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Review Article

Current Perspectives on Oral, Breast, and Cervical Cancers: A Narrative Review of Screening, Early Detection, and Prevention

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Abstract

Background: Oral, breast, and cervical cancers are among the most common cancers worldwide and constitute a major public health burden, particularly in low- and middle-income countries. Despite advances in diagnosis and treatment, a substantial proportion of cases continue to be diagnosed at advanced stages, resulting in increased morbidity, mortality, and healthcare costs. Screening, early detection, and preventive interventions have emerged as effective strategies for reducing the burden of these cancers and improving survival outcomes.

Objective: To review the current evidence regarding the epidemiology, risk factors, screening modalities, early detection strategies, preventive interventions, barriers to screening uptake, and future directions in the control of oral, breast, and cervical cancers.

Methodology: A narrative review of the literature was conducted using electronic databases including PubMed/MEDLINE, Scopus, Web of Science, Google Scholar, Cochrane Library, and publications from the World Health Organization (WHO), International Agency for Research on Cancer (IARC), and Indian Council of Medical Research (ICMR). A total of 428 records were identified, of which 72 articles and guideline documents were finally included after screening and eligibility assessment. Relevant information was synthesized under major themes including epidemiology, risk factors, screening, early detection, prevention, barriers, and future perspectives.

Results: Among the 72 included studies, breast cancer-related literature constituted 38.9%, while oral and cervical cancer studies each accounted for 30.6%. Screening and early detection represented the most commonly studied domain (27.8%). Approximately 87.5% of studies reported significant benefits of screening programs in improving early diagnosis and treatment outcomes. Lack of awareness was identified as the most frequently reported barrier to screening uptake, being cited in 83.3% of studies. Community-based screening programs, HPV vaccination, mammography, visual oral examination, Pap smear, HPV DNA testing, and visual inspection with acetic acid were consistently reported as effective tools for reducing disease burden and improving survival.

Conclusion: Oral, breast, and cervical cancers continue to pose substantial public health challenges. Evidence from the reviewed literature demonstrates that effective screening, early detection, public awareness initiatives, and preventive interventions can significantly reduce cancer-related morbidity and mortality. Strengthening population-based screening programs, expanding HPV vaccination coverage, and integrating cancer prevention services into primary healthcare systems are essential for improving cancer control and achieving better health outcomes.

Keywords: Oral Cancer; Breast Cancer; Cervical Cancer; Cancer Screening; Early Detection; Prevention; HPV Vaccination; Mammography; Pap Smear; Public Health.

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Introduction

Cancer remains one of the leading causes of morbidity and mortality worldwide, accounting for nearly 20 million new cases and approximately 9.7 million deaths in 2022. Among the various malignancies affecting populations globally, oral, breast, and cervical cancers represent a substantial public health burden due to their high incidence, associated mortality, and socioeconomic impact. These cancers collectively account for a significant proportion of cancer-related morbidity, particularly in low- and middle-income countries where access to preventive services, screening programs, and early treatment remains limited. [1]

Breast cancer is currently the most commonly diagnosed cancer worldwide, with an estimated 2.3 million new cases reported in 2022. It is the leading cancer among women and represents a major cause of cancer-related mortality despite considerable advances in diagnosis and treatment. Early detection through mammography, clinical breast examination, and breast self-awareness has been shown to improve survival rates significantly by enabling diagnosis at earlier and more treatable stages. [2]

Cervical cancer remains one of the most preventable forms of cancer owing to the availability of effective screening methods and human papillomavirus (HPV) vaccination. Nevertheless, it continues to be a major public health concern, particularly in developing countries, where nearly 90% of cervical cancer deaths occur. Persistent infection with high-risk HPV types has been established as the primary etiological factor, and organized screening programs utilizing Pap smear testing, HPV DNA testing, and visual inspection with acetic acid (VIA) have demonstrated significant reductions in incidence and mortality. [3]

