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MARINA DA SILVA

PREVALÊNCIA DE DOENÇAS BUCAIS EM PACIENTES SOB CUIDADOS PALIATIVOS: UMA REVISÃO SISTEMÁTICA E META-ANÁLISE

PREVALENCE OF ORAL DISEASES IN PATIENTS UNDER PALLIATIVE CARE: A SYSTEMATIC REVIEW AND META-ANALYSIS

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PREVALENCE OF ORAL DISEASES IN PATIENTS UNDER PALLIATIVE CARE: A SYSTEMATIC REVIEW AND META-ANALYSIS

Monografia apresentada à Faculdade de Odontologia de Piracicaba da Universidade Estadual de Campinas como parte dos requisitos exigidos para obtenção do título de especialista em Estomatologia.

Orientador: Prof. Dr. Alan Roger Santos-Silva

Este exemplar corresponde a versão final da monografia apresentada pela aluna Marina da Silva e orientada pelo Prof. Dr. Alan Roger Santos-Silva.

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RESUMO

A morte é uma parte natural da vida, mas muitas vezes é tratada como uma doença, levando muitas pessoas a morrerem em hospitais, com dor e sozinhas. Os cuidados paliativos visam melhorar a qualidade de vida de pacientes e seus familiares que enfrentam doenças incuráveis, focando na prevenção e alívio do sofrimento físico, psicossocial e espiritual. Esses cuidados requerem uma equipe multidisciplinar para avaliação, intervenção e monitoramento adequados. Pacientes em cuidados paliativos frequentemente apresentam alterações bucais, cujo diagnóstico precoce é essencial para o alívio dos sintomas e redução do sofrimento. Entre as principais causas das alterações orais estão os tratamentos antineoplásicos como quimioterapia e radioterapia, contudo a administração de outras drogas também pode ser um fator causal. Algumas das principais alterações orais são xerostomia, candidíase, mucosite, estomatite, ulceração, alteração do paladar, entre outras. Além disso, há um impacto nas relações sociais e inclusive no sono, afetando toda a qualidade de vida desses indivíduos. A literatura referente a este tema é limitada, portanto o objetivo desta revisão sistemática é analisar a prevalência de doenças bucais em pacientes em cuidados paliativos. As condições bucais também foram avaliadas, pois estão relacionadas de forma direta ou indireta a este tema.

Palavras-chave: doenças bucais, manifestações orais, cuidados terminais, cuidados paliativos.

ABSTRACT

Death is a natural process of life, however, it is often treated as a disease, which leads to many individuals dying in hospitals, in pain and alone. Palliative care is a specialized form of care that aims to improve the quality of life of patients and their families facing incurable diseases. It focuses on the prevention and relief of physical, psychosocial, and spiritual suffering. To ensure the most appropriate care, a multidisciplinary team is essential for assessment, intervention, and monitoring. Patients receiving palliative care frequently exhibit oral alterations, which necessitate early diagnosis to relieve symptoms and reduce suffering. Among the principal causes of oral alterations are antineoplastic treatments such as chemotherapy and radiotherapy. Other drug administration may also be a causal factor. Some of the most common oral alterations include xerostomia, candidiasis, mucositis, stomatitis, ulceration, altered taste, and others. Furthermore, there is an impact on social relationships and even sleep, which affects the overall quality of life of these individuals. The literature is limited on this subject therefore this systematic review aims to analyze the prevalence of oral diseases in palliative care patients. Furthermore, the oral conditions of the patients were also assessed as they are either directly or indirectly related to this topic.

Key-words: mouth diseases, oral manifestations, terminal care, palliative care.

SUMÁRIO

1 INTRODUÇÃO

Morrer é uma parte natural da vida, no entanto, a morte geralmente é encarada como doença, e não é incomum que inúmeras pessoas morram em hospitais, sentindo dor e sozinhas. Com o intuito de melhorar a qualidade de vida de pacientes e seus familiares que enfrentam doenças que não respondem aos tratamentos curativos disponíveis; os cuidados paliativos atuam na prevenção e da redução do sofrimento, identificando e tratando os problemas físicos, psicossociais ou relacionados a espiritualidade (WHO, 2002; Rome et al., 2011).

Os cuidados paliativos necessitam de uma estrutura multidisciplinar, uma vez que os pacientes que se encontram sob cuidados paliativos exclusivos demandam de uma série de avaliações, intervenções e monitoramento de diversos profissionais de diferentes áreas da saúde (O'Neill, 1997; Rome et al., 2011).

As alterações orais são observadas com frequência em pacientes em cuidados paliativos e devem ter diagnóstico clínico precoce para que as medidas necessárias sejam instituídas com brevidade, como controle da dor e alívio sintomático, com objetivo da redução do sofrimento (Saini et al., 2009). Os tratamentos empregados na doença de base do paciente, como radioterapia, quimioterapia e outras drogas administradas podem contribuir para as alterações orais. Diversas alterações orais neste grupo de paciente são citadas, e entre as mais comuns estão xerostomia, candidíase, mucosite, estomatite, ulceração, alteração do paladar, dor e entre outras alterações. Além disso, há um impacto nas relações sociais e inclusive no sono, afetando toda a qualidade de vida desses indivíduos (Meneguim et al., 2018; Kvalheim et al., 2022; Silva et al., 2023).

A literatura especializada atual é limitada e escassa quanto a prevalência de doenças bucais em pacientes em cuidados paliativos. Portanto, o presente trabalho como objetivo analisar a prevalência de doenças bucais em pacientes em cuidados paliativos, assim como a condição bucal dos pacientes, pois estão relacionadas de forma direta ou indireta a este tema.

2 ARTIGO

Prevalence of oral diseases in patients under palliative care: a systematic review and meta-analysis

Artigo aceito para publicação no jornal Supportive Care in Cancer. 2024 Aug 22;32(9):607. doi: 10.1007/s00520-024-08723-9. (Anexo 1).

Abstract

Purpose Oral alterations are frequently observed in patients undergoing palliative care and are linked to the direct or indirect effects of the primary medical condition, comorbidities and medical management, leading to oral pain, impacting oral intake, and affecting quality of life. This systematic review aims to assess the prevalence of oral disease in palliative care patients.

Methods The protocol was registered at the PROSPERO database, and a systematic review of the literature was performed based on the PRISMA statement. A thorough evaluation of studies from five databases and gray literature was conducted. The risk of bias in each study was assessed using the Joanna Briggs Institute checklist for cross-sectional and case-control studies. A quantitative analysis was conducted on five studies using meta-analysis, and the degree of certainty in the evidence was determined using the GRADE tool.

Results The sample consisted of 2,502 patients, with a slight male predominance (50.43%). The average age was 66.92 years. The prevalence of oral diseases among palliative care patients was as follows: caries 32% (95% CI, 0.11-0.56; I^2=93%), and oral candidiasis 17% (95% CI,0.11-0.25; I^2=74%). Gingivitis and stomatitis were also reported, but with less frequency.

Conclusion Dental intervention should take place as early as possible, ideally from the time of the patient's initial admission to palliative care, with regular monitoring of oral health. This approach can enhance the patient's comfort and quality of life and help prevent more severe complications in the future.

Key Words: mouth diseases, oral manifestations, terminal care, palliative care

1. Introduction

Palliative care is defined by the World Health Organization as care that enhances the quality of life for patients (adults and children) and their families who deal with issues related to life-threatening diseases [1]. Palliative care aims to promote early diagnosis and treatment of suffering from a biological, psychological, and spiritual perspective, avoiding and alleviating pain [1,2]. The involvement of a multidisciplinary team is essential to providing prevention and adequate treatment of the symptoms presented by patients with a life-threatening illness. The purpose of palliative care is to improve the quality of life of the patient and their caregivers and significant others, including family [2,3]. Patients with serious medical conditions, such as advanced organ failure (e.g., cardiomyopathy and chronic obstructive pulmonary disease (COPD)), neurological or other health conditions, and terminal cancer, are among the patients need of this type of care [4,5].

Oral alterations are frequently observed in patients undergoing palliative care, and they are associated with the direct or indirect effects of the primary medical condition [5,6]. Many therapies are utilized to treat the primary diseases that lead these patients to palliative care, and these oral alterations can be, direct or indirect, related to these therapies [6,7,8]. For example, some patients are treated with chemotherapy and/or radiotherapy for their primary neoplastic disease. Additionally, the management of patients who are on palliative care due to other diseases, such as is based on medications, such as opioids or antibiotics [6,7,8]. These therapies used for the primary disease can lead to the onset of a plethora of oral conditions, such as xerostomia, oral candidiasis, caries, mucositis, stomatitis, ulceration, impaired chewing function, taste disturbances, sore and dry lips, oral pain, and dysgeusia [9,10]. Importantly, these conditions can affect the overall quality of life for these individuals, which may result in multidimensional (biological, psychological, and spiritual) suffering [9,10].

Disease can be defined as a state of maladaptation to the physical, psychological, or social environment in which the individual feels unwell (has symptoms) and/or has objectively evident organic changes (clinical signs) [11]. However, the definition of disease can vary [12,13]. Oral manifestations are symptoms or conditions in the oral cavity that can arise due to disease affecting other organs [14,15]. Few studies in the literature have mapped the epidemiological profile and prevalence of these oral alterations in palliative care patients. Although there is a systematic review [16] that synthesizes the evidence on oral conditions in palliative care patients, this systematic

review with meta-analysis aims to assess the prevalence of oral disease in palliative care patients.

