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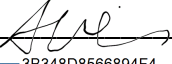
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Morooj Aljishi

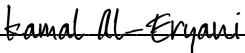
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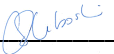
in  
Oral and Craniofacial Sciences

in the  
GRADUATE DIVISION  
of the  
UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

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The authors would like to thank Nancy Hills for her assistance in statistical analysis. We are also thankful for all the oncologists who responded to the survey.

# Assessing the Knowledge and Awareness of US Oncologists Regarding the Specialty of Oral Medicine

Morooj Aljishi

## Abstract

**Objectives:** This this cross-sectional study aimed to assess the awareness among United States (US) oncologists about oral medicine (OM) as a specialty of dentistry, and their collaboration with OM providers.

**Methods:** An online survey was conducted, inviting 1350 US oncologists, with data collected on demographics, practice background, comfort level with diagnosing and treating oral conditions, referral practices for oral conditions, and more.

**Results:** Of the invited 1350 oncologist, 192 respnded (14% response rate). Among respndents, 46% were familiar with the OM specialty. Of these, 73% had previously sought consultation from OM specialists. The primary reasons for referral included dental clearance before initiating chemotherapy (38.5%), dental clearance before initiating radiotherapy (37%), and managing oral ulcers and oral potentially malignant disorders equally (32.2%). Regarding referrals to providers outside of OM, oncologists primarily referred patients with oral lesions to otolaringologists (64.6%; followed by oral and maxillofacial surgeons (55.2%), and general dentists (45.3%).

**Conclusion:** Our study showed that over half of US oncologists were unfamiliar with the OM specialty. However, the referral rate to OM providers was high among oncologists who had prior OM knowledge. It is advisable to enhance the collaboration between OM and other oncology specialists to ensure optimal care for patients with cancer.

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## **List of Abbreviations**

ASCO: American Society of Clinical Oncologists

CODA: Commission on Dental Accreditation

GvHD: graft-versus-host disease

ICIs: immune checkpoint inhibitors

IQR: interquartile range

ir-AEs: immune-related adverse events

OM: oral medicine

OPC: oral and pharyngeal cancer

OPMDs: oral potentially malignant disorders

RT: radiotherapy

US: United States

## **Introduction:**

Oral medicine (OM) is defined by the American Academy of Oral Medicine as “*the specialty of dentistry responsible for the oral health care of medically complex patients and for the diagnosis and management of medically related disorders or conditions affecting the oral and maxillofacial region*”.<sup>(1)</sup> It is perceived as an intersection between medicine and dentistry.<sup>(2)</sup> OM clinicians are trained to critically evaluate, diagnose, and manage a wide range of disorders of the oral cavity, including oral potentially malignant disorders, and oral complications of cancer therapy.<sup>(2, 3)</sup>

OM is a specialty practice and patients are usually referred by their healthcare providers in the medical and/or dental field.<sup>(2, 3)</sup> On average, individuals seeking OM treatment typically describe experiencing oral symptoms for approximately 16.8 months, and seeing an average of 2 practitioners before seeing an OM specialist for a correct diagnosis and treatment.<sup>(4)</sup> Although numerous OM specialists work within cancer centers, only a small number of oncologists refer their patients to OM. Pinto et al, for example, analysed the characteristic of 916 patients referred to 74 OM providers practicing in the United States (US) and showed that only 5% of the patients were referred by oncologists.<sup>(4)</sup> Another study of 1043 OM new patient referrals at a hospital-based practice in the US showed that physicians had referred two-thirds of these patients, with primary care providers accounting for the largest proportion (23.8%) followed by oncologists (16.7%), otolaryngologists (10.1%), then dermatologists (6.2%).<sup>(5)</sup>

Oral toxicities from cancer treatment are common and on the rise among oncology patients due to the availability of new cancer therapies and increased number of survivors.<sup>(4, 6)</sup> Recently, the use of immune checkpoint inhibitors (ICIs) approved by the FDA in 2011 for cancer treatment has been associated with oral immune-related adverse events (ir-AEs), with an overall incidence of 6.8%<sup>(7)</sup>. As new cancer therapies with oral side effects emerge, proper management becomes increasingly important. Although OM is recognized as a distinct field in many countries, the understanding and implementation of OM in oncology settings remains limited. As such, the aim of this cross-sectional study was to assess awareness regarding OM as a specialty among US oncologists, and their level of collaboration with OM providers.

