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Assessments of the Quality, Understandability, and Actionability of Arabic Web-Based Content on Oral Cancer and Precancerous Disorders

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Keywords
Consumer health information · Health literacy · Patient education · Mouth diseases · Value-based health care

Abstract

Introduction: Empowering high-risk individuals to oral cancer and potentially cancerous disorders with written health information is needed for early detection of mucosal changes and self-care. This infodemiological study aimed to assess the web-based and Arabic content related to these disorders when quickly searching the internet. ***Methods:*** The top 20 websites yielded from each of the 7 searches were initially screened for eligibility (oral cancer, leukoplakia, erythroplakia, oral submucous fibrosis, oral lichen planus, oral lichenoid lesions, and oral graft-versus-host disease). These related to search terms written for healthcare consumers were assessed for website characteristics, quality criteria (4 JAMA benchmarks [authorship, attribution, disclosure, and currency] and Health on the Net seal), and understandability and actionability (Patient Education Materials Assessment Tool). The latter was scored from 0 to 100% based on meeting the criteria. Data representation and analysis were performed using Microsoft Excel and IBM SPSS. ***Results:*** Of the screened 140 websites, 70 (50%) were included in the analysis for all search terms, with oral cancer and lichen planus yielding the most relevant websites (19 and 17, respectively). Commercial and not-for-profit organisations created 50% of the analysed websites. The analysed content was mainly presented as medical facts (71%), often without presenting audiovisual aids (61%). The average JAMA benchmarks achieved per website were 2.5 out of 4, of which "disclosure" and "attribution" were often missing in more than 70% of these websites. Content related to oral cancer and leukoplakia considerably obtained higher average quality benchmarks than other disorders. Acceptable levels for understandability and actionability (≥70%) were found in 52% and 15% of all materials. ***Conclusion:*** Patients with these oral disorders seeking web-based information before or after healthcare visits are unlikely to find sufficient and reliable content they can understand and act upon accordingly. Thus, healthcare stakeholders may consider creating and integrating reliable information resources within the health services to support the patients' informed decision-making on their care plans and to maintain value-based healthcare services in line with Saudi Arabia's healthcare transformation vision for 2030.

Plain Language Summary

Patients with mouth skin changes, that raise the risk of mouth cancer, may search the net to find information to help them care for themselves and to ask for help – if they

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think a doctor visit will benefit them. There are good reading sources for Arabic health information about mouth health, but they are usually short and not enough. Also, the language can be difficult to understand and remember. To solve this, health professionals must create information about mouth diseases and make it available online to supplement what they have received during the clinical visits.

Introduction

Oral cancer (OC), mainly in the form of oral squamous cell carcinoma, remains a disease of concern to the affected individuals and healthcare services around the globe due to its high mortality and morbidity [1, 2]. In the Arab world, it is estimated that OC affects up to 1.8–2.3% of 100,000 of the population [3, 4]. These rates were comparable in Saudi Arabia, with an estimated incidence rate between 1994 and 2015 at 2.9/100,0000, distributed similarly between females (1.4 and 1.5 per 100,000, respectively) [5]. However, these rates might be higher considering other cancers affecting the oropharyngeal area, such as salivary gland neoplasms, leukaemias, and lymphomas [3]. Moreover, the population studies also indicated an increased age-specific incidence rate among females in their third to sixth decade and males aged 75 years old and above [5]. Regional differences within Saudi Arabia were also notable, with Jazan and Hail regions recording the highest and lowest OC incidences, respectively [5]. Such differences are likely due to dietary risk factors adopted in some regions, such as using smokeless tobacco (e.g., Shammah) and Khat plant (*Catha edulis*) [5, 6].

Many cases of oral squamous cell carcinoma are likely preceded by precursor oromucosal lesions collectively referred to as oral potentially malignant disorders (OPMDs) [7]. These include leukoplakia (LP), erythroplakia (EP), oral submucosal fibrosis (OSF), and oral lichen planus (OLP) [8]. Recently, oral graft-versus-host disease (OGvHD) and oral lichenoid lesions (OLLs) have been considered among the antecedent disorders that increase the risk of malignant transformation [8]. A systematic review indicated that this malignancy risk ranges between 4 and 11% for all OPMD subgroups and increased annual risk based on the presence and degree of oral dysplastic changes [9]. Recognised risk factors are similar to those associated with an increased risk of OC, such as using tobacco and drinking alcohol, chewing areca nut and betel quid, autoimmune disease (e.g., oral lichenoid changes), genetic disease (e.g., dyskeratosis congenital), and possibly human papillomavirus [10].

Regarding their prevalence, OPMDs are estimated to affect 3.7% of a Middle Eastern population, which is lower than their counterparts in Asia (10.5%) but slightly similar to those in South America/the Caribbean (3.9%) and Europe (3%) [11]. In Saudi Arabia, little is known about the population-based epidemiological and sociodemographic characteristics required to inform the national intervention strategies for individuals with these disorders [12]. Among tobacco users, up to 10% of adults attending dental clinics were found to have at least one of these disorders in Saudi Arabia [13]. Despite the methodological heterogeneity of assessed studies, a recent review indicated that prevalence rates of LP, OLP, and EP were between 0.2% and 11% among the studied populations in Saudi [12].