2. Methods

2.1. Eligibility criteria

The PECOS acronym (Population, Exposure, Comparison, Outcomes, Studies), in accordance with Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) recommendations [17] (Supplemental Table 1), was employed to formulate a focused research question and establish the inclusion criteria for this study, wherein: (P) patients under palliative care; (E) palliative care; (C) not applicable; (O) prevalence of oral diseases in a patient undergoing palliative care; (S) case-control, cross-sectional and cohort. Studies that did not align with the PECOS approach were excluded from the review. The following studies were excluded: (i) did not describe oral diseases in palliative care patients; (ii) reviews; (iii) clinical trials; (iv) case reports; (v) protocols; (vi) brief communications; (vii) personal opinions; (viii) letters; (ix) conference abstracts; (x) laboratory research; (xi) full texts were not available even after contacting the corresponding author, and (xii) published in a language other than English, Spanish or Portuguese.

2.2. Information sources and search strategy

The date of the electronic search was February 9, 2023, and updated on January 19, 2024. Five electronic databases were used in the search strategy: PubMed (via MEDLINE), Scopus, LILACS, Web of Science, and Embase. Additionally, ProQuest Dissertation & Theses Global and Google Scholar were reviewed as gray literature (Supplemental Table 2). To avoid overlooking studies during the initial search, an additional query was conducted on the list of references.

2.3. Selection process

Reference management software (Rayyan QCRIR) [18] was used to eliminate any duplicate articles after database scanning. The selection process consisted of two phases. During the initial phase, two reviewers (M.S. and E.S.S) independently evaluated the titles and abstracts of all articles identified from databases using Rayyan software. During the second phase, the authors read the full text of the articles and excluded those that did

not meet the inclusion criteria. Exclusion reasons were recorded and can be found in Supplemental Table 3.

2.4. Data collection process and data items

The two independent authors (M.S. and E.S.S) collected the data. Authors, publication year, country, study type, total number of patients, underlying disease, proportion of women, mean age, age range, oral diseases, and conclusions were among the data extracted from the included studies. In case of disagreement, a third author was consulted, and all disagreements were resolved by consensus.

2.5. Study risk of bias assessment

The methodological quality and risk of bias of the included research were assessed using two critical appraisal checklists from the Joanna Briggs Institute. These checklists corresponded to analytical cross-sectional studies and case-control studies [19]. Two independent authors (MS and ESS) completed this analysis. If there was any dispute, the third author (ARSS) was consulted. The risk of bias was determined based on the number of 'yes' responses to each question. Studies with more than 70% 'yes' were classified as having a low risk of bias. Studies with 50%-69% 'yes' were considered to have a moderate risk of bias, while those with less than 49% 'yes' were classified as having a high risk of bias.

2.6. Effect measures

The primary objective was to evaluate the prevalence of oral diseases among cancer patients under palliative care. Furthermore, an analysis of the demographic profile and clinical characteristics of these individuals was completed.

2.7. Synthesis methods

The data reported in the included studies on the outcomes assessed were grouped and compared for qualitative synthesis. The meta-analyses of proportions were performed using the MetaXL 5.3 (EpiGear International, Queensland, Australia) add-in for Microsoft Excel software. The random effects model was employed due to anticipated heterogeneity (I^2). Heterogeneity is considered high when (>50%) and low when (≤50%) [20].

2.8. Certainty assessment

The quality of evidence was assessed using GRADE (Grading of Recommendation, Assessment, Development, and Evaluation). All studies included in the meta-analysis were evaluated based on study design, risk of bias, inconsistency, indirectness, imprecision, and other considerations. The evidence was characterized as moderate or very low [21].

3. Results

3.1. Study selection

The literature search initially identified 1,098 records in the five databases. After removing duplicates, 974 records were screened for title and abstract, and 91 studies were selected for full-text reading. In the other sources, 107 studies were identified and 17 were evaluated for full-text reading.

Thirteen studies were selected for qualitative and quantitative synthesis after applying the inclusion and exclusion criteria. Figure 1 illustrates the study selection process.

3.2. Study characteristics

The studies covered four continents: North America [5,22,23] (n=3), South America [24] (n=1), Europe [25-29,30] (n=6), and Asia [31,32,33] (n=3) (Figure 2). The data collection period for the studies was from 1989 to 2022. They were characterized as retrospective studies [24,31,33] (n=3) and prospective studies [5,22,23,25-30,32] (n=10), being case-control [31,32] (n=2) and cross-sectional design [5,22- 29,30,32] (n=11). The clinical and epidemiological characteristics of the included studies are described in Table 1.

3.3. Risk of bias in studies

Most studies had a low risk of bias. Among the eleven cross-sectional studies, two had a moderate risk of bias [26,29] and nine had a low risk of bias [5,22-25,27,28,30,32] (Supplemental Figure S1A). One case-control study had a low risk of bias [31], while the other had a moderate risk of bias [33] (Supplemental Figure S1B). Supplemental Table 4 provides a complete assessment of the risk of bias.

3.4. Results of individual studies

Cancer was the disease most often described as a factor inducing the palliative state. The six most frequent cancer were lung [22,23,26-29,31,33] with 428 patients, breast with 179 patients [22,24,25-28,31,33], gastrointestinal with 766 patients [22,24,25-29,33], prostate [24,28,29,33] with 42 patients, head and neck [24,25,27,29,31] with 69 patients, and hematological [25,28,33] with 88 patients. Non-cancer was reported in 12 patients with organ failure (e.g., cardiomyopathic) [5], 8 patients with neurological or other health conditions [5], 16 patients with COPD [26], 9 patients with end stage organ failure [30]. One study used the term `terminal cancer` without specifying what type of cancer it is [5], eight studies [5,22,24,26-28,31,33] described “other” in 193 patients without specifying what type of cancer it is. Only one study [24] reported “not informed” for 1 patient.

3.5. Results of syntheses

The total sample size for this systematic review comprised 2,502 patients, with a range from 49 [5] to 669 [28]. Notably, there was a minor preference for males, constituting 1,262 of the sample, while the age range spanned from 21 to 112 years, with a mean age of 66.92 years.

The oral diseases reported in this review were oral candidiasis, which was reported in four studies [24,29,31,33] with 99 patients. Three studies [5,29,33] reported the presence of caries in 78 patients. One study [29] reported gingivitis in 11 patients. Only one study [22] described "oral diseases" in 10 patients without specifying the disease. Nakajima [31] described the presence of stomatitis in his study with a total of 38 patients. The prevalence of each disease was individually analyzed. A meta-analysis of three studies [5,29,33] revealed that caries showed a prevalence of 32% in three studies [5,29,33] (95% CI, 0.11, 0.56; $I^2 = 93\%$), and oral candidiasis had a prevalence of 17% in four studies [24,29,31,33] (95% CI, 0.11, 0.25; $I^2 = 74\%$) (Figure 3).

The oral manifestations reported in the reviewed studies encompass a range of oral conditions and orofacial symptoms. Xerostomia, or dry mouth, was documented in ten studies, involving a total of 1,253 patients [5,23,25-31,33]. Mucositis was observed in two studies [24,28], affecting 157 patients. Dental pain/toothache pain/pain in teeth was reported in three studies [5,25,32] among 41 patients. Taste changes/dysgeusia were noted in seven studies [5,23,24,25,26,29,30], involving 416 patients. Oral pain [5], mouth pain [29], intraoral pain [23], mouth discomfort/pain [25] without a precisely specified

origin, was described in four studies [5,23,25,29] with 222 patients. Periodontal abscess was mentioned in one study [5], affecting a single patient. A burning sensation in the mouth was reported in one study [25] with 24 patients, and tooth sensitivity was noted in 52 patients. Gingival inflammation was identified in one study [33] involving 48 patients. One study described teeth (caries, fracture, broken root stumps) in 41 patients [32] and one study teeth problems (plaque or debris) in 42 patients [30].

Lesions on the lips, characterized as dry, red, swollen, ulcerated, cracked, or fissured, were detailed in four studies [23,25,30,32], involving 424 patients. Lesions on the tongue, including coated, red and/or white patches, loss of papillae with a shiny appearance, ulcerated, sloughing, or inflamed, were described in four studies [25,30,32,33], affecting 300 patients. Gingival lesions, such as swelling, bleeding, white/red patches, ulcers, and redness under dentures, were reported in three studies [5,32,33] with 35 patients. Additionally, one study [25] noted the presence of oral ulcers in 42 patients, bleeding from mouth in 19 patients, bad breath in 41 patients, and bleeding spots in 25 patients (Table 2).

3.6. Certainty of evidence (by Grading of Recommendations Assessment, Development, and Evaluation)

In observational studies, the level of certainty can be classified as "low", "very low", "moderate" or "high". Due to the high degree of heterogeneity among studies and small sample sizes, the level of certainty of evidence regarding the prevalence of oral diseases, caries and gingivitis was very low. However, moderate certainty was observed for the prevalence of oral candidiasis (Supplemental Table 5).

