

Knowledge and Awareness of Chronic lower respiratory diseases among smokers population in Chennai, India: A cross sectional questionnaire survey

Abstract

Introduction: Tobacco is a key toxin in our civilization. Tobacco use and smoking is currently one of the leading causes of death and morbidity in both developed and developing nations. Tobacco is made from a plant native to South America, specifically Peru and Ecuador. Tobacco was originally brought to Europe from America in the fourteenth century for medical purposes.

Aim: To analyse the knowledge and awareness of chronic lower respiratory diseases among the smoker population.

Materials and Methods: The study to evaluate Knowledge and Awareness of chronic lower respiratory diseases among smokers population in Chennai, India. The targeted population for the study was 110 individuals within the age groups of 18-30. In this study, there was a formulation and distribution of a survey/ questionnaire, which was conducted among the students. The questionnaire consisted of twelve general questions to test not only their knowledge but also their awareness of the issue. Only completely filled online forms were included in the study. The filled responses were verified by two reviewers and the collected data was entered on the same day. The entered data was analysed using SPSS. Pearson Chi-square was performed to calculate frequencies of categorical variables.

Results: Symptoms cannot be seen and do not show up on medical tests. Some examples of symptoms are headache, fatigue, nausea and pain vary from each illness and diseases. 60% responded with their current symptoms as shortness of breath, 35% with coughing, 1.67% experiencing wheezing, 3.33% with lack of energy. Pearson Chi-square value was calculated, with values being statistically significant (p value is 0.000).

Conclusion: Smoking is clearly linked to systemic illnesses such as cardiovascular disease, lung problems, and various cancers. Smoking is proven to be harmful to mothers and children in particular. Cigarette smoking has a detrimental impact on the oral cavity.

Keywords: chronic respiratory disease, smokers, innovative technique, cardiovascular disease.

Introduction

Tobacco is a key toxin in our civilization. Tobacco use and smoking is currently one of the leading causes of death and morbidity in both developed and developing nations. Tobacco is made from a plant native to South America, specifically Peru and Ecuador (1). Tobacco was originally brought to Europe from America in the fourteenth century for medical purposes. It was afterwards burned in pipes for pleasure on a huge scale in England for over 100 years, and then across Europe and the rest of the world (2). Between the two

world wars, pipe smoking gave place to the use of tobacco as snuff, then cigars and cigarettes, which differed by nation, until cigarette smoking became the prevalent form in most industrialized countries (2,3).

Tobacco kills 5 million people per year, with estimates that by mid-2022, that number would have risen to over 10 million, making it the leading cause of death in developing nations. Around the world, about 1.1 billion people (or 29% of the adult population) smoke cigarettes. Cigarette smoke has a complex matrix with about 3800 chemicals that consists of a gas phase and a particle phase (4). 60 of these chemicals have been proven to be carcinogenic in animals, while 15 have been proven to be carcinogens in humans (5). Polycyclic aromatic hydrocarbons, aldehydes, arsenic, nickel, and cadmium are some of the carcinogens present in cigarette smoke. Smoking is harmful not just to smokers, but also to others around them (6).

Cigarette smoking is now proven to be positively related with approximately 40 illnesses and causes of death, while being adversely associated with eight or nine (6,7). Positive correlations can be partially or completely owing to confounding, although the most majority have been demonstrated to be causal. Cigarette smoking cuts life expectancy by 7 years on average, while tobacco use cuts disease-free life by 14 years (8).

Carbon monoxide, arsenic, cadmium, cobalt, and polycyclic aromatic hydrocarbons are the most hazardous chemicals found in cigarette smoke. Carboxyhaemoglobin is formed when carbon monoxide binds to haemoglobin, and it is a significant cause of hypoxia and vascular accidents. Smokers are also more likely than non-smokers to develop a peptic ulcer (9). Other potentially deadly illnesses linked to smoking include respiratory heart disease, pneumonia, aortic aneurysm, and ischemic heart disease, all of which are among the leading causes of mortality in industrialised nations (9,10).

Women are more vulnerable to the harmful consequences of smoking than males. Women confront unique risks in addition to the basic health issues that both genders encounter. The foetus being exposed to mother smoking is one example of this scenario (10). The foetus can be seriously harmed or perhaps killed if the mother is exposed to environmental tobacco smoke (ETS) (11). Spontaneous miscarriage, ectopic pregnancy, intrauterine growth retardation, premature membrane rupture, pre-term delivery, retroplacental haematoma, placenta praevia, and abrupt infant mortality are all risks associated with such exposure (12). Children, like women, are most susceptible throughout their first year of life. Their exposure to tobacco smoke in the environment, often known as passive smoking, can have significant short- and long-term health consequences (13). Passive smoking has been linked to an increased risk of chronic middle ear effusion, asthma attacks, and pulmonary function abnormalities in children (14). Respiratory infections, pneumonia, and bronchiolitis are more common in children whose parents smoke. Passive smoking can cause persistent cough, wheezing, runny nose, and frequent sneezing in children (15). Passive smoking exposure throughout childhood raises a child's risk of leukaemia and lymphoma later in life. It has been observed that mother smoking throughout children increases the likelihood of a kid becoming a young adult smoker (16,17). The aim of the study was to assess the knowledge and awareness of chronic lower respiratory diseases among the smoker population in Chennai.

Materials and Methods

The study to evaluate knowledge and awareness of chronic lower respiratory diseases among smokers population in Chennai, India. The targeted population for the study was 110 individuals within the age groups of 18-30. In this study, there was a formulation and distribution of a survey/ questionnaire, which was conducted among the students. The questionnaire consisted of twelve general questions to test not only their knowledge but also their awareness of the issue. Among the responses which were collected, those which were given by non smokers, living outside of chennai and had incomplete responses were excluded. The responses in the study of smokers in chennai were included into the study. The following research paper and results were approved by the Scientific Review Board of Saveetha Dental College and Hospitals.

Among the population of 110 participants, it was noted that gender stood as its independent variable whereas age group and the smoker population was classified into a dependent variable. The questionnaire was reviewed and amendments were made to improve clarity of pertinent questions and eliminate ambiguous responses. The survey instrument was a structured questionnaire with both open and close ended questions. The survey was completed voluntarily by the participants. The study was approved by the institutional review board. Informed consent from the participants were obtained. Only completely filled online forms were included in the study. The filled responses were verified by two reviewers and the collected data was entered on the same day. The entered data was analysed using SPSS. Pearson's Chi-square test was performed to calculate frequencies of categorical variables.