## **Materials and methods:**

### *Characteristics of study participants and data collection*

A convenience sample was selected from the American Society of Clinical Oncologists (ASCO) member directory. The directory was categorized into the 50 US States and the members were arranged in alphabetical order. To ensure an equitable geographical representation of the sample, we selected approximately the first 30% of oncologists from each State, resulting in a total of 1350 oncologists. Then, their contact details were manually compiled into an Excel spreadsheet. They were invited via Email to participate in an online survey using Qualtrics XM (Qualtrics) to assess their awareness about OM specialty and their level of collaboration with OM providers. The study was approved by the Institutional Review Board at University of California San Francisco. All subspecialties of oncology were included (such as medical oncology, radiation oncology, hematology oncology and others). Oncologists who work solely as researchers were excluded. Participants were sent an e-mail containing a link to the online survey, followed by reminder emails sent two and four weeks after the initial invitation. Participation in the survey was voluntary, and no incentives were provided to the participants.

### *Survey*

We used a modified version of the Almazrooa and Binmadi's survey.<sup>(3)</sup> To ensure the survey's validity and item effectiveness, we sought input from seven experienced oncologists who provided valuable feedback on the survey's content. We then made several adjustments to enhance the survey's accuracy and effectiveness as recommended by the oncologists. The survey consisted of 26 questions which were categorized into six domains: demographics (2 questions), clinical practice background (6 questions), clinical exposure to patients with oral diseases (1 question), ease/difficulty of diagnosis and treatment of different oral diseases (2 questions with 11 branching questions for each), familiarity with OM specialty and referral practices for oral diseases (9 questions), dental clearance before receiving oncology-related therapy (4 questions), and opinion on incorporating OM into hospitals and medical training (2 questions).

### *Statistical analysis*

Statistical analyses were performed using Stata v.17 (College Station, TX). Categorical variables were summarized using counts and percentages. A 5-point Likert scale was used to describe ease of diagnosis and treatment (1: extremely difficult, 2: slightly difficult, 3: neither easy nor difficult, 4: slightly easy, 5: extremely easy, 6: I do not diagnose/treat this condition). The responses were summarized using medians and interquartile ranges (IQR). Chi-square test and Fisher's exact tests were used to compare physicians' characteristics associated with knowledge of OM specialty. Associations were considered significant at P=.05 level.

## **Results:**

### *Characteristics of study participants*

Out of the 1350 invited oncologists, 211 initiated a response and 192 completed the survey (14%). Details on demographical data and practice characteristics are shown in Table 1. One hundred and two participants (53.1%) were men and 120 (62.5%) were below 50 years of age. Among the respondents, 55 (28.6%) had professional experience in the field of clinical oncology ranging from 6 to 10 years, while 48 (25%) had been practicing for 11 and 15 years. Approximately half of the oncologists (53.6%) were board-certified in either medical oncology, hematology, or both, and 66 (34.4%) were radiation oncologists or pediatric hematology-oncology specialists.

When the practice setting was considered, 67.1% (n=129) reported practicing exclusively in academic settings (full-time academic practices, practices with an academic affiliation, and State-funded institutions) or in combination with hospital system or physician-owned private practice. More than two-thirds (72.9%; n=140) were practicing in States that lacked accredited OM residency programs.

### *Ease of diagnosis and treatment of different oral diseases and conditions*

Forty-nine percent reported encountering more than 10 patients with non-tooth related oral lesions monthly. They also reported that the diagnosis of oral ir-AEs was their greatest challenge compared to the

diagnosis of other conditions listed (median=3.5, IQR=2-4). On the other hand, diagnosing oral graft vs host disease (GvHD) was comparatively the easiest, with a median score of 5 (IQR= 4-6). Taste changes were reported as being the most difficult for the surveyed oncologists to treat (median=2, IQR=1-3), while oral infections (bacterial, viral, and fungal) were the easiest to treat (median=4, IQR=3-4) (Figure 1 & 2).

### *Knowledge about OM specialty*

Out of the 192 oncologists, 89 (46.4%) reported prior familiarity with the OM specialty before receiving the survey. Of these, 53 (59.6%) were medical oncologists and/or hematologists/oncologists, 63 (70.8%) practiced at academic settings (either exclusively or in combination with hospital system or physician owned private practice), and nearly two thirds (60.7%) practiced in States that lacked an accredited OM residency program. Oncologists with >20 years of practice were more prone to know OM as a specialty (p-value= .001), as well as those practicing in the States that have accredited OM residency program (p-value < .001). There was no significant difference in knowledge in relation to specialty and practice setting (Table 2). Only 27 oncologists (14% of all survey respondents) were able to identify the correct educational background of OM providers.