4. Discussion

This systematic review was conducted to evaluate the prevalence of oral diseases in patients receiving palliative care. A total of 2,502 patients were included, with an average age of 66.9 years. Cancer was the most common condition observed among the palliative care patients included in this study. The prevalence of dental caries was 32%, and oral candidiasis was 17%. Additionally, the most common oral manifestation was xerostomia, present in 1,253 patients. It is of utmost importance that the care team remains vigilant for any oral manifestations to ensure early intervention and thus prevent future complications.

Palliative care aims to improve the quality of life for patients and their families who are facing serious diseases such as terminal cancer, neurological disorders, heart disease or other health problems that are life-threatening [14,34]. Palliative care has experienced significant growth and change in recent decades, including new models of care and increased public and professional consciousness [14,34]. It is not uncommon to find descriptions of oral manifestations in palliative care patients in the literature, so understanding the prevalence of oral disease is essential to improve dissemination of information, especially as the oral condition of many patients is often neglected by their care teams [7,35].

The treatment of patients in palliative care should be based on an integrated and holistic approach, considering the needs of both patients and their families throughout the course of the illness [36]. Radiotherapy and chemotherapy are commonly employed in cancer treatment and can lead to side effects in the oral cavity [37,38]. One of the side effects is mucositis, an acute complication characterized by ulceration, severe pain, burning sensation and discomfort, often resulting in challenges for the patient in consuming food and liquids. In addition, inflammation, bleeding and infections can occur, with oral candidiasis, caused by Candida albicans, being one of the most common infections that can appear in and coexist with mucositis lesions. Loss or alteration of taste is another frequent manifestation after this type of treatment [28,37-40]. Chronic complications can also arise or persist for months and years after the end of treatment, including xerostomia (dry mouth) and tooth decay [37-40]. It is important to remember that, although cancer is the most common disease in palliative care patients, not all patients will receive radiotherapy or chemotherapy, as treatment will be based on the individual needs of each patient [41].

There is a growing recognition of the significance of palliative care not just in oncology but across various medical fields. This is especially clear in the treatment of many neurological diseases, which are often chronic, incurable, and autonomy-impairing [42]. Patients with heart failure, pulmonary diseases, nephrological disorders, and other conditions can also require palliative care [43,44]. Various medications, including anticholinergics, antihypertensives, antiparkinsonians, bronchodilators, and diuretics, used to treat these underlying conditions, can lead to oral manifestations, with xerostomia being common. These drugs primarily work by inhibiting signaling pathways within salivary tissues and reducing the fluid output of the glands [43,45]. According to the National Cancer Institute at the National Institutes of Health in the United States, 80% of

patients undergoing myeloablative chemotherapy experience oral complications, and palliative drugs such as bisphosphonates and analgesics are linked to oral mucositis and taste disturbances [14].

Approximately 69% of patients in palliative care corresponds to older adults [46]. Towards end of life, approximately 50% to 76% of individuals become unable to perform oral self-care [30,47]. Overall, the oral hygiene of these patients tends to be suboptimal, marked by high rates of plaque on the teeth, thereby elevating the risk of caries and periodontal disease and impacting quality of life [30,48].

Xerostomia is a common condition, characterized by the dryness of the oral cavity due to inadequate saliva secretion or a complete absence of saliva, is associated with various causes such as the use of medications, cancer treatments, autoimmune diseases, dehydration, advanced age, among other factors [7,49]. A decrease in saliva production associated with xerostomia increases the risk of developing diseases such as oral candidiasis and tooth decay, which can make it difficult to chew and swallow, and can lead to changes in taste and other conditions [4,50,51]. The general prevalence of dry mouth in the population varies from 5.5% to 46%, depending on gender and age, with some studies indicating a higher prevalence of 78% or 81% in terminal cancer patients [29,52].

The host's overall health is generally considered the etiological factor in the development of oral candidiasis [53]. Hyposalivation, diabetes, specific medications, and reduced nutritional status are strongly linked to the occurrence of this disease [54]. More than 17 species of Candida can cause infections in the oral mucosa, with Candida albicans being the most frequently identified pathogen [53]. Clinically, oral candidiasis can be characterized as pseudomembranous, atrophic (erythematous), or hyperplastic. The erythematous type is the most common, causing a reddish lesion that mainly affects the tongue and palate, although other areas of the oral mucosa can also be affected. Burning in the mouth is one of the symptoms reported by patients with erythematous candidiasis [9]. Oral candidiasis in our study had a prevalence of 17%, falling within the reported range in the literature, which varies between 8% and 94% [55,56].

Caries is a multifactorial disease and can be related to xerostomia, radiation, poor hygiene and cariogenic diet [57]. Caries is a bacterial disease characterized by demineralization of the enamel and dentin. Initially asymptomatic, if left untreated, caries can develop into reversible or irreversible pulpitis, which causes severe pain. Untreated pulpitis can develop into an abscess, which can lead to more serious complications [57].

Differently, radiation caries is mainly due to damage to the salivary glands, resulting in hyposalivation and changes in the oral microflora. This disease becomes evident three months after irradiation and can have a rapid progression and usually no acute pain [58]. Hong et al. [59] reported a prevalence of dental caries of 21% in patients treated with chemotherapy and radiotherapy, while our study showed a prevalence of 32% for caries.

Described in 11 patients in this study, gingivitis can be divided into plaque-induced and non-plaque-induced gingivitis. Plaque-induced gingivitis is one of the most common inflammatory diseases in humans and is characterized by erythema, gingival swelling, and absence of periodontal loss. It is usually painless, rarely associated with spontaneous bleeding and often goes unnoticed by patients who are unaware of the disease. Gingivitis is considered a precursor to periodontitis, which is why it is so important to treat it [60,61]. The literature reports indicating a prevalence of 20% of gingivitis in patients undergoing chemotherapy and radiotherapy [59,62].

It is crucial to recognize limitations in this systematic review. Firstly, there is a discrepancy among studies in describing the manifestations of oral diseases, often without exploring into the specific type of disease or condition to which the reported lesion may refer. Secondly, some studies lacked detailed information about the pre-existing disease. In addition, the heterogeneity of the studies, in terms of variations in individual criteria utilized to describe the lesions precluded an extension of the analysis through meta-analysis.

5. Conclusions

Individuals receiving palliative care often experience oral diseases that significantly compromise their physical, psychological, and spiritual well-being. Comprehensive dental assessment and timely intervention should take place as early as possible, ideally from the patient's initial admission to palliative care, along with regular monitoring of oral health. This strategy will enhance the patient's comfort and quality of life, as well as prevent potential complications. It would be important to conduct studies with larger sample sizes that thoroughly document and standardize oral manifestations in palliative care patients would be crucial, enabling the development of more precise approaches for these individuals.

6. Other information

6.1. Protocol and registration

This systematic review is registered with PROSPERO (International Prospective Register of Systematic Reviews) under registration number CRD42023395301. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) was used as the foundation for the review.

6.2 Large Language Models

The content of this article is entirely original. ChatGPT was used to assist in organizing the text's structure in English.

7. Statements & Declarations

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7.2. Competing Interests

The authors have no conflict of interest.

7.3. Author contributions

M.S – methodology, formal analysis, investigation, data curation, writing – original draft, writing—review and editing, visualization, project administration.

E.S.S – conceptualization, methodology, formal analysis, investigation, data curation, writing – review and editing, visualization, supervision, project administration.

C.M.P – formal analysis, investigation, writing - review and editing, visualization.

J.B.E – writing - review and editing, visualization, validation.

A.R.S-S – conceptualization, methodology, project administration, writing - review and editing, visualization, supervision, project administration, resources, validation.

L.P.K – writing - review and editing, visualization, supervision, validation.

All authors have read and agreed to the published version of the manuscript.

7.4. Ethics Approval

This study represents a systematic review of the literature. The Research Ethics Committee from Piracicaba Dental School, University of Campinas, Brazil, has confirmed that ethical approval is unnecessary for this investigation.

7.5. Consent to participate

As this study is a systematic review of the literature, it did not involve the inclusion of human subjects. Consequently, the absence of informed consent from patients for study participation is justified.

7.6. Consent to publish

Not applicable.

References

[1] World Health Organization (2002) National cancer control programmes: policies and managerial guidelines. https://www.who.int/publications/i/item/national-cancer-control-programmes Accessed August 28, 2023.

[2] O'Neill B, Fallon M (1997) ABC of palliative care. Principles of palliative care and pain control. BMJ 315(7111):801-4. https://doi.org/10.1136/bmj.315.7111.801

[3] Rome RB, Luminais HH, Bourgeois DA, Blais CM (2011) The role of palliative care at the end of life. Ochsner J. Winter 11(4):348-52.

[4] Agarwal R, Epstein AS (2017) The Role of Palliative Care in Oncology. Semin Intervent Radiol 34(4):307-312. https://doi.org/10.1055/s-0037-1608702

[5] Chen X, D'Souza V, Thomsen TA, Gilbertson-White S, Madiloggovit, J, Pendleton C, Munjal A, Xianjin, X (2021) Oral health in adult patients receiving palliative care: a Mixed Method Study. American Journal of Hospice and Palliative Medicine 38(12):1516-1525. https://doi.org/10.1177/10499091211007449

[6] Saini R, Marawar Pp, Shete S, et al (2009) Dental expression and role in palliative treatment. Indian J Palliat Care 15(1):26–29. https://doi.org/10.4103/0973-1075.53508

[7] Kvalheim SF, Marthinussen IMC, Berg E, Strand GV (2022) Dry mouth in the seriously ill and dying. Tidsskr Nor Laegeforen 142(3). https://doi.org/10.4045/tidsskr.21.0232

[8] Integrating palliative care and symptom relief into primary health care: a WHO guide for planners, implementers and managers. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO.

