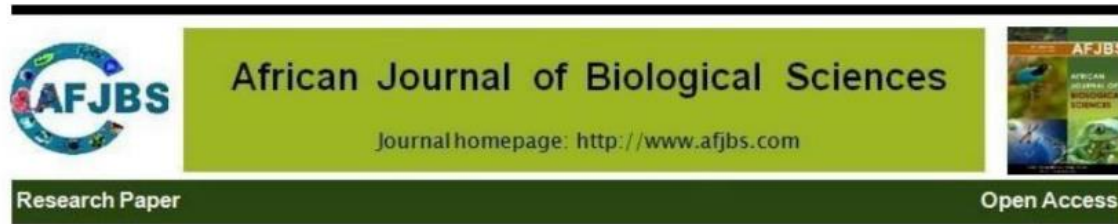# A Scientometric Journey; Assessing Research Trends on Oral Cancer Prevention

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Introduction

Oral cancer is found to be the thirteenth most common cancer as stated by the WHO. Risk factors associated with deleterious habits of tobacco consumption, alcoholism, low socio economic status, sharp teeth consequently contributes significantly to the disease burden, which is a major global health concern leading to death and crippling of life. With approximately 325,000 deaths each year, oral cancer is the sixth most frequent cancer globally(1). The number of estimated incident cases of lip and oral cavity cancers ranked 16th among all cancers (for both sexes); combined with cases of oropharyngeal cancers, the rank increased to the 13th most common cancer worldwide (2).Over the past ten years, there has been a noticeable rise in the occurrence of cancer. Globally, there were 23.6 million new cases of cancer in 2019 compared to 18.7 million in 2010. There is a corresponding increase in cancer mortality to this rise in incidence. The overall number of cancer deaths rose from 8.29 million to 10.0 million between 2010 and 2019, a 20.9% increase. As a result, the percentage of cancer-related deaths increased from 15.7% in 2010 to 17.7% in 2019, accounting for all causes of death (3).

The contemporary world is currently advancing towards numerous types of non - communicable diseases. oral cancer has been considered a chief public health problem.The critical need for improved cancer prevention, early detection, and treatment options is highlighted by this concerning development as the complained risk factors. Ageing populations, changes in lifestyle and advancements in diagnostic technology are all factors that are causing an increase in cancer incidence and mortality. To be more precise, in order to lessen the impact of oral cancer, which is frequently linked to risk factors like alcohol intake, tobacco use, and human papillomavirus (HPV) infection, certain public health initiatives are required. To reduce these risk factors and the incidence of oral cancer, effective public health initiatives and awareness campaigns are crucial. Early detection and prompt treatment is an conventional ideal strategy towards controlling this menace.

The escalating cases of oral cancer emphasizes the value of further focused researches in preventive, curative rehabilitative care for best prognosis.Public health campaigns too are need of an hour to increase the health literacy forbetter understand the disease's origin, enhance early detection, and create more potent treatments. Novel therapeutic methods have been made possible by the newfound understanding of the pathophysiology of oral cancer brought about by advancements in molecular biology and genetics. Furthermore, advances in screening methods, like the application of biomarkers and cutting-edge imaging technology, has substantiallyimprovedthe outcomes and early detection among cohorts of carcinomas.

Furthermore, multinational alliances and multidisciplinary cooperation are essential in the fight against the world's cancer epidemic. The International Agency for Research on Cancer (IARC) and the World Health Organization (WHO) are leading international initiatives to lower cancer incidence and mortality through policy advocacy, education, and research. These endeavours are of paramount importance in mitigating the inequalities in cancer care and guaranteeing that cancer therapeutic innovations are attainable by people globally.

To sum up a multimodal strategy combining prevention, early detection, and cutting-edge treatment techniques is required for better prognosis, due to the rising incidence and mortality rates of cancer, especially oral cancer. We can significantly lower the worldwide cancer burden and enhance the quality of life for cancer patients by addressing the underlying risk factors and utilizing technology developments in cancer research and treatment. To achieve these objectives, sustained funding for research, public health programs, and cross-border cooperation will be essential. Certain aspect of common risk factors are controllable by efficient, effective public health approach

Developing nations, especially those in South Asia, bear a disproportionately high burden of oral cancer. Every year, almost 100,000 new cases are reported in India alone. Though there may be regional differences, generally speaking, men are more likely than women to be affected by sickness; in Taiwan, for example, the male to female ratio is 10:1. As people age, the incidence of oral cancer increases; most instances are discovered in those 50 years of age and beyond.

