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Review Article

The Psychological Effect of Antimicrobial Resistance in Patients with Oral Squamous Cell Carcinoma (OSCC)

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Abstract

Background and Aim Oral squamous cell carcinoma (OSCC) is a common form of head and neck cancer, and the emergence of antimicrobial resistance (AMR) has made its treatment increasingly challenging. AMR contributes to treatment failures, increased morbidity, and reduced survival rates among OSCC patients. Beyond these clinical impacts, this review aims to evaluate the psychological burdens associated with AMR in OSCC and to explore the effectiveness of mental health interventions tailored to these patients.

Methods A comprehensive literature search was conducted across multiple databases, including PubMed, Scopus, APA PsycINFO, CINAHL, Cochrane Library, and Web of Science. To ensure a thorough examination of the topic, the review focused on the intersection of AMR, OSCC, and mental health interventions, with studies published from March 2001 to August 2024 being considered.

Results A total of 62 studies were reviewed, revealing that AMR in OSCC significantly exacerbates psychological burdens such as anxiety, depression, and social isolation. Interventions like mindfulness-based interventions (MBIs), cognitive-behavioral therapy (CBT), and acceptance and commitment therapy (ACT) were identified as effective in reducing psychological distress and improving quality of life.

Conclusion The results indicate that AMR significantly worsens the psychological well-being of OSCC patients. Healthcare providers and policymakers are recommended to integrate mental health support into standard cancer care, enhance training on the psychological impact of AMR, and address barriers to mental health services. Future research should focus on developing and evaluating innovative mental health interventions and strategies to mitigate the impact of AMR on OSCC patients.

Keywords Antimicrobial resistance · Oral squamous cell carcinoma · Psychological burdens · Mental health interventions · Psychosocial impact

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Introduction

The OSCC is a prevalent and potentially life-threatening form of head and neck cancer, accounting for over 90% of all oral malignancies (Kumar et al., 2020). Despite advancements in diagnostic techniques and treatment modalities, the 5-year survival rate for OSCC remains around 50-60%, largely due to late-stage diagnosis and the development of treatment resistance (Capote-Moreno et al., 2020, Chou et al., 2019). One of the most significant challenges in the management of OSCC is the emergence of AMR, which not only compromises treatment efficacy but also contributes to increased morbidity and mortality rates (Taj and Chattopadhyay, 2024). This challenge is further complicated by the fact that AMR in OSCC is a multifaceted issue. It involves the complex interplay of various factors, such as the overuse and misuse of antibiotics, alterations in the oral microbiome, and the acquisition of resistance mechanisms by the cancer cells themselves (Tanwar, 2024). Consequently, the development of AMR in OSCC not only leads to treatment failure and disease progression but also has profound psychological implications for the affected individuals (Al Suwyed et al., 2021). Patients with OSCC often experience significant emotional distress, anxiety, and depression, which can be further exacerbated by the uncertainty and fear associated with AMR (Kumar et al., 2018, Ying and Ling, 2023).

The psychological burdens experienced by OSCC patients with AMR are multidimensional and can have far-reaching consequences on their overall well-being and quality of life (Bachmann et al., 2018). In particular, the fear of treatment failure, the anxiety associated with the potential for disease recurrence, and the uncertainty surrounding the long-term prognosis can all contribute to heightened levels of psychological distress (Tauber et al., 2019). Moreover, the physical and functional impairments resulting from OSCC, such as facial disfigurement, speech difficulties, and eating problems, can further compound the emotional challenges faced by these patients (Pace-Balzan et al., 2011). Furthermore, the psychosocial impact of AMR in OSCC extends beyond the individual patient, affecting their family members and caregivers as well (Moore and Ewa Szumacher, 2016). The burden of caring for a loved one with a potentially treatment-resistant cancer can lead to significant emotional distress, financial strain, and disruptions in family dynamics (Deshields et al., 2022). This stress can cause caregivers to experience feelings of helplessness, guilt, and burnout, which can further contribute to the overall psychological burden associated with AMR in OSCC (Ajithakumari and Hemavathy, 2022).

Given the significant psychological burdens experienced by OSCC patients with AMR and their caregivers, there is a pressing need for effective mental health interventions to address these challenges. Psychosocial support, including counseling, support groups, and psychoeducation, has been shown to improve emotional well-being, coping skills, and quality of life in cancer patients (Wang et al., 2020, Lu et al., 2021, Hamad et al., 2024, Fareeq Saber et al., 2024, Saber et al., 2025a, Ahmed et al., 2024a). However, the specific needs of OSCC patients with AMR may require tailored interventions that address the unique psychological challenges associated with treatment resistance and the uncertainty surrounding long-term outcomes (Nayak et al., 2023). To address this need, one promising approach is the integration of the MBIs into the overall treatment plan. MBIs, such as mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT), have been shown to reduce anxiety, depression, and psychological distress in cancer patients (Lin et al., 2022, Park et al., 2020, Saber et al., 2025a, Hasan et al., 2025, Saber et al., 2025b, Ahmed et al., 2024c). By cultivating present-moment awareness, acceptance, and self-compassion, MBIs can help OSCC patients with AMR navigate the emotional challenges associated with treatment resistance and uncertainty.

In addition to MBIs, other psychosocial interventions, such as the CBT and ACT, may also be beneficial for OSCC patients with AMR (Wang et al., 2023). CBT can help patients identify and modify negative thought patterns and beliefs related to their diagnosis and treatment, while ACT emphasizes acceptance, values-based living, and committed action in the face of adversity (Orzechowska et al., 2021). These therapies can be implemented in various formats, including individual therapy, group sessions, and online or telephone-based support, to ensure accessibility and acceptability for patients and caregivers (Spelten et al., 2021). Despite the growing recognition of the psychological burdens associated with AMR in OSCC and the potential benefits of mental health interventions, there remain significant gaps in the literature regarding the specific needs and experiences of this patient population. Most notably, most studies to date have focused on the psychological impact of OSCC in general, with limited attention given to the unique challenges posed by AMR. Therefore, the present review aims to systematically explore the psychological burdens experienced by OSCC patients with AMR.

Methods

Study design and research question

This narrative review was conducted using a comprehensive approach, following established guidelines

for narrative reviews (Baumeister and Leary, 1997, Borella et al., 2016). The main research question guiding this review was: "What is the impact of antimicrobial resistance in oral squamous cell carcinoma on psychological burdens?

Search Strategy

A rigorous literature search was conducted to find studies on antimicrobial resistance in oral squamous cell carcinoma, specifically focusing on the psychological burdens and interventions for mental health. We systematically searched multiple databases including PubMed, Scopus, APA PsycINFO, CINAHL, Cochrane Library, and Web of Science. Our search strategy involved using specific keywords, Medical Subject Headings (MeSH) terms, and Boolean operators 'OR' and 'AND' to identify relevant articles. The search terms used were: 'Antimicrobial Resistance,' 'Oral Squamous Cell Carcinoma,' 'Mental Health,' 'Psychological Burden,' and 'Mental Health Interventions.' We tailored the search keywords for each database to include English literature published from March 1, 2001, to August 31, 2024. The detailed search strategy equations used for each database can be found in Table 1.

Table 1: Search strategy

Concept	Search Terms
Antimicrobial Resistance	("Antimicrobial Resistance" OR "Drug Resistance" OR "Antibiotic Resistance" OR "Multidrug Resistance" OR "AMR" OR "Resistance to Antibiotics" OR "Bacterial Resistance" OR "Antimicrobial Therapy Failures") AND ("Oral Infections" OR "Infection Control")
Oral Squamous Cell Carcinoma	("Oral Squamous Cell Carcinoma" OR "Oral Cancer" OR "OSCC" OR "Mouth Cancer" OR "Head and Neck Cancer" OR "Oral Neoplasm" OR "Squamous Cell Carcinoma of the Oral Cavity" OR "Oral Carcinoma") AND ("Cancer Treatment" OR "Oncological Outcomes")
Mental Health	("Mental Health" OR "Psychological Burden" OR "Psychological Distress" OR "Mental Well-being" OR "Psychosocial Issues" OR "Emotional Distress" OR "Mental Disorders" OR "Psychiatric Symptoms") AND ("Depression" OR "Anxiety" OR "Coping Mechanisms")
Psychological Interventions	("Cognitive Behavioral Therapy" OR "CBT" OR "Mindfulness-Based Stress Reduction" OR "MBSR" OR "Mindfulness-Based Cognitive Therapy" OR "MBCT" OR "Supportive Therapy" OR "Psychological Counseling" OR "Psychotherapy") AND ("Cancer Care" OR "Oncology")
Psychiatric Disorders	("Depression" OR "Major Depressive Disorder" OR "Anxiety Disorders" OR "Generalized Anxiety Disorder" OR "Panic Disorder" OR "Stress Disorders" OR "Adjustment Disorders" OR "PTSD" OR "Post-Traumatic Stress Disorder") AND ("Cancer Patients" OR "Survivors")
Study Population	("Cancer Patients" OR "OSCC Patients" OR "Head and Neck Cancer Patients" OR "Oral Cancer Patients" OR "Patients with Neoplasm" OR "Oncology Patients" OR "Patients with Oral Tumors") AND ("Treatment Challenges" OR "Care Management")
Related Terms	("Patient Outcomes" OR "Survival Rates" OR "Quality of Life" OR "Treatment Outcomes" OR "Clinical Outcomes" OR "Therapeutic Efficacy" OR "Health-Related Quality of Life" OR "Prognostic Factors") AND ("Cancer Care" OR "Therapeutic Strategies")
Geographical Focus	("Global" OR "Worldwide" OR "Developed Countries" OR "Developing Countries" OR "High-Income Countries" OR "Low-Income Countries") AND ("Healthcare Disparities" OR "Access to Care")