[9] Silva ARP, Bodanezi AV, Chrun ES, Lisboa ML, de Camargo AR, Munhoz EA (2023) Palliative oral care in terminal cancer patients: Integrated review. World J Clin Cases 11(13):2966-2980. https://doi.org/10.12998/wjcc.v11.i13.2966

[10] Meneguin S, Matos TDS, Ferreira MLDSM (2018) Perception of cancer patients in palliative care about quality of life. Rev Bras Enferm 71(4):1998-2004. https://doi.org/10.1590/0034-7167-2017-0360

[11] Funkhouser WK. Pathology: The Clinical Description of Human Disease. Molecular Pathology. 2009:197–207. https://doi.org/10.1016/B978-0-12-374419-7.00011-1.

[12] Kottow MH (1980) A medical definition of disease. Med Hypotheses 6(2):209-13. https://doi.org/10.1016/0306-9877(80)90085-7

[13] Eisenberg L (1977) Disease and illness. Distinctions between professional and popular ideas of sickness. Cult Med Psychiatry 1(1):9-23. https://doi.org/10.1007/BF00114808. PMID: 756356

[14] https://www.nature.com/subjects/oral-manifestations. Accessed June 15, 2023.

[15] Porter, S., Mercadente, V. & Fedele, S (2018) Oral manifestations of systemic disease. BDJ Team 5, 18012. https://doi.org/10.1038/bdjteam.2018.12

[16] Venkatasalu MR, Murang ZR, Ramasamy DTR, Dhaliwal JS (2020) Oral health problems among palliative and terminally ill patients: an integrated systematic review. BMC Oral Health 20(1):79. https://doi.org/10.1186/s12903-020-01075-w

[17] Page MJ, McKenzie JE, Bossuyt PM, et al (2021) The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 372:n71. https://doi.org/10.1136/bmj.n71

[18] Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A (2016) Rayyan-a web and mobile app for systematic reviews. Syst Rev 5(1):210. https://doi.org/10.1186/s13643-016-0384-4

[19] Moola S, Munn Z, Sears K, Sfetcu R, Currie M, Lisy K, Tufanaru C, Qureshi R, Mattis P, Mu P (2015) Conducting systematic reviews of association (etiology): The Joanna Briggs Institute's approach. Int J Evid Based Health 13(3):163-9. https://doi.org/10.1097/XEB.0000000000000064

[20] Migliavaca CB, Stein C, Colpani V, Barker TH, Ziegelmann PK, Munn Z, Falavigna M (2022) Meta-analysis of prevalence: I^2 statistic and how to deal with heterogeneity. Res Synth Methods 13(3):363-367. https://doi.org/10.1002/jrsm.1547

[21] Balshem H, Helfand M, Schünemann HJ, et al (2011) GRADE guidelines: 3. Rating the quality of evidence Clin Epidemiol 64(4):401-406. https://doi.org/10.1016/j.jclinepi.2010.07.015

[22] Burge FI (1993). Dehydration symptoms of palliative care cancer patients. Journal of pain and symptom management 8(7):454-464. https://doi.org/10.1016/0885-3924(93)90188-2

[23] Fischer DJ, Epstein JB, Yao Y, Wilkie DJ (2014) Oral health conditions affect functional and social activities of terminally ill cancer patients. Support Care Cancer 22(3):803-810. https://doi.org/10.1007/s00520-013-2037-7

[24] da Fonseca Orcina, B, Jaccottet, CMG, Savian, MCB (2021) Prevalence of Oral Manifestations in Cancer Patients Enrolled in a Home Care Program in the City of Pelotas-RS. Revista Brasileira de Cancerologia 67(2):081184. https://doi.org/10.32635/2176-9745.RBC.2021v67n2.1184

[25] Davies A, Buchanan A, Todd J, Gregory A, Batsari, KM (2021) Oral symptoms in patients with advanced cancer: an observational study using a novel oral symptom assessment scale. Supportive Care in Cancer 29(8):4357-4364. https://doi.org/10.1007/s00520-020-05903-1

[26] Fleming M, Craigs CL, Bennett MI (2020) Palliative care assessment of dry mouth: what matters most to patients with advanced disease? Supportive Care in Cancer 28(3):1121-1129. https://doi.org/10.1007/s00520-019-04908-9

[27] Maltoni, M, Pirovano M, Scarpi E, Marinari, M, Indelli, M., Arnoldi, E, Amadori, D (1995) Prediction of survival of patients terminally III with cancer. Results of an Italian prospective multicentric study. Cancer, 75(10):2613-2622. https://doi.org/10.1002/1097-0142(19950515)75:10<2613::aid-cncr2820751032>3.0.co;2-1

[28] Mercadante S, Aielli, F, Adile C, Ferrera, P, Valle A, Fusco F, Porzio, G (2015) Prevalence of oral mucositis, dry mouth, and dysphagia in advanced cancer patients. Supportive care in cancer 23(11):3249-3255. https://doi.org/10.1007/s00520-015-2720-y

[29] Wilberg, P, Hjermstad, MJ, Ottesen S, Herlofson BB (2012) Oral health is an important issue in end-of-life cancer care. Supportive Care in Cancer 20(12):3115-3122. https://doi.org/10.1007/s00520-012-1441-8

[30] Magnani C, Mastroianni C, Giannarelli D, Stefanelli MC, Di Cienzo, V, Valerioti, T, Casale G (2019) Oral hygiene care in patients with advanced disease: an essential measure to improve oral cavity conditions and symptom management. Am J Hosp Palliat Care 36(9):815-819. https://doi.org/10.1177/1049909119829411

[31] Nakajima N (2017) Characteristics of oral problems and effects of oral care in terminally ill patients with cancer. American Journal of Hospice and Palliative Medicine® 34(5):430-434. https://doi.org/10.1177/1049909116633063

[32] Amran NAH, Rahman HA, Awang AMZBH, Murang, ZR, Nara A, Teo SP, Dhaliwal JS (2022) Assessment of oral health problems and oral hygiene practices among palliative care patients using a new tool: A pilot study. Palliative Medicine in Practice 16(1):49-58. https://doi.org/10.5603/PMPI.2021.0030

[33] Matsuo K, Watanabe R, Kanamori D, et al (2016) Associations between oral complications and days to death in palliative care patients. Support Care Cancer 24(1):157-61. https://doi.org/10.1007/s00520-015-2759-9

[34] Kelley AS, Morrison RS (2015) Palliative Care for the Seriously Ill. N Engl J Med 373(8):747-55. https://doi.org/10.1056/NEJMra1404684.

[35] Wiseman MA (2000) Palliative care dentistry. Gerodontology 17(1):49-51. https:doi.org/10.1111/j.1741-2358.2000.00049.x

[36] Henson LA, Maddocks M, Evans C, Davidson M, Hicks S, Higginson IJ. Palliative Care and the Management of Common Distressing Symptoms in Advanced Cancer: Pain, Breathlessness, Nausea and Vomiting, and Fatigue. J Clin Oncol. 2020 Mar 20;38(9):905-914. https://doi.org/10.1200/JCO.19.00470.

[37] Soysa NS, Samaranayake LP, Ellepola NA (2004) Cytotoxic drugs, radiotherapy and oral candidiasis. Oral Oncol 40(10):971-8. https://doi.org/10.1016/j.oraloncology.2003.12.013.

[38] Specht L. Oral complications in the head and neck radiation patient. Introduction and scope of the problem (2002) Support Care Cancer 10(1):36-9. https://doi.org/10.1007/s005200100283.

[39] de Oliveira Lula EC, de Oliveira Lula CE, Alves CM, Lopes FF, Pereira AL (2007) Chemotherapy-induced oral complications in leukemic patients. Int J Pediatr Otorhinolaryngol 71(11):1681-5. https://doi.org/10.1016/j.ijporl.2007.07.006.

[40] McCarthy GM, Skillings JR (1992) Orofacial complications of chemotherapy for breast cancer. Oral Surg Oral Med Oral Pathol 74(2):172-8. https://doi.org/10.1016/0030-4220(92)90378-4.

[41] Siouta N, Beek K, Preston N, Hasselaar J, Hughes S, Payne S, et al. (2016) Towards integration of palliative care in patients with chronic heart failure and chronic obstructive pulmonary disease: a systematic literature review of European guidelines and pathways. BMC Palliative Care. https://doi.org/10.1186/s12904-016-0089-4.

[42] Provinciali L, Carlini G, Tarquini D et al. (2016) Need for palliative care for neurological diseases. Neurol Sci 37(10):1581-7. https://doi.org/10.1007/s10072-016-2614-x

[43] Pugian Jardim P, Dantas Cavalcanti AC, Santos Borges A, Peclat Flores PV, Achão Rosa C (2022) Signs and symptoms of patients with heart failure in palliative care: scoping review. Anna Nery School Journal of Nursing/Escola Anna Nery Revista de Enfermagem, 26.