Furthermore, the incidence of oral cancer varies significantly throughout geographical areas. The highest incidence is found in Papua New Guinea, with notable rates also found in Taiwan, parts of Eastern Europe (Hungary, Slovakia, and Slovenia), parts of Western Europe (northern France and Portugal), South Asia (Maldives, Sri Lanka, India, and Pakistan), and some regions of Latin America and the Caribbean (Brazil, Uruguay, and Puerto Rico). The chance to detect oral cancer in its early stages, when treatment outcomes and quality of life are noticeably better, by novelscreening strategies at molecular and genetic engineering levels. Unfortunately, early-stage oral malignancies frequently show no symptoms at all and might be misdiagnosed as benign illnesses, which discourages individuals from visiting a doctor (4). This emphasizes how important more sensitive screening devices or programs are for early detection and raising the chance of a successful course of therapy. Novel therapeutic approaches have proliferated as scientists and medical experts work to address the intricacies of this illness.

Saliva, for instance, has a lot of promise as a diagnostic tool for mass prevention, disease control, and early detection (5). There is still a significant knowledge vacuum on the prevention of oral cancer, notwithstanding these developments. It is imperative that we move toward a prevention-focused approach or detection at earliest in view of improving quality of

life. Population-based effective screening programs can greatly influence the course of the disease and improve prognosis and treatment outcomes by enabling early detection (6). Comprehensive scientometric analyses are thus necessitates to raise standards where we stand in diagnostic and therapeutic modalities. Through study of evidence based literature, trends and upgradation and gap analysis may reinforce insight in control of deadly disease. The increasing trends of prevalence and fatality rates of oral cancer, despite great breakthroughs in diagnosis and treatment need more comprehensive newer technological innovations in diagnostic and therapeutic field .

By highlighting the field's diversity, these analyses seek to advance our understanding of cancer prevention in a more panoramic way. Through the thorough understanding in evidence based literatureof these many facets, scientists can stimulate additional inquiry into sometimes disregarded facets of cancer prevention and the complained risk factors. There is still a significant public health concern regarding oral cancer, especially in underdeveloped nations where resources forprevention, early detection , and treatment may be limited. The burden of the disease is made worse in these areas by the high incidence of risk factors such as alcohol intake, tobacco use, and HPV infection. Research trends, gaps, and emerging topics in oral cancer prevention can be better understood by scientometric analysis, which can help direct future studies and public health initiatives. Furthermore, combining scientometricquantitative analysis with clinical and epidemiological data can be milestonesteps toimprove course and consequences of this fatal disease. The creation of more focused, effective interventions and policies with the goal of lowering the incidence and death rate of oral cancer may result from this integrated approach of common risk factors. In order to transmit transition to a prevention-focused era and eventually enhance patient outcomes and quality of life, we must promote interdisciplinary cooperation and make use of technological and data analytics advancements.

A quantitative method used to evaluate and quantify the results, significance, and patterns of scientific research in a certain topic or discipline is called scientometric analysis(7). Scientometric analysis provides important insights into the dynamics of scholarly communication and the transmission of knowledge by examining a variety of bibliometric indicators, including citations, publication counts, authorship patterns, and collaboration networks. Researchers can use this methodology to assess the impact of specific researchers, organizations, journals, and entire research fields, which helps with funding allocation, strategic planning, and decision-making (8).

Researchers can assess a publication's influence and reach by looking at its citation patterns. This helps them find important papers that have had a big impact on the field. Highly cited articles, for example, frequently provide original research that influenced later investigations and developments (9). Moreover, authorship trends and publication counts highlight collaborative efforts and prolific writers, demonstrating how cooperation and cooperative endeavours advance science (10). Networks of collaboration are especially crucial for comprehending how institutions and researchers are interconnected. Scientometric analysis can illustrate the degree of global collaboration and cross-border knowledge transfer by charting these networks (11). Policymakers and funding agencies should take note of this information since it emphasizes how important it is to create international cooperation in order to overcome difficult scientific problems.