Preventive measures to reduce the malignant transformation and early detection of oromucosal changes include periodic monitoring and providing high-risk individuals with tailored information about worrying symptoms that require urgent care [12, 14]. However, patients and clinicians might not always agree on what information they need about these disorders or what is important [15]. With the widespread use of the internet and its reachability, individuals with these disorders are likely to seek online information before or after healthcare visits to understand their oral health better [16, 17]. Concerning OC and OPMDs, patients may look for information about their unsettling or distressing symptoms (e.g., ulcerative or erosive lesions in the mouth), lowering risk factors (e.g., a reasonable amount of alcohol consumption), screening and diagnosis (e.g., where to go for screening and evaluation), management options, and making informed decisions about their care plans [16, 18, 19]. The websites of academic institutions, government-funded or private hospitals, professional associations, hospitals, and not-for-profit organisations often provide various information concerning these disorders [18, 20]. However, concerns remain about content quality, comprehensibility, understandability, and actionability regarding OC and OPMDs in different languages [17, 20, 21].

Numerous tools are available to assess health information, with some specific to web-based health information [20]. Adopting these tools is often based on their usability, generalisability (e.g., generic or disease-specific instruments), whether an instrument can measure whether it is intended with no errors, interpretability of

the yielded scores, and user-friendliness [20, 22]. For instance, some mainly aimed to assess the quality of online information content and design (e.g., DISCERN, HIWET, LIDA, QUEST, Self-Assessment Method, and TEMPtED), health information in general (e.g., EQIP), health literacy demands (e.g., Health Literacy INDEX), and health reports to laypeople (e.g., ISQ and QIMR) [23–33]. Others have tailored their assessments for information about specific health topics, including Alzheimer's disease, diabetes, and medications [34–36].

Moreover, the Journal of American Medical Association (JAMA) quality benchmarks are considered suitable for assessing the quality of health information, including those related to oral diseases [37, 38]. Unlike many instruments that lack assessments of whether a reader can understand and act upon what they read, the Patient Education Materials Assessment Tool (PEMAT) showed good psychometric properties to assess the understandability and actionability of health-related materials [39, 40]. Currently, no up-to-date studies comprehensively analyse Arabic web content about oral and dental illnesses, particularly OC and OPMDs. Previous work on these conditions was conducted in another language or did not assess the understandability and actionability of OC and OPMD materials [16, 41, 42]. Therefore, this infodemiological study aimed to assess the characteristics, quality, actionability, and understandability of information about OC and OPMDS when a patient or layperson quickly searches the internet.

Materials and Methods

This was an online-based assessment of the content, quality, understandability, and actionability of Arabic information concerning OC and recognised OPMDs using the most commonly used search engine for health information and often yields the highest related health content (https://www.google.com) [8, 41, 43].

Search Terms

OC and 6 OPMDs (oral leukoplakia, oral erythroplakia, oral lichen planus, oral lichenoid lesions, oral submucous fibrosis, and oral graft-versus-host disease) were searched following the Arabic terms used in daily clinical consultations, the Unified Medical Dictionary [44], and online translation encyclopaedia (https://www.tbeeb.net). Given that visitors spend 5–6 min on average and often visit the first 10 websites related to health information in search engines [41, 45, 46], the first 20 websites of each term were accessed in 1 day (November 9, 2024) and archived for the assessments to avoid periodic content changes (online suppl. Files 1 and 2; for all online suppl. material, see https://doi.org/10.1159/000539051).

Inclusion and Exclusion Criteria

All websites included information about OC and OPMDs written for patients and the public. Those aimed at healthcare professionals, commercial content related to clinical services or products, broken links or those presented in languages other than Arabic, or included only information about extra-oral involvement of these disorders were excluded [16, 20, 41, 42, 47]. The excluded websites were identified using complex language and terms, reviews of medical literature, and a focus on a specific commercial product or service with limited information rather than addressing the patient or laypersons [20, 21].

Assessment Methods

1. Content assessment: websites were evaluated based on similar previous work on head and neck cancer [48] to (i) website affiliation (commercial, not-for-profit, university or medical centre, governmental or health authority, and news or social media), (ii) specialisation (website is entirely or partially aimed for OC/OPMDs), (iii) content presentation (medical facts, questions and answers, human interest stories, or clinical trials), and (iv) the use of audiovisual materials (image, video, audio, or none).
2. Quality assessment: JAMA benchmarks were used to assess the quality. These include (i) authorship (authors, their credentials, website ownership), (ii) attribution (source/s of information), (iii) disclosure (declaring any conflict of interest, funding sources), and (iv) currency (dates are noted and recent) [37]. Health on the Net (HON) seal, introduced in 1996, is granted to websites that consider 8 criteria: authoritative, complementarity, privacy policy, attribution/reference criteria, dates, justifiability, transparency, and financial disclosure and advertising policy [49].
3. Understandability and actionability assessments: PEMAT for printed (PEMAT-P) and audiovisual (PEMAT-AV) materials were used [39]. Items included in PEMAT-P (n = 24) and PEMAT-AV (n = 17) aimed to assess the understandability of information (the content, word choice and style, using numbers, organisation, layout and design, and use of visual illustrations) and its actionability. Items were binary rated (agree = 1, disagree = 0), leading to a score for each domain, with some items being rated as not applicable. Total scores given to each domain were separated (all scored points/all x 100) and presented as percentages (highest = 100%, lowest = 0%). Acceptable scores for both dimensions are at or above 70% [39].