[44] Voltz R, Borasio G (1997) Palliative therapy in the terminal stage of neurological disease. Journal of Neurology 244 Suppl 4:S2-S10. https://doi.org/10.1007/PL00007721.

[45] Cassolato, S., & Turnbull, R. (2003). Xerostomia: clinical aspects and treatment. Gerodontology 20(2):64-77. https://doi.org/10.1111/J.1741-2358.2003.00064.X.

[46] Connor SR (2020) Global Atlas of Palliative Care. 2nd ed. London, UK: World Health Organization.

[47] Chen X, Chen H, Douglas C, Preisser JS, Shuman SK (2013) Dental treatment intensity in frail older adults in the last year of life. J Am Dent Assoc 144(11):1234-1242. https://doi.org/10.14219/jada.archive.2013.0051

[48] Vargas J, Hernandez M, Silvestri C, Jiménez O, Guevara N, Carballo M, et al (2006) Brain abscess due to *Arcanobacterium haemolyticum* after dental extraction. Clin Infect Dis 42:1810–1. https://doi.org/10.1086/504436

[49] Plemons JM, Al-Hashimi I, Marek CL (2014) American Dental Association Council on Scientific Affairs. Managing xerostomia and salivary gland hypofunction: executive summary of a report from the American Dental Association Council on Scientific Affairs. J Am Dent Assoc 145(8):867-73. https://doi.org/10.14219/jada.2014.44

[50] Phongtankuel V, Meador L, Adelman RD, et al (2018) Multicomponent Palliative Care Interventions in Advanced Chronic Diseases: A Systematic Review. American Journal of Hospice and Palliative Medicine 35(1):173-183. https://doi.org/10.1177/1049909116674669

[51] Guggenheimer J, Moore PA (2003) Xerostomia: etiology, recognition and treatment. *J Am Dent Assoc* 134(1):61–69. https://doi.org/10.14219/jada.archive.2003.0018

[52] Temel JS, Greer JA, Muzikansky A, Gallagher ER, Admane S, Jackson VA, Dahlin CM, Blinderman CD, Jacobsen J, Pirl WF, Billings JA, Lynch TJ (2010) Early palliative care for patients with metastatic non-small-cell lung cancer. N Engl J Med 363:733–742. https://doi.org/10.1056/NEJMoa1000678

[53] Lu SY (2021) Oral Candidosis: Pathophysiology and Best Practice for Diagnosis, Classification, and Successful Management. J Fungi (Basel) 7(7):555. https://doi.org/10.3390/jof7070555

[54] Pedersen AML, Sørensen CE, Proctor GB, Carpenter GH, Ekström J (2018) Salivary secretion in health and disease. J. Oral Rehabil 45(9):730–746. https://doi.org/10.1111/joor.12664

[55] Davies AN (1997) The management of xerostomia: a review. Eur J Cancer Care (Engl) 6(3):209–214. https://doi.org/10.1046/j.1365- 2354.1997.00036.x

[56] Davies AN, Brailsford SR, Beighton D (2006) Oral candidosis in patients with advanced cancer. Oral Oncol 42(7):698–702. https://doi.org/10.1016/j.oraloncology.2005.11.010

[57] Douglass AB, Douglass JM (2003) Common dental emergencies. Am Fam Physician 67(3):511-6.

[58] Vissink A, Jansma J, Spijkervet FK, Burlage FR, Coppes RP (2003) Oral sequelae of head and neck radiotherapy. Crit Rev Oral Biol Med 14(3):199-212. https://doi.org/10.1177/154411130301400305.

[59] Hong, C.H.L., Napeñas, J.J., Hodgson, B.D. et al (2010) A systematic review of dental disease in patients undergoing cancer therapy. Support Care Cancer 18(8):1007–1021. https://doi.org/10.1007/s00520-010-0873-2

[60] Holmstrup P, Plemons J, Meyle J. Non-plaque-induced gingival diseases. J Clin Periodontol (2018) 45 Suppl 20:S28-S43. https://doi.org/10.1111/jcpe.12938.

[61] Trombelli L, Farina R, Silva CO, Tatakis DN (2018) Plaque-induced gingivitis: Case definition and diagnostic considerations. J Clin Periodontol 45 Suppl 20:S44-S67. https://doi.org/10.1111/jcpe.12939.

[62] Navarrete-Reyes AP et al (2023) Oral health in older adults with cancer. Geriatrics, Gerontology and Aging 17:1-12. https://doi.org/10.53886/gga.e0230016

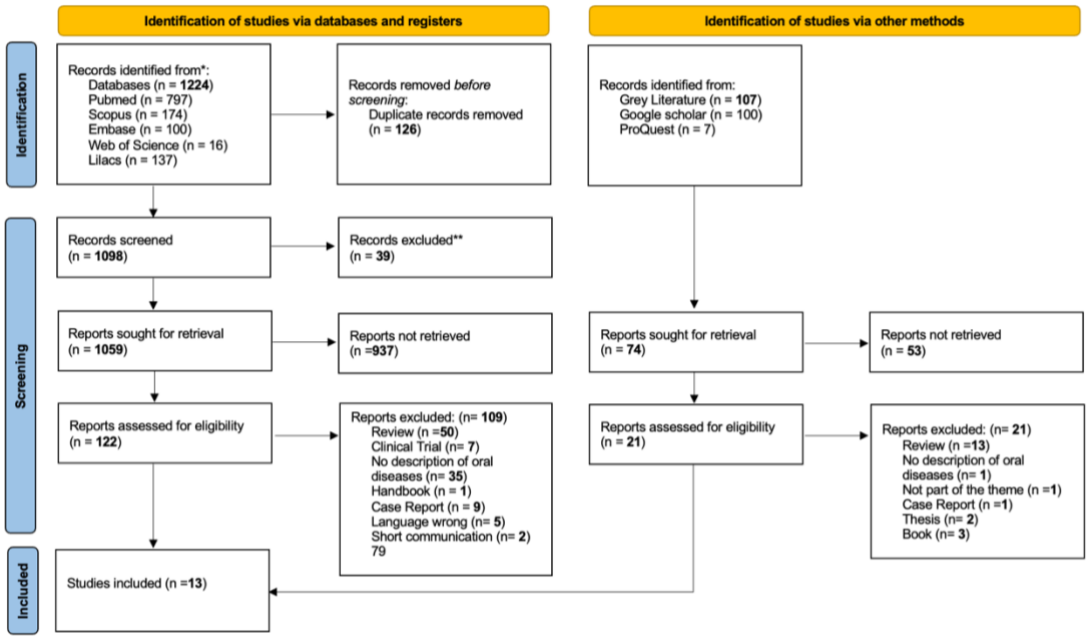


Fig. 1 – Flow Diagram showing references and selection criteria, based on PRISMA.

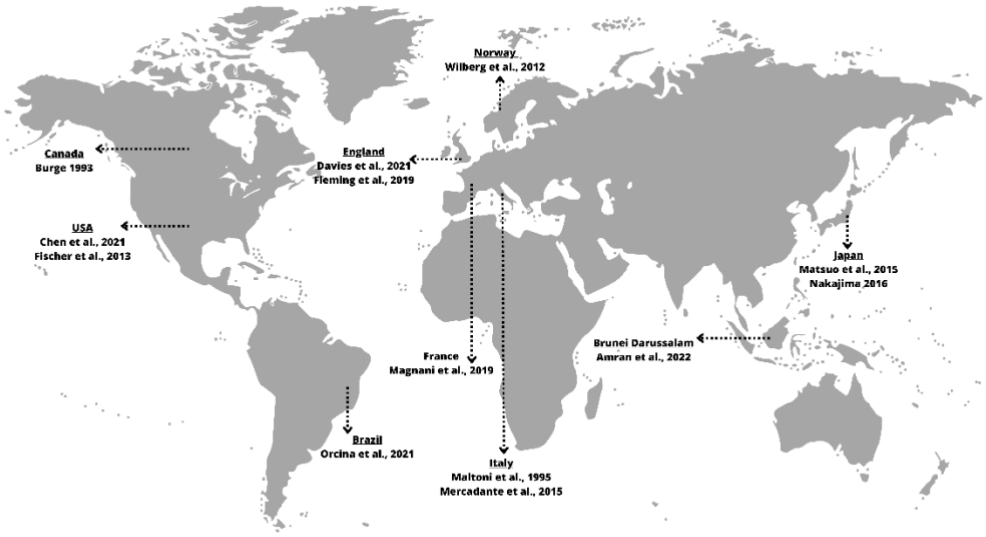


Fig. 2 - The global distribution of studies included in the systematic review.