Furthermore, scientometric analysis can be used to identify new areas of inquiry and monitor the advancement of science throughout time to time. Scholars can predict future directions

and opportunities within their areas by recognizing trends and shifts in research concentration (12). This predictive power is priceless for organizations trying to maintain their position at the vanguard of scientific advancement and for funding organizations trying to provide funds for innovative research.

The objective of currentscientometric analysis is to present significant data that could impact research initiatives in prevention, diagnosing and curing the crucial life threatening crippling disease. To provide insights into the future orientations of oral cancer prevention in terms of advanced diagnostics and innovative treatment. The study aims to considerably lower the death and morbidity rate of disease related to oral cancer by concentrating on primordial and primary preventive methods as disease is selfinflicting and risk factors are compliable. The approach specifically tries to reveal hidden trends, identify potential knowledge shortages, and promote debate around these important but sometimes missed areas by examining the least used terms and filling in gaps in the available literature (13).

This study's main goal is to close existing gaps in knowledge by identifying hidden knowledge concentrating more on submerged part of iceburg more than theappreciable tip by deepening the cognitive domain of all published available research trends. This entails exploring understudied areas of oral cancer research in order to spark additional study and conversation. Researchers can concentrate oncreating novel preventative methods that are more focused and successful by recognizing these gaps (14). This strategy is essential for improving our knowledge of the causes and prevention of oral cancer cohorts for better quality of living.

The study also highlights how critical it is to investigate underrepresented subjects in oral cancer research. The study looks at lesser-known keywords and topics in an effort to identify areas that need more focus and funding. This may result in the development of cutting-edge treatment and preventive strategies that have a big impact on public health outcomes (15). To successfully minimize the incidence and impact of oral cancer, comprehensive measures that address these gaps are needed. This scientometric analysis also aims to stimulate additional research into successful preventive measures. The study fosters interdisciplinary project collaboration and new routes of investigation by drawing attention to under-researched regions. In order to progress the area and guarantee that research findings are implemented into useful public health initiatives, collaboration is essential (16). The ultimate objective is to drastically lower the morbidity and death rate related to oral cancer by using creative and knowledgeable preventative techniques.

The scientific literature on oral cancer prevention is thoroughly examined in this article, which also identifies important researchers and institutions and lists the top nations and journals in the subject. It does this by examining publishing trends. We hope to provide insightful information on the current state of research and developing themes in oral cancer prevention by carefully examining highly-cited articles and providing a network map of pertinent keywords (13).

A thorough evaluation of the most significant investigators and organizations involved in the field of oral cancer prevention research is part of our investigation. Through the mapping of authorship patterns and collaboration networks, we are able to pinpoint the key players and institutions propelling these developments. According to Aria and Cuccurullo (14), this data is essential for establishing future partnerships and allocating funds to high-impact research

projects. We may also gain a better understanding of the worldwide landscape of oral cancer research and knowledge sharing by identifying the top nations and journals.

To find hidden trends and knowledge gaps, we will investigate the network of pertinent terms used in the literature in addition to these metrics. This network analysis makes it easier to see how various research topics are related to one another and pinpoints new areas that need more study. Our goal is to improve knowledge of oral cancer prevention measures overall and to encourage new research approaches by offering a thorough assessment of the keyword landscape (15). Our ultimate objective is to help advance a deeper and more complex understanding of oral cancer prevention, opening the door to a time when the illness won't have such a severe impact on world health.

Methodology

Search Strategy

In November 2023, an extensive electronic search was conducted using the PubMed database to gather literature on the topic "assessing trends on oral cancer prevention." The initial search yielded 237 documents. To refine the results, predefined criteria were applied. These criteria included narrowing the search period to publications from 2015 to 2023. This step reduced the number of relevant documents to 197.

