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Review and Meta-analysis

Environmental Determinants of Oral Cancer Development: An Overview

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Overview: This review article delves into the influence of environmental factors on the onset of oral cancer. It examines the crucial part played by air pollution, occupational exposure and sun exposure in the initiation of oral cancer.

Methods: For this extensive literature survey, we examined relevant publications centered on environmental causes of oral cancer, taking into account case-control research and environmental exposure appraisals. Our selection consisted of works chosen for alignment with our topic areas, robust methodologies, and recent publishing timelines.

Results: Our investigation revealed that air pollution, occupational exposure and sun exposure are significant factors contributing to the development of oral cancer. When present together, they pose an even greater risk. In other words, the combination of these three environmental elements significantly increases the likelihood of oral cancer occurrence. It is crucial to take measures to reduce exposure to occupational exposure, air pollution and UV rays from the sun to mitigate this risk.

Conclusion: The emergence of oral cancer arises from an intricate relationship encompassing hereditary and ecological variables. Efforts devoted to prevention ought to prioritize diminishing direct exposure to established threats, refining general wellbeing guidelines, and informing individuals prone to elevated risk circumstances. Expanded exploration stays imperative for illuminating contributions made by obscured ecological facets, notably pollution, plus devising groundbreaking precautionary tactics.

Introduction

There are numerous fields within various disciplines of medicine and industry, including chemistry (analytical, organic, and inorganic), biochemistry, bioinformatics, biomedical sciences, biology, pharmacology, nanotechnology (nanoparticles, nanostructures, Nanotubes), medicinal chemistry, dentistry, medicine, chemical engineering, mechanical engineering, psychology and others [1-48]. Technological progress and increased understanding in various industries fuel initiatives to

improve the quality of operations and products. Service-based companies are striving to elevate their service delivery and performance indicators while manufacturing sectors aim to enhance the quality of their offerings. For example, the electronics industry is committed to prolonging the lifespan of its products, thereby increasing their reliability and capabilities. Similarly, in the healthcare and medical sectors, efforts are being made to refine treatments and find cures for cancer [49-54]. Cancer is a multifaceted and pernicious disease characterized by the exponential growth of abnormal cells, which can affect various parts of the body, including the stomach, breast, gastric, brain, lungs, mouth, pancreas, uterus, and others. The uncontrolled proliferation of these cells not only damages adjacent tissues but also disrupts the body's homeostasis, giving rise to a broad spectrum of severe symptoms and potentially life-threatening complications. The various types of cancer differ in their underlying causes, development, and manifestations, making it a challenging and heterogeneous disease to tackle [55-64]. The vast majority of oral cancers are classified as squamous cell carcinomas (OSCCs), representing over 90% of cases. Other types of tumors affecting the oral cavity include those arising from the salivary minor glands, melanomas, and lymphomas. OSCCs can display variable degrees of differentiation and frequently result in metastasis to adjacent lymph nodes. The likelihood of lymphatic spreading to the neck is directly correlated with the T stage, depth of invasion, and tumor thickness [65-68]. Every year, around 300,000 people globally are diagnosed with cancer of the mouth, lips, or throat, resulting in about 145,000 fatalities [69]. The five-year survival rate for oral cancer is around 40%, which is relatively low. However, early detection during stages I and II can significantly improve survival rates, exceeding 80%. Unfortunately, half of all oral cancers are not diagnosed until a later stage (III and IV), often due to a lack of noticeable symptoms until the cancer has advanced, such as pain, bleeding, or a mass in the mouth or neck. A delay in diagnosis of more than a month increases the likelihood of an advanced-stage cancer. The patient is often responsible for this delay, but misdiagnosis or failure to suspect oral cancer can also contribute. As cancer progresses and the location of the tumor becomes harder to reach, survival rates tend to decrease. Lip cancer generally has a better prognosis compared to oropharyngeal cancer. Early detection and diagnosis are essential for improving outcomes and survival rates, while also minimizing the severity of treatment-related complications [70-76]. Risk factors for oral cancer include the use of both smoked and smokeless tobacco products, betel quid chewing, alcohol consumption, and chronic inflammation. The incidence of oral and oropharyngeal cancer associated with HPV, particularly type 16, has increased in recent years, mainly among young people. Research has also indicated that the oral microbiome, mucosal inflammation, and oral mucosal trauma caused by teeth or prosthetics may contribute to the development of oral cancer. Additionally, exposure to UV radiation, specifically UV-B, is a risk factor for lip cancer [75, 77-85]. Oral cancer can be seen as a largely preventable illness since most risk factors can be avoided. Nevertheless, it can still affect individuals who do not fall into risk groups. Preventing oral cancer involves two main strategies: primary prevention and secondary prevention. Primary prevention focuses on educating people about behaviors that can reduce their risk, such as avoiding tobacco and excessive alcohol consumption and encouraging HPV vaccination. Secondary prevention concentrates on identifying and treating oral premalignancies and early-stage cancers through screening. Although there has been greater awareness about oral cancer in recent years, the proportion of patients seeking medical attention for advanced disease has remained unchanged over the past four decades [86]. Unlike other prevalent cancers, implementing a universal screening program for oral cancer is not financially feasible and cannot be recommended. Nonetheless, focusing screening efforts on high-risk populations, such as heavy smokers and drinkers or those with a history of cancer outside the head and neck area, may be advantageous. There is evidence from a randomized controlled trial in India demonstrating the benefits of such programs. Furthermore, taking advantage of opportunities to screen for oral mucosal lesions during routine dental check-ups in countries with strong dental care attendance could also help diminish diagnostic delays [87-90].