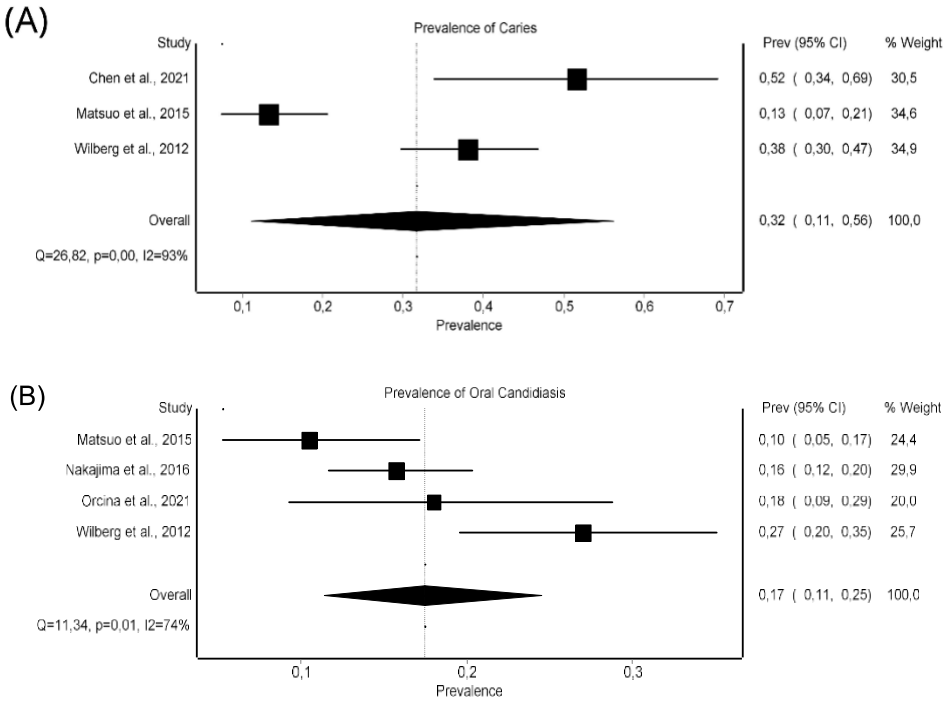


Fig. 3 – Forest Plot. (A) Prevalence of caries; (B) Prevalence of oral candidiasis.

Table 1 – Clinical and demographic characteristics of the study samples included in the Systematic Review.

Authors year country	Sample (n)	Age range	Mean age (years)	Sex		Pre-existing disease	Oral manifestations
				Female (%)	Male(%)		
Amran et al. 2022 Brunei Darussalam	73	29-91	62	47 (64.4%)	26 (35.6%)	NI	15 (20.5%) Dental pain 26 (35.6%) Gums (swollen, bleeding, white/red patches, ulcers, redness under dentures) 47 (64.4%) Lip (dry, red, swollen, ulcerated cracked, or ulcerated at corners) 41 (56.2%) Teeth (caries, fracture, broken root stumps) 37 (50.7%) Tongue (Red and/or white patch, fissured/cracked, coated)
Burge 1993 Canada	52	NI	64.4	26 (50%)	26 (50%)	4 (8%) Breast cancer 2 (4%) Central nervous system cancer 14 (27%) Gastrointestinal cancer 10 (19%) Genitourinary cancer 11 (21%) Lung cancer 11 (21%) Other cancer	10 (19%) Oral disease
Chen et al. 2021 United States	49*	32-93	58.3	28 (57.14%)	NI	12(25%) Organ failure (e.g., cardiomyopathy) 33 (67.50%) Terminal cancer 8(17.50%) neurological or other health conditions	5 (12.5%) Bleeding gums 16 (51.6%) Decayed/broken tooth 1 (2.5%) Toothache 41 (83.67%) Xerostomia 12 (26.5%) Oral pain 13 (32.50%) Oral soft tissue pathology 1 (3.5%) Periodontal abscess 4 (10%) Swollen gums 15 (31.2%) Difficulty tasting
Davies et al. 2021 England	250	36-91	68	146 (58.5%)	104 (41.5%)	36 (14%) Breast cancer 80 (32%) Gastrointestinal cancer 24 (9.5%) Gynecological cancer 14 (5.5%) Head & Neck cancer 12 (5%) Hematological cancer 46 (18.5%) Lung cancer 2 (1%) Neurological cancer 2 (1%) Skin cancer 4 (1.5%) Unknown primary cancer 30 (12%) Urological cancer	41 (16.5%) Bad breath 19 (7.5%) Bleeding from mouth 24 (9.5%) Burning sensation in mouth 85 (34%) Cracking lips 56 (22.5%) Cracking of corner of mouth 117 (47%) Coating tongue 25 (10%) Toothache/pain in teeth 209 (83.5%) Dry mouth 96 (38.5%) Lip discomfort 76 (30.5%) Mouth discomfort/pain 52 (21%) Sensitivity of teeth 139 (55.5%) Taste disturbance 42 (17%) Ulcers in mouth
Fleming et al. 2019 England	135	NI	71	82 (60.7%)	53 (39.3%)	12 (8.9%) Breast cancer 10 (7.4%) Colorectal cancer 25 (18.5%) Lung cancer 31 (23%) Non-malignancy (e.g., COPD) 57 (42.2%) Other malignancy	112 (83%) Dry Mouth 80 (59.7%) Taste interference

Authors year country	n)	Age range	Mean age (years)	Sex		Pre-existing disease	Oral manifestations
				Female (%)	Male (%)		
Fischer et al. 2013 United States	104	29-112	70.5	61 (59%)	42 (40%)	NI	96 (92%) Dry lips 94 (91%) Dry mouth 50 (52%) Intraoral pain 74 (71%) Taste change
Magnani et al. 2019 France	75	21-94	74	39 (52%)	36 (48%)	66 (88%) Cancer 9 (12%) Non-cancer (end stage organ failure)	56 (74.9%) Dry mouth 44 (58.7%) Lip alterations 37 (49.3%) Dysgeusia 42 (56%) Teeth problems (plaque or debris in localized areas) 53 (70.7%) Tongue problems
Maltoni et al. 1995 Italy	530	30-92	67	227 (42.8%)	303 (57.2%)	53 (10.0%) Breast cancer 86 (16.2%) Colorectal cancer 30 (5.7%) Head and neck cancer 103 (19.4%) Lung cancer 47 (8.9%) Male urogenital cancer 71 (13.4%) Pancreas, liver, gall bladder cancer 55 (10.4%) Stomach cancer 23 (4.3%) Unknown primary site cancer 33 (6.2%) Others cancer	154 (29.1%) Dry mouth
Matsuo et al. 2015 Japan	105	NI	73	49 (46.6%)	56 (53.4%)	5 (4.76%) Breast cancer 5 (4.76%) Cranio facial cancer 15 (14.29%) Colon cancer 8 (7.62%) Gynecological cancer 10 (9.52%) Lung cancer 9(8.57%) Lymphoma/Leukemia cancer 20 (19.05%) Pancreas/biliary cancer 3 (2.86%) Prostate cancer 6 (5.71%) Renal/Urinary tract cancer 1 (0.95%) Other cancer	Group short (DTD) 17 (34.7%) Bleeding spots 5 (10.2%) Candidiasis 8 (16.3%) Dental caries 38 (77.6%) Dry mouth 25 (51.0%) Gingival inflammation 13 (26.5%) Tongue coating 33 (67.3%) Tongue inflammation Group long (DTD) 8 (14.3%) Bleeding spots 6 (10.7%) Candidiasis 6 (10.7%) Dental caries 30 (53.6%) Dry mouth 23 (41.1%) Gingival inflammation 21 (37.5%) Tongue coating 26 (46.4%) Tongue inflammation
Mercadante et al. 2015 Italy	669	NI	72.1	327 (48.8%)	342 (51.2%)	54 (8.4 %) Breast cancer 243 (38 %) Gastrointestinal cancer 41 (6.4 %) Gynecological cancer 20 (3.1 %) Head- neck cancer 67 (10.5 %) Hematological cancer 134 (21 %) Lung cancer 20 (3.1 %) Prostate cancer 35 (5.5 %) Urological cancer 55 (8.4 %) Other cancer	270 (40.4 %) Dry mouth 149 (22.3 %) Mucositis

Authors year Country	Sample (n)	Age range	Mean age (years)	Sex Female (%)	Male (%)	Pre-existing disease	Oral manifestations
Nakajima 2016 Japan	Group A: 115 Group B 158	Group A: 42-83 Group B: 48-89	Group A: 62.4 Group B: 66.2	Group A: 52 (45.2%) Group B: 77 (48.7%)	Group A: 63 (54.8%) Grupo B: 88 (51.3%)	Group A 7 (6%) Breast cancer 10 (8.69%) Colon/rectum cancer 5 (4.34%) Head and neck cancer 13 (11.30%) Kidney/bladder cancer 18 (15.65%) Liver/bile duct/pancreas cancer 38 (33%) Lung cancer 7 (6%) Stomach cancer 10 (8.69%) Uterus/ovary cancer 7 (6%) Other cancer Group B 3 (1.9%) Breast cancer 15 (9.49%) Colon/rectum cancer 3 (1.89%) Esophagus cancer 8 (5%) Head and neck cancer 8 (5.06%) Kidney/bladder cancer 30 (19%) Liver/bile duct/pancreas cancer 48 (30.38%) Lung cancer 15 (9.49%) Stomach cancer 12 (7.59%) Uterus/ovary cancer 16 (10.12%) Other cancer	43 (15.8%) Oral candidiasis 172 (63%) Dry mouth 38 (13.9%) Stomatitis
Orcina et al. 2021 Brazil	61	27-89	64	27 (44.3%)	34 (55.7%)	5 (8.2%) Breast cancer 22 (36.1%) Digestive System cancer 3 (4.9%) Endocrine System cancer 6 (9.8%) Female reproductive system cancer 7 (11.5%) Head and neck cancer 5 (8.2%) Prostate cancer 7 (11.5%) Respiratory System cancer 5 (8.2%) Others cancer 1 (1.6%) No information	11 (18%) Candidiasis 8 (13.1%) Mucositis 6 (9.8%) Dysgeusia
Wilberg et al. 2012 Norway	126	36-90	64	53 (54%)	46 (46%)	26 (21%) Gastrointestinal cancer 24 (19%) Lung cancer 14 (11%) Prostate cancer	34 (34%) Candida infection 48 (51%) Caries 77 (78%) Xerostomia 11 (11%) Gingivitis 84 (67%) Mouth pain 65 (68%) Taste alterations

Abbreviations: NI: Not information; group A: good oral intake; group B: poor oral intake; DTD: days to death; group short (DTD): <28 days; group long (DTD): ≥28 days.