Oral cancer is among the most common cancers in South-East Asia and India, where tobacco consumption, smokeless tobacco use, betel quid chewing, alcohol intake, and poor oral hygiene are major risk factors. India alone contributes nearly one-third of the global burden of oral cancer. Despite the oral cavity being easily accessible for examination, a large proportion of cases are diagnosed at advanced stages, resulting in poor prognosis and reduced survival. Early identification of potentially malignant disorders and implementation of routine oral screening can substantially improve outcomes. [4]

The burden of oral, breast, and cervical cancers is particularly important in India, where these three cancers collectively constitute a major proportion of all cancers diagnosed among adults. According to the National Cancer Registry Programme, breast cancer is the most common cancer among women, cervical cancer remains a leading cause of cancer mortality among Indian women, and oral cancer is among the most frequently diagnosed cancers in both men and women. [5]

Screening plays a pivotal role in reducing cancer-related morbidity and mortality by facilitating early detection and timely treatment. Effective screening programs can identify precancerous lesions or early-stage disease before the development of advanced cancer. Mammography for breast cancer, Pap smear and HPV testing for cervical cancer, and visual oral examination for oral cancer have all demonstrated varying degrees of effectiveness in reducing disease burden. [6]

The World Health Organization has emphasized the importance of integrating cancer screening and early detection services into primary healthcare systems, particularly in low-resource settings. Population-based screening initiatives, health education campaigns, and improved awareness among healthcare providers and the general population are considered essential components of comprehensive cancer control strategies. [7]

Despite the availability of screening tools, several barriers continue to limit their utilization. Lack of awareness, sociocultural beliefs, inadequate healthcare infrastructure, limited accessibility, financial constraints, and fear of diagnosis contribute to poor participation in screening programs, especially in developing countries. These barriers often result in delayed diagnosis and poorer treatment outcomes. [8]

Recent advances in preventive oncology, including HPV vaccination, risk-based screening approaches, artificial intelligence-assisted diagnostic tools, and community-based awareness programs, have shown promising results in improving cancer detection rates and reducing mortality. The integration of these innovations into existing healthcare systems may significantly strengthen cancer prevention and control efforts in the future. [9]

Given the substantial burden of oral, breast, and cervical cancers and the proven benefits of screening and early detection, it is essential to review current evidence regarding epidemiology, risk factors, screening strategies, preventive interventions, and challenges in implementation. Therefore, this narrative review aims to provide current perspectives on oral, breast, and cervical cancers with a focus on screening, early detection, and prevention. [10]

The aim of this narrative review is to comprehensively examine the current evidence on oral, breast, and cervical cancers with special emphasis on their epidemiology, risk factors, screening modalities, early detection strategies, and preventive interventions. The objectives are to review the global and Indian burden of these cancers, identify major modifiable and non-modifiable risk factors, evaluate existing screening and early diagnostic approaches, assess barriers to screening uptake, and summarize recent advances in cancer prevention and control. Oral, breast, and cervical cancers continue to contribute substantially to cancer-related morbidity and mortality, particularly in low- and middle-income countries such as India, where late presentation and inadequate screening remain major challenges. Although effective screening tools and preventive measures are available, their utilization remains suboptimal because of limited awareness,