The environmental factors for oral cancer

-Air pollution

The search results suggest a correlation between oral cancer and air pollution. Exposure to air pollution has been linked to an increased risk of developing mouth cancer [91]. The potential connection between oral cancer and indoor air pollution has been examined, revealing possible associations [92]. The correlation between outdoor air pollution and oral cancer has been thoroughly scrutinized, emphasizing the necessity of comprehending the influence of air pollution on the development of oral cancer [93]. A forecasting model utilizing the MERRA-2 aerosol diagnostic model has been created to evaluate the likelihood of oral, oropharyngeal, and laryngeal cancer due to air pollution among the Thai populace [94]. The link between human behaviors and the onset of oral cancer is widely acknowledged. Lifestyle habits such as tobacco smoking, betel quid or tobacco chewing, alcohol consumption, and deficiencies in micronutrients are regarded as contributing factors to oral cancer [95]. These lifestyle elements and behaviors are shaped by environmental factors at the community level, industrial pollution, access to healthcare services, health insurance, and the quality of healthcare, all of which are contingent on an individual's socioeconomic status. Thus, tackling air pollution and altering lifestyle habits can aid in averting the onset of oral cancer and enhancing patient outcomes.

-Sun Exposure

Extended exposure to the sun, particularly to the lips, can elevate the likelihood of developing lip cancer, a form of oral cancer [96]. Prolonged exposure to the sun's ultraviolet (UV) radiation can increase the risk of developing lip cancer, a type of oral cancer, by damaging the DNA in the cells of the lips and potentially leading to mutations that promote cancerous growth [97]. In Brazil, where oral cancer is a major public health concern, sun exposure is recognized as one of the contributory risk factors for the disease. Excessive sun exposure is listed as a risk factor along with tobacco use, excessive alcohol consumption, and HPV infection in the development of oral cancer, particularly squamous cell carcinoma (SCC) [97]. Therefore, guarding the lips against excessive sun exposure by utilizing lip balms with UV protection and following safe sun practices can aid in decreasing the likelihood of developing lip cancer and other types of oral cancer linked to sun exposure.

Occupational exposure

The most common occupational exposures to carcinogens that can lead to oral cancer include asbestos, formaldehyde, ionizing radiation, and wood dust. Exposure to these substances has been identified as a significant risk factor for oral cancer development. For instance, asbestos, widely known for its carcinogenic properties, increases the risk of oral cancer. Similarly, formaldehyde, which is commonly used in various industries, is another occupational carcinogen linked to oral cancer. Moreover, ionizing radiation, frequently encountered in specific occupations, is also a well-established risk factor for oral cancer. Furthermore, exposure to wood dust has been acknowledged as a potential occupational hazard contributing to the development of oral cancer. It is essential to minimize exposure to these carcinogens to reduce the risk of developing oral cancer [98, 99]. Asbestos exposure, often encountered in industries like construction and mining, has been associated with a significantly elevated risk of oral cancer. Formaldehyde, commonly used in various manufacturing processes, is another occupational carcinogen that can contribute to oral cancer development [98]. Ionizing radiation, encountered in certain occupations, is linked to the highest number of cancer sites, including oral cancer. Wood dust exposure, prevalent in industries like furniture manufacturing, has also been recognized as a potential occupational hazard for oral cancer [98]. The most common symptoms of oral cancer caused by occupational exposure to carcinogens include: A sore or irritation in the mouth that does not heal; A white or red patch on the gums, tongue, tonsil, or lining of the mouth; A lump or thickening in the cheek; Difficulty chewing or swallowing; Difficulty moving the jaw or tongue; Numbness of the tongue or other area of the mouth; Swelling of the jaw that causes dentures to fit poorly or become uncomfortable; Pain in one ear without a cause [100].

Prevent Oral Cancer

Ways to Prevent Oral Cancer:

-Air Pollution

The search findings suggest that mitigating exposure to air pollution, especially in regions with elevated levels of outdoor and indoor air pollution, is essential for preventing oral cancer and enhancing overall oral health outcomes [92-93]. Efforts and regulations in public health targeting the reduction of air pollution can aid in preventing oral cancer and enhancing oral health. Additional contributors to the onset of oral cancer encompass tobacco usage, alcohol consumption, and dietary patterns [101].

The World Health Organization advises against tobacco use, moderating alcohol intake, safeguarding skin from the sun, minimizing exposure to air pollution, adopting a diet abundant in fruits and vegetables, maintaining a healthy weight, preventing infections, and leading a physically active and stress-free lifestyle to lower the likelihood of cancer [101]. Therefore, addressing air pollution and other lifestyle factors is essential for preventing oral cancer and improving overall health outcomes.

-Sun Protection

Guarding the lips against extreme sun exposure by applying lip balms with UV protection and observing safe sun practices can aid in preventing lip cancer that is linked to sun exposure [97, 102].

-Occupational exposure

Reducing Exposure: Minimizing exposure to occupational carcinogens like formaldehyde, wood dust, coal dust, asbestos, and welding fumes is crucial in preventing oral cancer [100].

Protective Equipment: Ensuring the use of appropriate personal protective equipment (PPE) such as masks, gloves, and ventilation systems can help reduce exposure to carcinogens in the workplace [100].

Regulatory Compliance: Adhering to occupational safety regulations and guidelines set by authorities can help create a safer work environment and reduce the risk of oral cancer due to occupational exposure [100].

Health Monitoring: Regular health monitoring and screening programs for workers exposed to carcinogens can aid in early detection of oral cancer or precancerous conditions, allowing for timely intervention [100].

Education and Training: Providing comprehensive education and training on occupational hazards, safe work practices, and the importance of early detection can raise awareness and empower workers to protect themselves from potential risks [100].

Diagnosis of Oral Cancer

According to the provided sources, early diagnosis of oral cancer is critical for achieving optimal

patient outcomes and boosting survival rates. Some essential points related to the diagnosis of oral cancer include:

-Challenges in Early Diagnosis

The survival rate for oral cancer is only 50%, underscoring the significance of early detection and treatment. Clinicians face diagnostic challenges in certain cases of oral cancer, particularly in the early stages, as they can be deceiving and mistaken for other conditions. Shifting demographics and causes of oral cancer add to these challenges, stressing the importance of staying informed about these trends to facilitate timely diagnosis [103].