Data Analysis and Quality Assurance

Descriptive analysis (mean [±SD], median, and percentages) was performed for the study variables on each assessed website. Data were initially represented and coded using Microsoft Excel (v. 16) and analysed using IBM SPSS Statistics (v. 29).

Results

A total of 140 websites were initially identified for the Arabic terms for "oral cancer," "leukoplakia," "erythroplakia," "oral lichen planus," "oral lichenoid lesions," "oral submucous fibrosis," and "oral graft-versus-host

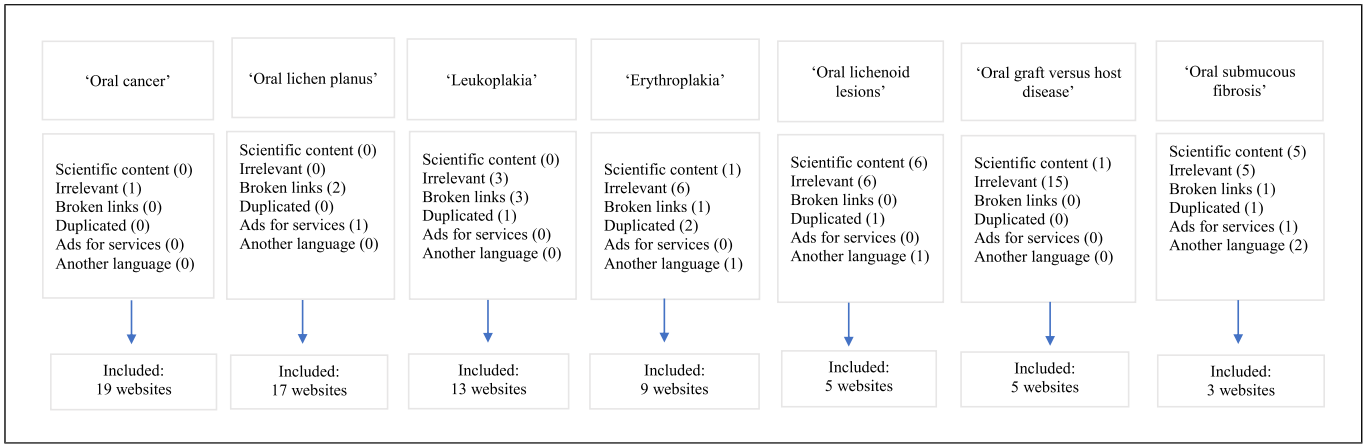

Fig. 1. Analysed and included website concerning OC and potentially malignant disorders.

disease" (online suppl. File 2). A total number of 70 websites were included in the analysis after excluding those with scientific content aimed at health professionals (n = 13), irrelevant content (n = 36), links that were broken (n = 8), duplicated (n = 7), advertisements for services or products (n = 5), and content presented in languages other than Arabic (n = 5) as shown in Figures 1 and 2. Of note, OC yielded the highest number of relevant websites (n = 19), followed by OLP (n = 17), compared to OSF, which yielded the lowest number of relevant websites (n = 3). Regarding the reasons for exclusion, irrelevant content was increasingly encountered in OGvHD searches (n = 15), whereas OSF generated the highest scientific content (n = 5) and languages other than Arabic (n = 2).

Regarding the website characteristics, 50% (n = 35) of the 70 included websites were affiliated with commercial (n = 20) and not-for-profit organisations (n = 14), 100% were partially related to OC and precancer (n = 70), 71% presented their content as medical facts (n = 50), and 61% presented their content as written information only without audiovisual materials (n = 43). Furthermore, the analysis for JAMA benchmarks indicated that 35 of these websites (50%) met the "currency" criteria compared to "disclosure," which was only met by 15 websites (21%). Also, the mean and median number of benchmarks obtained by the analysed websites was 2.5 and 2 out of 4, respectively. The HON seal was only found in only 1 of these 70 websites (Table 1).

The sub-analysis for each searched term showed that OC and LP websites obtained the highest average JAMA benchmarks (3.5 out of 4 for each), and the lowest was noted with OSF and OLL (1.33 and 1.2, respectively). Despite the variation of included websites for each term, OLP yielded the highest percentage of websites that met "authorship" criteria (58%), OGvHD for "attribution" (75%), OC for "disclosure" (36%), and LP for "currency" (69%) (Table 2).

Figure 3 indicates that only six websites (8%) achieved four JAMA benchmarks, 16 (22%) with three benchmarks, 23 (32%) with two benchmarks, 15 (21%) with only one benchmark, and 7 (10%) with none. Additionally, 57% of OC websites achieved three or more JAMA benchmarks compared to OGvHD (25%), LP (23%), and EP and OLP (22% each). OLL and OSF websites had the lowest scores in meeting three or more of these benchmarks.

Furthermore, the analysis of the 65 screened websites with printed materials using PEMAT-P indicated an overall low understandability and actionability at 63% and 45%, respectively. The six websites with audiovisual materials had relatively higher understandability (83%) and actionability (62%), as indicated by PEMAT-AV (Table 3). The highly rated understandability items for printed and audiovisual materials included making the material's purpose evident (93% and 100%), having informative headers (91% and 75%), breaking the information into short sections (89% and 100%), using visual cues to bring attention for key points (87% and 100%), providing a summary (85% and 100%), presenting information in a logical sequence (83% and 100%), and using everyday language (75% and 100).

PEMAT-P items with the lowest scores included lacking clear titles or captions for visual aids (51%), presenting information or content that distracts from its purpose (58%), and lacking the use of active voice (59%). Also, none of the websites with printed materials have used simple tables to illustrate the management or advice.