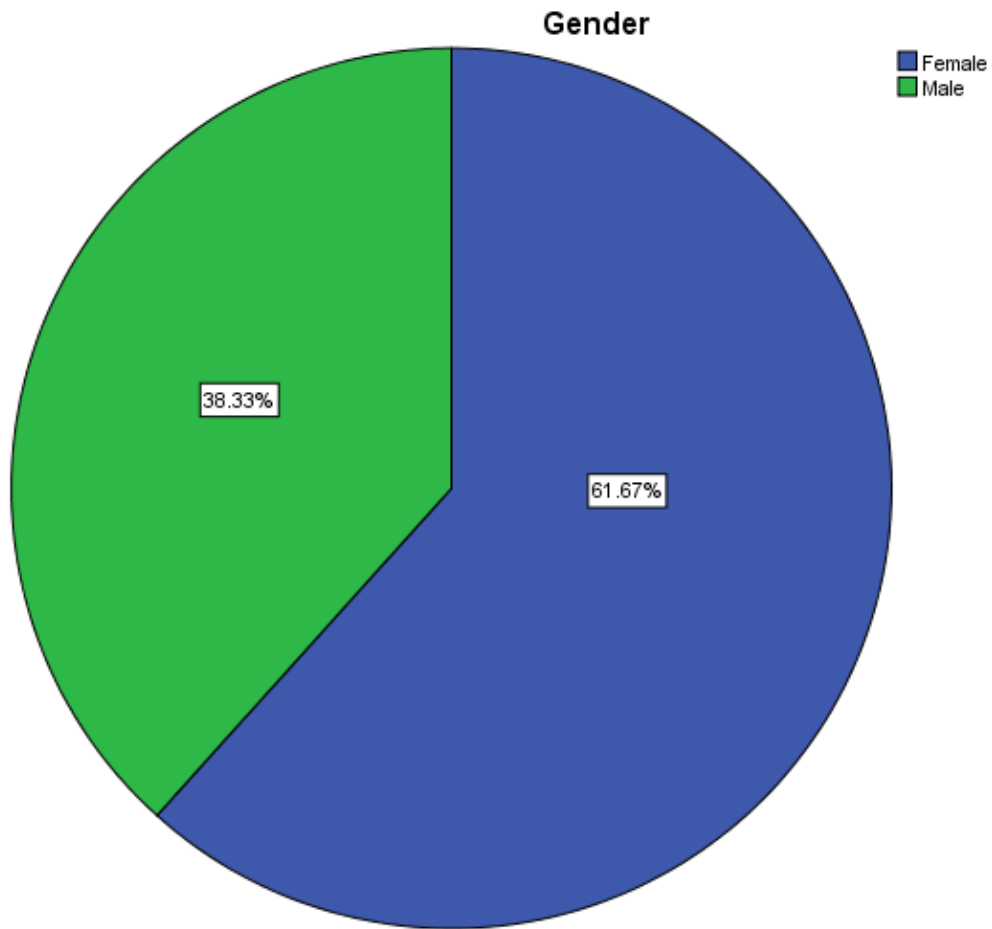
The following questions within the questionnaire:

1. Gender
2. Age
3. How many cigarettes do you consume per day?
4. What are the reasons for smoking?
5. How frequently do you smoke?
6. How many years have you been smoking?
7. Do you experience any of the following symptoms?
8. As a smoker, what can chronic respiratory diseases lead to?
9. Systemic disease related to chronic lower respiratory diseases?
10. Asthma, which is a particularly common effect; unfortunately, this condition lasts with a person for?
11. Which of the following can serve as a treatment plan for chronic respiratory disease?
12. What are the risk factors associated with CLRD?

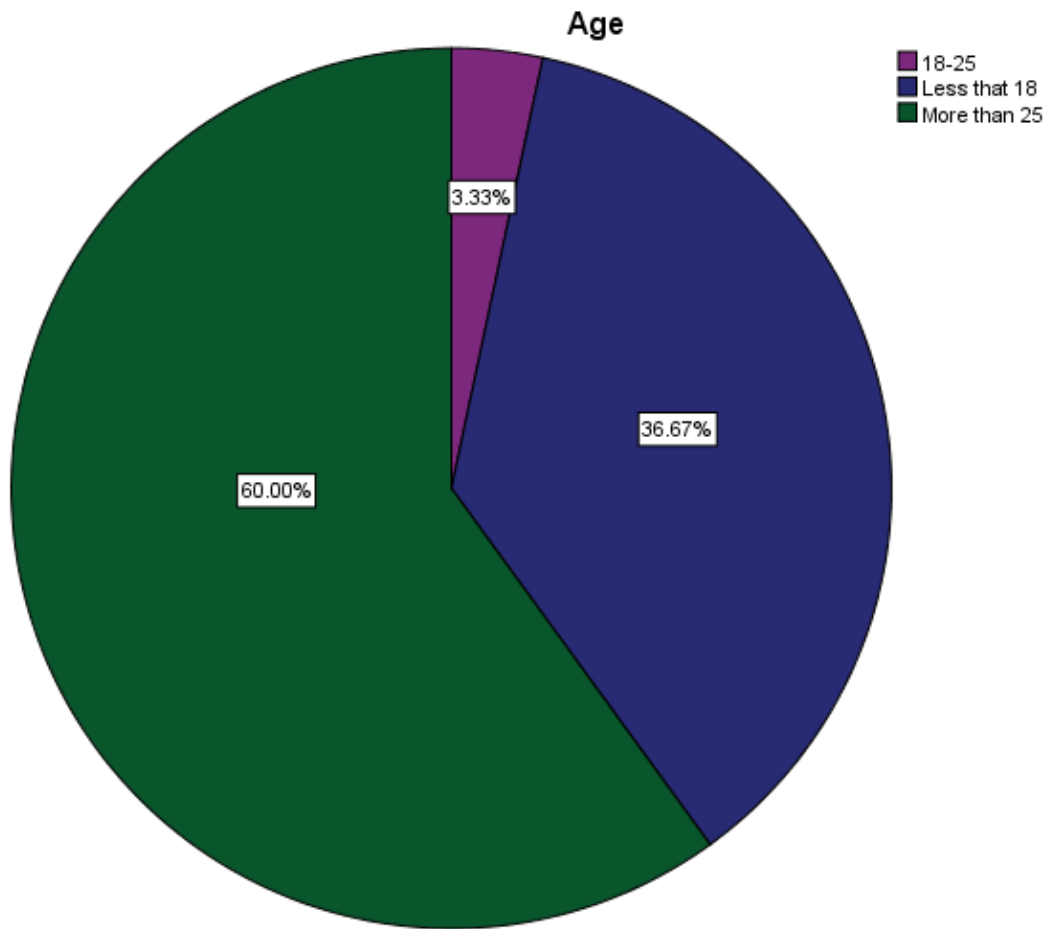
Results

In this study, I came to know that approximately 61.67% of the individuals were females, and 38.33% were males (Graph 1). 60% of the population of both genders were more than 25 of age, 3.33% from the age groups of 18-25, and 36.67% less than 18 (Graph 2). Though there is a variation on how many cigarettes an individual would consume per day, 35% consume 7-10 cigarettes, 1.67% consume 4-6 cigarettes, and 63.33% consume 1-3 cigarettes (Graph 3). There are various reasons for one to form a new habit. As smoking is one of the leading habits and addictions around the world, people choose to go through with their actions for several reasons. 61.67% was for emotional triggers, 1.67% was for nicotine (or physical) addiction, 1.67% for situational triggers, and 35% for other reasons (Graph 4). It