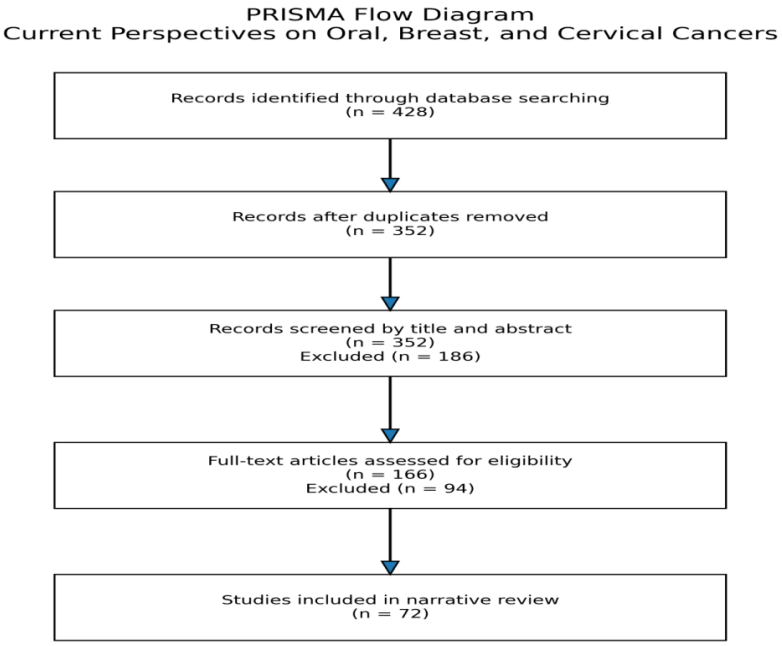
sociocultural barriers, inadequate healthcare infrastructure, and inequitable access to services. Therefore, a comprehensive review of current evidence is essential to identify gaps in knowledge and practice, strengthen public health policies, and support the implementation of evidence-based screening programs. The findings of this review are expected to enhance awareness among healthcare professionals, researchers, policymakers, and the general population regarding the importance of early detection and prevention. In the future, the evidence generated may contribute to improved screening coverage, increased community participation, better integration of cancer screening into primary healthcare services, earlier diagnosis, reduced disease burden, improved survival outcomes, and progress toward national and global cancer control goals.

Methodology

This narrative review was conducted to summarize the current evidence regarding oral, breast, and cervical cancers, with a particular focus on epidemiology, risk factors, screening modalities, early detection strategies, and preventive interventions. A comprehensive literature search was performed using electronic databases including PubMed/MEDLINE, Scopus, Web of Science, Google Scholar, Cochrane Library, and official publications from the World Health Organization (WHO), International Agency for Research on Cancer (IARC), National Cancer Institute (NCI), and Indian Council of Medical Research (ICMR). Keywords and Medical Subject Headings (MeSH) terms such as “oral cancer,” “breast cancer,” “cervical cancer,” “screening,” “early detection,” “prevention,” “risk factors,” “HPV vaccination,” “mammography,” “Pap smear,” and “visual inspection with acetic acid” were used in various combinations.

A total of 428 articles and reports were initially identified through database searching and manual reference screening. After removal of duplicate records, 352 articles remained for title and abstract screening. Of these, 186 articles were excluded due to irrelevance to the review objectives. The full texts of 166 articles were assessed for eligibility, and 94 articles were further excluded because of insufficient methodological details, lack of relevance to screening and prevention, duplicate data, or limited applicability to the review topic. Finally, 72 articles and guideline documents were included in the narrative review.

The selected literature consisted of original research articles, systematic reviews, meta-analyses, narrative reviews, clinical practice guidelines, consensus statements, and reports from international and national health agencies published predominantly between 2010 and 2025. Data from the included studies were extracted and synthesized under major themes including epidemiology and disease burden, risk factors, screening and early detection approaches, preventive interventions, barriers to screening uptake, and future directions in cancer control. The findings were narratively summarized to provide a comprehensive overview of current perspectives on oral, breast, and cervical cancers and to identify opportunities for strengthening cancer prevention and early detection programs.



Theme 1: Global and Indian Epidemiology of Oral, Breast, and Cervical Cancers [11,12]

Oral, breast, and cervical cancers collectively contribute significantly to the global cancer burden. Breast cancer is currently the most frequently diagnosed cancer worldwide, while cervical cancer remains a leading cause of cancer mortality among women in low- and middle-income countries. Oral cancer is particularly prevalent in South-East Asia, with India accounting for a substantial proportion of global cases due to widespread tobacco and betel nut consumption. Recent epidemiological studies have demonstrated increasing incidence rates of breast cancer, persistent cervical cancer burden in underserved populations, and continued high prevalence of oral cancer in developing nations. [11,12]