Eligibility, review of the literature and selection process

The selected literature for this narrative review included English-language abstracts and full-text papers published from March 1, 2001, to August 31, 2024. The focus was on antimicrobial resistance in oral squamous cell carcinoma and its psychological impact. Studies were eligible if they specifically examined the psychological burdens and mental health interventions related to antimicrobial resistance in this particular type of cancer. The review of the literature was conducted by the author (AS) using a systematic approach to identify relevant studies. Moreover, the narrative review involved analyzing and synthesizing findings across different sources, focusing on thematic connections and drawing insights from both qualitative and quantitative studies to comprehensively assess the impact of antimicrobial resistance on psychological burdens in oral squamous cell carcinoma patients.

Results

Our comprehensive literature search across multiple databases, including PubMed, Scopus, APA PsycINFO, CINAHL, Cochrane Library, and Web of Science, initially identified a total of 870 records. After removing 520 duplicate records, 350 studies were screened by title and abstract, leading to the exclusion of 250 records due to inappropriate study design or irrelevance to Oral Squamous Cell Carcinoma. This left 100 records for full-text retrieval, from which 10 could not be retrieved. Further screening excluded 28 studies for reasons including non-mental health interventions (10), ineligible participants (8), unrelated outcomes (5), and other factors (5). Ultimately, 62 studies were thoroughly considered and reviewed. For a detailed representation of the study selection process, refer to Figure 1 in our PRISMA flow chart.

Impact of Antimicrobial Resistance on Treatment

The AMR has emerged as a significant challenge in the treatment of OSCC, a prevalent form of head and neck cancer (Irfan et al., 2020). AMR occurs when bacteria, viruses, fungi, and parasites evolve to withstand the effects of antimicrobial agents, rendering these treatments ineffective (Ahmed et al., 2024a, Tang et al., 2023). As a result, in the context of OSCC, AMR can lead to treatment failure, increased morbidity, and reduced survival rates (Bugshan and Farooq, 2020). The development of AMR in OSCC is a multifactorial process, involving the overuse and

misuse of antibiotics, alterations in the oral microbiome, and the acquisition of resistance mechanisms by cancer cells (Puca et al., 2024). The role of the oral microbiome is particularly crucial, as the oral cavity harbors a diverse microbial community, which plays a crucial role in maintaining oral health and preventing the development of malignancies (Di Stefano et al., 2022). However, the disruption of this delicate balance, often caused by factors such as poor oral hygiene, smoking, and alcohol consumption, can lead to dysbiosis and the overgrowth of pathogenic bacteria (Santacroce et al., 2023). Consequently, these bacteria can contribute to the development and progression of OSCC by inducing chronic inflammation, producing carcinogenic metabolites, and facilitating the invasion and metastasis of cancer cells (Karpiński, 2019, Li et al., 2020).

In addition to these microbiome alterations, the use of antibiotics in the management of OSCC, either as prophylaxis to prevent postoperative infections or as part of the treatment regimen for advanced-stage disease, can further exacerbate the problem of AMR (Haque et al., 2019). The indiscriminate use of broad-spectrum antibiotics can lead to the selection and proliferation of resistant bacterial strains, which can then colonize the tumor microenvironment and compromise the efficacy of anticancer treatments (Terreni et al., 2021). Moreover, the presence of resistant bacteria in the oral cavity can serve as a reservoir for the transmission of resistance genes to other bacterial species, further compounding the problem of AMR (Brooks et al., 2022). Complicating matters further, the acquisition of resistance mechanisms by cancer cells themselves also plays a significant role in the development of AMR in OSCC (Ayob and Ramasamy, 2018). Cancer cells can acquire resistance to antimicrobial agents through various mechanisms, such as the overexpression of efflux pumps, the alteration of drug targets, and the activation of detoxification pathways (Lowrence et al., 2019). These mechanisms, influenced by selective pressure from the use of antimicrobial agents and the genetic instability and heterogeneity of cancer cells, can result in the development of multidrug-resistant tumors. These tumors are highly challenging to treat and are associated with unfavorable clinical outcomes (Kapse-Mistry et al., 2014).

The impact of AMR on the treatment of OSCC extends beyond the direct effects on cancer cells and the oral microbiome. Importantly, the presence of resistant bacteria in the tumor microenvironment can also impair the efficacy of other therapeutic modalities, such as radiation therapy and immunotherapy (Ozpiskin et al., 2019). Resistant bacteria can produce protective biofilms that shield cancer cells from the cytotoxic effects of radiation, while also secreting immunosuppressive factors that inhibit the activation and function of immune cells (Lazar et al., 2018). This highlights the complex interplay between AMR, the tumor microenvironment, and the host immune response, underscoring the need for a multidisciplinary approach to address the challenges posed by AMR in OSCC treatment.

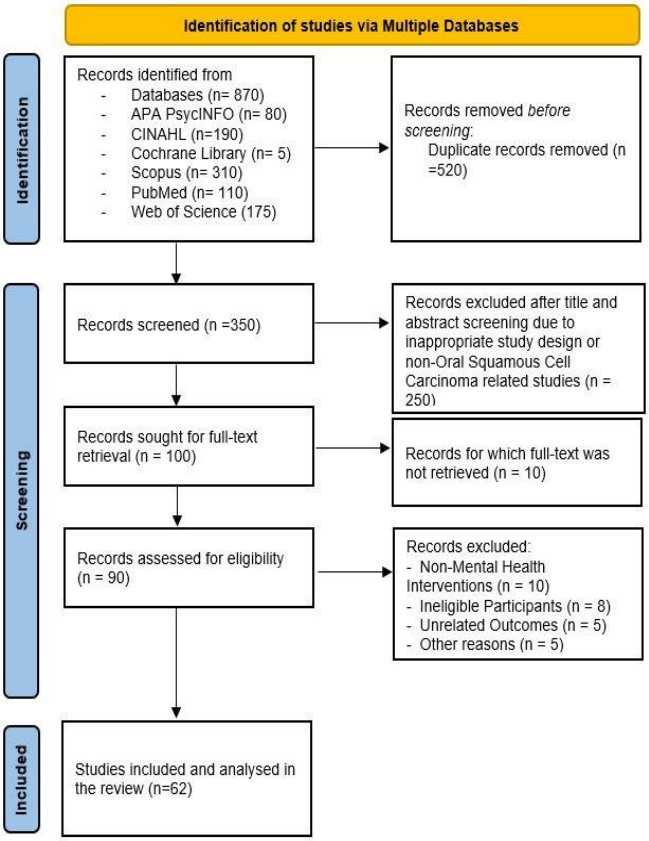

Figure 1: Prisma Flow Chart

Psychological Burdens in Oral Squamous Cell Carcinoma

Patients diagnosed with OSCC often experience significant psychological burdens that can profoundly impact their quality of life and overall well-being (Ying and Ling, 2023). The psychological distress experienced by OSCC patients is multifaceted and can stem from various factors, including the diagnosis itself, the physical and functional impairments caused by the disease, and the challenges associated with treatment (Bachmann et al., 2018). Among these burdens, one of the most prevalent psychological burdens faced by OSCC patients is anxiety, which can manifest as feelings of worry, fear, and apprehension about the future (Vallath and Salins, 2017). The uncertainty surrounding the diagnosis, prognosis, and treatment outcomes can contribute to heightened levels of anxiety, which can persist throughout the cancer journey (Curran et al., 2017). Additionally, depression is another common psychological burden experienced by OSCC

patients, often characterized by feelings of sadness, hopelessness, and loss of interest in daily activities (McDowell et al., 2022). The physical and functional impairments caused by OSCC, such as facial disfigurement, speech difficulties, and eating problems, can contribute to the development of depressive symptoms. Patients may struggle to adapt to the changes in their appearance and abilities, leading to feelings of depression (Ying and Ling, 2023). Moreover, the side effects of cancer treatments, such as pain, fatigue, and nutritional deficiencies, can further exacerbate depressive symptoms and negatively impact patients' emotional well-being (Tofthagen and McMillan, 2010).