is often seen that the two groups of individuals smoke; one at certain times whereas the other smoke at a set timing and part of the day. It was collected from the survey that 60% smoke right after waking up, 36.67% before going to sleep, and 3.33% every few hours. (Graph 5). In the current century, many individuals start smoking at a young age. It is seen that 60% have been smoking for over 5 years, and 40% for 3-5 years (Graph 6). Symptoms being defined as 'A physical or mental problem that a person experiences that may indicate a disease or condition. Symptoms cannot be seen and do not show up on medical tests. Some examples of symptoms are headache, fatigue, nausea, and pain.(18) vary from each illness and diseases. 60% responded with their current symptoms as shortness of breath, 35% with coughing, 1.67% experiencing wheezing, 3.33% with lack of energy (Graph 7). The principle of causality which is influenced by one event or process to another event or process where the cause is responsible for the effect, and the effect is dependent on the cause. This concept is widely known as the cause and effect principle. If the individual smokes a less number of cigarettes per day but for a prolonged time period versus an individual who smokes 10 cigarettes per day but for a shorter time period, both individuals will eventually succumb to a chronic respiratory disease over time. 60% opted for asthma, 35% for Chronic Obstructive Pulmonary Disease (COPD), 1.67% for lung cancer, cystic fibrosis, and all of the above (Graph 8). There are several systemic diseases related to chronic lower respiratory diseases, 60% for Alzheimer's disease, 1.67% for cerebrovascular diseases, and 38.33% for cardiovascular diseases (Graph 9). Asthma is a condition in which a person's airways become inflamed, narrow, and swollen and produce more mucus, which can lead to breathing difficulties. Asthma can be mild or it can interfere with daily activities. In some cases, it can cause a life-threatening attack. This condition lasts with people for different time periods. 61.67% were 15 years, 1.67% for 10 year and a lifetime, 35% for 2 years. Countless number of procedures and steps can be taken and served as a treatment plan for chronic respiratory disease, as 63.33% of the study population believed in inhalers and 36.67% for oxygen therapy. The copious number of risk factors associated with CLRD is a field in which has been showcased on a daily basis around the world. 60% of the study population were aware that tobacco use (including second hand smoke) is the number one risk factor, 35% for air pollution (outdoor and indoor), 1.67% for occupational agents, 1.67% for raised blood pressure, 1.67% for allergic sensitization.

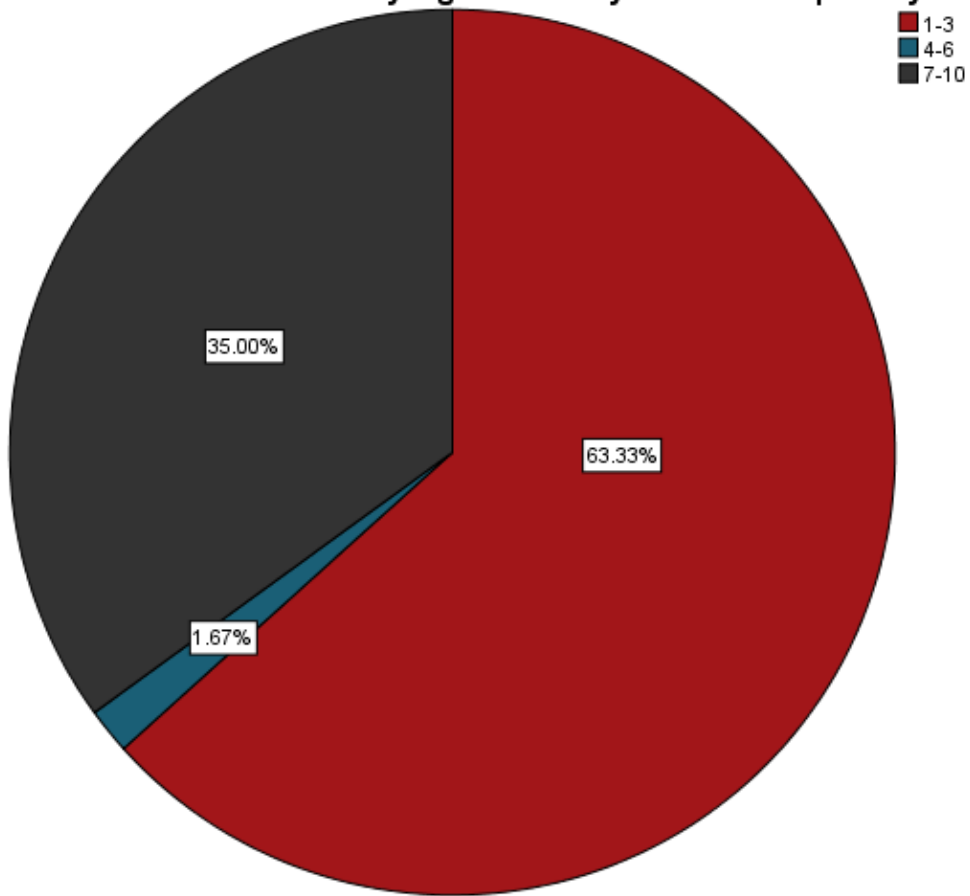


Graph 1: Pie-chart represents responses regarding the gender of the participants. 61.67% - females (blue), 38.33% males (green).

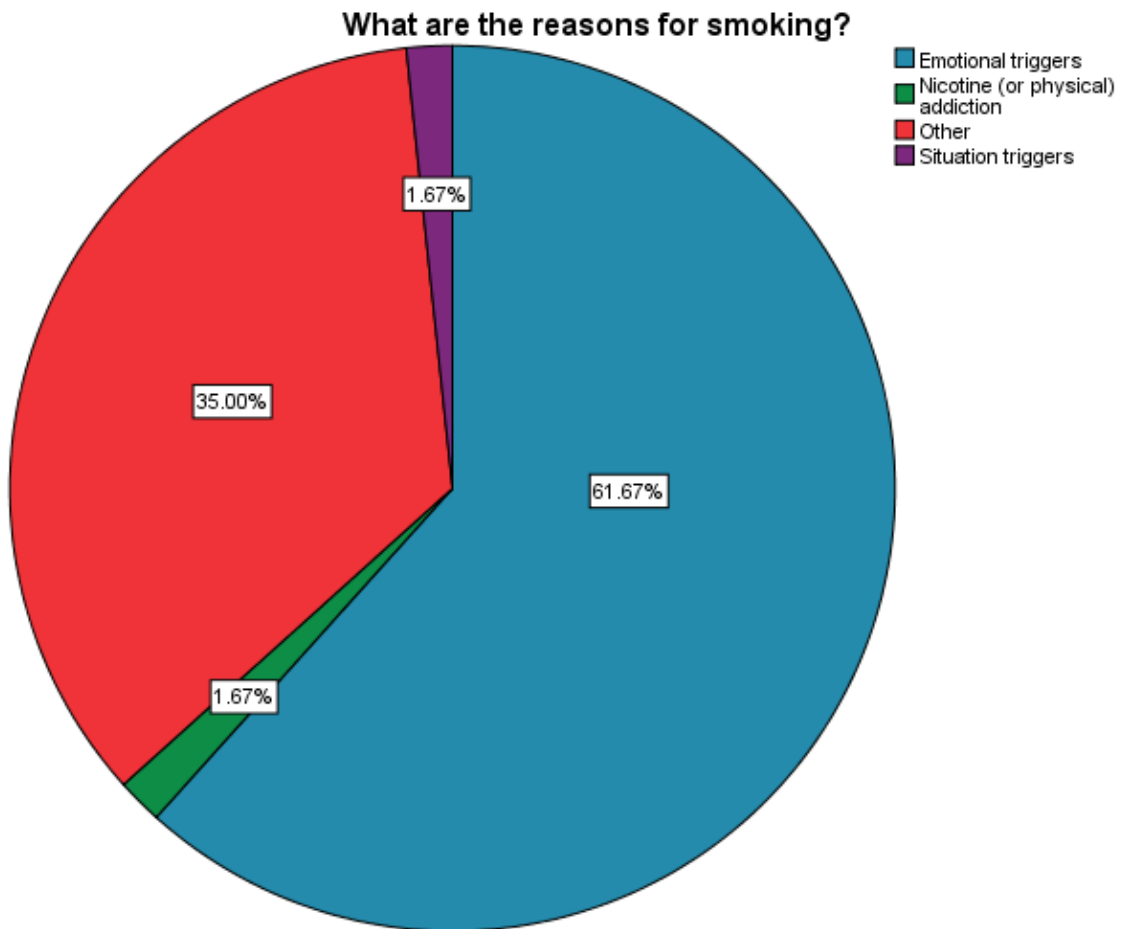


Graph 2: Pie-chart represents responses regarding the age of the participants who have attended the survey. 60% - more than 25 (british racing), 36.67% - less than 18 (navy blue), 3.33% - 18-25 (violet).