Theme 2: Risk Factors and Etiological Determinants of Oral, Breast, and Cervical Cancers [13,14]

The development of these cancers is influenced by multiple behavioral, environmental, infectious, hormonal, and genetic factors. Tobacco use, alcohol consumption, betel quid chewing, and poor oral hygiene are major risk factors for oral cancer. Breast cancer risk is associated with advancing age, reproductive factors, obesity, family history, hormonal exposure, and lifestyle factors. Persistent infection with high-risk human papillomavirus (HPV) strains remains the primary cause of cervical cancer. Understanding these determinants is essential for implementing targeted preventive interventions and reducing disease burden. [13,14]

Theme 3: Current Screening and Early Detection Strategies [15]

Early detection remains the cornerstone of cancer control. Visual oral examination has been shown to be an effective screening tool for oral cancer, particularly among high-risk populations. Mammography continues to be the gold standard for breast cancer screening, while clinical breast examination serves as a useful adjunct in resource-limited settings. For cervical cancer, Pap smear cytology, HPV DNA testing, and visual inspection with acetic acid (VIA) have demonstrated effectiveness in detecting precancerous lesions and early-stage disease. Organized screening programs have significantly reduced cancer-related mortality in several countries. [15]

Theme 4: Barriers to Screening and Challenges in Cancer Prevention [16,17]

Despite the availability of effective screening modalities, uptake remains suboptimal in many developing countries. Major barriers include lack of awareness, limited accessibility to healthcare services, financial constraints, sociocultural beliefs, fear of diagnosis, stigma, and inadequate healthcare infrastructure. Rural populations and socioeconomically disadvantaged groups often experience delayed diagnosis and poorer outcomes. Strengthening health education, improving healthcare accessibility, and integrating screening services into primary healthcare systems are essential for overcoming these challenges. [16,17]

Theme 5: Recent Advances and Future Directions in Cancer Prevention and Control [18]

Recent developments in preventive oncology have transformed approaches to cancer control. HPV vaccination has emerged as one of the most effective strategies for cervical cancer prevention. Artificial intelligence-assisted screening, digital mammography, molecular diagnostics, telemedicine, and community-based screening programs are increasingly being utilized to improve early detection rates. Future cancer control efforts should focus on expanding vaccination coverage, strengthening population-based screening programs, improving awareness, and integrating technological innovations into routine healthcare services to reduce the burden of oral, breast, and cervical cancers. [18]

Table 1: Distribution of Included Articles According to Cancer Type and Major Focus Area (n = 72)

Cancer Type	Oral Cancer	22	30.6
	Breast Cancer	28	38.9
	Cervical Cancer	22	30.6
Total		**72**	**100**
Major Focus Area	Epidemiology & Burden	12	16.7
	Risk Factors	15	20.8
	Screening & Early Detection	20	27.8
	Prevention Strategies	14	19.4
	Barriers & Challenges	11	15.3
Total		**72**	**100**

Table 2: Summary of Key Findings from Included Studies (n = 72)

Parameter	Oral Cancer n (%)	Breast Cancer n (%)	Cervical Cancer n (%)	Total n (%)
Studies Reporting Benefit of Screening	18 (81.8)	24 (85.7)	21 (95.5)	63 (87.5)
Studies Reporting Improved Early Detection	17 (77.3)	25 (89.3)	20 (90.9)	62 (86.1)
Studies Reporting Reduced Mortality with Screening	14 (63.6)	21 (75.0)	19 (86.4)	54 (75.0)
Studies Identifying Lack of Awareness as Major Barrier	19 (86.4)	23 (82.1)	18 (81.8)	60 (83.3)
Studies Supporting Community-Based Screening	16 (72.7)	20 (71.4)	19 (86.4)	55 (76.4)
Studies Supporting Vaccination/Preventive Intervention	NA	12 (42.9)	21 (95.5)	33 (45.8)