The psychological burdens experienced by OSCC patients can also extend to their social and interpersonal relationships (Khattak et al., 2021). Specifically, the physical and functional impairments caused by the disease can lead to social isolation and withdrawal, as patients may feel self-conscious about their appearance or struggle to communicate effectively with others (Stout et al., 2013). This social isolation can further compound feelings of loneliness and depression, as patients may lack the support and understanding of their loved ones (Scott et al., 2006). In addition to these social challenges, the financial burden associated with cancer treatment, including the costs of medication, surgery, and rehabilitation, can contribute to psychological distress and strain on personal relationships (Wagner et al., 2011). These challenges are further intensified by the presence of AMR in OSCC, which can exacerbate the psychological burdens experienced by patients. The development of AMR can lead to treatment failure, prolonged hospital stays, and increased morbidity, all of which can contribute to heightened levels of anxiety, depression, and emotional distress (Meyer and Harder, 2007). The uncertainty surrounding the effectiveness of antimicrobial treatments and the potential for disease progression can further compound patients' psychological burdens, as they may fear the consequences of treatment-resistant infections (Coque et al., 2023).

Furthermore, the psychological impact of AMR in OSCC extends beyond the individual patient, affecting their family members and caregivers as well (Ewa Szumacher et al., 2019). Caregivers of OSCC patients with AMR may experience significant emotional distress, burnout, and financial strain as they navigate the challenges of providing care for their loved ones (Ewa Szumacher et al., 2019). This caregiving burden can lead to feelings of helplessness, guilt, and anxiety, as caregivers may struggle to balance their own needs with the demands of caring for a patient with a treatment-resistant infection (Mintz, 2022).

Mental Health Interventions for Affected Patients

Given the significant psychological burdens experienced by patients with OSCC facing AMR, there is a pressing need for effective mental health interventions to address these challenges and promote emotional well-being. One approach that shows promise is the integration of MBIs into the overall treatment plan for OSCC patients with AMR (Lesho and Laguio-Vila, 2019). MBIs, such as MBSR and MBCT, have been shown to reduce anxiety, depression, and psychological distress in cancer patients (Compen et al., 2018, Cillessen et al., 2019). By cultivating present-moment awareness, acceptance, and self-compassion, MBIs can help OSCC patients with AMR navigate the emotional challenges associated with treatment resistance and uncertainty (Ying and Ling, 2023). In addition to MBIs, CBT is another effective mental health intervention for OSCC patients facing AMR (Noviyani et al., 2024). CBT focuses on identifying and modifying negative thought patterns and beliefs that contribute to emotional distress, while also teaching coping strategies and problem-solving skills (Peat, 2013). For these patients, CBT can help address the cognitive and emotional aspects of treatment resistance, such as fear of treatment failure, anxiety about disease progression, and feelings of hopelessness (Westra and Norouzian, 2018). By reframing negative thoughts and beliefs, and developing adaptive coping mechanisms, CBT can enhance patients' resilience and improve their overall quality of life (Wesner et al., 2015).

Complementing these approaches is the ACT, another promising mental health intervention for OSCC patients facing AMR (Dhingra et al., 2020). ACT emphasizes acceptance of difficult emotions and experiences, while also encouraging patients to engage in values-based actions that promote a sense of meaning and purpose (Barrett et al., 2019). This therapy can be particularly useful for OSCC patients with AMR, as it helps foster a sense of acceptance and psychological flexibility in the face of treatment challenges and uncertainty (McCracken and Morley, 2014). By focusing on values and committed action, ACT can help patients maintain a sense of agency and control, even in the context of a difficult and unpredictable cancer journey (Renes and Aarts, 2017). In addition to these individual-focused interventions, group-based support programs can also be beneficial for OSCC patients with AMR (Smith-Turchyn et al., 2016). Psychoeducational support groups can provide patients with valuable information about AMR, treatment options, and coping strategies, while also fostering a sense of community and shared experience (Littlejohn et al., 2019). Peer support groups, led by trained facilitators or survivors of OSCC, can offer patients a safe and supportive space to share their experiences, emotions, and challenges, while also learning from the insights and strategies of others

who have faced similar struggles (Mahalik, 2019). For a clearer visualization of these interventions, take a look at Figure 2.

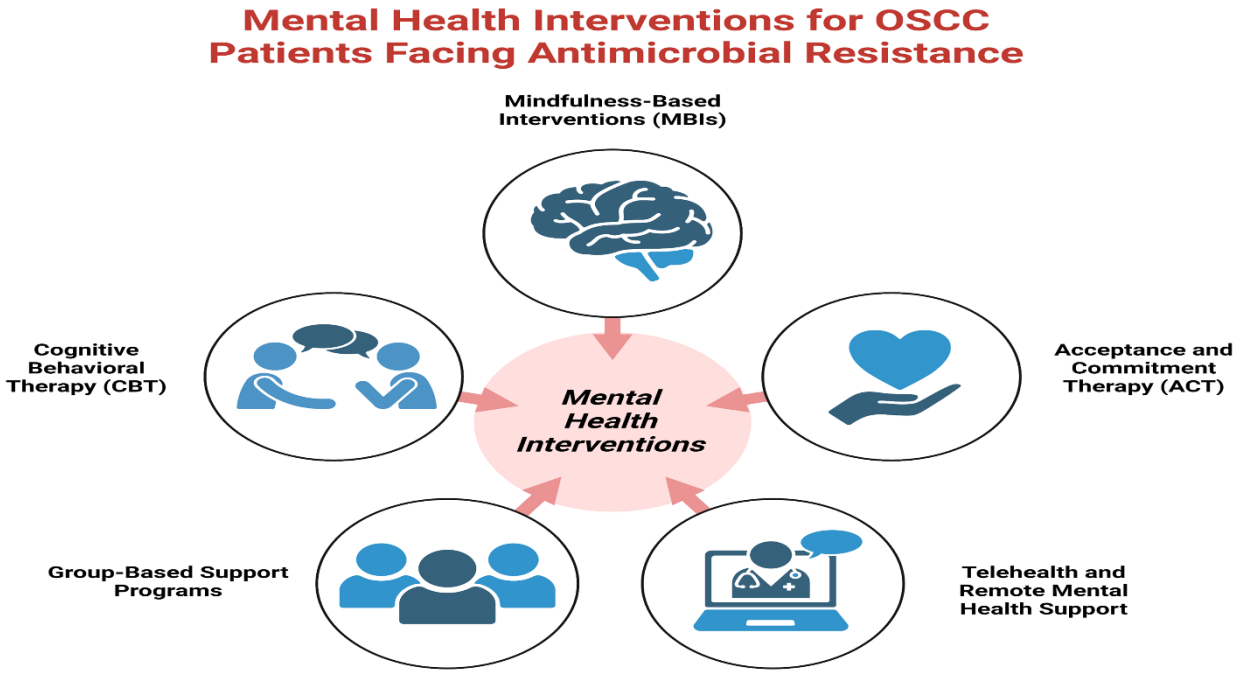

Figure 2: Visual Representation of Mental Health Interventions for OSCC Patients Facing Antimicrobial Resistance. Created with BioRender.com

Challenges in Integrating Mental Health Support in Cancer Care

Although there is an increasing awareness of the significance of mental health support for patients with OSCC who are dealing with AMR, incorporating these interventions into standard cancer care still poses a major obstacle. One of the primary barriers to this integration is the limited availability and accessibility of specialized mental health professionals (Granek et al., 2019). Many cancer treatment centers lack dedicated psycho-oncology services or have insufficient staff to meet the mental health needs of their patients (Holland, 2018). As a result, this shortage of mental health professionals can lead to long wait times, limited treatment options, and fragmented care for OSCC patients with AMR who are in need of psychological support (Reid and Brown, 2008). Additionally, another challenge in integrating mental health support in cancer care is the lack of standardized screening and assessment tools for identifying patients with psychological distress (Carlson et al., 2012). While several screening instruments, such as the Hospital Anxiety and Depression Scale (HADS) and the Distress Thermometer (DT), have been developed to assess emotional distress in cancer patients, their use is not consistently implemented across cancer treatment settings (Civilotti et al., 2020). Moreover, these screening tools may not adequately capture the unique psychological challenges faced by OSCC patients with AMR, such as fears of treatment failure and concerns about disease progression (Schellekens et al., 2016). Without reliable and valid screening and assessment tools, identifying patients in need of mental health support can be difficult, leading to unmet psychological needs and suboptimal care.