The selected documents then underwent a rigorous screening process. Two reviewers independently assessed the titles and abstracts of these documents to ensure they met the inclusion criteria. This meticulous review process aimed to identify studies that were most relevant to the research question. Any discrepancies between the reviewers were resolved through mutual discussion and agreement to ensure a consistent and unbiased selection process.

After excluding publications that did not meet our inclusion criteria, a final total of 157 documents were deemed suitable for detailed analysis. These selected studies provided a comprehensive overview of the current trends in oral cancer prevention, incorporating the latest research findings and methodologies.

Data Retrieval and Data Analysis

The PubMed database was used to export a thorough metadata report in Comma Separated Value (CSV) format. This report included comprehensive details on a number of the extracted data's features, such as authors, titles, publishing year, journal names, volumes, issues, DOIs, keywords, document kinds, and publication phases. After which, Microsoft Excel was used to assess the CSV file for accuracy and to carry out some basic data classification and sorting. A strong tool for building and viewing bibliometric networks is VOSviewer. The dataset was imported into VOSviewer version 1.6.18 for a thorough Scientometric study after the preliminary analysis in Excel.

With the aid of this program, it was possible to create visual maps based on bibliometric data and analyze linkages between the documents in terms of co-authorship, co-occurrence of keywords, citation, bibliographic coupling, and co-citation. The thematic structure of the literature on oral cancer prevention, important contributions, and research trends were all insightfully shown by these analyses. The integration of Excel and VOSviewer facilitated an

exhaustive scrutiny of the dataset, guaranteeing a sturdy and all-encompassing evaluation of the patterns in research on oral cancer prevention. The literature provides strong support for this analytical approach when performing scientometric and bibliometric analyses (16).

Results:
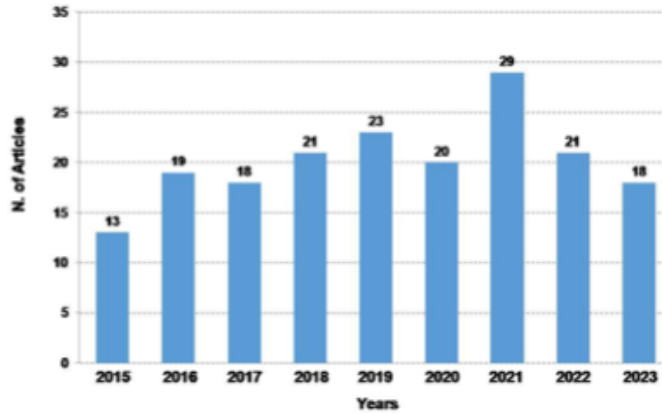
Graph 1 : Publication by year as per PubMed database analysis.

Based on a review of the PubMed database, the graph 1, shows the number of publications on oral cancer prevention published each year. The years, which run from 2015 to 2023, are represented by the x-axis, while the number of publications is represented by the y-axis, with 38 being the highest value and 0 being the lowest. Over the past eight years, the number of publications has consistently increased, according to the data, demonstrating a growing interest in this topic for research. In 2020, there is a little decrease in publications, but not to the extent that would buck the general upward trend. This means that over time, research on oral cancer prevention will likely receive more attention and funding (17).

It is crucial to understand that the publication patterns shown in this graph are limited to the PubMed database, a collection of biomedical literature. As a result, it might not fully represent the breadth of scientific output across all databases and fields. Relevant scientific publications can also be found in other databases like Web of Science and Scopus; combining data from multiple sources would give researchers a more complete picture of publishing patterns (18). However, the encouraging pattern seen in PubMed underscores the increasing focus on mouth cancer prevention across the biomedical research community.
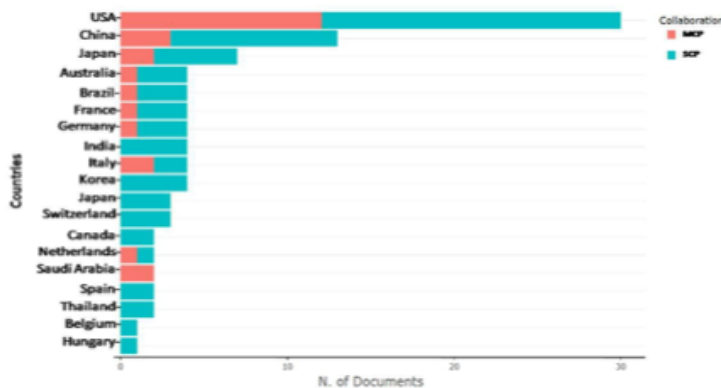
Graph 2:Publication by country as per PubMed database analysis