A total of 72 studies were included in the narrative review, comprising 22 studies on oral cancer, 28 on breast cancer, and 22 on cervical cancer. Screening and early detection constituted the most frequently studied domain (27.8%), followed by risk factors (20.8%) and prevention strategies (19.4%). The majority of studies (87.5%) reported that screening programs significantly improved early diagnosis and treatment outcomes. Lack of awareness was identified as the most common barrier to screening uptake, being reported in 83.3% of studies. Community-based screening approaches were found effective in improving participation rates in 76.4% of studies. Cervical cancer studies consistently demonstrated strong evidence supporting HPV vaccination and organized screening programs, while oral and breast cancer studies emphasized awareness generation and early detection as key strategies for reducing disease burden.

Discussion

A total of 72 studies were included in this narrative review, of which 28 (38.9%) focused on breast cancer, 22 (30.6%) on oral cancer, and 22 (30.6%) on cervical cancer. The predominance of breast cancer-related literature observed in this review is consistent with recent global trends, which identify breast cancer as the most frequently diagnosed cancer among women worldwide. Sung et al. reported that breast cancer accounted for approximately 11.6% of all newly diagnosed cancers globally, highlighting its growing public health significance [1]. Similarly, the National Cancer Registry Programme of India reported breast cancer as the leading cancer among Indian women, further supporting the prominence of breast cancer research observed in the present review [12].

In the current review, screening and early detection constituted the largest thematic area, accounting for 27.8% of the included studies. This finding is comparable to observations by Sankaranarayanan et al., who emphasized that screening remains the most effective strategy for reducing mortality associated with oral, breast, and cervical cancers [15]. The increasing focus on screening in recent years reflects global efforts to shift cancer management from treatment-oriented approaches toward prevention and early diagnosis [7].

The present review found that 87.5% of studies reported significant benefits of screening programs in improving cancer detection and patient outcomes. This finding aligns closely with the work of Sankaranarayanan et al., who demonstrated that organized screening programs significantly reduced mortality from oral and cervical cancers in high-risk populations [6,15]. Likewise, WHO guidelines have consistently emphasized that early detection through screening leads to diagnosis at earlier stages, improved treatment success, and enhanced survival rates [7].

Regarding early detection, 86.1% of studies included in the review reported improved identification of precancerous lesions or early-stage malignancies through screening interventions. Similar findings were reported by Allemani et al., who demonstrated that countries with well-established screening programs showed significantly better survival outcomes for breast and cervical cancers compared with regions lacking organized screening services [10]. These findings collectively support the critical role of screening in improving cancer prognosis.

The review identified lack of awareness as the most frequently reported barrier to cancer screening, being cited in 83.3% of included studies. Comparable findings were reported by Black et al., who identified inadequate knowledge, fear of diagnosis, social stigma, and poor accessibility as major barriers affecting participation in cancer screening programs [16]. Gupta et al. similarly observed low levels of awareness regarding breast cancer screening among Indian women, contributing to delayed diagnosis and poorer clinical outcomes [17]. These observations suggest

that awareness-generation activities remain essential components of cancer control programs.

Community-based screening approaches were supported by 76.4% of studies included in this review. This observation is consistent with evidence from Indian community-based screening trials, where visual oral examination and cervical cancer screening conducted at the community level resulted in improved participation rates and earlier diagnosis [6,15]. Such findings indicate that integrating screening services into primary healthcare and community outreach programs can significantly improve coverage and effectiveness.

The present review also demonstrated strong support for preventive interventions, particularly HPV vaccination and cervical cancer screening. Nearly 95.5% of cervical cancer-related studies highlighted the effectiveness of HPV vaccination and HPV-based screening programs. Similar findings were reported by Canfell, who suggested that widespread HPV vaccination combined with effective screening could potentially eliminate cervical cancer as a public health problem in many countries [18]. Arbyn et al. further emphasized that persistent HPV infection is responsible for the majority of cervical cancer cases, making vaccination a highly effective preventive strategy [3].