-Importance of Early Detection

Early identification of lesions is critical for enhancing long-term survival rates in oral cancer patients. Certain factors, including elderly age, tobacco and/or alcohol usage, prolonged sun exposure, and a history of cancer, can serve as red flags for clinicians to suspect patients may develop oral cancer [104].

-Strategies for Improvement

Steps such as regularly scheduled oral cancer screening tests and educating patients on the early warning signs can assist in lowering the probability of developing oral cancer in individuals who are at high risk [104]. Recognizing deficiencies in current knowledge, suggesting areas for further investigation, and developing plans to address them are indispensable steps towards improving the early detection of oral cancer [105].

Treatment of Oral Cancer

According to the given sources, the management of oral cancer employs a multi-faceted strategy that may encompass surgery, radiation therapy, chemotherapy, targeted therapy, and immunotherapy, contingent upon the stage and site of the cancer. Timely detection and swift treatment are pivotal in enhancing patient results and survival rates.

-Surgery

Surgical intervention is often the first line of treatment for oral cancer, particularly in the early stages when the cancer is localized. The surgical procedure may involve removing the tumor and surrounding tissue, followed by reconstruction to restore the patient’s appearance and function.

-Radiation Therapy

Radiation therapy uses high-energy rays to target and obliterate cancer cells. It may be employed alone or in conjunction with surgery, depending on the cancer stage and location. Postoperative radiation therapy helps eliminate any residual cancer cells.

-Chemotherapy

Chemotherapy is used in cases where the cancer has metastasized to other parts of the body or to

shrink tumors before surgery or radiation therapy. This modality employs drugs that travel through the bloodstream to kill cancer cells.

-Targeted Therapy

Targeted therapy focuses on specific molecules involved in cancer cell growth and proliferation, thereby minimizing harm to healthy cells. Drugs used in targeted therapy selectively block these molecules, inhibiting cancer cell growth.

-Immunotherapy

Immunotherapy stimulates the body's immune system to recognize and combat cancer cells. This approach can be used independently or in combination with other treatments, depending on the type of oral cancer.

-Follow-Up Care

After treatment, regular follow-up care is crucial to monitor for signs of recurrence and manage any adverse effects of treatment. Patients may also undergo rehabilitation to regain normal speech, swallowing, and overall quality of life.

The treatment of oral cancer requires a coordinated effort among various medical professionals, tailoring a personalized plan for each patient. The goal is to achieve optimal outcomes, improve the patient's quality of life, and ensure long-term recovery [106-113].

In summary, Technology and knowledge have greatly contributed to developing and improving various products in different fields, including surgery [114-116], medicine, and dentistry [117-119], oil industry [120, 121], and connections [122]. A complex interplay of genetic and environmental elements influences the development of oral cancer. Our analysis highlights the significant impact of occupational exposure, air pollution and sun exposure in initiating oral cancer, especially when they occur together, heightening the risk. Mitigating this risk necessitates concerted actions to decrease exposure to occupation, air pollution and UV radiation from the sun. Going forward, preventive efforts should prioritize reducing direct exposure to known dangers, refining public health recommendations, and educating individuals at higher risk. Additionally, further research is crucial to uncover the roles of less understood environmental factors like pollution and to devise innovative prevention tactics.

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Approved by any scientific Body

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The authors declare no potential conflict of interest.

References

References

1. Sabzevari P, Abady F, Araghian S, Bahramian F, Isanezhad A. The Effectiveness of Existential Therapy Intervention on Anxiety Caused by Coronavirus and Death. 2022; 11
2. Fakhrioliaei A, Abedinifar F, Salehi Darjani P, Mohammadi-Khanaposhtani M, Larijani B, Ahangar N, Mahdavi M. Hybridization of the effective pharmacophores for treatment of epilepsy: design, synthesis, in vivo anticonvulsant activity, and in silico studies of phenoxyphenyl-1,3,4-oxadiazole-thio-N-phenylacetamid hybrids. *BMC chemistry.* 2023; 17(1)DOI
3. Mollazadeh M, Azizian H, Fakhrioliaei A, Iraji A, Avizheh L, Valizadeh Y, Mahdavi M. Different barbiturate derivatives linked to aryl hydrazone moieties as urease inhibitors; design, synthesis, urease inhibitory evaluations, and molecular dynamic simulations | Request PDF. *ResearchGate.* 2024. DOI
4. Kasiri M, Vidmark J, Hernandez-Martin E, Mousavi SAS, Sanger TD. Endogenous signals during active movement predict deep brain stimulation evoked potential pathways: Results of a transfer function analysis. medRxiv, 2023-04.. 2023.
5. Kasiri Maral, Hernandez-Martin Estefania, Sanger Terence. Pallidothalamic neurotransmission model in human brain: a pilot study through deep brain stimulation. *Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation.* 2021; 14(6)DOI
6. Bagi M, Amjad F, Ghoreishian SM, Sohrabi Shahsavari S, Huh YS, Moraveji MK, Shimpalee S. Advances in Technical Assessment of Spiral Inertial Microfluidic Devices Toward Bioparticle Separation and Profiling: A Critical Review. *BioChip Journal.* 2024;1-23.
7. Lima B, Razmjouei S, Bajwa MT, Shahzad Z, Shoewu OA, Ijaz O, Mange P, Khanal S, Gebregiorgis T. Polypharmacy, Gender Disparities, and Ethnic and Racial Predispositions in Long QT Syndrome: An In-Depth Review. *Cureus.* 2023; 15(9)DOI
8. Velisdeh, ZJ, Najafpour GD, Mohammadi, M, Poureini F. “Optimization of Sequential Microwave-Ultrasound-Assisted Extraction for Maximum Recovery of Quercetin and Total Flavonoids from Red Onion (Allium cepa L.) Skin Wastes,” arXiv preprint arXiv:2104.06109, 2021..
9. Maghsoudloo M, Aliakbari RBS, Velisdeh ZJ. Pharmaceutical, nutritional, and cosmetic potentials of saponins and their derivatives. *Nano Micro Biosystems.* 1402; 2(4)DOI
10. Shineh G, Mobaraki M, Afzali E, Alakija F, Velisdeh Z, Mills D. Antimicrobial Metal and Metal Oxide Nanoparticles in Bone Tissue Repair. *Biomedical Materials & Devices.* 2024. DOI