### *Referrals to OM and other specialties*

Among the 89 oncologists who indicated prior knowledge of the OM specialty, a substantial majority (73%) had previously sought consultation and/or referred patients to OM specialists. The primary reasons for referral included dental clearance before initiating chemotherapy (38.5%, n=25), dental clearance before initiating radiotherapy (RT) (36.9%, n=24), as well as managing oral ulcers and OPMDs equally (32.3%, n=21) (Figure 3). Eighty-nine percent of these oncologists reported having excellent to very good experience while collaborating with OM providers. However, 7 (11%) participants expressed fair experience, primarily attributing the challenges to issues related to insurance coverage and shortage of OM staff leading to lack of timely evaluations. Among the oncologists who had not consulted or referred any patients to OM providers, the main reasons cited were lack of availability of OM specialists nearby and

not knowing any OM providers (45% each). One oncologist mentioned managing oral conditions personally and seeking consultations from colleagues.

Regarding referral pattern to other healthcare professionals, 124 (64.6%) oncologists referred their patients with oral lesions to otolaryngologists; 106 (55.2%) referred to oral and maxillofacial surgeons, and 87 (45.3%) referred to general dentists. Other healthcare providers to whom oncologists referred patients with oral lesions included dermatologists, pediatric dentists, oral pathologists, dental oncologists, and periodontists.

### *Oncologists' perspective on dental clearance for cancer patients and incorporating OM in hospitals and medical training*

The vast majority of oncologists (88%) agreed that it was a necessity to refer patients who are scheduled to receive radiotherapy to the head and neck area for dental examination before commencing therapy. In addition, 148 (77.1%) and 140 (72.9%) agreed that patients should undergo dental examination prior to initiation of antiresorptive therapy and receiving hematopoietic stem cell transplant, respectively. However, 30 (15.6%) and 32 (16.7%) respondents expressed uncertainty regarding the necessity of such referrals in the mentioned contexts. With respect to chemotherapy, 71 (37%) oncologists believed that patients should undergo dental examination before treatment initiation, while 75 (39.1%) held the opposing view, and 46 (24%) remained undecided. More than two thirds (71.4%) of respondents were in favor of integration of OM specialists into hospitals/cancer centers providing clinical care to patients with cancer. Additionally, 90 (46.9%) oncologists supported including a clinical rotation in OM clinics as part of the training and educational experience of medical residents and fellows.

### **Discussion:**

The aims of our study were to assess US oncologists' knowledge of the OM specialty, their referral practices for oral mucosal lesions, and the level of collaboration between OM and other oncologic specialties. Over half of the respondents (53.4%) did not know about OM as a distinct specialty in the field

of dentistry. Oncologists with longer duration of clinical experience (>20 years) were more likely to be aware of OM. In Jordan, Alrashdan et al. showed 52% overall awareness about the OM specialty among medical practitioners, which was significantly associated with a higher age group, but not with the number of years in practice.<sup>(8)</sup> In our study, oncologists practicing in States where there are accredited OM residency programs (California, Massachusetts, North Carolina, Pennsylvania, and Washington) demonstrated higher awareness of the OM specialty than oncologists practicing in States lacking an OM residency program. This observation could be a result of the OM residency programs structure, fulfilling the requirements of the Commission on Dental Accreditation (CODA), where OM residents are exposed to hospital medical services and rotate in different oncology services including medical oncology, radiation oncology, head and neck oncology, and bone marrow transplant for pediatric patients.<sup>(9)</sup> This exposure creates a foundation for fostering interdisciplinary collaboration.

Our data showed that the diagnosis of oral ir-AEs represented the greatest challenge to the oncologists compared to the other oral diseases and conditions listed in the survey. According to the literature, the incidence of oral ir-AEs varied based on the therapeutic agent used. Although it may take more than 2 years to manifest, their onset most commonly occurs within 2 months of immunotherapy initiation.<sup>(7)</sup> The clinical presentation also varies; these lesions can resemble oral lichen planus, vesiculobullous disease, erythema multiforme, or manifest with symptoms of xerostomia or dysgeusia. It is critical to understand that some cases may display an overlap of features of more than one disease entity.<sup>(10)</sup> Given that immunotherapy is a therapy available only relatively recently, the broad variation in onset and clinical presentation of these adverse events is expected to result in diagnosis uncertainty.