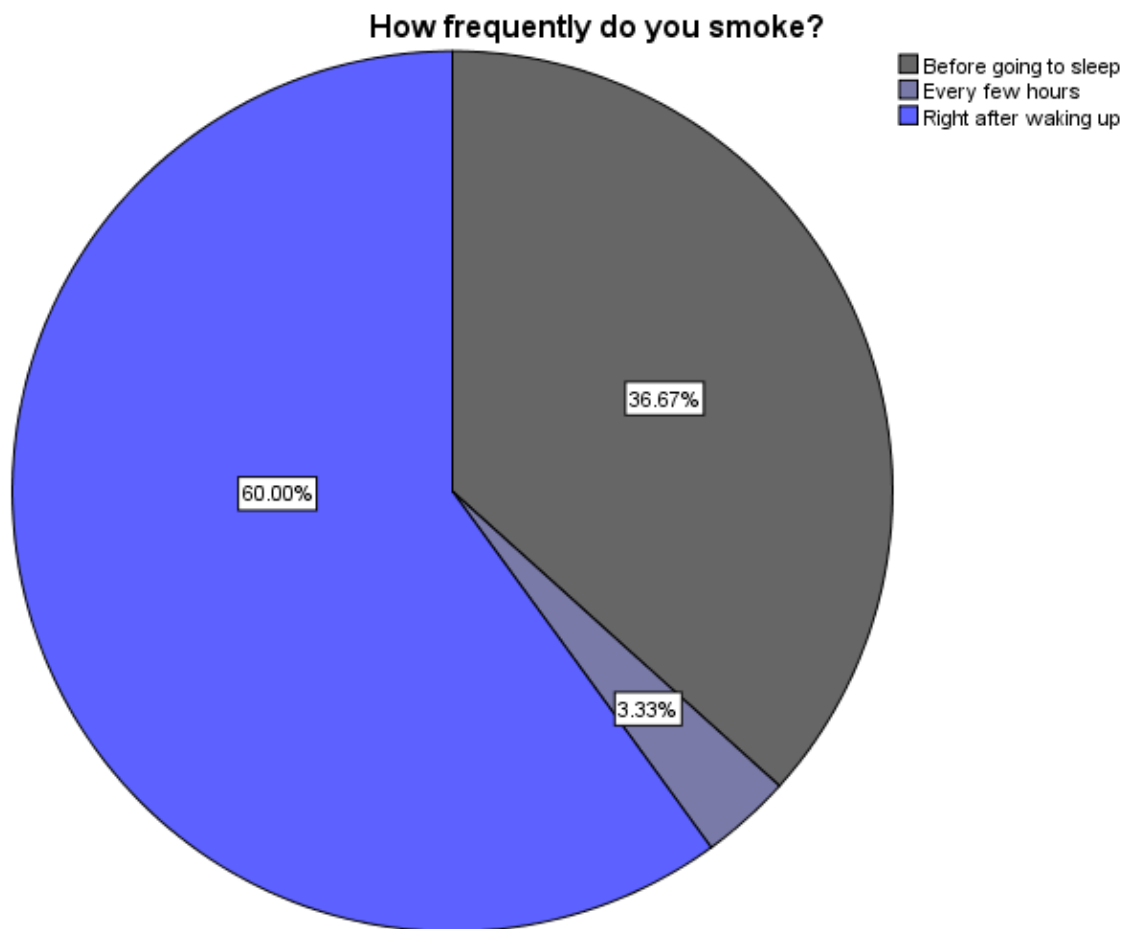
How many cigarettes do you consume per day?



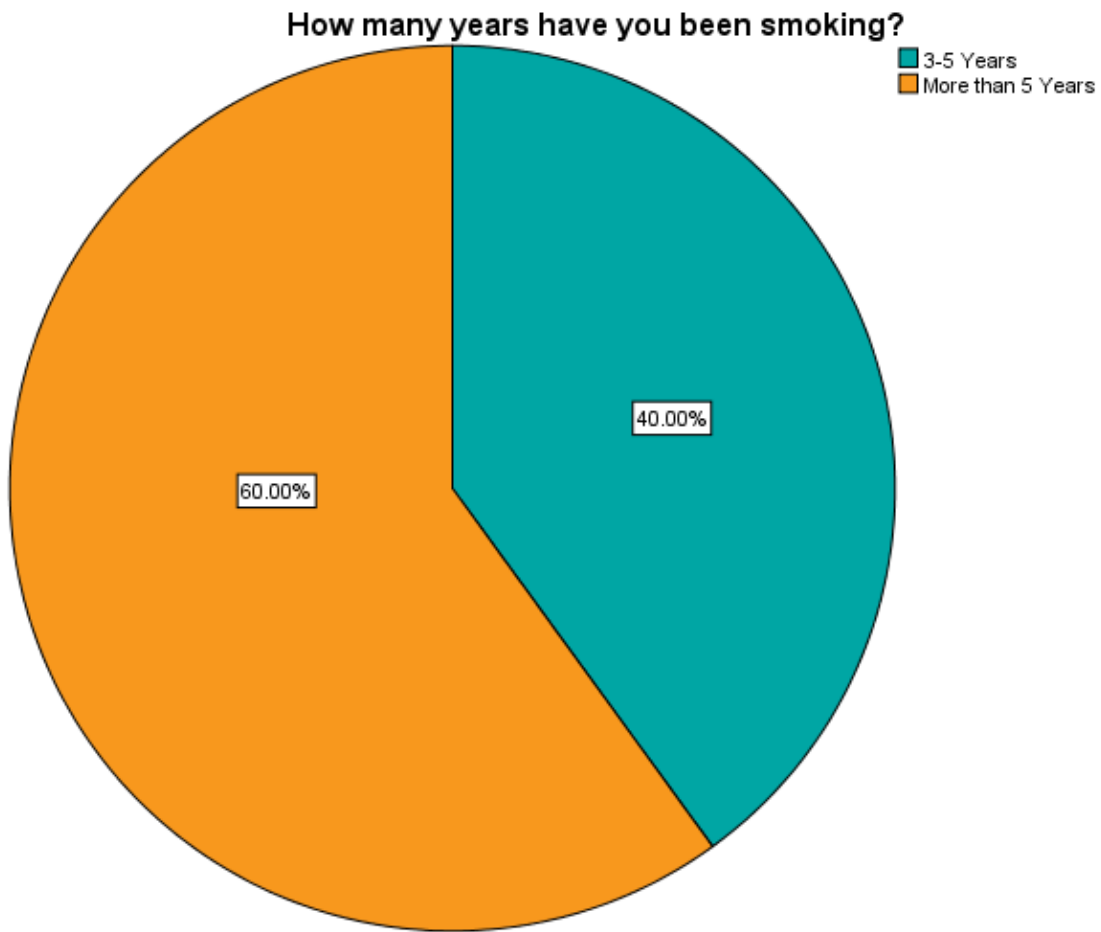
Graph 3: Pie-chart represents responses regarding the number of cigarettes that are consumed per day. 35% - 7 to 10 cigarettes (pebble), 63.33% - 1 to 3 cigarettes (ruby), 1.67% - 4 to 6 cigarettes (ocean).