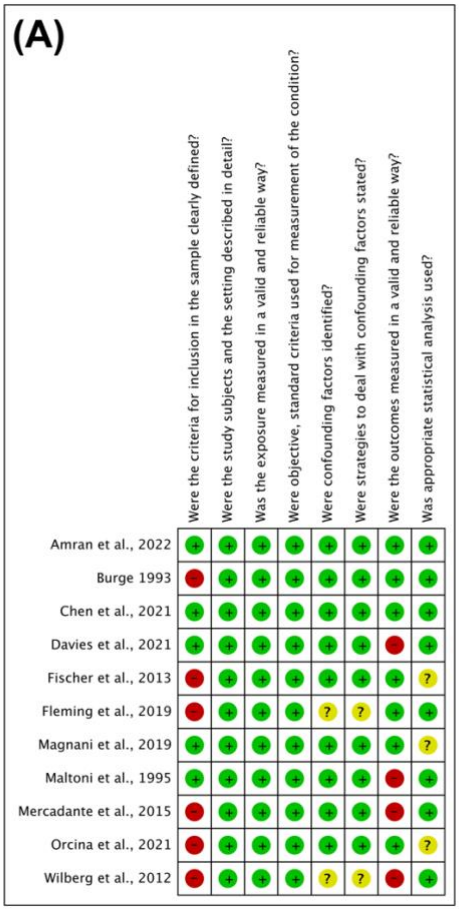
* The sample size varied because some participants did not complete the oral examination due to limited time, exhaustion, or terminal illness; therefore, the absolute and relative frequencies reported may vary.

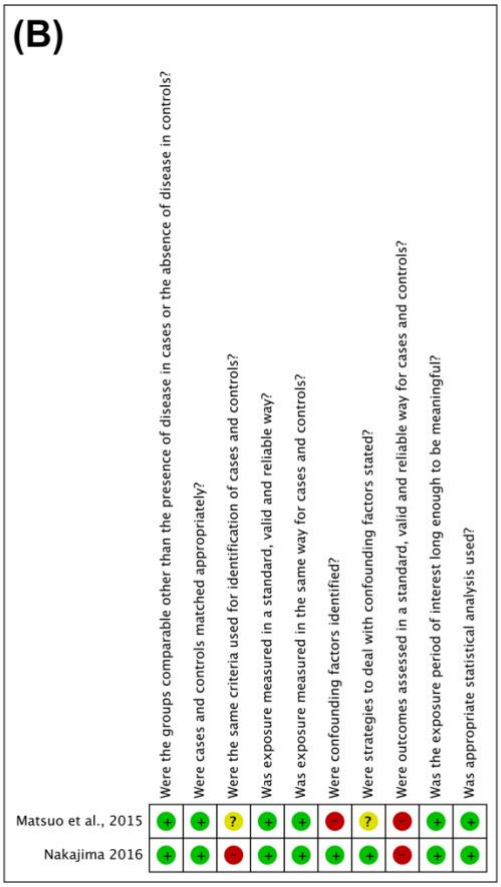
Table 2 - Distribution of oral alterations in palliative care patient.

Oral alterations	Patients (n)
Bad breath	41
Bleeding from mouth	19
Bleeding spots	25
Burning sensation	24
Caries	78
Dental pain/ toothache/pain in teeth	41
Gingival inflammation	49
Gingival lesions (swelling, bleeding, white/red patches, ulcers, and redness under dentures)	35
Gingivitis	11
Lesions on the lips (dry, red, swollen, ulcerated, cracked, or fissured)	424
Lesions on the tongue (coated, red and/or white patches, loss of papillae with a shiny appearance, ulcerated, sloughing, or inflamed)	300
Mucositis	157
Oral candidiasis	99
Oral diseases	10
Oral pain/mouth pain/intraoral pain/mouth discomfort/pain	222
Oral soft tissue pathology	13
Periodontal abscess	1
Stomatitis	38
Taste changes/dysgeusia	414
Teeth (caries, fracture, broken root stumps)	41
Teeth problems (plaque or debris)	42
Tooth sensitivity	52
Ulcers in mouth	42
Xerostomia	1,253

MATERIAL SUPLEMENTAR DO ARTIGO

Supplementary Figure 1 - Risk of bias assessment according to Joanna Brings Institute critical appraisal tool for each study design: (A) Cross-sectional studies; (B) Case-control studies.





Supplementary Table 1 –PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	3
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	3, 4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	4
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	4
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	4
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	4
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	5
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	5
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	5
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	5
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	5
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	5
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	5
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	5
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	5
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	5
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	5
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	6
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	6
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	6

Section and Topic	Item #	Checklist item	Location where item is reported
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	6
Study characteristics	17	Cite each included study and present its characteristics.	6
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	6
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	7
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	7
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	7
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	7
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	7
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	7
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	8
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	9,12
	23b	Discuss any limitations of the evidence included in the review.	11,12
	23c	Discuss any limitations of the review processes used.	11,12
	23d	Discuss implications of the results for practice, policy, and future research.	12
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	12
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	12
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	12
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	12
Competing interests	26	Declare any competing interests of review authors.	13
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	-

Supplementary Table 2. Search strategies with appropriated key words and MeSH terms.

Database	Search (Search date: February 9th, 2023 and update on January 19th, 2024)
Pubmed	("Mouth diseases"[MeSH Terms] OR "Mouth disease") OR ("Oral Manifestations"[MeSH Terms] OR "Oral Manifestation") OR ("Oral diseases") AND ("Palliative Care"[Mesh] OR "Palliative Treatment" OR "Palliative Treatments" OR "Palliative Therapy" OR "Palliative Supportive Care" OR "Palliative Surgery")
Scopus	TITLE-ABS-KEY (*"Mouth diseases"* OR *"Mouth disease"* OR *"Oral Manifestations"* OR *"Oral Manifestation"* OR *"Oral diseases"*) AND TITLE-ABS-KEY (*"Palliative Care"* OR *"Palliative Treatment"* OR *"Palliative Treatments"* OR *"Palliative Therapy"* OR *"Palliative Supportive Care"* OR *"Palliative Surgery")*
Web of Science	("Mouth diseases" OR "Mouth disease" OR "Oral Manifestations" OR "Oral Manifestation" OR "Oral diseases") AND ("Palliative Care" OR "Palliative Treatment" OR "Palliative Treatments" OR "Palliative Therapy" OR "Palliative Supportive Care" OR "Palliative Surgery")
Embase	('mouth diseases'/de OR 'mouth disease'/de OR 'oral manifestations'/de OR 'oral manifestation' OR 'oral diseases') AND ('palliative care'/de OR 'palliative treatment'/de OR 'palliative treatments' OR 'palliative therapy'/de OR 'palliative supportive care' OR 'palliative surgery'/de)
Lilacs	("Mouth diseases" OR "Mouth disease" OR "Oral Manifestations" OR "Oral Manifestation") AND ("Palliative Care" OR "Palliative Treatment" OR "Palliative Treatments" OR "Palliative Therapy" OR "Palliative Supportive Care" OR "Palliative Surgery")
Google Scholar	("Mouth diseases" OR "Mouth disease" OR "Oral Manifestations" OR "Oral Manifestation" OR "Oral diseases") AND ("Palliative Care" OR "Palliative Treatment" OR "Palliative Treatments" OR "Palliative Therapy" OR "Palliative Supportive Care" OR "Palliative Surgery")
ProQuest	TI,AB("Mouth diseases" OR "Mouth disease" OR "Oral Manifestations" OR "Oral Manifestation" OR "Oral diseases") AND TI,AB("Palliative Care" OR "Palliative Treatment" OR "Palliative Treatments" OR "Palliative Therapy" OR "Palliative Supportive Care" OR "Palliative Surgery")

Supplementary Table 3. Excluded articles and reasons for exclusion (n=95).