Treatment of taste changes represented the greatest therapeutic difficulty for oncologists. Patients receiving RT to the head and neck and/or chemotherapy are at a high risk of developing alterations in taste, with some reports demonstrating a prevalence as high as 100% and 93%, respectively.<sup>(11,12)</sup> Taste changes, whether complete (ageusia) or partial (hypogeusia) loss of taste, have been associated with reduced quality of life due to lower levels of physical and social well-being, and higher levels of stress.<sup>(13)</sup> Unfortunately, the management of taste disorders poses inherent challenges with only a few treatment options investigated

in the literature. Referring patients to specialized taste and smell disorder centers could be beneficial, offering them expert counseling and support.

A substantial majority of our study participants (73%) who had prior knowledge about the OM specialty reported referring patients to OM providers; dental clearance before initiating chemotherapy and RT ranked as the first two main reasons for referral, followed by management of oral ulcers and OPMDs. Almazrooa et al showed that physicians in Saudi Arabia exhibited a higher tendency to refer cases of oral ulcers and vesiculobullous diseases to OM clinics, while clearance prior to chemotherapy and RT initiation had the least frequency.<sup>(3)</sup> Alrashdan et al. assessed the ability of medical practitioners (who are aware of the OM specialty) to identify oral conditions that warrant a referral to OM providers. Interestingly, only 38% identified orofacial neuropathic pain as a reason to refer, and 31% incorrectly thought that the construction of dentures falls within the scope of OM practice.<sup>(8)</sup> It is the responsibility of OM specialists, as well as dentists, to raise the awareness within the medical community about the services provided by OM specialists to ensure optimal care for patients requiring these services.

The oral cavity is a known site for antineoplastic treatment toxicity. A prospective study conducted in Colombia showed a significant increase in the frequency of gingivitis, dental caries, xerostomia, and osteonecrosis of the jaw 40 days after the initiation of chemotherapy, RT, and/or cancer surgery.<sup>(14)</sup> Assessment of radiation-induced oral complications in 216 head and neck cancer patients 6 months after the start of RT revealed substantial reduction in mean stimulated whole salivary flow, mean maximal mouth opening, and oral health-related quality of life.<sup>(15)</sup> Furthermore, use of chemotherapy for the treatment of acute lymphoblastic leukemia resulted in oral mucositis in 75% of treated children.<sup>(16)</sup> Moreover, evaluation of the oral health of 19 pediatric patients four weeks after receiving hematopoietic stem cell transplant demonstrated gradual worsening of plaque accumulation over time, and 68% developed mucositis.<sup>(17)</sup>

Despite the fact that there are many reports in the literature on oral cavity-related complications of antineoplastic therapy<sup>(14, 15, 16, 17)</sup>, it appears that dental examination prior to commencement of therapy is not a protocol followed by all practitioners. As detailed in the results section, a third of our study population believed that it was not necessary, or at least, expressed uncertainty regarding such a decision. This is



consistent with the findings of Almazrooa's et al., where they demonstrated a total of 57.4% and 26.3% of physicians believed dental examination before starting bisphosphonates and chemotherapy, respectively, was not necessary or expressed uncertainty.<sup>(3)</sup> In addition to the direct impact of antineoplastic therapy on oral health, the immunosuppressed state of patients receiving antineoplastic agents can render them susceptible to serious oral infections, either from new onset or exacerbation of existing ones that had not been addressed before the initiation of therapy. A panel of experts from ASCO emphasized the importance of adopting a multispecialty approach to care for head and neck cancer survivors, which includes the involvement of dentists and dental specialists.<sup>(18)</sup> Therefore, dental practitioners are advised to advocate for these protocols to decrease the likelihood of complications and prevent disruptions to cancer treatment.

In the state of North Carolina, a survey of self-perceived adequacy of training in oral and pharyngeal cancer (OPC) screening revealed that family physicians and nurse practitioners were less likely to feel adequately trained to perform OPC screening than were dentist and dental hygienists.<sup>(19)</sup> In another report from Maryland, 46% of family physicians reported training on oral cancer was not provided during their medical school education.<sup>(20)</sup> These findings reflect an immense gap between the medical and dental fields. Bridging this gap can be achieved through enhancement of oral health education, interdisciplinary collaboration between medical and dental academic institutions, and more importantly, incorporating OM specialists in the care team of medically compromised patients.