Furthermore, the limited integration of mental health support in cancer care can also be attributed to the lack of education and training among healthcare professionals regarding the psychological aspects of cancer and AMR (Greer et al., 2013). Many oncologists, nurses, and other healthcare providers may not have received sufficient training in recognizing and addressing the mental health needs of their patients (Granek et al., 2018). Consequently, this lack of training can lead to a failure to identify patients who are experiencing psychological distress, as well as a reluctance to initiate conversations about mental health concerns (Combes et al., 2019). In addition, healthcare professionals may not be aware of the available mental health resources and referral pathways, further limiting their ability to connect patients with appropriate psychological support (Leijdesdorff et al., 2021). Financial barriers further complicate the situation, as insurance coverage limitations

can pose significant challenges to the integration of mental health support in cancer care (Carrera et al., 2018). Mental health services, such as individual therapy, group support programs, and psychiatric medication management, can be costly and may not be fully covered by patients' insurance plans (Walker et al., 2015). This financial burden can prevent OSCC patients with AMR from accessing the mental health support they need, particularly if they are already struggling with the financial strain of cancer treatment. Moreover, insurance reimbursement rates for mental health services may be lower than those for medical procedures, disincentivizing cancer treatment centers from investing in comprehensive psycho-oncology programs (Levit et al., 2013).

Finally, the stigma associated with mental health issues can also hinder the integration of psychological support in cancer care (Irwin et al., 2014). Many patients may feel ashamed or reluctant to discuss their emotional struggles, fearing judgment or discrimination from healthcare providers, family members, or society at large (Rewerska-Juśko and Rejdak, 2022). This stigma can lead to a reluctance to seek mental health support, even when services are available and accessible (Ahmed et al., 2024b). Additionally, cultural beliefs and attitudes regarding mental health can also influence patients' willingness to engage in psychological interventions, particularly among minority and underserved populations (Maura and Weisman de Mamani, 2017).

Public Health Implications and Future Directions

The growing prevalence of AMR in OSCC has significant public health implications, highlighting the need for urgent action and innovative strategies to address this complex issue. AMR's impact on OSCC not only compromises treatment outcomes and increases morbidity and mortality rates but also poses a significant burden on healthcare systems and societies as a whole (Moore and Ewa Szumacher, 2018). The economic costs associated with AMR in cancer care, including prolonged hospital stays, additional diagnostic tests, and expensive second-line treatments, can strain already limited healthcare resources and exacerbate health disparities (Michael et al., 2020). Moreover, the spread of resistant bacteria within healthcare settings and communities can further amplify the public health threat of AMR, underscoring the need for comprehensive surveillance, infection control, and antibiotic stewardship programs (Salam et al., 2023). To effectively address the public health implications of AMR in OSCC, a multidisciplinary and collaborative approach is required, engaging stakeholders across the healthcare continuum, including oncologists, infectious disease specialists, mental health professionals, policymakers, and patient advocates (Spivak and Greenlee, 2023). As a result, future directions in addressing AMR in OSCC should prioritize the development and implementation of evidence-based guidelines for the careful and appropriate use of antibiotics in cancer care. Additionally, it is important to explore novel therapeutic strategies that can effectively overcome resistance mechanisms and improve the effectiveness of current treatments. These strategies may include the use of targeted antimicrobial therapy, combination therapies, and immunomodulatory agents that can harness the power of the immune system to combat resistant infections (Kumar et al., 2021).

In addition to clinical and therapeutic strategies, it is important to address the psychological burdens associated with AMR in OSCC as a critical public health priority. This is because the mental health needs of cancer patients have significant implications for treatment adherence, quality of life, and overall health outcomes (Shoshani and Kanat-Maymon, 2018). Therefore, future research should focus on developing and evaluating the effectiveness of tailored mental health interventions for OSCC patients with AMR, taking into account the unique challenges and stressors faced by this population. This research should explore the integration of mindfulness-based interventions, cognitive-behavioral therapy, acceptance and commitment therapy, and group support programs into routine cancer care. Additionally, it should focus on developing innovative delivery models that could improve access to mental health services, especially for underserved and vulnerable populations. Moreover, addressing the systemic barriers and challenges that hinder the integration of mental health support in cancer care is essential. These barriers include the limited availability and accessibility of specialized mental health professionals, lack of standardized screening and assessment tools, insufficient education and training among healthcare providers, financial barriers and insurance coverage limitations, and the stigma associated with mental health issues. Overcoming these barriers will require a concerted effort from healthcare organizations, policymakers, and advocates to prioritize the mental health needs of cancer patients and to develop innovative strategies for integrating psychological support into comprehensive, patient-centered care. For a summary of studies included and an overview, refer to Table 2.

Table 2: Summary of Findings on the Impact of Antimicrobial Resistance and Mental Health in Oral Squamous Cell Carcinoma

Area of Application	Summary of Findings	Significance	Ethics and Challenges	Additional Considerations
Impact of Antimicrobial Resistance on Treatment	AMR in OSCC is caused by antibiotic misuse, changes in the oral microbiome, and cancer cell resistance. It results in treatment failures, increased morbidity, and reduced survival rates.	Highlights the need for careful antibiotic use and multidisciplinary treatment approaches to manage AMR in OSCC effectively.	**Ethics:** Ensuring responsible antibiotic use and patient education. **Challenges:** Managing resistant bacterial strains and maintaining the effectiveness of cancer treatments amid rising AMR.	Integration with existing treatment protocols and the development of new therapeutic strategies to address the impact of AMR on OSCC treatment outcomes. .
Psychological Burdens in OSCC	OSCC patients experience anxiety, depression, and social isolation due to the disease, its treatment, and the complications of AMR.	Emphasizes the importance of mental health support for OSCC patients to improve their quality of life and overall well-being.	**Ethics:** Addressing the psychological impact of treatment and ensuring equitable access to mental health services. **Challenges:** Managing the compounded emotional burden due to AMR and ensuring comprehensive support systems are in place.	Development of targeted mental health interventions and support programs tailored to the specific needs of OSCC patients dealing with AMR.
Mental Health Interventions for OSCC Patients	Interventions like MBIs, CBT, and ACT are effective in reducing psychological distress in OSCC patients facing AMR.	These interventions can significantly improve patients' resilience, treatment adherence, and overall quality of life.	**Ethics:** Ensuring patient-centered care and informed consent for mental health interventions. **Challenges:** Integrating mental health support into standard cancer care and overcoming stigma associated with mental health treatment.	Incorporating mental health interventions into routine cancer care and exploring innovative delivery models, such as telemedicine and group therapy, to increase access to support services.
Challenges in Integrating Mental Health Support	Integration of mental health support in cancer care is hindered by the lack of specialized professionals, standardized tools, and training among healthcare providers.	Addressing these challenges can improve the overall effectiveness of cancer care and ensure that patients' mental health needs are met.	**Ethics:** Ensuring that mental health support is accessible and tailored to the needs of cancer patients. **Challenges:** Overcoming systemic barriers, such as insufficient resources and training, and ensuring comprehensive care that addresses both physical and mental health aspects of cancer treatment.	Advocacy for policy changes to prioritize mental health in cancer care and increased investment in training healthcare professionals to recognize and address the psychological needs of cancer patients.
Public Health Implications and Future Directions	The growing prevalence of AMR in OSCC poses significant public health challenges, including increased healthcare costs, health disparities, and the spread of resistant bacteria.	Addressing AMR in OSCC through multidisciplinary approaches and evidence-based guidelines can help mitigate its impact on public health. .	**Ethics:** Balancing the need for aggressive treatment with the risk of contributing to AMR. **Challenges:** Developing and implementing effective antibiotic stewardship programs and ensuring equitable access to new therapies.	Future research should focus on innovative therapeutic strategies and mental health interventions, along with systemic changes to improve access to comprehensive care for OSCC patients, especially those dealing with AMR.

Discussion

This comprehensive review synthesized evidence from 62 studies spanning from March 1, 2001, to August 31, 2024, highlighting not only the profound impact of AMR on the psychological burdens experienced by OSCC patients but also the critical need for effective mental health interventions in this context. The emergence of AMR as a significant challenge in OSCC treatment has far-reaching consequences for patients' physical and emotional well-being.

As evidenced by the studies reviewed, AMR can lead to treatment failure, increased morbidity, and reduced survival rates in OSCC patients (Terreni et al., 2021, Haque et al., 2019, Bugshan and Farooq, 2020). The development and progression of AMR in OSCC is a multifactorial process, involving the overuse and misuse of antibiotics, alterations in the oral microbiome, and the acquisition of resistance mechanisms by cancer cells (Kapse-Mistry et al., 2014, Ayob and Ramasamy, 2018, Puca et al., 2024). These findings underscore the complexity of AMR in OSCC and the need for a comprehensive approach to address this growing public health threat. However, the studies by Brooks et al. (2022) and Santacroce et al. (2023) suggest that the oral microbiome's role in AMR development may be more nuanced, with certain commensal bacteria potentially offering protective effects against resistant pathogens. This points to the importance of further research to elucidate the intricate relationships between the oral microbiome, AMR, and OSCC progression.