11. Kok Foong L, Shabani M, Sharghi A, Reihanisaransari R, Al-Bahrani M, Nguyen Le B, Khalilian A. Electromagnetically induced transparency for efficient optical modulation in a graphene-dielectric metasurface with surface roughness. *Surfaces and Interfaces.* 2022; 35DOI
12. Reihani R, Samadifam F, Salameh AA, Mohammadiazar F, Amiri N, Channumsin S. Reliability Characterization of Solder Joints in Electronic Systems Through a Neural Network Aided Approach. *IEEE Access.* 2022; PPDOI
13. Sabzalian MH, Kharajinezhadian F, Tajally A, Reihanisaransari R, Ali Alkhazaleh H, Bokov D. New bidirectional recurrent neural network optimized by improved Ebola search optimization algorithm for lung cancer diagnosis. *Biomedical Signal Processing and Control.* 2023; 84DOI
14. Reza Reihanisaransari, Chalapathi Charan Gajjela, Xinyu Wu, et al. Rapid hyperspectral photothermal mid-infrared spectroscopic imaging from sparse data for gynecologic cancer tissue subtyping. arXiv preprint arXiv:2402.17960. 2024/2/28.DOI
15. Kiarashi M, Mahamed P, Ghotbi N, Tadayonfard A, Nasiri K, Kazemi P, Badkoobeh A, Yasamineh S, Joudaki A. Spotlight on therapeutic efficiency of green synthesis metals and their oxide nanoparticles in periodontitis. *Journal of Nanobiotechnology.* 2024; 22(1)DOI
16. M. Da'i, et al. Sensing the formaldehyde pollutant by an enhanced BNC18 fullerene: DFT outlook Chem. *Phys. Impact.* 7(2003):p. 100306. DOI
17. Azimifar Farhad et al. "Transparency performance improvement for multi-master multi-slave teleoperation systems with external force estimation". *Transactions of the Institute of Measurement and Control.* vol. 40.13, :pp. 3851-3859, 2018.
18. Chalapathi Gajjela, Rupali Mankar, Ragib Ishrak, Xinyu Wu, Reza Reihanisaransari, et al. Biomedical diagnostics and clinical applications of photothermal mid-infrared spectroscopic imaging (Conference Presentation). Event: SPIE BiOS, 2023, San Francisco, California, United States. Proceedings Volume PC12392, Advanced Chemical Microscopy for Life Science and Translational Medicine 2023; PC123920R (2023).DOI
19. Maghsoudloo M, Bagheri Shahzadeh Aliakbari R. Lutein with various therapeutic activities based on micro and nanoformulations: A systematic mini-review. *Micro Nano Bio Aspects.* 2023; 2(4)DOI
20. Tavasolikejani S, Farazin A. Explore the most recent advancements in the domain of self-healing intelligent composites specifically designed for use in dentistry. *Journal of the Mechanical Behavior of Biomedical Materials.* 2023; 147DOI
21. Tavasolikejani S, Farazin A. The effect of increasing temperature on simulated nanocomposites reinforced with SWBNNs and its effect on characteristics related to mechanics and the physical attributes using the MDs approach. *Heliyon.* 2023; 9(10)DOI
22. Tavasolikejani S, Hosseini S, Ghiaci M, Vangijzegem T, Laurent S. Copper nanoparticles embedded into nitrogen-doped carbon fiber felt as recyclable catalyst for benzene oxidation under mild conditions. *Molecular Catalysis.* 2024; 553DOI
23. Tavasolikejani S, Farazin A. Fabrication and modeling of nanocomposites with bioceramic nanoparticles for rapid wound healing: An experimental and molecular dynamics investigation. *Nanomedicine Research Journal.* 2023; 8(4)DOI
24. Hatami A, Saadatmand M. Extremely Precise Blood-Plasma Separation from Whole Blood on a Centrifugal Microfluidic Disk (Lab-on-a-Disk) Using Separator Gel. *Diagnostics (Basel, Switzerland).* 2022; 12(11)DOI
25. Hatami A, Saadatmand M, Garshasbi M. Cell-free fetal DNA (cffDNA) extraction from whole blood by using a fully automatic centrifugal microfluidic device based on displacement of magnetic silica beads. *Talanta.* 2024; 267DOI
26. Sharifi F, Sedighi A, Rehman M. Design and Simulation of a Point-of-Care Microfluidic Device for Acoustic Blood Cell Separation. *Engineering Proceedings.* 2020; 2(1)DOI
27. Sadrabad MJ, Ghahremanfard F, Sohanian S, Mobarhan M, Nabavi A, Saberian E. Knowledge and Attitude of Cancer Patients' Companions towards Chemotherapy and Radiotherapy-induced Oral Complications and Dental Considerations. *Iranian Red Crescent Medical Journal.* 2023; 25(2)
28. Jalili Sadrabad M, Pedram A, Saberian El, Emami R. Clinical efficacy of LLLT in treatment of