Reference	Author/Year	Reasons for exclusion
1	Asaba et al. (2009)	6
2	Bagg et al. (2003)	1
3	Brant (1998)	7
4	Caballero et al. (2009)	3
5	Chiodo et al. (1998)	5
6	Cummings et al. (1982)	7
7	D'Cruz et al. (2018)	2
8	D'Hondt et al. (2006)	3
9	Davies et al. (2006)	3
10	De Conno et al. (1989)	1
11	Domka et al. (1995)	6
12	Elackattu et al. (2009)	1
13	Farris et al. (2013)	1
14	Feio et al. (2005)	1
15	Fischman (1994)	3
16	Fleming et al. (1972)	4
17	Franchebois et al. (1982)	6
18	Genoud et al. (2003)	6
19	Glass et al. (1986)	1
20	Goldstein et al. (2008)	5
21	Good et al. (2006)	4
22	Grewal et al. (2019)	1
23	Guggenheimer et al. (2003)	1
24	Hegarty et al. (2008)	1
25	Hemalatha et al. (2019)	7
26	Holt et al. (2015)	1
27	Jones et al. (2007)	3
28	Kahn et al. (2005)	2
29	Kamisetty et al. (2014)	4
30	Kutzner et al. (1982)	6
31	Kvalheim et al. (2022)	3
32	Laurie et al. (2006)	2

33	Leemhuis et al. (2019)	2
34	Lucas et al. (1998)	1
35	Mohod et al. (2016)	3
36	Morita et al. (2008)	1
37	Mroueh et al. (2019)	4
38	Murphy et al. (2011)	1
39	Murphy (1970)	4
40	Napenas et al. (2007)	1
41	Narayanan et al. (1988)	4
42	Narhi et al. (1999)	1
43	Neumann et al. (2003)	1
44	Ohno et al. (2016)	4
45	Onkologiepflege (2006)	6
46	Ortholan et al. (2009)	3
47	Pagni et al. (1970)	7
48	Paine et al. (2020)	4
49	Patil et al. (2012)	3
50	Paunovich et al. (2000)	3
51	Quinn (2013)	1
52	Rai et al. (2015)	3
53	Regnard et al. (1997)	1
54	Reychler (1999)	3
55	Rider (1990)	4
56	Ridge (1993)	1
57	Rohr et al. (2010)	3
58	Rothwell et al. (1990)	2
59	Rydholm et al. (2002)	3
60	Saito et al. (2014)	2
61	Sawhney et al. (2020)	1
62	Schimmel et al. (2008)	5
63	Schwarz et al. (1952)	4
64	Schiødt (1996)	4
65	Sciubba (2016)	1
66	Singh et al. (2021)	3
67	Slieker et al. (2020)	3

68	Skołyszewski et al. (1988)	6
69	Souter (2003)	5
70	Sweeney et al. (1995)	1
71	Sweeney et al. (2000)	1
72	Sweeney et al. (1998)	3
73	Tinti et al. (2020)	1
74	Tschoppe et al. (2010)	1
75	Tucker et al. (1973)	3
76	Van (2009)	5
77	Venkatasalu et al. (2020)	1
78	Watson et al. (1998)	1
79	Wiseman (2006)	1
80	World Health Organization (2013)	1
81	Bernardes et al. 2021	4
82	Brown et al. 1990	1
83	Carneiro et al. 2022	1
84	D'Souza et al. 2019	1
85	Da Rocha et al. 2011	1
86	Davies et al. 2005	1
87	Elad et al. 2014	1
88	Garg et al. 2017	1
89	Hart et al. 2022	1
90	Hedge et al. 2016	1
91	Macpherson 2013	1
92	Pereira et al. 2022	1
93	Priyanshi et al. 2020	1
94	Sankar et al. 2011	1
95	Souto 2019	1

Supplementary Table 4 – Risk of bias assesed using the Joanna Briggs Institute tool for use in Systematic Reviews. The risk of bias was categorized as high, when the study scores up to 49% “yes”, moderate when the study scored 50% to 69% “yes”, and low when the study scored more than 70% “yes”.

Cross-sectional studies

Authors	**Q.1**	**Q.2**	**Q.3**	**Q.4**	**Q.5**	**Q.6**	**Q.7**	**Q.8**	**% yes / risk**
Amran et al., 2022	Y	Y	Y	Y	Y	Y	Y	Y	100% / L
Burge 1993	N	Y	Y	Y	Y	Y	Y	Y	87,5% / L
Chen et al., 2021	Y	Y	Y	Y	Y	Y	Y	Y	100% / L
Davies et al., 2021	Y	Y	Y	Y	Y	Y	N	Y	87.5% / L
Fischer et al., 2013	N	Y	Y	Y	Y	Y	Y	Y	87.5% / L
Fleming et al., 2019	N	Y	Y	Y	U	U	Y	Y	62.5% / M
Magnani et al., 2019	Y	Y	Y	Y	Y	Y	Y	Y	100% / L
Maltoni et al, 1995	Y	Y	Y	Y	Y	Y	N	Y	87.5% / L
Mercandante et al., 2015	N	Y	Y	Y	Y	Y	N	Y	75% / L
Orcina et al., 2021	N	Y	Y	Y	Y	Y	Y	Y	87.5% / L
Wilberg et al., 2012	N	Y	Y	Y	U	U	N	Y	50% / M

Y-Yes; N- No; H- High, M- Moderate; L- Low.

Q.1 Were the criteria for inclusion in the sample clearly defined?

Q.2 Were the study subjects and the setting described in detail?

Q.3 Was the exposure measured in a valid and reliable way?

Q.4 Were objective, standard criteria used for measurement of the condition?

Q.5 Were confounding factors identified?

Q.6 Were strategies to deal with confounding factors stated?

Q.7 Were the outcomes measured in a valid and reliable way?

Q.8 Was appropriate statistical analysis used?

Case control study

Authors	Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Q.7	Q.8	Q.9	Q.10	% yes / risk
Matsuo et al., 2015	Y	Y	U	Y	Y	N	U	N	Y	Y	60% / M
Nakajima 2016	Y	Y	N	Y	Y	Y	Y	N	Y	Y	80% / L

Y-Yes; N- No; H- High, M- Moderate; L- Low.

Q.1. Were the groups comparable other than the presence of disease in cases or the absence of disease in controls?

Q.2. Were cases and controls matched appropriately?

Q.3.Were the same criteria used for identification of cases and controls?

Q.4. Was exposure measured in a standard, valid and reliable way?

Q.5. Was exposure measured in the same way for cases and controls?

Q.6. Were confounding factors identified?

Q.7. Were strategies to deal with confounding factors stated?

Q.8.Were outcomes assessed in a standard, valid and reliable way for cases and controls?

Q.9.Was the exposure period of interest long enough to be meaningful?

Q.10. Was appropriate statistical analysis used?

Supplementary Table 5 – Grading of Recommendations, Assessment, Development, and Evaluation (GRADE).

№ of studies	Certainty assessment						Effect			Certainty	Importance
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	№ of events	№ of individuals	Rate (95% CI)		
Prevalence of Caries											
3	observational studies	not serious	very serious[a]	not serious	very serious[b]	all plausible residual confounding would suggest spurious effect, while no effect was observed	Caries 78 total sample 262 (32%)			⊕◯◯◯ Very low	
Prevalence of Oral Candidiasis											
4	observational studies	not serious	serious[a]	not serious	serious[b]	all plausible residual confounding would suggest spurious effect, while no effect was observed	Oral Candidiasis 99 total sample 464 (17%)			⊕⊕⊕◯ Moderate	

Explanations a. There is statistically significant heterogeneity; b. Large confidence interval.

3 CONCLUSÃO

- Os cânceres de pulmão, mama, gastrointestinal, próstata, cabeça e pescoço, e hematológico estão entre as doenças pré-existentes mais frequentes dentre os pacientes em cuidados paliativos analisados neste estudo;
- A prevalência de cárie foi de 32%, enquanto a de candidíase oral foi de 17%;
- A manifestação oral mais frequente foi a xerostomia;
- É crucial realizar estudos com amostras maiores para documentar e padronizar as manifestações bucais em pacientes em cuidados paliativos, permitindo o desenvolvimento de abordagens mais precisas.

REFERÊNCIAS[1]

National cancer control programmes: policies and managerial guidelines. World Health Organization. 2002. https://www.who.int/publications/i/item/national-cancer-control-programmes Accessed August 28, 2023.

Rome RB, Luminais HH, Bourgeois DA, Blais CM. The role of palliative care at the end of life. Ochsner J. 2011 Winter;11(4):348-52.

O'Neill B, Fallon M. ABC of palliative care. Principles of palliative care and pain control. BMJ. 1997 Sep;315(7111):801-4. https://doi.org/10.1136/bmj.315.7111.801

Saini R, Marawar Pp, Shete S, et al. Dental expression and role in palliative treatment. Indian J Palliat Care. 2009 Jan;15(1):26–29. https:doi.org/10.4103/0973-1075.53508

Meneguin S, Matos TDS, Ferreira MLDSM (2018) Perception of cancer patients in palliative care about quality of life. Rev Bras Enferm. 2018 Jul-Aug;71(4):1998-2004. https:doi.org/10.1590/0034-7167-2017-0360

Kvalheim SF, Marthinussen IMC, Berg E, Strand GV (2022) Dry mouth in the seriously ill and dying. Tidsskr Nor Laegeforen. 2022 Feb;142(3). https:doi.org/10.4045/tidsskr.21.0232

Silva ARP, Bodanezi AV, Chrun ES, Lisboa ML, de Camargo AR, Munhoz EA. Palliative oral care in terminal cancer patients: Integrated review. World J Clin Cases. 2023 May;11(13):2966-2980. https:doi.org/10.12998/wjcc.v11.i13.2966

[1] De acordo com as normas da UNICAMP/FOP, baseadas na padronização do International Committee of Medical Journal Editors - Vancouver Group. Abreviatura dos periódicos em conformidade com o PubMed

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