In parallel, the psychological burdens experienced by OSCC patients with AMR are multifaceted and can profoundly impact their quality of life and overall well-being. As demonstrated by the reviewed studies, anxiety, depression, and emotional distress are prevalent among OSCC patients, often stemming from the diagnosis itself, physical and functional impairments, and treatment challenges (Vallath and Salins, 2017, Bachmann et al., 2018, Ying and Ling, 2023). The presence of AMR further exacerbates these psychological burdens, as patients grapple with the uncertainty surrounding treatment effectiveness and the potential for disease progression (Coque et al., 2023, Meyer and Harder, 2007). Moreover, the social and financial strains associated with OSCC and AMR can compound patients' emotional distress and strain interpersonal relationships (Wagner et al., 2011, Khattak et al., 2021). While these findings paint a grim picture of the psychological toll of AMR in OSCC, the studies by Stout et al. (2013) and Scott et al. (2006) highlight the potential for social support and adaptive coping strategies to buffer against the negative emotional impact of the disease.

Given the significant psychological burdens faced by OSCC patients with AMR, the integration of effective mental health interventions into comprehensive cancer care is crucial. The reviewed studies demonstrate the promise of MBIs, CBT, ACT, and group support programs in reducing anxiety, depression, and psychological distress among cancer patients (Cillessen et al., 2019, Lesho and Laguio-Vila, 2019, Mintz, 2022, Fareeq et al., 2024, Wesner et al., 2015) . By fostering present-moment awareness, adaptive coping strategies, and a sense of community, these interventions can enhance patients' resilience and improve their overall quality of life in the face of treatment challenges and uncertainty (Mahalik, 2019, Littlejohn et al., 2019, Renes and Aarts, 2017, McCracken and Morley, 2014, Barrett et al., 2019). However, as noted by Noviyani et al. (2024) and Ying and Ling (2023), the effectiveness of these interventions may vary depending on individual patient characteristics and preferences, underscoring the need for personalized and flexible approaches to mental health support in OSCC care. Despite these promising developments, significant challenges remain in integrating these interventions into routine cancer care. The limited availability and accessibility of specialized mental health professionals, lack of standardized screening and assessment tools, insufficient education and training among healthcare providers, financial barriers and insurance coverage limitations, and the stigma associated with mental health issues all contribute to the suboptimal integration of psychological support in OSCC care (Holland, 2018, Granek et al., 2019, Greer et al., 2013, Carlson et al., 2012). These findings underscore the need for systemic changes and collaborative efforts to overcome these barriers and prioritize the mental health needs of OSCC patients with AMR.

The growing prevalence of AMR in OSCC has significant public health implications, further emphasizing the urgent need for innovative strategies and multidisciplinary collaboration to address this complex issue. As evidenced by the reviewed studies, AMR not only compromises treatment outcomes and increases morbidity and mortality rates but also poses a significant burden on healthcare systems and societies as a whole (Michael et al., 2020, Moore and Ewa Szumacher, 2018, Ahmed et al., 2024a). Thus, future directions in tackling AMR in OSCC should prioritize the development and implementation of evidence-based guidelines for antibiotic stewardship, exploration of novel therapeutic strategies, and the integration of tailored mental health interventions into comprehensive cancer care (Spivak and Greenlee, 2023, Kumar et al., 2021, Salam et al., 2023). Moreover,

addressing the systemic barriers and challenges that hinder the integration of mental health support in OSCC care is essential to ensure equitable access to comprehensive, patient-centered care for all patients, regardless of their socioeconomic status or cultural background (Shoshani and Kanat-Maymon, 2018).

The significance of this review lies in its comprehensive exploration of the interplay between AMR and psychological burdens in OSCC patients, alongside its emphasis on the critical role of mental health interventions in improving patient outcomes and quality of life. By synthesizing evidence from a wide range of studies spanning over two decades, this review provides a solid foundation for understanding the complex challenges posed by AMR in OSCC and the importance of addressing patients' psychological needs alongside their physical treatment. Consequently, the insights gained from this review can inform the development of evidence-based, patient-centered approaches to OSCC care that prioritize both physical and mental well-being.

However, the findings of this review also highlight the importance of conducting further research to address the gaps in our understanding of AMR in OSCC and its psychological impact on patients. Future studies should aim to clarify the intricate relationships between the oral microbiome, AMR development, and OSCC progression. Furthermore, exploring innovative therapeutic strategies that can overcome resistance mechanisms and improve treatment effectiveness is crucial. In addition, additional research is necessary to assess the efficacy of tailored mental health interventions for OSCC patients with AMR, while considering the unique challenges and stressors faced by this particular group. Conducting large-scale, multicultural studies with longer follow-up periods and utilizing a combination of qualitative and quantitative methods would provide valuable insights into the long-term effects of cultural influences on end-of-life decision-making. It would also help to determine the specific effectiveness of mental health interventions in diverse OSCC patient populations.

Conclusion

The findings clearly show that AMR has a significant negative impact on the psychological well-being of OSCC patients. Given these implications, it is recommended that healthcare providers and policymakers take steps to include mental health support as part of standard cancer care, improve training on the psychological effects of AMR, and address any obstacles to accessing mental health services. To further support patient care, efforts should be made to enhance interdisciplinary collaboration between oncologists, mental health professionals, and infectious disease specialists to create comprehensive care plans. Furthermore, future research should concentrate on developing and evaluating new interventions and strategies to help alleviate the impact of AMR on OSCC patients, with an emphasis on personalized and culturally sensitive approaches.

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References

AHMED, S. K., HUSSEIN, S., QURBANI, K., IBRAHIM, R. H., FAREEQ, A., MAHMOOD, K. A. & MOHAMED, M. G. 2024a. Antimicrobial resistance: Impacts, challenges, and future prospects. Journal of Medicine, Surgery, and Public Health, 2, 100081. https://doi.org/10.1016/j.glmedi.2024.100081

AHMED, S. M., SABER, A. F., NAIF, A. A., HAMAD, A. H., AHMED, S. K., ABDULLAH, A. Y., QURBANI, K. & HUSSEIN, S. 2024b. Exploring Young Adults' Reluctance to Engage With Psychiatric Hospitals in Erbil, Iraq: Identifying Barriers to Psychiatric Care. Cureus, 16. https://doi.org/10.7759/cureus.62164

AHMED, S. M., SABER, A. F., NAIF, A. A., HAMAD, A. H., AHMED, S. K., ABDULLAH, A. Y., QURBANI, K., HUSSEIN, S. & NAIF, A. 2024c. Exploring young adults' reluctance to engage with psychiatric hospitals in Erbil, Iraq: identifying barriers to psychiatric care. Cureus, 16. https://doi.org/10.7759/cureus.62164

AJITHAKUMARI, G. & HEMAVATHY, V. 2022. Caregivers Burnout Syndrome: Support Yourself While Caring For A Loved One. Cardiometry, 965-969. https://doi.org/10.18137/cardiometry.2022.24.965969

AL SUWYED, A. S., AL ZOMAN, K. H., ROBERT, A. A., AL-NOWAISER, A. M., ALABDELY, M. H. & AL MUBARAK, S. 2021. The silent epidemic of common oral diseases among the Arab population: An emerging health problem. Journal of Family Medicine and Primary Care, 10, 2768-2774. https://doi.org/10.4103/jfmpc.jfmpc_323_21

AYOB, A. Z. & RAMASAMY, T. S. 2018. Cancer stem cells as key drivers of tumour progression. Journal of biomedical science, 25, 1-18. https://doi.org/10.1186/s12929-018-0426-4

BACHMANN, A. S., ZAUNBAUER, A. C., TOLKE, A. M., SINIATCHKIN, M., KLUCK, C., WILTFANG, J. & HERTRAMPF, K. 2018. Well-being and quality of life among oral cancer patients–Psychological vulnerability and coping responses upon entering initial treatment. Journal of Cranio-Maxillofacial Surgery, 46, 1637-1644. https://doi.org/10.1016/j.jcms.2018.05.042

BARRETT, K., O'CONNOR, M. & MCHUGH, L. 2019. A systematic review of values-based psychometric tools within acceptance and commitment therapy (ACT). The Psychological Record, 69, 457-485. https://doi.org/10.1007/s40732-019-00352-7

BAUMEISTER, R. F. & LEARY, M. R. 1997. Writing narrative literature reviews. Review of general psychology, 1, 311-320. https://doi.org/10.1037//1089-2680.1.3.311

BORELLA, P., BARGELLINI, A., MARCHEGIANO, P., VECCHI, E. & MARCHESI, I. 2016. Narrative review. Ann Ig, 28, 98-108.