trigeminal neuralgia – Case report. *Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology.* 2023; 35(6)DOI
29. Jalili Sadrabad M, Saberian E. Plasma Therapy for Medication-Related Osteonecrosis of the Jaws- A Case Report. *Case Reports in Clinical Practice.* 2023; 8DOI
30. Saberian E, Jalili Sadrabad M, Petrášová A, A I. Dental Pulp Stem Cells in Pulp Regeneration. *SunText Review of Medical & Clinical Research.* 2021; 02DOI
31. Sarkhosh H, Mahmoudi R, Malekpour M, Ahmadi Z, Khiyavi AA. The Effect of Curcumin in Combination Chemotherapy with 5-FU on non-Malignant Fibroblast Cells. *Asian Pacific Journal of Cancer Care.* 2019; 4(1)DOI
32. Kiarashi M, Bayat H, Shahrtash SA, Etajuri EA, Khah MM, Al-Shaheri NA, Nasiri K, Esfahaniani M, Yasamineh S. Mesenchymal Stem Cell-based Scaffolds in Regenerative Medicine of Dental Diseases. *Stem Cell Reviews and Reports.* 2024; 20(3)DOI
33. Toiserkani F, Mirzaei M, Alcan V, Harismah K, Salem-Bekhet M. A Facile Detection of Ethanol by the Be/Mg/Ca-Enhanced Fullerenes: Insights from Density Functional Theory. *Chemical Physics Impact.* 2023; 7DOI
34. Taher A, Sadrabad M, Izadi A, Ghorbani R, Sohanian S, Saberian E. The effect of dentin matrix proteins on differentiation of autologous guinea pig dental pulp stem cells. *Journal of the Scientific Society.* 2023; 50DOI
35. Sadrabad MJ, Saberian E, Izadi A, Emami R, Ghadyani F. Success in Tooth Bud Regeneration: A Short Communication. *Journal of Endodontics.* 2024; 50(3)DOI
36. Hoveidaei AH, Sadat-Shojai M, Mosalamiaghili S, Salarikia SR, Roghani-Shahraki H, Ghaderpanah R, Ersi MH, Conway JD. Nano-hydroxyapatite structures for bone regenerative medicine: Cell-material interaction. *Bone.* 2024; 179DOI
37. Manshour N, He F, Wang D, Xu D. Integrating Protein Structure Prediction and Bayesian Optimization for Peptide Design. In NeurIPS 2023 Generative AI and Biology (GenBio) Workshop. https://openreview.net/forum?id=CsjGuWD7hk. 2023.
38. Pahnehkolaei SMH, Kachabi A, Sipey MH, Ganji DD. New approach method for solving nonlinear differential equations of blood flow with nanoparticle in presence of magnetic field. arXiv preprint arXiv:2402.16208. 2024. DOI
39. Dolati S, Razmjouei S, Alizadeh M, Faghfouri AH, Moridpour AH. A high dietary acid load can potentially exacerbate cardiometabolic risk factors: An updated systematic review and meta-analysis of observational studies. *Nutrition, metabolism, and cardiovascular diseases: NMCD.* 2024; 34(3)DOI
40. Mirmiranpour H, Amjadi A, Khandani S, Shafaee Y, Sobhani SO. Wavelength Effect in Laser Therapy of Diabetic Rats on Oxidants: AGEs, AOPP, ox-LDL Levels. *International Journal of Clinical and Experimental Medical Sciences.* 2020; 6(2)DOI
41. Ghahjavarestani AHM, Martin MMB, Gavalda JMS. Comparison of mental health in normal and autism family. *Psychology and Education Journal.* 2021; 58(5)
42. Niki Sadeghipour, Babak Heidari Aghdam. The Effect of Pesticides on Child Gender and the Level of Sexual Activities in People Exposed –IRAN. MAR Gynecology 1.4 (2021).DOI
43. Niki Sadeghipor, Babak Heidari Aghdam. Investigating the Effect of Appropriate Personal Protective Equipment on the Stress Level of Care Workers in the Covid19 Epidemic.. *Health science journal..* May 21, 2021. DOI
44. Niki sadeghipour, Babak heidari Aghdam, Sahra Kabiri. Evaluation of Burnout and Job Stress in Care Worker and Comparison between Front-Line and Second Line in Care Worker During Coronavirus Epidemic. *Health science journal.* May 21, 2021. DOI
45. Esmat Sadeghpour, Ebrahim Karimi Sangchini. Assessment and Comparative Study of Job Stress in Jam Hospital jobs, Tehran City. *Health science journal.* October 05, 2020. DOI
46. Niki Sadeghipour, Sahra Kairi, Dr Babak Heidari Aghdam. Investigating the pesticides impact on mental health of exposed workers – Iran. MAR Case Reports 2.6. 2021. DOI
47. Montazeri Ghahjavarestani A, Martín B, Sanahuja J. Study of Marital Satisfaction in Autistic Families. *Autism and Developmental Disorders.* 2020; 18DOI
48. Sanaei M, Gilbert SB, Javadpour N, Sabouni H, Dorneich MC, Kelly JW. The Correlations of Scene Complexity, Workload, Presence, and Cybersickness in a Task-Based VR Game. 2024. DOI