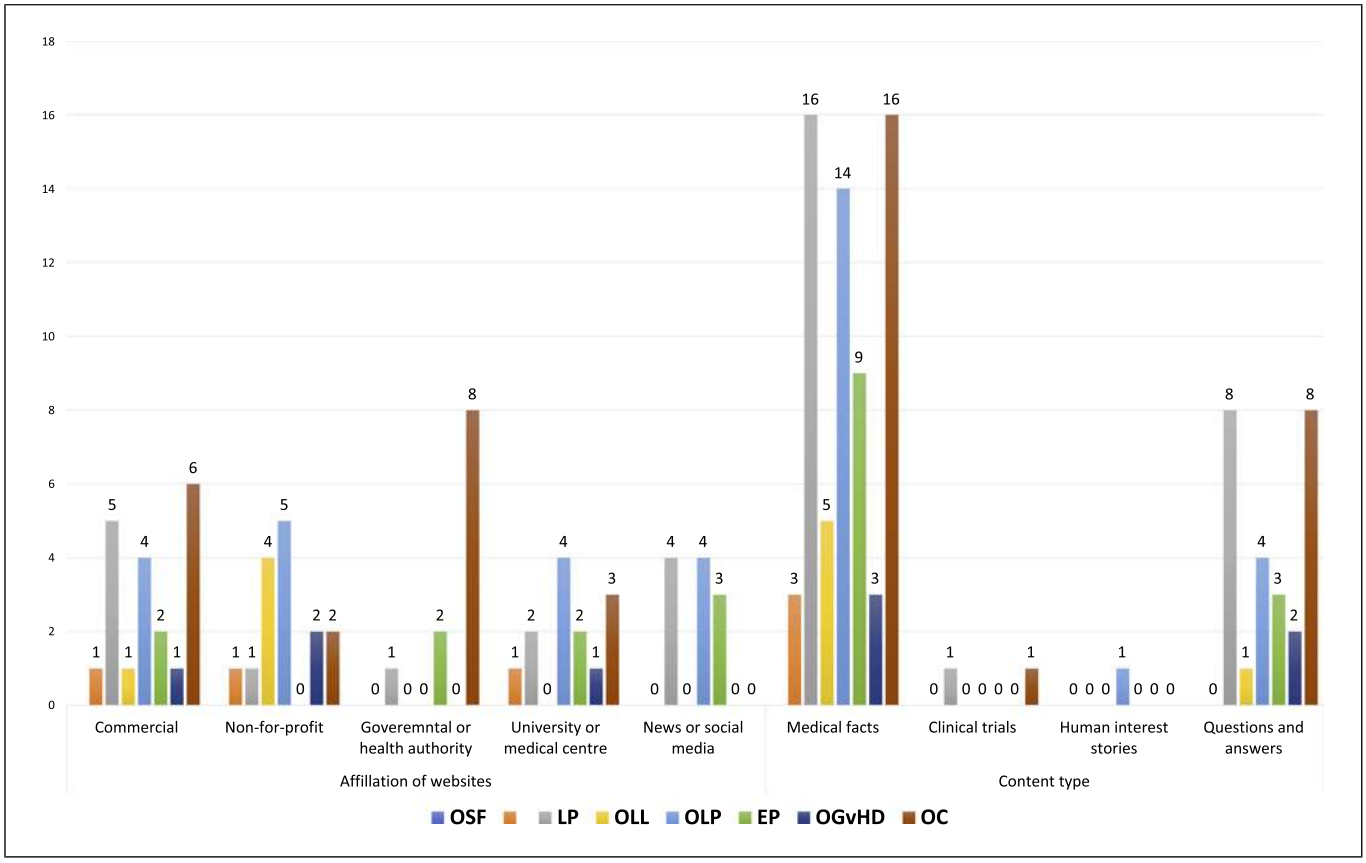

Fig. 2. Visual representation of website characteristics for each searched term.

PEMAT-AV indicated that all understandability items for audiovisual materials had scored 75% or higher (Table 3 and online suppl. File 3).

Concerning the actionability for both materials, most websites identified at least one action the user can take (100% and 87%) and broke down any action into manageable and explicit steps (75% and 87%) but inadequately addressed the user directly when describing actions (67% and 62%). Moreover, none of the websites with printed materials (n = 65) has shown simple instructions on how to perform calculations, and none of the websites (n = 70) explains how to use charts, graphs, or others to act (Table 3 and online suppl. File 4).

Regarding the acceptable level of PEMAT (≥70%) for understandability and actionability, a total of 37 and 11 of the 71 sources have scored this level or higher (52% and 15%, respectively). These were 64 websites with printed information, 6 with AV, and 1 with printed and AV materials. The sub-analysis of PEMAT-P demonstrated that this level was obtained by only 31 (47%) for understandability and 9 (13%) for actionability of the 65 websites. In contrast, 6 (100%) and 2 (33%) of the six websites with PEMAT-AV exceeded this cut-off level for both dimensions, respectively. Despite the low number of websites analysed with AV materials, content related to OLL, OC, OLP, and EP obtained high PEMAT-AV understandability scores (>80%). Furthermore, none of the LP, OSF, and OGvHD searches yielded any AV material (Table 4). Figure 4 also shows the general observations related to (1) web searches, (2) content quality and presentation, (3) language and translation, and (4) declarations among the analysed websites.