The distribution of research publications among different countries is shown in the graph 2, named "Publication by Country as per PubMed Database Analysis". List of countries are shown on the y-axis, and the number of publications is shown on the x-axis, where 30 is the highest value and 0 is the lowest. These are the main lessons to be learned from this graph: China and Japan are the next two countries with the most publications, after the United States. The number of publications from the United States and other nations differs noticeably, demonstrating the importance of American research in this area (17).

A handful of European nations, such as France, Germany, and Italy, consistently contribute to the global research scene with a moderate number of publications. Furthermore, a few developing nations, including Brazil and India, also have a moderate degree of research activity. Switzerland, Canada, and the Netherlands, on the other hand, have comparatively less publications. Acknowledging the significance of additional characteristics, such as research impact and quality, in addition to publication count, is crucial for a thorough evaluation of research output (18).
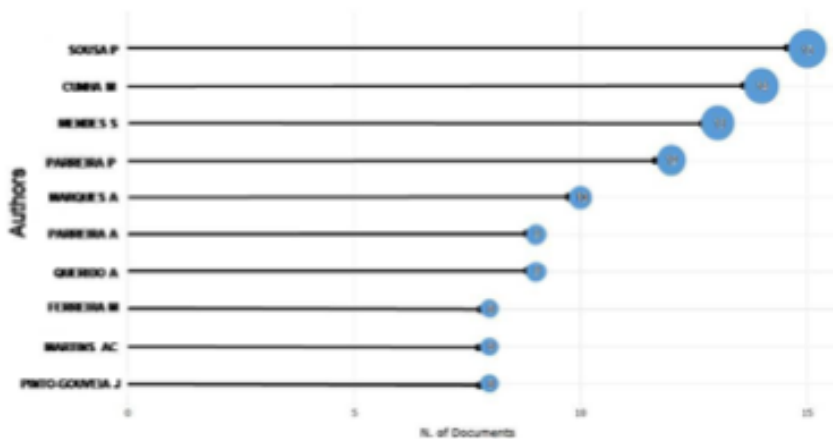
Graph 3:Most relevant authors as per PubMed database analysis

The graph 3, shows a bar graph that shows how many documents each author has published. The y- axis shows the number of published documents, ranging from 5 to 15, while the x-axis includes the names of the authors. The graph's main findings are as follows: Sousa P. has the most publications-15, followed by Cunha M.-14, and Mendes F.-13. According to Garfield (19), the remaining authors have each released 12 or fewer documents.

These results demonstrate the productivity of individual scientists working in the subject. The fact that Sousa P. is regarded as the primary author highlights their important contribution to the corpus of literature. In a similar vein, Cunha M. and Mendes F.'s notable accomplishments demonstrate their active participation in research. Research trends and possible collaborations can be gleaned from analyzing the publication patterns of eminent writers (19).