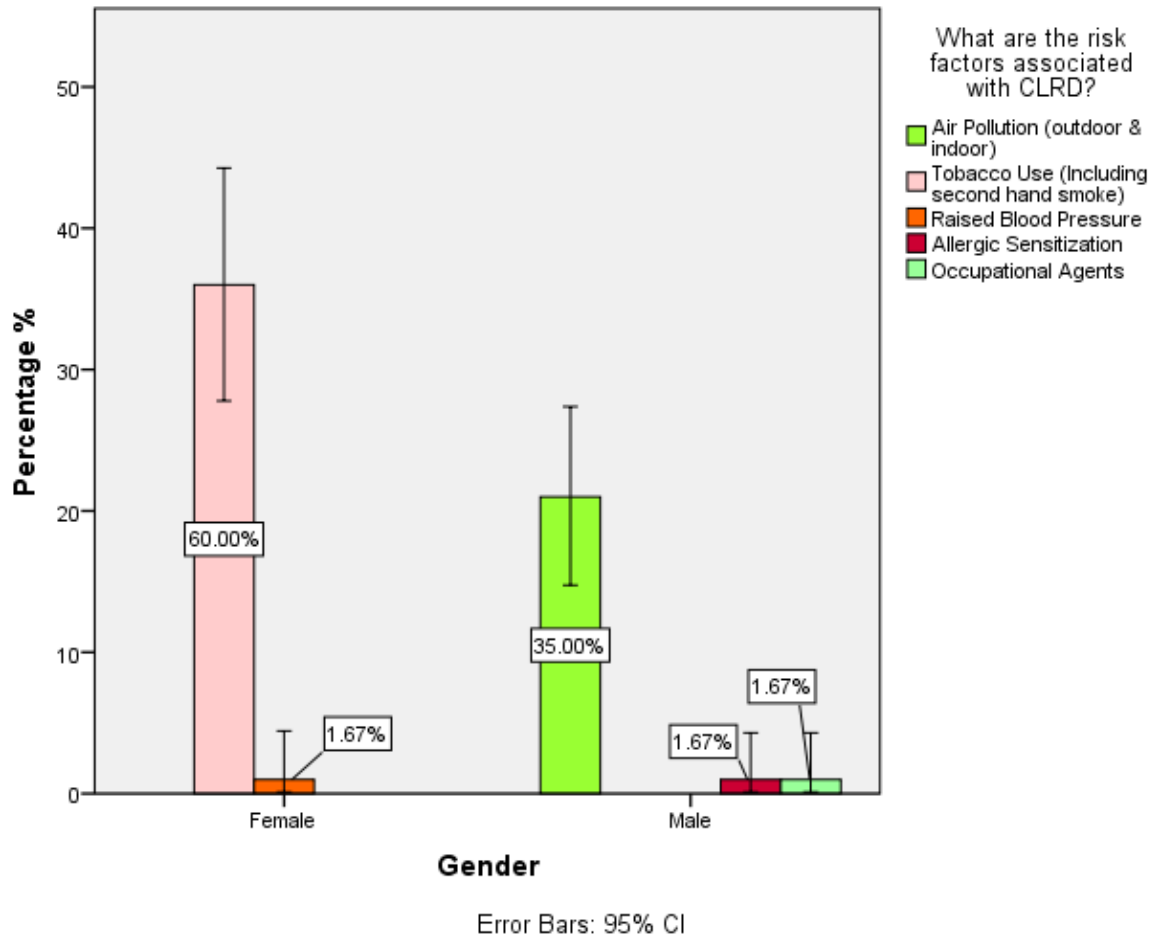
Graph 4: Pie-chart represents responses regarding the reasons for smoking. 61.67% - emotional triggers (cerulean), 35% - other (rose), 1.67% - nicotine (or physical) addiction (forest green), 1.67% - situation triggers (rain).



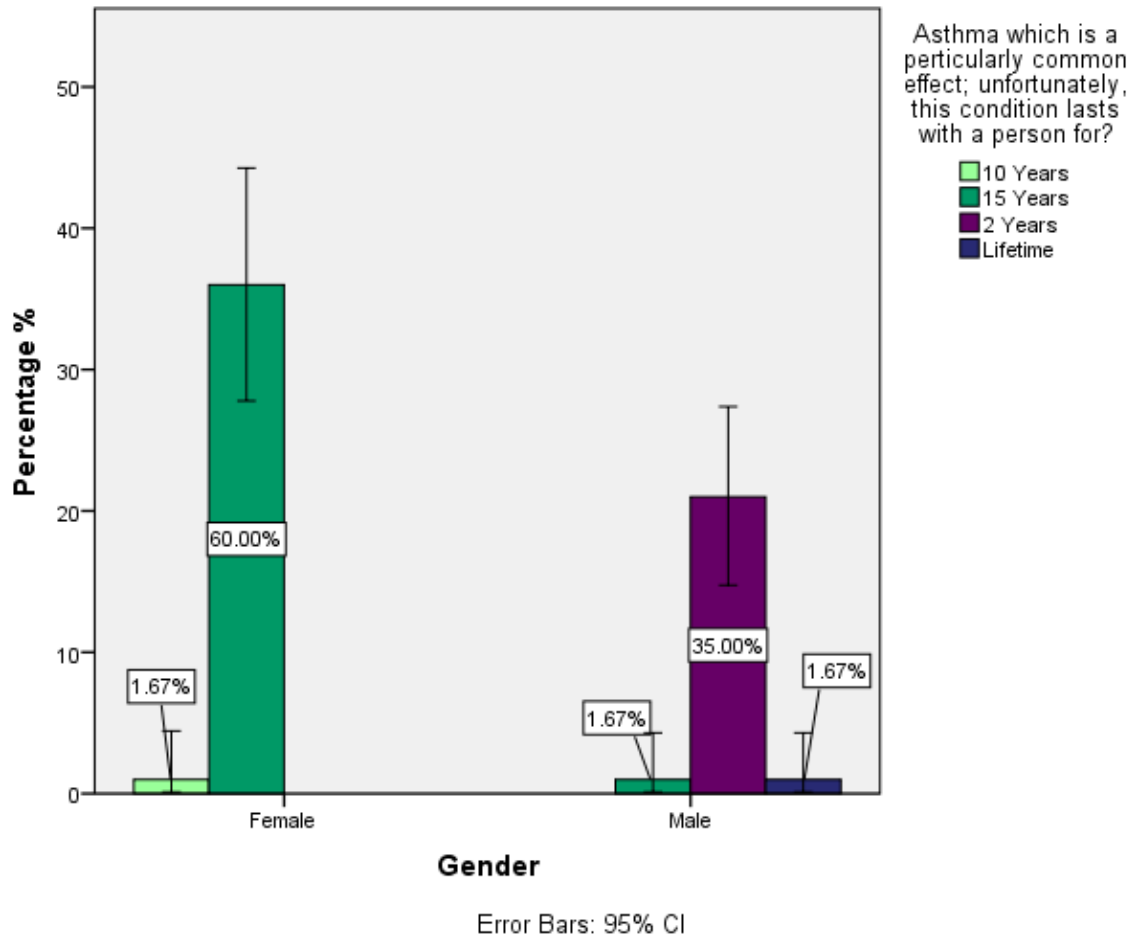
Graph 5: Pie-chart represents responses regarding the frequency of individuals smoking habit. 60% - right after waking up (cobalt), 3.33% - every few hours (flint), 36.67% - before going to sleep (graphite).