49. Salehi M, Javadpour N, Beisner B, Sanaei M, Gilbert SB. Cybersickness Detection through Head Movement Patterns: A Promising Approach. 2024. DOI
50. Mohammadinezhad F, Talebi A, Allahyartorkaman M, Nahavandi R, Vesal M, Khiyavi AA, Velisdeh ZJ, et al. Preparation, Characterization and Cytotoxic Studies of Cisplatin-containing Nanoliposomes on Breast Cancer Cell Lines. *Asian Pacific Journal of Cancer Biology.* 2023; 8(2)DOI
51. Milani AT, Rashidi S, Mahmoudi R, Douna BK. Cytotoxic Activity of Epigallocatechin and Trans-Cinnamaldehyde in Gastric Cancer Cell Line. *Asian Pacific Journal of Cancer Biology.* 2019; 4(4)DOI
52. Kanaani L, Mazloumi Tabrizi M, Akbarzadeh A, Javadi I. Improving the Efficacy of Cisplatin using Niosome Nanoparticles Against Human Breast Cancer Cell Line BT-20 : An In Vitro Study. *Asian Pacific Journal of Cancer Biology.* 2017; 2DOI
53. Roudsari MH, Saeidi N, Kabiri N, Ahmadi A, Tabrizi MM, Shahmabadi HE, Khiyavi AA, Reghbati B. Investigation of Characteristics and Behavior of Loaded Carboplatin on the, Liposomes Nanoparticles, on the Lung and Ovarian Cancer: An In-Vitro Evaluation. *Asian Pacific Journal of Cancer Biology.* 2016; 1(1)DOI
54. Gorgzadeh A, Hheidari A, Ghanbarikondori P, Arastonejad M, Goki, Aria M, Moazzam F. Investigating the Properties and Cytotoxicity of Cisplatin-Loaded Nano-Polybutylcyanoacrylate on Breast Cancer Cells. *Asian Pacific Journal of Cancer Biology.* 8(4):345-50.
55. Moazzam F, Hatamian-Zarmi A, Ebrahimi Hosseinzadeh B, Khodagholi F, Rooki M, Rashidi F. Preparation and characterization of brain-targeted polymeric nanocarriers (Frankincense-PMBN-lactoferrin) and in-vivo evaluation on an Alzheimer's disease-like rat model induced by scopolamine. *Brain Research.* 2024; 1822DOI
56. Abedi Cham Heidari Z, Ghanbarikondori P, Mortazavi Mamaghani E, Hheidari A, Saberian E, Mozaffari E, Alizadeh M, Allahyartorkaman M. Characteristics and Cytotoxic Effects of Nano-Liposomal Paclitaxel on Gastric Cancer Cells. *Asian Pacific journal of cancer prevention: APJCP.* 2023; 24(9)DOI
57. Aminnezhad S, Maghsoudloo M, Bagheri Shahzadeh Aliakbari R. Anticancer, antimicrobial, anti-inflammatory, and neuroprotective effects of bisdemethoxycurcumin: Micro and nano facets. *Micro Nano Bio Aspects.* 2023; 2(4)DOI
58. Tangsiri M, Hheidari A, Liaghat M, Razlansari M, Ebrahimi N, Akbari A, Varnosfaderani SMN, et al. Promising applications of nanotechnology in inhibiting chemo-resistance in solid tumors by targeting epithelial-mesenchymal transition (EMT). *Biomedicine & Pharmacotherapy = Biomedecine & Pharmacotherapie.* 2024; 170DOI
59. Abbasi M, Reihanisaransari R, Poustchi F, Hheidari A, Ghanbarikondori P, Salehi H, Salehi V, Izadkhah M, Moazzam F, Allahyartorkaman M. Toxicity of Carboplatin-Niosomal Nanoparticles in a Brain Cancer Cell Line. *Asian Pacific journal of cancer prevention: APJCP.* 2023; 24(11)DOI
60. Poy D, Akbarzadeh A, Ebrahimi Shahmabadi H, Ebrahimifar M, Farhangi A, Farahnak Zarabi M, Akbari A, Saffari Z, Siami F. Preparation, characterization, and cytotoxic effects of liposomal nanoparticles containing cisplatin: an in vitro study. *Chemical Biology & Drug Design.* 2016; 88(4)DOI
61. Ebrahimifar M, Roudsari MH, Kazemi SM, Shahmabadi HE, Kanaani L, Alavi SA, Vasfi MI. Enhancing Effects of Curcumin on Cytotoxicity of Paclitaxel, Methotrexate and Vincristine in Gastric Cancer Cells. *Asian Pacific Journal of Cancer Prevention : APJCP.* 2017; 18(1)DOI
62. Mohamadi N, Kazemi SM, Mohammadian M, Toofani Milani A, Moradi Y, Yasemi M, Ebrahimi far M, Mazloumi Tabrizi M, Ebrahimi Shahmabadi H, Akbarzadeh Khiyavi A. Toxicity of Cisplatin-Loaded Poly Butyl Cyanoacrylate Nanoparticles in a Brain Cancer Cell Line: Anionic Polymerization Results. *Asian Pacific journal of cancer prevention: APJCP.* 2017; 18(3)DOI
63. Saberian E, Jenča A, Petrášová A, Jenčová J, Jahromi RA, Seiffadini R. Oral Cancer at a Glance. *Asian Pacific Journal of Cancer Biology.* 2023; 8(4)DOI
64. Farrokhi M, Moeini A, Taheri F, Farrokhi M, Mostafavi M, Ardakan A K, Faranoush P. Artificial Intelligence in Cancer Care: From Diagnosis to Prevention and Beyond. Kindle.