But it's important to take into account these articles' influence and quality in addition to their quantity. Citation analysis and other metrics should be used to assess the impact of these works because large publication counts do not always translate to high impact (Bornmann, 2010). This all- encompassing strategy guarantees an impartial evaluation of research contributions.
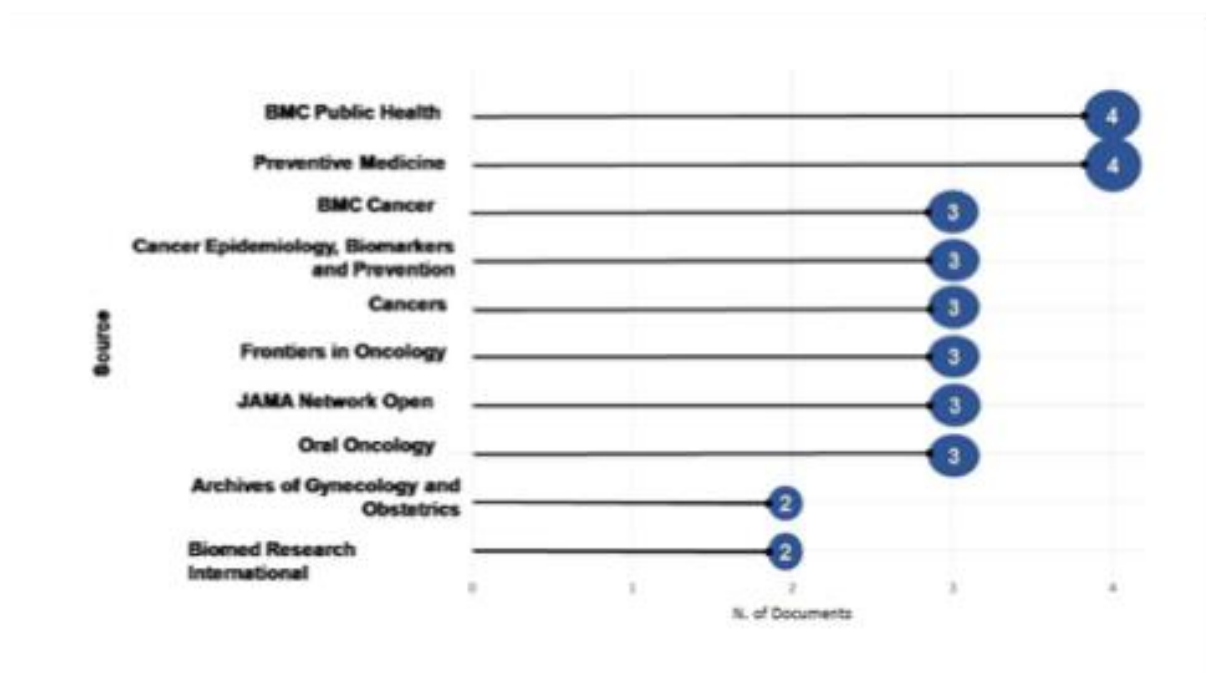
Graph 4: Publication by source as per PubMed database analysis

Graph 4, shows a line graph that shows the quantity of papers about cancer that were published in different journals between 2013 and 2023. The journal names are displayed on the x-axis, and the number of published documents—which ranges from 3 to 38—is shown on the y-axis. Important findings from the graph show that, with 38 articles, BMC Cancer is in the lead, followed by

Frontiers in Oncology and Cancers, with 23 and 22 publications, respectively. Oral oncology and JAMA Network Open, with 15 and 14 publications respectively, also made a substantial contribution. During this time, less than ten papers on cancer research were published in the remaining publications (19). These results demonstrate how frequently specific publications publish cancer research. BMC Cancer has a large number of publications, which suggests that it plays a crucial role in the field. In a similar vein, Frontiers in Oncology and Cancers have made significant contributions that highlight their significance as channels for disseminating cancer research. It is important to remember, nevertheless, that the number of publications

does not always equate to the caliber or significance of the research. A more thorough evaluation of the effect and importance of the research is offered by metrics like the journal's impact factor and the citation rates of the articles (20).

Deeper insights can be gained by assessing the quality and impact of research using citation analysis and impact factors in addition to publication counts. Even though they publish fewer pieces, journals like Oral Oncology and JAMA Network Open can nevertheless have a big impact if their work gets a lot of citations. Therefore, a comprehensive evaluation of a journal's contribution to cancer research requires a balanced approach that takes into account both the amount and quality of publications (21).

Graph 5 : Keywords and their co-occurrence as per bibliometric analysis

The analysis draws attention to the co-occurrence of keywords found through bibliometric analysis in cancer research(Graph 5). The main ideas and scientific concepts that are provided in articles are summarized using keywords. Keywords show significant trends and topics equally as well as author keywords in bibliometric studies that look at the knowledge structure of scientific subjects (22). The terms "mouth neoplasms," "head and neck neoplasms," "biomarkers," "tumor," and "anti-neoplastic agents" are among the most often used terms in cited references. These phrases denote the main areas of interest for cancer research, with an emphasis on therapeutic drugs, tumor biology, and diagnostic markers.