BROOKS, L., NARVEKAR, U., MCDONALD, A. & MULLANY, P. 2022. Prevalence of antibiotic resistance genes in the oral cavity and mobile genetic elements that disseminate antimicrobial resistance: A systematic review. Molecular Oral Microbiology, 37, 133-153. https://doi.org/10.1111/omi.12375

BUGSHAN, A. & FAROOQ, I. 2020. Oral squamous cell carcinoma: metastasis, potentially associated malignant disorders, etiology and recent advancements in diagnosis. F1000Research, 9. https://doi.org/10.12688/f1000research.22941.1

CAPOTE-MORENO, A., BRABYN, P., MUÑOZ-GUERRA, M., SASTRE-PÉREZ, J., ESCORIAL-HERNANDEZ, V., RODRÍGUEZ-CAMPO, F., GARCÍA, T. & NAVAL-GÍAS, L. 2020. Oral squamous cell carcinoma: epidemiological study and risk factor assessment based on a 39-year series. International journal of oral and maxillofacial surgery, 49, 1525-1534. https://doi.org/10.1016/j.ijom.2020.03.009

CARLSON, L. E., WALLER, A. & MITCHELL, A. J. 2012. Screening for distress and unmet needs in patients with cancer: review and recommendations. Journal of Clinical Oncology, 30, 1160-1177. https://doi.org/10.1200/JCO.2011.39.5509

CARRERA, P. M., KANTARJIAN, H. M. & BLINDER, V. S. 2018. The financial burden and distress of patients with cancer: understanding and stepping-up action on the financial toxicity of cancer treatment. CA: a cancer journal for clinicians, 68, 153-165. https://doi.org/10.3322/caac.21443

CHOU, H.-C., LIN, H.-W., YANG, J.-H., LIN, P.-Y., CHENG, S.-J., WU, Y.-H. & KUO, Y.-S. 2019. Clinical outcomes of oral cancer patients who survive for more than 5 years in Taiwan. Journal of the Formosan Medical Association, 118, 1616-1622. https://doi.org/10.1016/j.jfma.2019.07.022

CILLESSEN, L., JOHANNSEN, M., SPECKENS, A. E. & ZACHARIAE, R. 2019. Mindfulness-based interventions for psychological and physical health outcomes in cancer patients and survivors: a systematic review and meta-analysis of randomized controlled trials. Psycho-oncology, 28, 2257-2269. https://doi.org/10.1002/pon.5214

CIVILOTTI, C., ACQUADRO MARAN, D., SANTAGATA, F., VARETTO, A. & STANIZZO, M. R. 2020. The use of the Distress Thermometer and the Hospital Anxiety and Depression Scale for screening of anxiety and depression in Italian women newly diagnosed with breast cancer. Supportive Care in Cancer, 28, 4997-5004. https://doi.org/10.1007/s00520-020-05343-x

COMBES, G., DAMERY, S., SEIN, K., ALLEN, K., NICHOLAS, J. & BAHARANI, J. 2019. Distress in patients with end-stage renal disease: staff perceptions of barriers to the identification of mild-moderate distress and the provision of emotional support. PloS one, 14, e0225269. https://doi.org/10.1371/journal.pone.0225269

COMPEN, F., BISSELING, E., SCHELLEKENS, M., DONDERS, R., CARLSON, L., VAN DER LEE, M. & SPECKENS, A. 2018. Face-to-face and internet-based mindfulness-based cognitive therapy compared with treatment as usual in reducing psychological distress in patients with cancer: a multicenter randomized controlled trial. Journal of Clinical Oncology, 36, 2413-2421. https://doi.org/10.1200/JCO.2017.76.5669

COQUE, T. M., CANTÓN, R., PÉREZ-COBAS, A. E., FERNÁNDEZ-DE-BOBADILLA, M. D. & BAQUERO, F. 2023. Antimicrobial resistance in the global health network: known unknowns and challenges for efficient responses in the 21st century. Microorganisms, 11, 1050. https://doi.org/10.3390/microorganisms11041050

CURRAN, L., SHARPE, L. & BUTOW, P. 2017. Anxiety in the context of cancer: a systematic review and development of an integrated model. Clinical psychology review, 56, 40-54. https://doi.org/10.1016/j.cpr.2017.06.003

DESHIELDS, T. L., KAPLAN, J. & RYNAR, L. Z. 2022. Psychological Approaches to Cancer Care, Hogrefe Publishing GmbH. https://doi.org/10.1027/00511-000

DHINGRA, S., RAHMAN, N. A. A., PEILE, E., RAHMAN, M., SARTELLI, M., HASSALI, M. A., ISLAM, T., ISLAM, S. & HAQUE, M. 2020. Microbial resistance movements: an overview of global public health threats posed by antimicrobial resistance, and how best to counter. Frontiers in Public Health, 8, 535668. https://doi.org/10.3389/fpubh.2020.535668

DI STEFANO, M., POLIZZI, A., SANTONOCITO, S., ROMANO, A., LOMBARDI, T. & ISOLA, G. 2022. Impact of oral microbiome in periodontal health and periodontitis: a critical review on prevention and treatment. International journal of molecular sciences, 23, 5142. https://doi.org/10.3390/ijms23095142

EWA SZUMACHER, M., YVONNE ANGWENYI, M., CLEMENT GWEDE PHD, M. & BRANSON, D. 2019. 2019 International Cancer Education Conference. Journal of Cancer Education, 34, S1-S58.

FAREEQ, A., AHMED, S. K., HUSSEIN, S. & QURBANI, K. 2024. Artificial intelligence-assisted nursing interventions in psychiatry for oral cancer patients: A concise narrative review. Oral Oncology Reports, 100343. https://doi.org/10.1016/j.oor.2024.100343

FAREEQ SABER, A., MASIH, S., KARIMIRAD, M. R., SHARIFI, F. & MANOOKIAN, A. 2024. The relationship between internet addiction, sleep quality, and psycho-social problems among secondary school students in Erbil, 2023–2024. Public Health Nursing, 41, 933-942. https://doi.org/10.1111/phn.13353

GRANEK, L., NAKASH, O., ARIAD, S., SHAPIRA, S. & BEN-DAVID, M. Strategies and Barriers in Addressing Mental Health

and Suicidality in Patients With Cancer. Oncology nursing forum, 2019. https://doi.org/10.1188/19.ONF.561-571

GRANEK, L., NAKASH, O., BEN-DAVID, M., SHAPIRA, S. & ARIAD, S. 2018. Oncologists', nurses', and social workers' strategies and barriers to identifying suicide risk in cancer patients. Psycho-Oncology, 27, 148-154. https://doi.org/10.1002/pon.4481

GREER, J. A., JACKSON, V. A., MEIER, D. E. & TEMEL, J. S. 2013. Early integration of palliative care services with standard oncology care for patients with advanced cancer. CA: a cancer journal for clinicians, 63, 349-363. https://doi.org/10.3322/caac.21192

HAMAD, A. H., TAHER, D. H., NAIF, A. A., OMAR, I. F., MANOOKIAN, A., SABER, A. F., AHMED, S. K., HUSSEIN, S. & NAIF, A. 2024. Assessment of anxiety, stress, and depression among COVID-19 survivors after 40 months in the Kurdistan region of Iraq: an online cross-sectional study. Cureus, 16. https://doi.org/10.7759/cureus.63739

HAQUE, M., MCKIMM, J., GODMAN, B., ABU BAKAR, M. & SARTELLI, M. 2019. Initiatives to reduce postoperative surgical site infections of the head and neck cancer surgery with a special emphasis on developing countries. Expert review of anticancer therapy, 19, 81-92. https://doi.org/10.1080/14737140.2019.1544497

HASAN, H. A., SABER, A. F. & NASRABADI, A. N. 2025. Knowledge and Attitude of Emergency Nurses Regarding Work-Related Legal Issues in Erbil Hospitals: A Cross-Sectional Study, 2023–2024. Health Science Reports, 8, e70496. https://doi.org/10.1002/hsr2.70496

HOLLAND, J. C. 2018. Psycho-oncology: Overview, obstacles and opportunities. Psycho-oncology, 27, 1364-1376. https://doi.org/10.1002/pon.4692

IRFAN, M., DELGADO, R. Z. R. & FRIAS-LOPEZ, J. 2020. The oral microbiome and cancer. Frontiers in immunology, 11, 591088. https://doi.org/10.3389/fimmu.2020.591088

IRWIN, K. E., HENDERSON, D. C., KNIGHT, H. P. & PIRL, W. F. 2014. Cancer care for individuals with schizophrenia. Cancer, 120, 323-334. https://doi.org/10.1002/cncr.28431