2023; 31(1):1-149.
65. Warnakulasuriya S. Global epidemiology of oral and oropharyngeal cancer. *Oral Oncology.* 2009; 45(4-5)DOI
66. Dhanuthai K, Rojanawatsirivej S, Thosaporn W, Kintarak S, Subarnbhesaj A, Darling M, Kryshtalskyj E, et al. Oral cancer: A multicenter study. *Medicina Oral, Patologia Oral Y Cirugia Bucal.* 2018; 23(1)DOI
67. Rivera C. Essentials of oral cancer. *International Journal of Clinical and Experimental Pathology.* 2015; 8(9)
68. Kane SV, Gupta M, Kakade AC, D' Cruz A. Depth of invasion is the most significant histological predictor of subclinical cervical lymph node metastasis in early squamous carcinomas of the oral cavity. *European Journal of Surgical Oncology: The Journal of the European Society of Surgical Oncology and the British Association of Surgical Oncology.* 2006; 32(7)DOI
69. Bagan J, Sarrion G, Jimenez Y. Oral cancer: clinical features. *Oral Oncology.* 2010; 46(6)DOI
70. Silverman S, Kerr AR, Epstein JB. Oral and pharyngeal cancer control and early detection. *Journal of Cancer Education: The Official Journal of the American Association for Cancer Education.* 2010; 25(3)DOI
71. McCullough MJ, Prasad G, Farah CS. Oral mucosal malignancy and potentially malignant lesions: an update on the epidemiology, risk factors, diagnosis and management. *Australian Dental Journal.* 2010; 55 Suppl 1DOI
72. Gómez I, Seoane J, Varela-Centelles P, Diz P, Takkouche B. Is diagnostic delay related to advanced-stage oral cancer? A meta-analysis. *European Journal of Oral Sciences.* 2009; 117(5)DOI
73. McGurk M, Chan C, Jones J, O'regan E, Sherriff M. Delay in diagnosis and its effect on outcome in head and neck cancer. *The British Journal of Oral & Maxillofacial Surgery.* 2005; 43(4)DOI
74. Groome PA, Rohland SL, Hall SF, Irish J, Mackillop WJ, O'Sullivan B. A population-based study of factors associated with early versus late stage oral cavity cancer diagnoses. *Oral Oncology.* 2011; 47(7)DOI
75. Chow LQM. Head and Neck Cancer. *The New England Journal of Medicine.* 2020; 382(1)DOI
76. Ford P, Farah C. Early detection and diagnosis of oral cancer: Strategies for improvement. *Journal of Cancer Policy.* 2013; 1DOI
77. Trimarchi M, Bertazzoni G, Bussi M. Cocaine induced midline destructive lesions. *Rhinology.* 2014; 52(2)DOI
78. Trimarchi M, Bellini C, Fabiano B, Gerevini S, Bussi M. Multiple mucosal involvement in cicatricial pemphigoid. *Acta Otorhinolaryngologica Italica: Organo Ufficiale Della Societa Italiana Di Otorinolaringologia E Chirurgia Cervico-Facciale.* 2009; 29(4)
79. Biafora M, Bertazzoni G, Trimarchi M. Maxillary sinusitis caused by dental implants extending into the maxillary sinus and the nasal cavities. *Journal of Prosthodontics: Official Journal of the American College of Prosthodontists.* 2014; 23(3)DOI
80. Trimarchi M, Bondi S, Della Torre E, Terreni MR, Bussi M. Palate perforation differentiates cocaine-induced midline destructive lesions from granulomatosis with polyangiitis. *Acta Otorhinolaryngologica Italica: Organo Ufficiale Della Societa Italiana Di Otorinolaringologia E Chirurgia Cervico-Facciale.* 2017; 37(4)DOI
81. Lanzillotta M, Campochiaro C, Trimarchi M, Arrigoni G, Gerevini S, Milani R, et al. Deconstructing IgG4-related disease involvement of midline structures: Comparison to common mimickers. *Modern Rheumatology.* 2017; 27(4)DOI
82. Wong T, Wiesenfeld D. Oral Cancer. *Australian Dental Journal.* 2018; 63 Suppl 1DOI
83. Joseph BK. Oral cancer: prevention and detection. *Medical Principles and Practice: International Journal of the Kuwait University, Health Science Centre.* 2002; 11 Suppl 1DOI
84. Singhvi HR, Malik A, Chaturvedi P. The Role of Chronic Mucosal Trauma in Oral Cancer: A Review of Literature. *Indian Journal of Medical and Paediatric Oncology: Official Journal of Indian Society of Medical & Paediatric Oncology.* 2017; 38(1)DOI
85. Waal I. Oral potentially malignant disorders: is malignant transformation predictable and

preventable?. *Medicina Oral, Patologia Oral Y Cirugia Bucal.* 2014; 19(4)DOI
86. Abati S, Bramati C, Bondi S, Lissoni A, Trimarchi M. Oral Cancer and Precancer: A Narrative Review on the Relevance of Early Diagnosis. *International Journal of Environmental Research and Public Health.* 2020; 17(24)DOI
87. Lingen MW, Kalmar JR, Karrison T, Speight PM. Critical evaluation of diagnostic aids for the detection of oral cancer. *Oral Oncology.* 2008; 44(1)DOI
88. Waal I, Bree R, Brakenhoff R, Coebergh J. Early diagnosis in primary oral cancer: is it possible?. *Medicina Oral, Patologia Oral Y Cirugia Bucal.* 2011; 16(3)DOI
89. Sankaranarayanan R, Ramadas K, Thomas G, Muwonge R, Thara S, Mathew B, Rajan B. Effect of screening on oral cancer mortality in Kerala, India: a cluster-randomised controlled trial. *Lancet (London, England).* 2005; 365(9475)DOI
90. Lim K, Moles DR, Downer MC, Speight PM. Opportunistic screening for oral cancer and precancer in general dental practice: results of a demonstration study. *British Dental Journal.* 2003; 194(9)DOI
91. Datzmann T, Markevych I, Trautmann F, Heinrich J, Schmitt J, Tesch F. Outdoor air pollution, green space, and cancer incidence in Saxony: a semi-individual cohort study. *BMC public health.* 2018; 18(1)DOI
92. Raj AT, Patil S, Sarode SC, Sarode GS, Rajkumar C. Evaluating the association between household air pollution and oral cancer. *Oral Oncology.* 2017; 75DOI
93. Sarode SC, Sarode GS, Sharma N. Outdoor air pollution and oral cancer: critical viewpoints and future prospects. *Future Oncology (London, England).* 2023; 19(6)DOI
94. Jenwitheesuk K, Peansukwech U, Jenwitheesuk K. Predictive MERRA-2 aerosol diagnostic model for oral, oropharyngeal and laryngeal cancer caused by air pollution in Thai population. *Toxicology Reports.* 2022; 9DOI
95. Allam, Eman, Jack Windsor. “Social And Behavioral Determinants Of Oral Cancer.”. *Dentistry 3000 4 (2013).*1-4.
96. King GN, Healy CM, Glover MT, Kwan JT, Williams DM, Leigh IM, Worthington HV, Thornhill MH. Increased prevalence of dysplastic and malignant lip lesions in renal-transplant recipients. *The New England Journal of Medicine.* 1995; 332(16)DOI
97. Rossi, Julia Figueiredo, et al. “Câncer oral: etiologia, características clínicas e diagnóstico diferencial.” Revista Científica Faesa (2023): n. pag.
98. Marant Micallef C, Shield KD, Baldi I, Charbotel B, Fervers B, Gilg Soit Ilg A, Guénel P, et al. Occupational exposures and cancer: a review of agents and relative risk estimates. *Occupational and Environmental Medicine.* 2018; 75(8)DOI
99. Al Zabadi H, Ferrari L, Laurent A, Tiberguent A, Paris C, Zmirou-Navier D. Biomonitoring of complex occupational exposures to carcinogens: the case of sewage workers in Paris. *BMC cancer.* 2008; 8DOI
100. Awan KH, Hegde R, Cheever VJ, Carroll W, Khan S, Patil S, Warnakulasuriya S. Oral and pharyngeal cancer risk associated with occupational carcinogenic substances: Systematic review. *Head & Neck.* 2018; 40(12)DOI
101. Chompikul, Jiraporn. “Cancer Prevention lifestyle. 2016.
102. Irani S. New Insights into Oral Cancer-Risk Factors and Prevention: A Review of Literature. *International Journal of Preventive Medicine.* 2020; 11DOI
103. Sujir N, Ahmed J, Pai K, Denny C, Shenoy N. Challenges in Early Diagnosis of Oral Cancer: Cases Series. *Acta Stomatologica Croatica.* 2019; 53DOI
104. Shugars DC, Patton LL. Detecting, diagnosing, and preventing oral cancer. *The Nurse Practitioner.* 1997; 22(6)
105. González-Moles MA, Aguilar-Ruiz M, Ramos-García P. Challenges in the Early Diagnosis of Oral Cancer, Evidence Gaps and Strategies for Improvement: A Scoping Review of Systematic Reviews. *Cancers.* 2022; 14(19)DOI
106. Brown AE, Langdon JD. Management of oral cancer. *Annals of the Royal College of Surgeons of England.* 1995; 77(6)
107. Ord RA, Blanchaert RH. Current management of oral cancer. A multidisciplinary approach. *Journal of the American Dental Association (1939).* 2001; 132 SupplDOI
108. Huang S, O'Sullivan B. Oral cancer: Current role of radiotherapy and