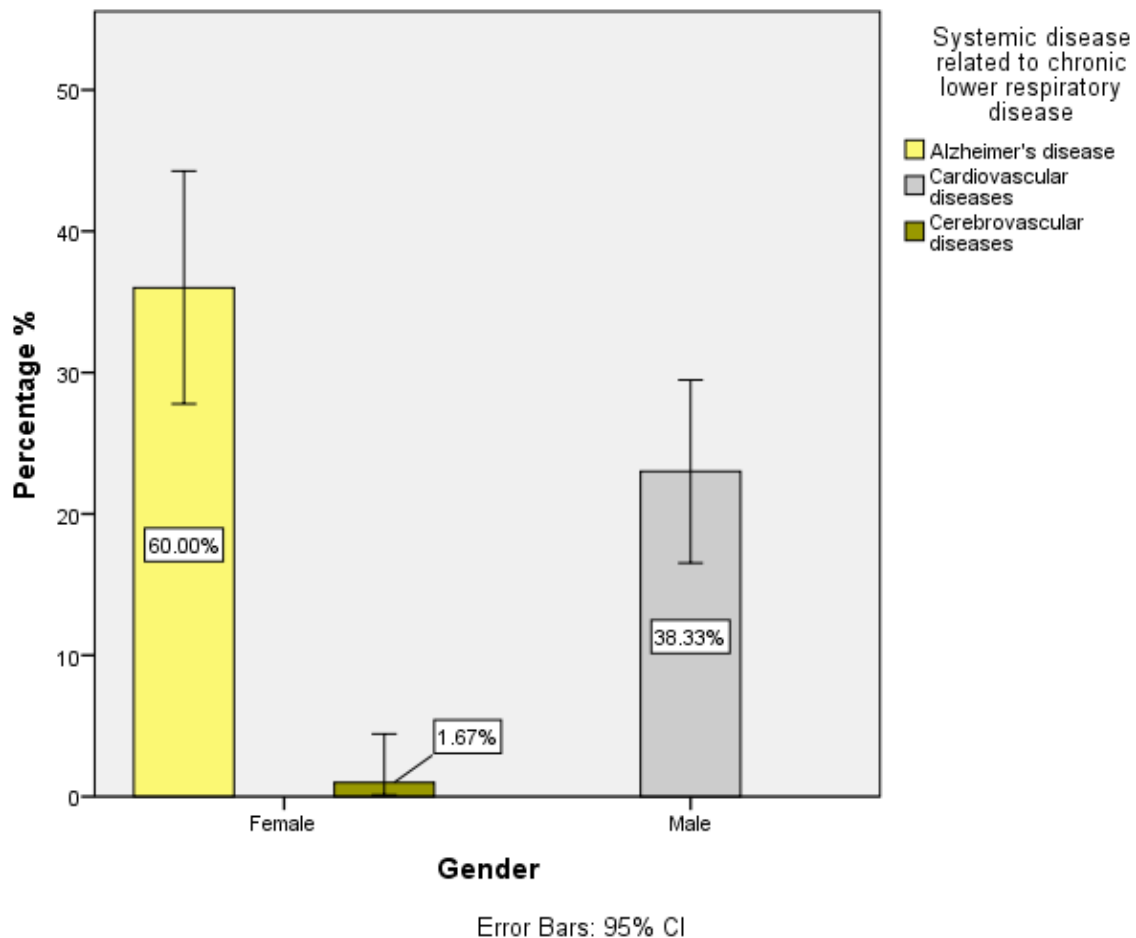
Graph 6: Pie-chart represents responses regarding the number of years the participant has been smoking. 60% - more than 5 years (honey), 40% - 3 to 5 years (teal).



Graph 7: Bar graph showing the association of responses based on different gender to the risk factors associated with CLRD, where pink denotes tobacco use (including second hand smoke), orange denotes raised blood pressure, lime green denotes air pollution (outdoor & indoor), red denotes allergic sensitization, teal denotes occupational agents. X axis represents gender and Y axis represents percentage. Out of 100 participants, 60% responded to tobacco use (including second hand smoke) and 1.67% responded to raised blood pressure among females, 35% responded to air pollution (outdoor & indoor), 1.67% responded to allergic sensitization, 1.67% responded to occupational agents among males. Gender does not have an influence on the general opinion and perception. Pearson Chi-square value = 0.000, statistically significant.



Graph 8: Bar graph showing the association of responses based on different gender to the number of years asthma lasts with a person, where teal denotes 10 years, turquoise denotes 15 years, purple denotes 2 years, and blue denotes lifetime. X axis represents gender and Y axis represents percentage. Out of 100 participants, 1.67% responded to 10 years and 60% responded to 15 years among females, 1.67% responded to 15 years, 35% responded to 2 years, and 1.67% responded to lifetime among males. Gender does not have an influence on the general opinion and perception. Pearson Chi-square value = 0.000, statistically significant.



Graph 9: Bar graph showing the association of responses based on different gender to the systemic disease related to chronic lower respiratory disease, where yellow denotes Alzheimer's disease, grey denotes cardiovascular disease, green denotes cerebrovascular disease. X axis represents gender and Y axis represents percentage. Out of 100 participants, 60% responded to Alzheimer's disease and 1.67% responded to cerebrovascular disease among females, 38.33% responded to cardiovascular disease among males. Gender does not have an influence on the general opinion and perception. Pearson Chi-square value = 0.000, statistically significant.

Discussion

Respiratory infections are prevalent in poor and middle-income nations, but their effects are seldom recorded, and due to a lack of good data, no real incidence can be determined. Bronchiectasis is prevalent in children after viral infections. Tuberculosis can cause severe complications such as bronchiectasis, pachypleuritis, or aspergillosis (19). Although it appears that a large number of TB fatalities are caused by post-tuberculosis chronic respiratory illness, data to support this claim is missing. Respiratory tract infections in children and adolescents can potentially lead to chronic respiratory illnesses in adults in high-income nations. Interactions with smoking or HIV/AIDS have a significant negative impact (20).

Many nations now have considerable evidence that circumstances before birth and in early childhood have an impact on adult health. Children have no control over their living environment, food, living condition, or exposure to tobacco smoke and other air contaminants. They also have a poor understanding of the long-term implications of their actions. However, it is at this critical period that many health behaviours are formed. Young tobacco smokers, for example, may develop a habit and become addicted long before they reach maturity (21).

1.1 Oral Cancer

Oral cancer is caused by cigarette smoking and other tobacco products. Oral cancer primarily affects adults in their forties and fifties, and it is more frequent in males than in women. It accounts for 2% to 3% of all malignancies globally. Smokers have a two to five times higher risk of oral cancer than non-smokers, with the risk increasing with the number of cigarettes smoked and the number of years smoked. Cessation, on the other hand, lowers the danger. The primary carcinogens in mainstream tobacco smoke include tobacco-specific N-nitrosamines, aromatic amines, and polycyclic aromatic hydrocarbons, which are thought to contribute to the risk of mouth cancer from smoked tobacco products (22).