KAPSE-MISTRY, S., GOVENDER, T., SRIVASTAVA, R. & YERGERI, M. 2014. Nanodrug delivery in reversing multidrug resistance in cancer cells. Frontiers in pharmacology, 5, 159. https://doi.org/10.3389/fphar.2014.00159

KARPIŃSKI, T. M. 2019. Role of oral microbiota in cancer development. Microorganisms, 7, 20. https://doi.org/10.3390/microorganisms7010020

KHATTAK, M. I., KHAN, M., KHATTAK, S. I., KHAN, Z., HAQ, Z. U. & SADDKI, N. 2021. The experiences of oral cancer patients: A narrative review. Malaysian Journal of Public Health Medicine, 21, 168-177. https://doi.org/10.37268/mjphm/vol.21/no.2/art.902

KUMAR, A. R., DEVAN, A. R., NAIR, B., VINOD, B. S. & NATH, L. R. 2021. Harnessing the immune system against cancer: current immunotherapy approaches and therapeutic targets. Molecular biology reports, 1-21. https://doi.org/10.1007/s11033-021-06752-9

KUMAR, K., KUMAR, S., MEHROTRA, D., TIWARI, S., KUMAR, V., KHANDPUR, S. & DWIVEDI, R. 2018. Prospective evaluation of psychological burden in patients with oral cancer. British Journal of Oral and Maxillofacial Surgery, 56, 918-924. https://doi.org/10.1016/j.bjoms.2018.09.004

KUMAR, S. A., INDU, S., GAUTAMI, D. & VARRUCHI, S. 2020. Oral squamous cell carcinoma (OSCC) in humans: Etiological Factors, diagnostic and therapeutic relevance. Research Journal of Biotechnology Vol, 15, 10.

LAZAR, V., DITU, L.-M., PIRCALABIORU, G. G., GHEORGHE, I., CURUTIU, C., HOLBAN, A. M., PICU, A., PETCU, L. & CHIFIRIUC, M. C. 2018. Aspects of gut microbiota and immune system interactions in infectious diseases, immunopathology, and cancer. Frontiers in immunology, 9, 1830. https://doi.org/10.3389/fimmu.2018.01830

LEIJDESDORFF, S., KLAASSEN, R., WAIRATA, D.-J., ROSEMA, S., VAN AMELSVOORT, T. & POPMA, A. 2021. Barriers and facilitators on the pathway to mental health care among 12-25 year olds. International journal of qualitative studies on health and well-being, 16, 1963110. https://doi.org/10.1080/17482631.2021.1963110

LESHO, E. P. & LAGUIO-VILA, M. The slow-motion catastrophe of antimicrobial resistance and practical interventions for all prescribers. Mayo Clinic Proceedings, 2019. Elsevier, 1040-1047. https://doi.org/10.1016/j.mayocp.2018.11.005

LEVIT, L., BALOGH, E., NASS, S. & GANZ, P. A. 2013. The Workforce Caring for Patients with Cancer. Delivering High-Quality Cancer Care: Charting a New Course for a System in Crisis. National Academies Press (US). https://doi.org/10.17226/18359

LI, Q., HU, Y., ZHOU, X., LIU, S., HAN, Q. & CHENG, L. 2020. Role of oral bacteria in the development of oral squamous cell carcinoma. Cancers, 12, 2797. https://doi.org/10.3390/cancers12102797

LIN, L.-Y., LIN, L.-H., TZENG, G.-L., HUANG, Y.-H., TAI, J.-F., CHEN, Y.-L., WU, C.-J., CHEN, P.-H., LIN, P.-C. & HUNG, P.-L. 2022. Effects of mindfulness-based therapy for cancer patients: A systematic review and meta-analysis. Journal of Clinical Psychology in Medical Settings, 29, 432-445. https://doi.org/10.1007/s10880-022-09862-z

LITTLEJOHN, A., CHARITONOS, K. & KAATRAKOSKI, H. The role of professional learning in addressing global challenges: Tensions and innovations associated with AMR. Frontiers in Education, 2019. Frontiers Media SA, 112. https://doi.org/10.3389/feduc.2019.00112

LOWRENCE, R. C., SUBRAMANIAPILLAI, S. G., ULAGANATHAN, V. & NAGARAJAN, S. 2019. Tackling drug resistance with efflux pump inhibitors: from bacteria to cancerous cells. Critical reviews in microbiology, 45, 334-353. https://doi.org/10.1080/1040841X.2019.1607248

LU, Q., CHEN, L., SHIN, L. J., WANG, C., DAWKINS-MOULTIN, L., CHU, Q., LOH, A., YOUNG, L. & WANG, C. 2021. Improvement in quality of life and psychological well-being associated with a culturally based psychosocial intervention for Chinese American breast cancer survivors. Supportive Care in Cancer, 29, 4565-4573. https://doi.org/10.1007/s00520-020-05942-8

MAHALIK, K. S. 2019. The Lived Experience of Recovery Following Transoral Robotic Surgery (TORS) for Head and Neck Cancer. Duquesne University.

MAURA, J. & WEISMAN DE MAMANI, A. 2017. Mental health disparities, treatment engagement, and attrition among racial/ethnic minorities with severe mental illness: A review. Journal of clinical psychology in medical settings, 24, 187-210. https://doi.org/10.1007/s10880-017-9510-2

MCCRACKEN, L. M. & MORLEY, S. 2014. The psychological flexibility model: a basis for integration and progress in

psychological approaches to chronic pain management. The Journal of Pain, 15, 221-234. https://doi.org/10.1016/j.jpain.2013.10.014

MCDOWELL, L., RISCHIN, D., GOUGH, K. & HENSON, C. 2022. Health-related quality of life, psychosocial distress and unmet needs in older patients with head and neck cancer. Frontiers in Oncology, 12, 834068. https://doi.org/10.3389/fonc.2022.834068

MEYER, J. E. & HARDER, J. 2007. Antimicrobial peptides in oral cancer. Current pharmaceutical design, 13, 3119-3130. https://doi.org/10.2174/138161207782110372

MICHAEL, A., MICHELE, C. & ELIAS, M. 2020. Challenges to tackling antimicrobial resistance economic and policy responses: economic and policy responses, OECD Publishing.

MINTZ, D. 2022. Psychodynamic psychopharmacology: caring for the treatment-resistant patient, American Psychiatric Pub. https://doi.org/10.1176/appi.books.9781615379064

MOORE, C. & EWA SZUMACHER, M. 2016. Late-Breaking Abstracts. cancer, 28.

MOORE, C. & EWA SZUMACHER, M. 2018. 2018 International Cancer Education Conference. Journal of Cancer Education, 33, S1-S48. https://doi.org/10.1007/s13187-018-1414-9

NAYAK, J. S., JAMES, T. T., MENARIA, S. & DHARGAVE, P. 2023. PP-07_141. Indian Journal of Palliative Care, 29, 106.

NOVIYANI, R., DUONG, K. N., NGO, N. T., KULARATNA, S., WIDATAMA, A. & SRINADI, I. G. A. M. 2024. Empirical antibiotics versus definitive antibiotics for Sepsis patients in Indonesia: A cost-effectiveness analysis. Journal of Applied Pharmaceutical Science. https://doi.org/10.7324/JAPS.2024.195834

ORZECHOWSKA, A., MARUSZEWSKA, P. & GAŁECKI, P. 2021. Cognitive behavioral therapy of patients with somatic symptoms—Diagnostic and therapeutic difficulties. Journal of Clinical Medicine, 10, 3159. https://doi.org/10.3390/jcm10143159

OZPISKIN, O. M., ZHANG, L. & LI, J. J. 2019. Immune targets in the tumor microenvironment treated by radiotherapy. Theranostics, 9, 1215. https://doi.org/10.7150/thno.32648

PACE-BALZAN, A., SHAW, R. J. & BUTTERWORTH, C. 2011. Oral rehabilitation following treatment for oral cancer. Periodontology 2000, 57. https://doi.org/10.1111/j.1600-0757.2011.00384.x

PARK, S., SATO, Y., TAKITA, Y., TAMURA, N., NINOMIYA, A., KOSUGI, T., SADO, M., NAKAGAWA, A., TAKAHASHI, M. & HAYASHIDA, T. 2020. Mindfulness-based cognitive therapy for psychological distress, fear of cancer recurrence, fatigue, spiritual well-being, and quality of life in patients with breast cancer—a randomized controlled trial. Journal of pain and symptom management, 60, 381-389. https://doi.org/10.1016/j.jpainsymman.2020.02.017

PEAT, C. M. 2013. Cognitive-behavioral therapy. Non-suicidal self-injury in eating disorders: Advancements in etiology and treatment. Springer. https://doi.org/10.1007/978-3-642-40107-7_7

