/
[22] Dela Cruz CS, Tanoue LT, Matthay RA. Lung Cancer: Epidemiology, Etiology, and Prevention. Clinics in Chest Medicine. 2011; 32(4): 605-644.
[23] Baldacci S, Maio S, Meschi C, Chimera D, Tagliaferro S, Angio AA, et al. A narrative review of epidemiology and prevention of lung cancer: sex/gender difference?. Precis Cancer Med. 2022; 5: 23.
[24] Niyomthong P. Lung cancer can be prevented with knowledge. Journal of the Phrae Hospital [Internet]. 2018 [cite 2023 Dec 14]; 26(1): 61-80. Available from: https://thaidj.org/index.php/jpph/article/view/7062/6547
[25] Li R, Zhou R, Zhang J. Function of PM2.5 in the pathogenesis of lung cancer and chronic airway inflammatory diseases. Oncol Lett. 2018; 15(5): 7506-7514.
[26] Chulalongkorn University [Internet]. Bangkok: Chulalongkorn University; 2023. Doctors at Chulalongkorn University point out that "lung cancer" can be cured if you understand it, detect it early, and treat it in a timely manner; 2023 [cite 2023 Dec 15]. Available from: https://www.chula.ac.th/highlight/118356/
[27] RAMA Channel [Internet]. Bangkok: Ramathibodi Hospital; c2023. Lung cancer is treatable and not as scary as you think; 2023 [cite 2023 Dec 15]. Available from: https://www.rama.mahidol.ac.th/ramachannel/article/โรคมะเร็งปอด-รักษาได้ไม/
[28] The Agenda Agency [Internet]. Bangkok: The Agenda Co.,ltd.; 2022. How much lung cancer is there in each province? ; 2022 [cite 2023 Dec 17]. Available from: https://www.agenda.co.th/social/lung-cancer-thailand/
[29] National Cancer Institute [Internet]. Maryland: National Cancer Institute; 2023. Lung Cancer Prevention (PDQ®)–Patient Version ; 2023 [cite 2023 Dec 17]. Available from: https://www.cancer.gov/types/lung/patient/lung-prevention-pdq
[30] Siriraj Piyamaharajkarun Hospital [Internet]. Bangkok: Siriraj Piyamaharajkarun Hospital; c2023. Lung cancer at every stage can be treated; 2022 [cite 2023 Dec 20]. Available from: https://www.siphhospital.com/th/news/article/share/lung-cancer
[31] Intuluck W. The Factors affecting the Choice of Conventional and Electronic Cigarettes among Adolescent Students in the Central Region of Thailand. Journal of Public and Private Management. 2023; 30(1): 37- 52.
[32] Ratchasap W, Praphuetthoi N, Thongphichit A, Deemek P. Smoking Behavior of Adolescents Kamphaengphet [Internet]. [cite 2023 Dec 23]. Available from: https://research.kpru.ac.th/research2/pages/filere/3532020-01-10.pdf
[33] Mahasuan S, Homsin P, Srisuriyawet R. Factors Related to Smoking Initiation among Female Vocational Students in Chachoengsao Province. Journal of Public Health Nursing. 2018; 32(1): 29-44.
[34] Thairath [Internet]. Bangkok; TREND VG3 CO., LTD: 2023. Cannabis policy #saidanddone in the Pheu Thai government, moving forward or turning it into a drug?; 2023 [cite 2023 Dec 23]. Available from: https://plus.thairath.co.th/topic/politics&society/103652
[35] Vutiso P, PhattharasirisombooP, Rodrungse B. Factors predicting smoking behavior among adolescents at Mueang District in Chaiyaphum Province. Thai Journal of Nursing. 2022; 71(1): 1-9.
[36] Meetawon J, Kiatrungrit K, Hongsanguansri S, Pipattanachat V. The Factors Associated with Persistent Smoking in Adolescents. J Psychiatr Assoc Thailand. 2022; 67(1): 21-34.