Discussion

It was not unexpected that Arabic readers looking for printed and audiovisual sources concerning oral diseases with increased risk for MT and OC will encounter difficulties finding adequate, reliable, understandable, and actionable online content allied to these diseases. It was

Table 1. The characteristics of the analysed websites (n = 70)

Characteristics	Criteria	*N* (%)
Affiliation of websites	Commercial	20 (28.5)
	Not for profit	15 (21.4)
	University or medical centre	13 (18.5)
	Governmental or health authority	11 (15.7)
	News or social media	11 (15.7)
Specialisation of websites	Partially related to OC and precancer	70 (100)
	Entirely related to OC and precancer	0 (0)
Content type[1]	Medical facts	50 (71.4)
	Questions and answers	18 (25.7)
	Clinical trials	1 (1.4)
	Human interest stories	1 (1.4)
Content presentation[2]	No audiovisual materials used	43 (61.4)
	Images	6 (8.5)
	Video	6 (8.5)
	Audio	0 (0)
JAMA benchmarks	Currency	35 (50)
	Authorship	26 (37.1)
	Attribution	21 (30)
	Disclosure	15 (21.4)
	Mean (SD)/median number of achieved benchmarks	2.5/2
HON seal	Yes	1 (1.4)
	No	69

[1]Some websites had one or more content types. [2]Some websites had one or more content presentations.

Table 2. The JAMA benchmark distribution for the included websites for each term

Term	Websites, *n* (%)				Mean total JAMA score
	authorship	attribution	disclosure	currency	
OC	7 (36.8)	7 (36.8)	7 (36.8)	10 (52.6)	3.5
LP	5 (38.4)	7 (53.8)	2 (15.3)	9 (69.2)	3.5
OGvHD	2 (50)	3 (75)	0 (0)	3 (75)	2
EP	4 (44.4)	4 (44.4)	2 (22.2)	7 (77.7)	1.89
OLP	10 (58.8)	5 (29.4)	3 (17.6)	10 (58.8)	1.65
OSF	0 (0)	2 (66.6)	0 (0)	2 (66.6)	1.33
OLL	3 (60)	0 (0)	1 (20)	3 (60)	1.2

EP, erythroplakia; LP, leukoplakia; OGvHD, oral graft-versus-host disease; OLL, oral lichenoid lesion; OSF, oral submucous fibrosis; OC, oral cancer.

noted that English content written for patients with these oral diseases was primarily designed for professionals [16, 17] – the Arabic content was no exception. In line with other similar previous studies in other languages, the found content was sometimes highly irrelevant to the searched disorders, often overlooking or overemphasising the risk of oral MT, and lacked declarations of funding and conflict of interests, and disease-specific information was difficult to understand and acted upon [16, 21, 50, 51]. Moreover, non-specialists and non-humans generally created/translated most of the analysed content (e.g., machine-translated to Arabic). As a result, this may affect