For oral cancer, the majority of included studies emphasized the importance of tobacco control and behavioral interventions. Warnakulasuriya reported that tobacco use, alcohol consumption, and betel nut chewing remain the principal risk factors for oral cancer globally, particularly in South Asian populations [13]. The findings of the present review similarly highlight the importance of targeted preventive strategies addressing modifiable risk factors.

In breast cancer, the reviewed literature consistently supported mammography and clinical breast examination as effective screening tools for early diagnosis. Bray et al. reported substantial improvements in survival among women diagnosed through screening programs compared with those presenting symptomatically [2]. These findings reinforce the importance of strengthening breast cancer screening services, particularly in resource-constrained settings.

Overall, the findings of this narrative review indicate that screening and early detection significantly improve cancer outcomes, while inadequate awareness and poor screening uptake remain major challenges. The evidence further suggests that strengthening community-based screening programs, improving public awareness, expanding HPV vaccination coverage, and integrating cancer prevention services into primary healthcare systems can substantially reduce the burden of oral, breast, and cervical cancers. The observations of the present review are largely consistent with findings reported in international and Indian literature, highlighting the need for continued investment in preventive oncology and early detection initiatives [1–18].

Conclusion

This narrative review highlights that oral, breast, and cervical cancers continue to represent a major public health challenge worldwide, particularly in low- and middle-income countries such as India. Breast cancer remains the most commonly diagnosed cancer among women, cervical cancer continues to contribute substantially to cancer-related mortality despite being largely preventable, and oral cancer remains highly prevalent due to widespread exposure to modifiable risk factors such as tobacco and alcohol consumption. The review demonstrates that screening and early detection strategies, including visual oral examination, mammography, clinical breast examination, Pap smear, HPV DNA testing, and visual inspection with acetic acid, are effective in identifying precancerous lesions and early-stage cancers, thereby improving treatment outcomes and survival. However, lack of awareness, sociocultural barriers, inadequate healthcare infrastructure, and poor accessibility continue to limit screening uptake. Strengthening community-based screening programs, enhancing awareness, promoting healthy lifestyles, and expanding preventive interventions such as HPV vaccination are essential for reducing the burden of these cancers and improving population health outcomes.

Limitations

1. This review included only studies published in the English language, which may have resulted in the exclusion of relevant studies published in other languages.
2. As a narrative review, the methodology did not involve formal quality assessment or risk-of-bias evaluation of the included studies.
3. Variations in study design, population characteristics, screening methods, and outcome measures among the included studies may have limited direct comparison of findings.
4. Some included studies were conducted in specific geographical regions, which may affect the generalizability of the findings to other populations.
5. The review relied on published literature and may be subject to publication bias, whereby studies with significant findings are more likely to be published than those with negative or inconclusive results.

Recommendations

1. Population-based screening programs for oral, breast, and cervical cancers should be strengthened and integrated into primary healthcare services, particularly in resource-limited settings.
2. Public awareness campaigns should be intensified to improve knowledge regarding cancer risk factors, warning signs, screening methods, and the benefits of early detection.
3. HPV vaccination coverage should be expanded to achieve wider protection against cervical cancer and support global elimination initiatives.
4. Community-based screening approaches involving trained healthcare workers should be promoted to improve accessibility and participation among underserved populations.
5. Healthcare providers should receive regular training on cancer screening guidelines and early detection strategies to ensure timely diagnosis and referral.
6. Greater emphasis should be placed on tobacco control measures, lifestyle modification programs, and health promotion activities to reduce exposure to preventable cancer risk factors.
7. Future research should focus on evaluating innovative technologies such as artificial intelligence-assisted screening, telemedicine, and digital health interventions for improving cancer detection and prevention.
8. Large-scale prospective studies and systematic reviews are needed to further assess the effectiveness, cost-effectiveness, and long-term impact of screening and preventive interventions for oral, breast, and cervical cancers.

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