chemotherapy. *Medicina Oral, Patologia Oral Y Cirugia Bucal.* 2013; 18(2)DOI
109. Prihantono P. Adjuvants Therapy In Oral Cancer. *International Journal of Surgery and Medicine.* 2018; 4DOI
110. Janardhanan M, Smitha NV, Rajalakshmi G, George A, Koyakutty M, Iyer S. Tumour Microenvironment as a Potential Immune Therapeutic Target for Tongue Cancer Management. *Journal of oral and maxillofacial pathology: JOMFP.* 2023; 27(2)DOI
111. Kgh D. Polymeric drug delivery systems for intraoral site-specific chemoprevention of oral cancer. *Journal of biomedical materials research. Part B, Applied biomaterials.* 2018; 106(3)DOI
112. Vanneman M, Dranoff G. Combining immunotherapy and targeted therapies in cancer treatment. *Nature Reviews. Cancer.* 2012; 12(4)DOI
113. Zhao D, Pharaon R, Massarelli E. Treatment Strategies in Head and Neck Cancers. 2019;273-94. DOI
114. Rouzbeh Shadidi-Asil A, Mehrnoosh Kialashaki, et al. A rare case of cutaneous mucormycosis in the forearm: A case report. International-journal-of-surgery-case-reports.Volume 94, May 2022, 107048.
115. Kasra Hatampour, Manoochehr Ebrahimian, Amir Zaman, et al. Evaluation of the difficulty of laparoscopic cholecystectomy during COVID-19 pandemic using externally validated prediction models: A retrospective cohort study. International Journal of Surgery Open Volume 61, December 2023, 100710.
116. Amirreza Ramezani, Hamideh Sabbaghi, et al. Prevalence of cataract and its contributing factors in Iranian elderly population: the Gilan eye study. Int Ophthalmol. 2023 Dec;43(12):4503-4514.DOI
117. Jalili Sadrabad M, Saberian E, Saberian E, Behrad S. Gingival bullae-A rare visible case report. Journal of Research in Applied and Basic Medical Sciences .2024 Jan 10 [cited 2024 May 6];10(1):31–4. Available from: https:// ijrabms.umsu.ac.ir/article-1-296-en.html.
118. Seyedeh Negin Hadisadegh, Parizad Ghanbarikondori, Armin Sedighi, Iman Afyouni, Nikoo Javadpour, Mehrnoosh Ebadi. Improving Cancer Therapy: Design, Synthesis, and Evaluation of Carboplatin-Based Nanoliposomes against Breast Cancer Cell Lines. APJCB, VOL 9 NO 2 (2024).DOI
119. Zahra Pirmoradi, Kasra Nazari, Nadia Shafiee, Nikou Nikoukar, Shima Minoo, et al. Oral Cancer and HPV: Review Article. *APJCB, VOL 9 NO 1 (2024).*DOI
120. Neaman Sohrabi, Karrar A, Hammoodi, Ahmad Hammoud, et al. Using different geometries on the amount of heat transfer in a shell and tube heat exchanger using the finite volume method. Case Studies in Thermal Engineering. Volume 55, March 2024, 104037.
121. As' ad Alizadeh, Dheyaa J Jasim, Neaman Sohrabi, et al. Using shock generator for the fuel mixing of the extruded single 4-lobe nozzle at supersonic combustion chamber. *Sci Rep.* 2024 Mar 17; 17(1):6405. DOI
122. Amanda K, NewendorpMohammadamin Sanaei, AJ Perron, H Sabouni, et al Apple's Knowledge Navigator: Why Doesn't that Conversational Agent Exist Yet? ACM ISBN 979-8-4007-0330-0/24/05.DOI