Appropriate oral health care for cancer patients impacts not only their overall health and treatment outcome, but also their financial wellbeing. Choi et al. used claims data from a commercial insurer in the US to analyze the costs and duration of management of common oral toxicities in patients with oral and oropharyngeal cancer. They concluded that engaging dentists in the management of acute complications resulted in lower cost and shorter durations of management compared to patients whose care did not involve a dentist. Although the cost was higher when management of chronic complication involved a dentist, the average treatment duration was shorter than that of their counterparts.<sup>(21)</sup> Patients who are under active cancer therapy, and those with a history of cancer treatment may face difficulty obtaining proper dental care since general dentists often lack the necessary experience needed to effectively manage these

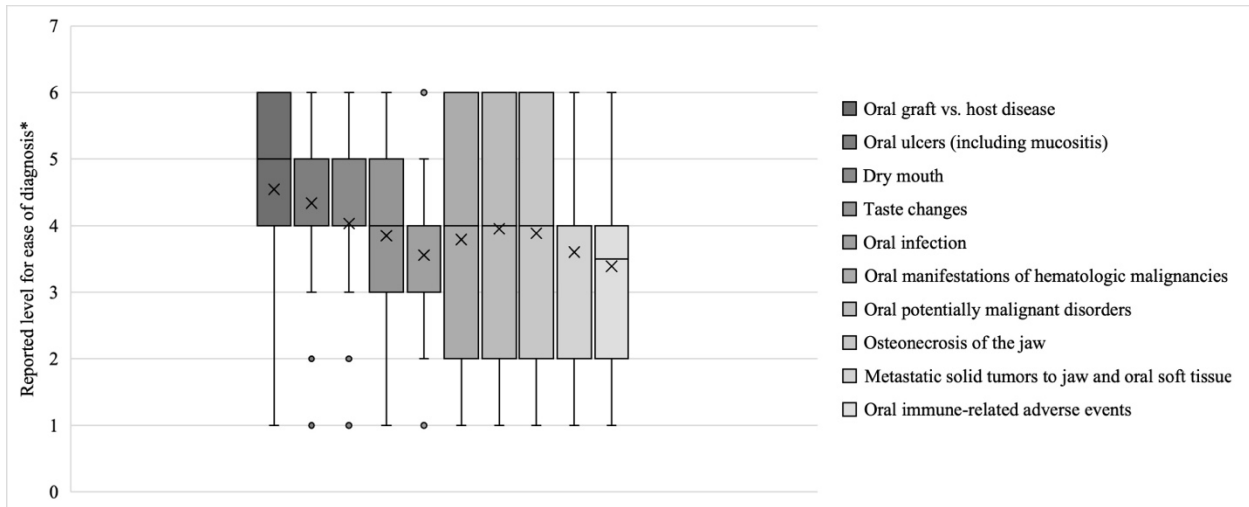
patients.<sup>(22)</sup> Hence, early integration of specialized dental providers to the care teams of cancer patients holds a significant long-term benefit.

The current study findings provide a valuable contribution towards multidisciplinary approach for the oral health care of cancer patients. However, there are limitations that should be taken into consideration when interpreting these results. First, the response rate was considerably low, raising the potential of nonresponse bias. The available data of the non-respondants was limited and inaccurate, rendering it infeasible to conduct a thorough nonresponse bias analysis. Moreover, the majority of participants were medical oncologists and hematologists, limiting the ability to generalize the results to the other specialties of oncology. Furthermore, the reported percentage of familiarity with OM specialty is likely to be inflated as those who agreed to complete the survey were more likely to be aware of the specialty. Considering the importance of oncologists having a comprehensive understanding of OM specialty, studies with a larger sample size that equally includes a diverse population of oncology specialties remain needed.

In conclusion, our study showed a lack of awareness among US oncologists about OM specialty. Considering that oral lesions are a frequent occurrence among oncology patients, which in some instances results in interruption of cancer therapy, it is advisable to enhance the collaboration between these OM and oncology specialties. This will ensure optimal comprehensive care for patients dealing with cancer.