1.2 Oral Leukoplakia

Leukoplakia is thought to be a precancerous lesion linked to the onset of oral cancer. The most important recognized etiological factor in the development of oral leukoplakia is tobacco use. Cross-sectional studies reveal a greater frequency of leukoplakia in smokers, with a dose-response connection between tobacco use and oral leukoplakia, while intervention studies show the lesion regressing following smoking cessation. Smokers appeared to have a higher prevalence of leukoplakia of the mouth floor than non-smokers. In comparison to non-smokers, smokers have a six-fold increased chance of developing oral mucosal leukoplakia(23)

In six European investigations, smoking was revealed to be the cause of leukoplakia in 56–97% of individuals. According to one of these investigations, the majority of smokers with leukoplakia (74%) smoked more than 20 cigarettes per day, compared to 34.5 percent of non-smoker (24).

1.3 Oral candidiasis and hairy tongue

Cigarette smoke produces a series of changes in the oral cavity and has an impact on oral commensal bacteria and fungus, particularly *Candida* species, which cause oral candidiasis. It's yet unclear how cigarette smoke affects oral *Candida*. More research and investigations are needed to determine the specific cause of smoking and oral candidiasis. Some *Candida* infections have been observed to resolve with smoking cessation alone, according to clinical experience. Another oral lesion known as "hairy tongue" or "black hairy tongue" is a benign disease marked by hypertrophy of the filiform papillae, which gives the dorsum of the tongue a furry look and is occasionally linked to excessive smoking, although the cause is unknown (25).

Though the research was among the age groups of 18 to 30, the study was limited to only the maximum age group of 30, which could have been much more broad. The study was also limited to the location of just Chennai, India, or else the results would have had an impact/influence if other cities or countries were added into the mix. The future scope of the study has to be about the extensive knowledge and research experience that has translated into high quality publications (26–43).

Conclusion

Smoking is clearly linked to systemic illnesses such as cardiovascular disease, lung problems, and various cancers. Smoking is proven to be harmful to mothers and children in particular. Cigarette smoking has a detrimental impact on the oral cavity. Although it has been proven that smoking causes illnesses such as oral cancer, periodontitis, leukoplakia, and a variety of other oral lesions, the direct effect of smoking on dental caries has yet to be proven. Smoking, coupled with poor oral hygiene, eating habits, preventative dental checkups, and overall health standards, has been linked to a high prevalence of caries.

References

1. Proctor RN. Tobacco and the global lung cancer epidemic [Internet]. Vol. 1, *Nature Reviews Cancer*. 2001. p. 82–6. Available from: <http://dx.doi.org/10.1038/35094091>
2. Proctor RN. The Global Smoking Epidemic: A History and Status Report [Internet]. Vol. 5, *Clinical Lung Cancer*. 2004. p. 371–6. Available from: <http://dx.doi.org/10.3816/clc.2004.n.016>
3. Cooley ME, Kaiser LR, Abrahm JL, Giarelli E. The Silent Epidemic: Tobacco and the Evolution of Lung Cancer and Its Treatment [Internet]. Vol. 19, *Cancer Investigation*. 2001. p. 739–51. Available from: <http://dx.doi.org/10.1081/cnv-100106149>
4. Parascandola M, Xiao L. Tobacco and the lung cancer epidemic in China [Internet]. Vol. 8, *Translational Lung Cancer Research*. 2019. p. S21–30. Available from: <http://dx.doi.org/10.21037/tlcr.2019.03.12>
5. Zaridze D. Passive smoking and the risk for lung cancer [Internet]. *Tobacco: The Growing Epidemic*. 2000. p. 143–5. Available from: http://dx.doi.org/10.1007/978-1-4471-0769-9_56
6. Lee PN. Environmental tobacco smoke, lung cancer and heart disease [Internet]. *Tobacco: The Growing Epidemic*. 2000. p. 145–50. Available from: http://dx.doi.org/10.1007/978-1-4471-0769-9_57
7. Lin R-T, Takahashi K. 34 The global asbestos epidemic and its reflections in the recent Japanese experience [Internet]. Vol. 54, *Lung Cancer*. 2006. p. S9. Available from: [http://dx.doi.org/10.1016/s0169-5002\(07\)70110-1](http://dx.doi.org/10.1016/s0169-5002(07)70110-1)
8. Parkin DM, Pisani P, Masuyer E. Tobacco-attributable cancer burden: A global review [Internet]. *Tobacco: The Growing Epidemic*. 2000. p. 81–4. Available from: http://dx.doi.org/10.1007/978-1-4471-0769-9_29
9. Stephens R. Time for a global strategy to improve the treatment of lung cancer? [Internet]. Vol. 31, *Lung Cancer*. 2001. p. 349. Available from: [http://dx.doi.org/10.1016/s0169-5002\(00\)00237-3](http://dx.doi.org/10.1016/s0169-5002(00)00237-3)
10. Seton-Rogers S. Complex effects of tobacco on lung tissue [Internet]. Vol. 20, *Nature Reviews Cancer*. 2020. p. 199–199. Available from: <http://dx.doi.org/10.1038/s41568-020-0249-y>
11. Hecht SS. Tobacco carcinogens, their biomarkers and tobacco-induced cancer [Internet]. Vol. 3, *Nature Reviews Cancer*. 2003. p. 733–44. Available from: <http://dx.doi.org/10.1038/nrc1190>
12. Warshawsky D, Landolph JR Jr. *Molecular Carcinogenesis and the Molecular Biology of Human Cancer*. CRC Press; 2005. 592 p.