On the other hand, the investigation also identifies less common keywords like "cancer vaccine research," "early diagnosis," "prevention," and "precancerous lesions." The need for focused research projects in various fields is highlighted by the underrepresentation of these terms. It emphasizes the urgent need for further targeted research on early detection techniques, vaccine development, precancerous condition management, and cancer prevention strategies (23). By enabling early intervention and preventive actions, filling in these gaps could greatly advance the field and improve patient outcomes.

Discussion

Although everyone agrees that early cancer detection is crucial, this scientometric analysis highlights how little research has been done in this area in the academic literature. Our results suggest that, in comparison to other fields of oncological research, important areas like "early detection of cancer," "cancer vaccine" research, and "precancerous lesions" have gotten relatively less attention. This vacuum in the literature makes it necessary to look more closely at the chances that were lost in these important areas of cancer research. Even though oral cancer is frequently a self-inflicted disease due to factors like tobacco use and betel quid chewing, the high prevalence of the disease in South and Southeast Asian countries raises serious concerns, particularly when juxtaposed with the relatively scarce levels of research and limited focus on prevention (24). Financial limitations, conflicting healthcare objectives, and a deficient research infrastructure could all be contributing factors to this disparity. Given the potential for early interventions to greatly reduce morbidity and death associated with oral cancer, the absence of effective research and preventive initiatives in these regions is especially concerning (25).

The high expense of cancer treatment in these areas is one major obstacle. A tactical change in favor of early diagnosis and preventative measures is necessary in this case. The care of oral cancer can be made more cost-effective by early detection through routine screenings, cutting-edge techniques including salivary biomarkers for early diagnosis, and public awareness programs (26). Healthcare systems may be able to lower the cost of advanced cancer therapies and enhance patient outcomes by emphasizing these preventive interventions (27).

The observed rise in publications following COVID-19, however, points to a constructive realignment of research agendas. The pandemic has highlighted the significance of public health, motivating scientists to investigate approaches that prioritize long-term health outcomes, such as early cancer detection and prevention, in addition to addressing the immediate threat of infectious diseases (28). This change emphasizes how better cancer prevention initiatives could be achieved by utilizing the heightened focus on health research.

Targeted investments in healthcare facilities and education should be made in tandem with efforts to increase research and publication in South and Southeast Asia. In order to promote a research ecosystem that focuses on oral cancer prevention and early intervention, collaboration between governments, non-profit organizations, and the commercial sector might be extremely important (29). The development of long-lasting and successful public health policies suited to the unique requirements of these areas depends on these cooperative efforts

Even though oral cancer is still a major health concern in South and Southeast Asia, there may be a shift in the future because to the increased attention being paid to research and publishing since the outbreak. It is possible to reduce the burden of oral cancer and improve the general well-being of the people in these areas by refocusing attention on early detection and prevention in conjunction with strategic investments (30). By using bibliometric analysis to uncover research gaps, trends, and significant contributors, policymakers can better allocate resources for oral cancer prevention
programs and efforts by developing evidence-based solutions.

The analysis identifies key areas in oral cancer prevention that need more focus. By directing researchers toward understudied subjects, this data gives medical practitioners a thorough grasp of the state of the field. With this knowledge, they may put evidence-based procedures

into action, tell the public about important facts, and support the development of more successful early detection and preventive tactics. The analysis's conclusions can also be utilized to develop targeted public health campaigns, raising awareness about risk factors, preventive measures, and the importance of early detection (31).

Conclusion

This bibliometric review of scientometriceson oral cancer prevention, unveiling least explored areas in early detection, cancer vaccine research, and precancerous lesions, underscores the imperative for targeted research initiatives and strategic interventions. This emphasizes how important more sensitive screening devices or programs are for early detection and raising the chance of a successful course of therapy.

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