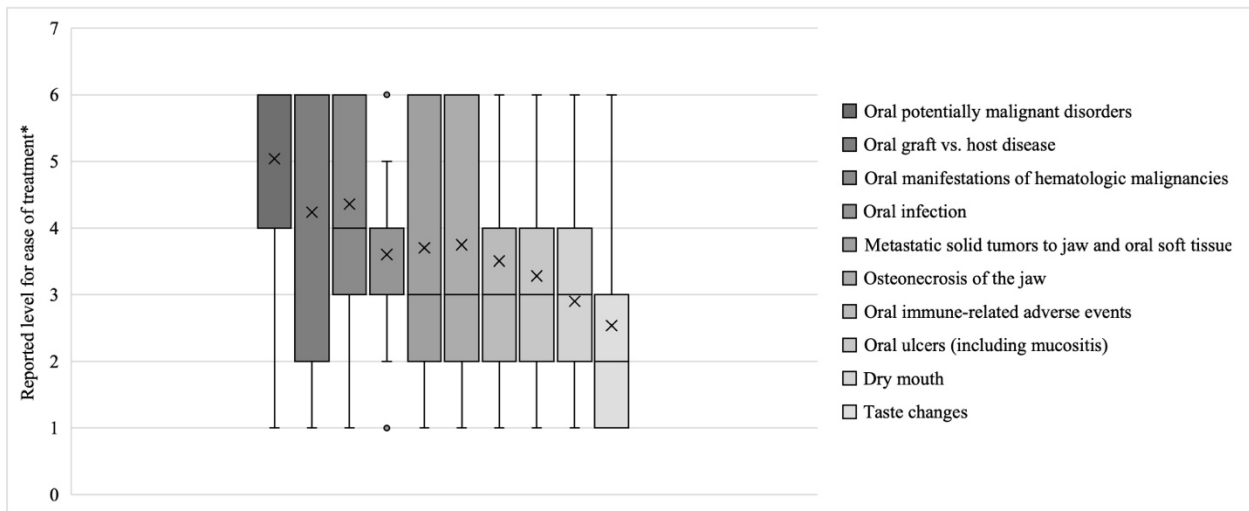
**Table 1.** Demographics and practice characteristics of the survey participants

	N	(%)
<b>Age in years</b>		
31-40	49	(25.5)
41-50	71	(37.0)
51-60	46	(24.0)
≥60	26	(13.5)
<b>Gender</b>		
Male	102	(53.1)
Female	86	(44.8)
Non-binary	4	(2.1)
<b>Years in clinical oncology practice</b>		
< 5 years	23	(12.0)
6-10 years	55	(28.6)
11-15 years	48	(25.0)
16-20 years	28	(14.6)
>20 years	38	(19.8)
<b>Specialty</b>		
Hematology and/or medical oncology	103	(53.6)
Radiation oncology	33	(17.2)
Surgical oncology	13	(6.8)
Gynecology oncology	10	(5.2)
Pediatric hematology-oncology	33	(17.2)
<b>Practice location:</b>		
State with medical residency	52	(27.1)
State without medical residency	140	(72.9)
<b>Practice setting</b>		
Academic only	116	(60.4)
Academic and physician owned	2	(1.0)
Academic and hospital/health system	11	(5.7)
Physician owned only	13	(6.8)
Physician owned and hospital/health system	1	(0.5)
Hospital/health system owned	49	(25.5)
<b>Patients age</b>		
Adult	144	(75.0)
Pediatric	37	(19.3)
Both	11	(5.7)
<b>Cancer patients seen per month</b>		
<60	53	(27.6)
61-80	51	(26.6)
81-100	41	(21.4)
>100	47	(24.5)
<b>Patients with non-tooth oral lesions per month</b>		
< 10	98	(51.0)
11-20	65	(33.9)
>20	29	(15.1)



**Figure 1.** Box plot showing sample distribution regarding the reported level for ease of diagnosis of different oral diseases and conditions by oncologists (N=192).

\*1: extremely difficult, 2: slightly difficult, 3: neither easy nor difficult, 4: slightly easy, 5: extremely easy, 6: I do not diagnose this condition.