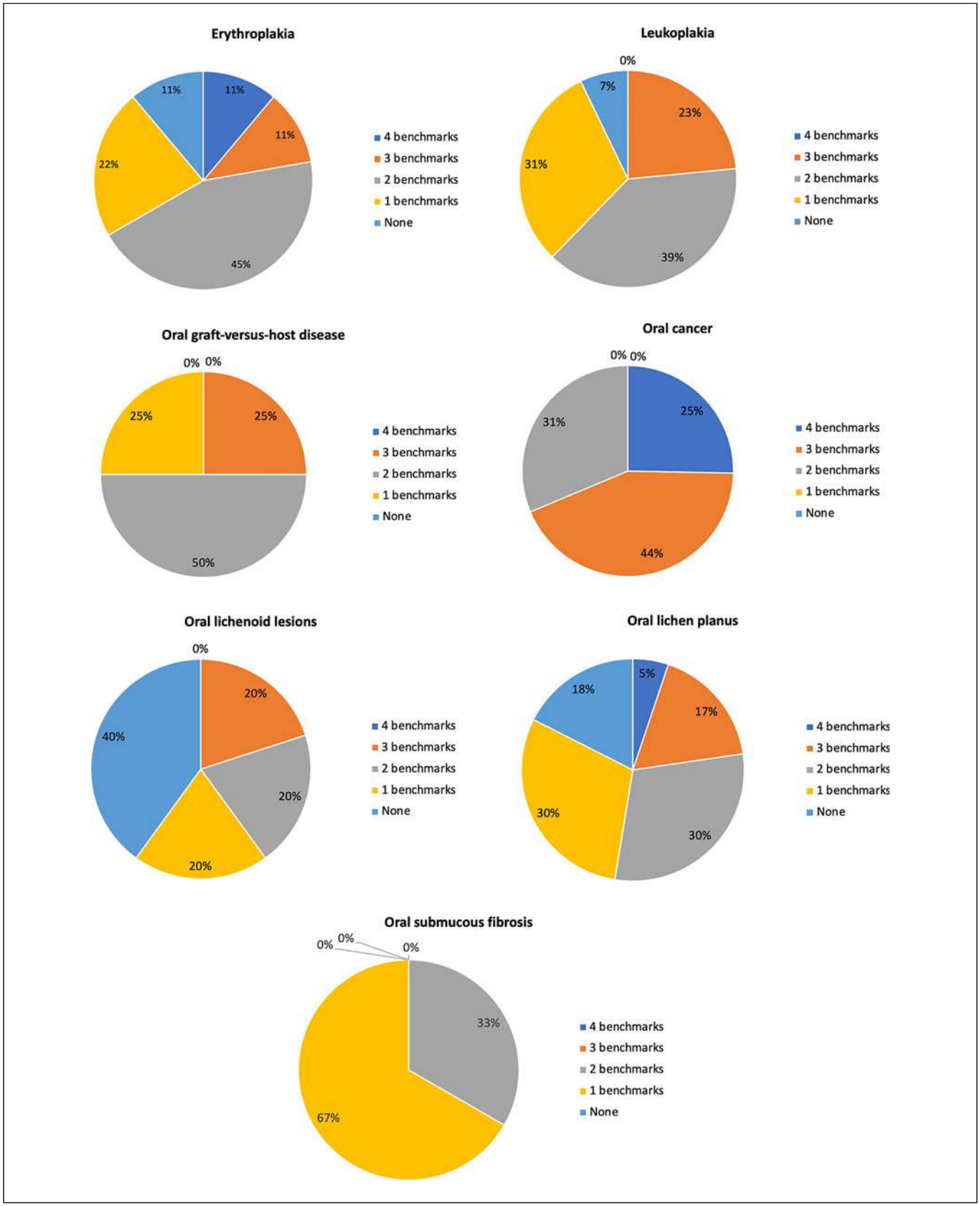

Fig. 3. The percentages of websites are based on the number of obtained JAMA benchmarks for each searched term.

Table 3. The mean PEMAT scores for all analysed websites (n = 70)

PEMAT items	PEMAT-P score, %	PEMAT-AV score, %
Overall understandability score	63	83
It makes its purpose completely evident	93	100
Sections have informative headers	91	75
Breaks or "chunks" information into short sections	89	100
Uses visual cues to draw attention to key points	87	100
Provides a summary	85	100
Presents information in a logical sequence	83	87.50
Uses common, everyday language	75	100
Does not expect the user to perform calculations[1]	67	–
Uses illustrations and photographs that are clear and uncluttered	66	100
Visual aids reinforce rather than distract from the content[1]	66	–
Medical terms are used only to familiarise the audience with the terms	65	100
Uses visual aids whenever they could make content more easily understood[1]	63	–
Numbers appearing in the material are clear and easy to understand	60	
It uses the active voice	59	75
Does not include information or content that distracts from its purpose[1]	58	–
Visual aids have clear titles or captions[1]	51	–
Uses visual cues to draw attention to key points[2]	–	100
Text on the screen is easy to read[2]	–	100
Allows the user to hear the words clearly[2]	–	100
Uses simple tables with short and clear row and column headings	N/A[3]	100
Overall actionability score	45	62.75
Clearly identifies at least one action the user can take	100	87.50
Uses visual aids whenever they could make it easier to act on the instructions[1]	85	–
Breaks down any action into manageable, explicit steps	75	87.50
Addresses the user directly when describing actions	67	62.50
Provides a tangible tool whenever it could help the user take action[1]	47	–
Provides simple instructions or examples of how to perform calculations[1]	N/A[3]	–
Explains how to use the charts, graphs, tables, or diagrams to take actions	N/A[3]	N/A[3]

[1]The item is specific to PEMAT-P (printable materials). [2]The item is specific to PEMAT-AV (audiovisual materials). [3]All items were scored as not applicable according to PEMAT.

Table 4. The mean PEMAT scores for all analysed websites (n = 70)

Search term (analysed printed and audiovisual websites, n)[1]	PEMAT-P scores, %		PEMAT-AV scores, %	
	understandability	actionability	understandability	actionability
LP (p = 13, av = 0)	79	45	N/A[2]	N/A[2]
OLP (p = 15, av = 2)	75	50	85	16
OC (p = 18, av = 2)	74	56	90	67
EP (p = 8, av = 1)	61	54	83	66
OSF (p = 3, av = 0)	54	53	N/A[2]	N/A[2]
OGvHD (p = 4, av = 0)	53	35	N/A[2]	N/A[2]
OLL (p = 4, av = 1)	45	30	91	100

EP, erythroplakia; LP, leukoplakia; OGvHD, oral graft-versus-host disease; OLL, oral lichenoid lesion; OSF, oral submucous fibrosis; OC, oral cancer. [1]Some websites included both printed and AV materials. [2]N/A: not applicable as no AV found.