13. Ahmad A, Gadgeel S. Lung Cancer and Personalized Medicine: Current Knowledge and Therapies. Springer; 2015. 228 p.
14. Sculean A. Periodontal Regenerative Therapy. Quintessence Publishing Company; 2010. 294 p.
15. Medical Principles and Practice: International Journal of the Kuwait University, Health Science Centre. 2003.
16. Axéll T. A Prevalence Study of Oral Mucosal Lesions in an Adult Swedish Population. 1976. 103 p.
17. Saraswathi TR, Ranganathan K, Shanmugam S, Sowmya R, Narasimhan P, Gunaseelan R. Prevalence of oral lesions in relation to habits : Cross-sectional study in South India [Internet]. Vol. 17, Indian Journal of Dental Research. 2006. p. 121. Available from: <http://dx.doi.org/10.4103/0970-9290.29877>
18. NCI Dictionary of Cancer Terms [Internet]. 2011 [cited 2021 Aug 16]. Available from: <https://www.cancer.gov/publications/dictionaries/cancer-terms>
19. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans, World Health Organization, International Agency for Research on Cancer. Tobacco Smoke and Involuntary Smoking. IARC; 2004. 1452 p.
20. Al Moustafa A-E. Development of Oral Cancer: Risk Factors and Prevention Strategies. Springer; 2018. 217 p.
21. International Agency for Research on Cancer. Cancer in Thailand: Vol. II, 1992-1994. World Health Organization; 1999. 135 p.
22. Patil P, Bathi R, Chaudhari S. Prevalence of oral mucosal lesions in dental patients with tobacco smoking, chewing, and mixed habits: A cross-sectional study in South India [Internet]. Vol. 20, Journal of Family and Community Medicine. 2013. p. 130. Available from: <http://dx.doi.org/10.4103/2230-8229.114777>
23. Kumar KK, Kiran Kumar K, Saraswathi TR, Ranganathan K, Uma Devi M, Elizabeth J. Oral submucous fibrosis: A clinico-histopathological study in Chennai [Internet]. Vol. 18, Indian Journal of Dental Research. 2007. p. 106. Available from: <http://dx.doi.org/10.4103/0970-9290.33785>
24. Kahar P, Harvey I, Tisone C, Khanna D. Prevalence of dental caries, patterns of oral hygiene behaviors, and daily habits in rural central India: A cross-sectional study [Internet]. Vol. 14, Journal of Indian Association of Public Health Dentistry. 2016. p. 389. Available from: <http://dx.doi.org/10.4103/2319-5932.195828>
25. Shetty M, Sowmya. A cross sectional study of periorbital dermatoses in a tertiary care hospital in South India [Internet]. Vol. 4, IP Indian Journal of Clinical and Experimental Dermatology. 2020. p. 297–301. Available from: <http://dx.doi.org/10.18231/2581-4729.2018.0062>
26. Liu S, Fang J, Jiao D, Liu Z. Elevated Platelet Count Predicts Poor Prognosis in Breast Cancer Patients with Supraclavicular Lymph Node Metastasis [Internet]. Vol. 12, Cancer Management and Research. 2020. p. 6069–75. Available from: <http://dx.doi.org/10.2147/cmar.s257727>
27. Jayaseelan VP, Paramasivam A. Emerging role of NET inhibitors in cardiovascular diseases [Internet]. Vol. 43, Hypertension Research. 2020. p. 1459–61. Available from: <http://dx.doi.org/10.1038/s41440-020-0527-9>
28. Sivakumar S, Smiline Girija AS, Vijayashree Priyadharsini J. Evaluation of the inhibitory effect of caffeic acid and gallic acid on tetR and tetM efflux pumps mediating tetracycline resistance in *Streptococcus* sp., using computational approach [Internet]. Vol. 32, Journal of King Saud University - Science. 2020. p. 904–9. Available from: <http://dx.doi.org/10.1016/j.jksus.2019.05.003>

29. Girija ASS, Smiline Girija AS. Delineating the Immuno-Dominant Antigenic Vaccine Peptides Against *gacS*-Sensor Kinase in *Acinetobacter baumannii*: An in silico Investigational Approach [Internet]. Vol. 11, *Frontiers in Microbiology*. 2020. Available from: <http://dx.doi.org/10.3389/fmicb.2020.02078>
30. Jaisankar AI, Smiline Girija AS, Gunasekaran S, Vijayashree Priyadharsini J. Molecular characterisation of *csgA* gene among ESBL strains of *A. baumannii* and targeting with essential oil compounds from *Azadirachta indica* [Internet]. Vol. 32, *Journal of King Saud University - Science*. 2020. p. 3380–7. Available from: <http://dx.doi.org/10.1016/j.jksus.2020.09.025>
31. Jayaseelan VP, Ramesh A, Arumugam P. Breast cancer and DDT: putative interactions, associated gene alterations, and molecular pathways [Internet]. Vol. 28, *Environmental Science and Pollution Research*. 2021. p. 27162–73. Available from: <http://dx.doi.org/10.1007/s11356-021-12489-6>
32. Arumugam P, George R, Jayaseelan VP. Aberrations of m6A regulators are associated with tumorigenesis and metastasis in head and neck squamous cell carcinoma. *Arch Oral Biol*. 2021 Feb;122:105030.
33. Kumar SP, Praveen Kumar S, Smiline Girija AS, Vijayashree Priyadharsini J. Targeting NM23-H1-mediated Inhibition of Tumour Metastasis in Viral Hepatitis with Bioactive Compounds from *Ganoderma lucidum*: A Computational Study [Internet]. Vol. 82, *Indian Journal of Pharmaceutical Sciences*. 2020. Available from: <http://dx.doi.org/10.36468/pharmaceutical-sciences.650>
34. Girija SA, Priyadharsini JV, Paramasivam A. Prevalence of carbapenem-hydrolyzing OXA-type β -lactamases among *Acinetobacter baumannii* in patients with severe urinary tract infection [Internet]. *Acta Microbiologica et Immunologica Hungarica*. 2019. p. 1–7. Available from: <http://dx.doi.org/10.1556/030.66.2019.030>
35. Priyadharsini JV, Paramasivam A. RNA editors: key regulators of viral response in cancer patients [Internet]. Vol. 13, *Epigenomics*. 2021. p. 165–7. Available from: <http://dx.doi.org/10.2217/epi-2021-0001>
36. Mathivadani V, Smiline AS, Priyadharsini JV. Targeting Epstein-Barr virus nuclear antigen 1 (EBNA-1) with *Murraya koenigii* bio-compounds: An in-silico approach [Internet]. Vol. 64, *Acta virologica*. 2020. p. 93–9. Available from: http://dx.doi.org/10.4149/av_2020_111
37. As SG, Vijayashree PJ, Paramasivam A. Prevalence of Acb and non-Acb complex in elderly population with urinary tract infection (UTI) [Internet]. Vol. 76, *Acta Clinica Belgica*. 2021. p. 106–12. Available from: <http://dx.doi.org/10.1080/17843286.2019.1669274>
38. Girija ASS, Smiline Girija AS, Shoba G, Vijayashree Priyadharsini J. Accessing the T-Cell and B-Cell Immuno-Dominant Peptides from *A.baumannii* Biofilm Associated Protein (bap) as Vaccine Candidates: A Computational Approach [Internet]. Vol. 27, *International Journal of Peptide Research and Therapeutics*. 2021. p. 37–45. Available from: <http://dx.doi.org/10.1007/s10989-020-10064-0>
39. Arvind P, Jain RK. Skeletally anchored forsus fatigue resistant device for correction of Class II malocclusions—A systematic review and meta-analysis [Internet]. Vol. 24, *Orthodontics & Craniofacial Research*. 2021. p. 52–61. Available from: <http://dx.doi.org/10.1111/ocr.12414>
40. Venugopal A, Vaid N, Jay Bowman S. Outstanding, yet redundant? After all, you may be another *Choluteca* Bridge! [Internet]. Vol. 27, *Seminars in Orthodontics*. 2021. p. 53–6. Available from: <http://dx.doi.org/10.1053/j.sodo.2021.03.007>
41. Ramadurai N, Gurunathan D, Victor Samuel A, Subramanian E, Rodrigues SJL. Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial [Internet]. Vol. 23, *Clinical Oral Investigations*. 2019. p. 3543–50. Available from: <http://dx.doi.org/10.1007/s00784-018-2775-5>

42. Varghese SS, Ramesh A, Veeraiyan DN. Blended Module-Based Teaching in Biostatistics and Research Methodology: A Retrospective Study with Postgraduate Dental Students [Internet]. Vol. 83, Journal of Dental Education. 2019. p. 445–50. Available from: <http://dx.doi.org/10.21815/jde.019.054>
43. Mathew MG, Samuel SR, Soni AJ, Roopa KB. Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: randomized controlled trial [Internet]. Vol. 24, Clinical Oral Investigations. 2020. p. 3275–80. Available from: <http://dx.doi.org/10.1007/s00784-020-03204-9>

UNDER PEER REVIEW