PUCA, V., MARINACCI, B., PINTI, M., DI CINTIO, F., SINJARI, B., DI MARCANTONIO, M. C., MINCIONE, G., ACHARYA, T. R., KAUSHIK, N. K. & CHOI, E. H. 2024. Antimicrobial efficacy of direct air gas soft jet plasma for the in vitro reduction of oral bacterial biofilms. Scientific Reports, 14, 10882. https://doi.org/10.1038/s41598-024-61438-z

REID, G. J. & BROWN, J. B. 2008. Money, case complexity, and wait lists: Perspectives on problems and solutions at children's mental health centers in Ontario. The journal of behavioral health services & research, 35, 334-346. https://doi.org/10.1007/s11414-008-9115-5

RENES, R. A. & AARTS, H. 2017. The sense of agency in health and well-being: Understanding the role of the minimal self in action-control. Routledge International Handbook of Self-Control in Health and Well-Being. Routledge. https://doi.org/10.4324/9781315648576-16

REWERSKA-JUŚKO, M. & REJDAK, K. Social stigma of patients suffering from COVID-19: challenges for health care system. Healthcare, 2022. MDPI, 292. https://doi.org/10.3390/healthcare10020292

SABER, A. F., ALI, A., HASAN, H. A., AHMED, S. K. & HUSSEIN, S. 2025a. Cognitive behavioral therapy for suicidal ideation: extending the stepped care model. Journal of Contemporary Psychotherapy, 55, 21-28. https://doi.org/10.1007/s10879-024-09639-5

SABER, A. F., HUSSEIN, S., AHMED, S. K. & MANOOKIAN, A. 2025b. Mindfulness Interventions in Managing Paranoia: A Scoping Review. BioMed Target Journal. https://doi.org/10.59786/bmtj.312

SALAM, M. A., AL-AMIN, M. Y., SALAM, M. T., PAWAR, J. S., AKHTER, N., RABAAN, A. A. & ALQUMBER, M. A. Antimicrobial resistance: a growing serious threat for global public health. Healthcare, 2023. MDPI, 1946. https://doi.org/10.20944/preprints202305.0555.v1

SANTACROCE, L., PASSARELLI, P. C., AZZOLINO, D., BOTTALICO, L., CHARITOS, I. A., CAZZOLLA, A. P., COLELLA, M., TOPI, S., GODOY, F. G. & D'ADDONA, A. 2023. Oral microbiota in human health and disease: A perspective. Experimental Biology and Medicine, 248, 1288-1301. Health Innovation Reports 2025,1(1):18-31

SCHELLEKENS, M. P., VAN DEN HURK, D. G., PRINS, J. B., MOLEMA, J., VAN DER DRIFT, M. A. & SPECKENS, A. E. 2016. The suitability of the Hospital Anxiety and Depression Scale, Distress Thermometer and other instruments to screen for psychiatric disorders in both lung cancer patients and their partners. Journal of affective disorders, 203, 176-183. https://doi.org/10.1016/j.jad.2016.05.044

SCOTT, S., GRUNFELD, E., MAIN, J. & MCGURK, M. 2006. Patient delay in oral cancer: a qualitative study of patients' experiences. Psycho-Oncology: Journal of the Psychological, Social and Behavioral Dimensions of Cancer, 15, 474-485. https://doi.org/10.1002/pon.976

SHOSHANI, A. & KANAT-MAYMON, Y. 2018. Involvement in care in pediatric cancer patients: implications for treatment compliance, mental health and health-related quality of life. Quality of Life Research, 27, 567-575. https://doi.org/10.1007/s11136-017-1744-9

SMITH-TURCHYN, J., MORGAN, A. & RICHARDSON, J. 2016. The effectiveness of group-based self-management programmes to improve physical and psychological outcomes in patients with cancer: a systematic review and meta-analysis of randomised controlled trials. Clinical Oncology, 28, 292-305. https://doi.org/10.1016/j.clon.2015.10.003

SPELTEN, E. R., HARDMAN, R. N., PIKE, K. E., YUEN, E. Y. & WILSON, C. 2021. Best practice in the implementation of telehealth-based supportive cancer care: Using research evidence and discipline-based guidance. Patient education and counseling, 104, 2682-2699.

https://doi.org/10.1016/j.pec.2021.04.006

SPIVAK, E. S. & GREENLEE, S. B. 2023. Antimicrobial Stewardship: Where We've Come and Where We're Going, An Issue of Infectious Disease Clinics of North America, E-Book, Elsevier Health Sciences. https://doi.org/10.1016/S0891-5520(23)00072-7

STOUT, R. A., BECKMAN, N. J., SHELBY, S. R. & LABOTT, S. M. 2013. Psychological issues in head and neck cancer. Head & Neck Cancer: Current Perspectives, Advances, and Challenges, 751-800. https://doi.org/10.1007/978-94-007-5827-8_25

TAJ, Z. & CHATTOPADHYAY, I. 2024. In Silico Prediction and Molecular Simulation of Antimicrobial peptide variants from Lactobacillus sp. Against Porphyromonas gingivalis and Fusobacterium nucleatum in oral squamous cell carcinoma. Peptide Science, e24348. https://doi.org/10.1002/pep2.24348

TANG, K. W. K., MILLAR, B. C. & MOORE, J. E. 2023. Antimicrobial resistance (AMR). British Journal of Biomedical Science, 80, 11387. https://doi.org/10.3389/bjbs.2023.11387

TANWAR, A. S. 2024. Microbiome and its role in shaping planetary health.

TAUBER, N. M., O'TOOLE, M. S., DINKEL, A., GALICA, J., HUMPHRIS, G., LEBEL, S., MAHEU, C., OZAKINCI, G., PRINS, J. & SHARPE, L. 2019. Effect of psychological intervention on fear of cancer recurrence: a systematic review and meta-analysis. Journal of clinical oncology, 37, 2899-2915. https://doi.org/10.1200/JCO.19.00572

TERRENI, M., TACCANI, M. & PREGNOLATO, M. 2021. New antibiotics for multidrug-resistant bacterial strains: latest research developments and future perspectives. Molecules, 26, 2671. https://doi.org/10.3390/molecules26092671

TOFTHAGEN, C. & MCMILLAN, S. C. 2010. Pain, neuropathic symptoms, and physical and mental well-being in persons with cancer. Cancer Nursing, 33, 437-444. https://doi.org/10.1097/NCC.0b013e3181e212b4

VALLATH, N. & SALINS, N. 2017. Holistic supportive care in oral cancer: principles and practice. Contemporary Oral Oncology: Rehabilitation and Supportive Care, 121-231. https://doi.org/10.1007/978-3-319-43857-3_5

WAGNER, C. D., DAS, L. T., BIGATTI, S. M. & STORNIOLO, A. M. 2011. Characterizing burden, caregiving benefits, and psychological distress of husbands of breast cancer patients during treatment and beyond. Cancer Nursing, 34, E21-E30. https://doi.org/10.1097/NCC.0b013e31820251f5

WALKER, E. R., CUMMINGS, J. R., HOCKENBERRY, J. M. & DRUSS, B. G. 2015. Insurance status, use of mental health services, and unmet need for mental health care in the United States. Psychiatric Services, 66, 578-584. https://doi.org/10.1176/appi.ps.201400248

WANG, R., ZHENG, X., SU, X., HUANG, X., LIU, H., GUO, Y. & GAO, J. 2023. The development of a Cancer Pain Belief Modification Program for patients with oral cancer in China: a feasibility study. BMC nursing, 22, 206. https://doi.org/10.1186/s12912-023-01372-z

WANG, Y., LIN, Y., CHEN, J., WANG, C., HU, R. & WU, Y. 2020. Effects of Internet-based psycho-educational interventions on mental health and quality of life among cancer patients: a systematic review and meta-analysis. Supportive Care in Cancer, 28, 2541-2552. https://doi.org/10.1007/s00520-020-05383-3

WESNER, A. C., GOMES, J. B., DETZEL, T., GUIMARÃES, L. S. & HELDT, E. 2015. Booster sessions after cognitive-behavioural group therapy for panic disorder: impact on resilience, coping, and quality of life. Behavioural and Cognitive Psychotherapy, 43, 513-525. https://doi.org/10.1017/S1352465814000289

WESTRA, H. A. & NOROUZIAN, N. 2018. Using motivational interviewing to manage process markers of ambivalence and resistance in cognitive behavioral therapy. Cognitive Therapy and Research, 42, 193-203. https://doi.org/10.1007/s10608-017-9857-6

YING, W. & LING, T. M. 2023. Understanding the Psychosocial Impact of Oral Squamous Cell Carcinoma (OSCC) on Patients. Journal of Advanced Analytics in Healthcare Management, 7, 132-151.