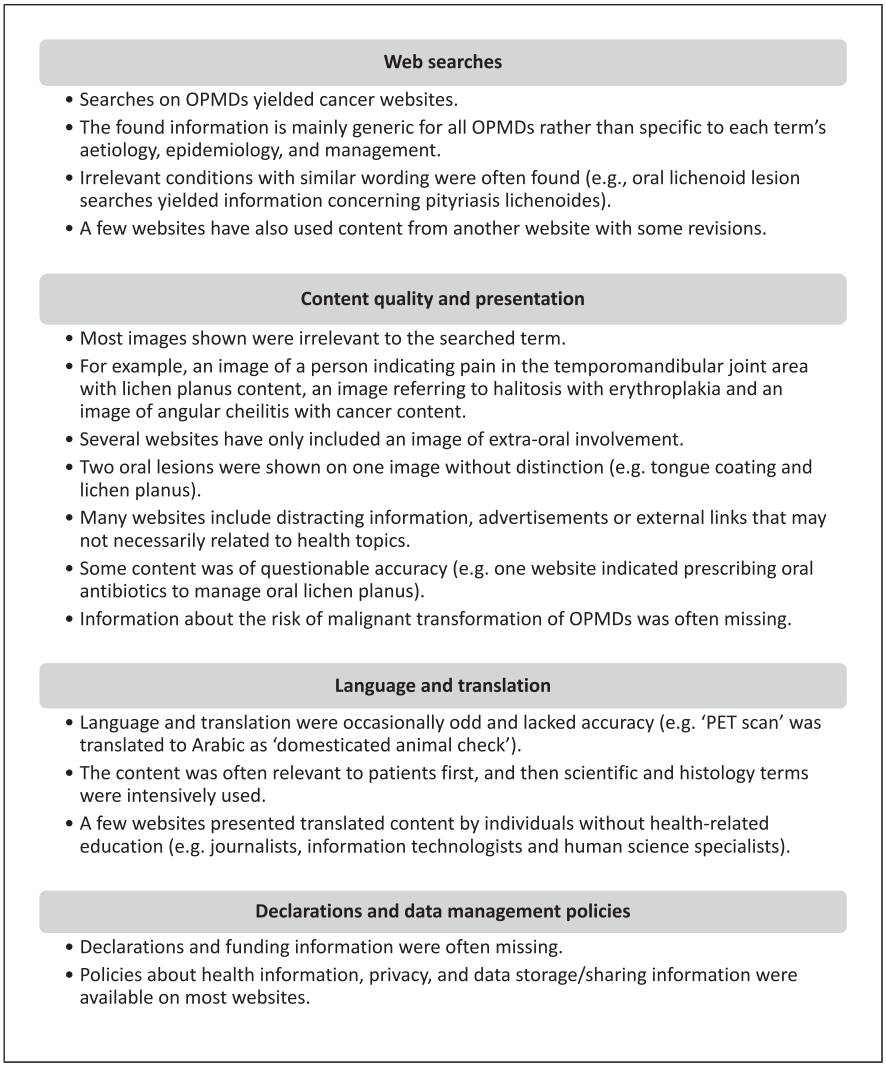

Fig. 4. General observations related to the web searches.

the patient's oral health literacy to obtain and comprehend health information needed to make informed decisions about the management of OPMDs and in adopting positive health-related behavioural changes (e.g., quitting tobacco use) that lower the risk of oral MT [41, 52, 53].

Individuals (or patients) with disabilities are likely to struggle to access and recall what they read as many websites lack AV materials, use irrelevant or unclear images, offer no text-to-audio function, and require calculation of risk or prevalence. Notably, most websites lack essential qualities for visual aids that could help understand the content, such as presenting clear titles for visual aids or using visual aids that distract the readers [54]. Also, several lacked active voice needed to make content readable, engaging, and interesting, especially among patients with low health literacy [55, 56]. As a result, these individuals could be less capable of identifying worrying oral mucosal changes (e.g., a white patch that lasts longer than 2 weeks) and seek professional assistance when symptoms arise or progress [52, 57, 58].

Each term's included websites were proportional to their prevalence in a population and previous studies [13, 16] except for OSF. This might reflect the generally lower prevalence of OSF in the Middle East than in other parts of the world despite the widespread use of various chewing habits (e.g., Khat and Shammah) in specific areas of this region [11, 59].

Previous studies indicated generally low-quality online content regarding OPMDs: many lacked evidence to support the information, and the content might have raised disproportionate alarm, inadequate symptom

description, and questionable suitability of the suggested advice [16, 17, 21]. Differences were sometimes between languages as the English content on OC might present a higher quality and comprehensiveness than that of Spanish and Portuguese languages [20, 42]. Nevertheless, the present low achievement of JAMA benchmarks indicated by their achieved numbers per site presently (2.5 out of 4) was higher than those found in English dental topics such as medication-induced osteonecrosis of the jaw [1.6] [60] and molar hypomineralisation [1.3] [61].

Some websites (e.g., Wikipedia) met the "disclosure" criterion but lacked this on content creators due to their collaborative content generation and editing functions [62]. Furthermore, the present analysis of Arabic OC websites (n = 19) indicated lower rates of presenting authors/their affiliations and attributions of content (36% each) compared to 56% and 67% of 27 Portuguese OC websites, respectively [42]. Furthermore, previous assessments of Arabic OC websites demonstrated low attainment of authorship (17%) and attribution (12%) compared to disclosure (59%) in 86 websites [41]. There was no notable difference between these benchmarks (36% each), perhaps due to the 4-year difference and the number of analysed websites between both studies.

HON seal was rarely found in parallel with studies assessing online oral health topics [17, 60, 61]. This is likely because professionals are unaware of its existence, health information seekers do not usually know its purposes, or these websites do not meet the necessary HON certification criteria [49, 60]. Concerning understandability and actionability, it was notable that content in most analysed websites was presently scored below the recommended cut-off (>70%) for material to be read and acted upon [39]. Like other studies on health topics, most of the found materials received lower actionability scores than understandability [61, 63, 64]. Hence, this may hint at a limited reader's ability to take action despite being able to understand what they have read [39].