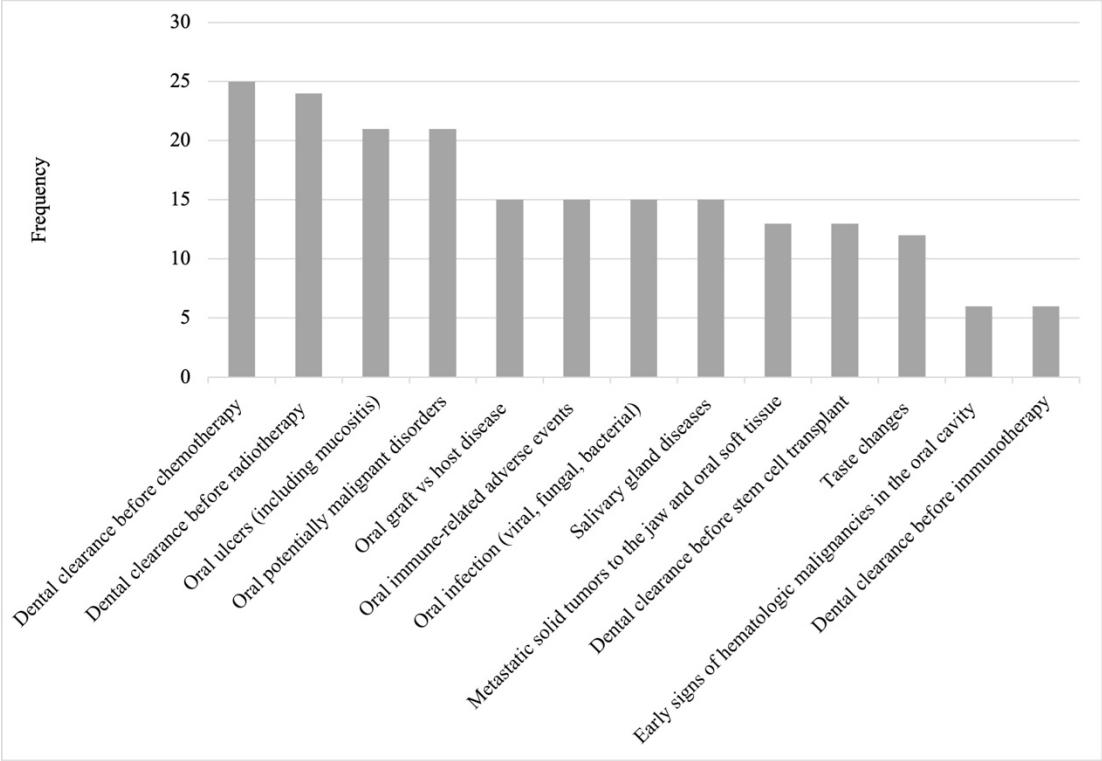


**Figure 2.** Box plot showing sample distribution regarding the ease of treatment of different oral diseases and conditions by oncologists (N=192).

\*1: extremely difficult, 2: slightly difficult, 3: neither easy nor difficult, 4: slightly easy, 5: extremely easy, 6: I do not diagnose this condition.

**Table 2.** Practice characteristics among oncologists (N=192) by reported knowledge of oral medicine specialty. OM: oral medicine.

Characteristic	Knowledge about OM (N=89)		No knowledge about OM (N=103)		p-value*
	N	(%)	N	(%)	
<b>Number of years in practice</b>					0.001
< 5 years	7	(7.9)	16	(15.5)	
6-10 years	28	(31.5)	27	(26.2)	
11-15 years	15	(16.9)	33	(32.0)	
16-20 years	11	(12.4)	17	(16.5)	
>20 years	28	(31.5)	10	(9.7)	
<b>Specialty</b>					0.28**
Hematology and medical oncology	53	(59.6)	50	(48.5)	
Radiation oncology	15	(16.9)	18	(17.5)	
Surgical oncology	4	(4.5)	9	(8.7)	
Gynecology oncology	2	(2.2)	8	(7.8)	
Pediatric hematology-oncology	15	(16.9)	18	(17.5)	
<b>Practice setting</b>					0.32
Academic only, academic with hospital/health system, or academic with physician owned	63	(70.8)	66	(64.1)	
Hospital/health system only, physician owned only, or both	26	(29.2)	37	(35.9)	
<b>Practice location in:</b>					<0.001
State without medical residency	54	(60.7)	86	(83.5)	
State with medical residency	35	(39.3)	17	(16.5)	
* P-values calculate using chi-square test unless otherwise indicated.					
** P-value calculate using Fisher's exact test unless otherwise indicated.					
OM: oral medicine					



**Figure 3.** Reasons for oral medicine referrals reported by oncologists (N=192)

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