Many websites were not-for-profit initiatives towards supporting high-quality Arabic health information online with an editorial board of health practitioners (e.g., https://www.sehatok.com/, https://www.ibelieveinsci.com). Other websites presented the estimated time needed to read their material (e.g., https://www.ilajak.com/ar/blog/oral-cancer) and a downloadable audio version of the written information and text display options (e.g., interactive and slide showing content, text magnification, and highlighting) (https://www.moh.gov.sa/awarenessplateform/ChronicDisease/Pages/HeadAndNeckCancer.aspx). Therefore, clinicians and health education specialists may consider these functions and initiatives when developing online health information and hinting at trusted information sources during clinical consultations and patient education materials [17, 50].

The study's strengths included assessing Arabic web-based content concerning seven oral diseases, which were not previously assessed except for OC [41]. It also provides informative findings about who created the content and its characteristics, reliability, trustworthiness, and the ability of a person to understand and act upon the Arabic printed/AV materials on OPMDs and OC by using validated instruments, which are considered suitable to assess information in different languages and health topics [37, 39]. Previous studies did not necessarily assess the understandability and actionability of the searched materials on these disorders and other Arabic oral health-related topics [18, 21, 47, 65].

The study was limited by restricting the searches to the top 20 websites for each term and limiting the search to one search engine [42]. This was in line with the present objectives to see what comes up when a patient "quickly" searches the internet for oral cancer and precancers, as most health information seekers do online [22]. It did not intend to comprehensively assess the content for each disorder, which is usually assessed independently considering their different aetiology, epidemiology, clinical presentations, and sometimes management approaches [20, 21, 42, 51]. Furthermore, the low number of eligible websites (70 out of 140) is likely due to the several Arabic synonyms for OPMDs, like those concerning Arabic dental caries materials [47].

Previous work used more than one search engine to assess online information for OPMDs, but these were commonly used in countries (e.g., the UK and USA) where the study was conducted [16, 20]. Also, whether the found Arabic content is accurate, up-to-date, and evidence-based is yet unknown [20, 66]. There was no patient input or assessments on their internet and health information use. Most websites do not count the number of hits or visitors that can help estimate their use. Finally, some disorders or lesions that could increase the risk of OC (e.g., actinic cheilitis, dyskeratosis congenita, palatal lesions in reverse smokers, Bloom's syndrome, and xeroderma pigmentosum) were not included due to their relatively rare incidence worldwide and among non-white populations compared to the searched terms [8, 11, 67].

Further assessments may, therefore, consider conducting focused analysis on each using different search engines (e.g., Google, Bing, Yahoo, YouTube), social media platforms (e.g., Twitter, Facebook, TikTok) using their Arabic synonyms of these disorders [17, 20, 21, 38]. Also, healthcare providers and patient education experts may consider liaison with experts in Arabic linguistics and translation to update the WHO-adopted Unified Medical Dictionary (https://umd.emro.who.int/whodictionary) that currently lacks the translation of combined terms such as OLL and OGvHD – should a clinician search for it.

Saudi Arabia's Health Sector Transformation Program for Vision 2030 ensures sufficient health information for healthcare consumers. It also promotes understanding their disease, prevention, and self-care as part of their value-based management plans [46]. There is a high need for organisational efforts and initiatives that address the present study limitations for qualitative assessments of the accuracy, comprehensiveness, and evidence-based basis of Arabic health on the web, specifically towards OC and OPMDs. The nationally recognised King Abdullah Bin Abdulaziz Arabic Health Encyclopaedia initiated in 2012 is worth highlighting. It aimed to provide the community with reliable, up-to-date Arabic health information on various medical topics, human body anatomy, tips for a healthy lifestyle, and valuable links for self-care and advice [68]. Such national initiatives may include population and patient-based appraisals on the utilisation to obtain health information on OC and OPMDs. Also, seeking online health information about these disorders can be assessed with relevance to the patient's preferred source/s of health information (e.g., governmental or healthcare services, health professionals, and not-for-profit or social networks). Whether this information led to adopting favourable health behaviour changes and outcomes could also be addressed.

Healthcare performance assessment and improvement can be conducted by asking patients and the public about their perspectives and satisfaction towards the appropriateness of obtained information and whether this affected the healthcare utilisation (e.g., number and pattern of visits to oral or general healthcare services) [69, 70]. These assessments could also consider the self-rated general and oral health, demographics, and socioeconomic characteristics to deliver a high-quality and value-based healthcare service that reduces the unmet needs of specific patient populations and the public [46].

Conclusion

The present findings indicated that patients or the public seeking online information about OC and OPMDS are likely to encounter difficulty in finding sufficient and reliable content that will meet their information needs and help them understand and act based on what they read. Only 50% of the 140 screened websites were found relevant, with OC and OLP websites representing half of the relevant ones. These websites achieved only 2.5 of the 4 JAMA quality benchmarks, and many failed to declare any conflict of interest, funding, and sources of information. It seemed that materials in more than half of these websites are easily understood, but only 15% achieved the recommended level for actionability. The study findings could help inform a national incentive for an Arabic information encyclopaedia that meets the needs and expectations and promotes awareness of the patients and the public towards these possibly life-threatening and morbidity-causing oral disorders.

Statement of Ethics

An ethics statement was not required for this study type; no human or animal subjects or materials were used.

Conflict of Interest Statement

The author has no conflicts of interest to declare.

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Author Contributions

Abdullah Alsoghier designed the study, analysed the data, prepared the initial manuscript, and approved the final manuscript.

Data Availability Statement

The data that support the findings of this study are not publicly available due to detailed analysis of the numerous search terms and assessment tools, but are available from the corresponding author (A.A., aalsoghier@ksu.edu.sa).

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