

Assessment Of Knowledge About Oral Cancer Among Medical Students In Khartoum State 2021 - 2022

(Institutional Based Cross sectional study at faculty of Medicine in Karary University, Neelain University and Nile University.)

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Abstract:

Background:

Oral cancer is a global public health issue, with developing countries bearing the brunt of the disease burden. In Sudan, oral cancer is the third most common cancer, significantly associated with lifestyle risk factors such as tobacco and alcohol use. Early detection is critical for improving survival rates, yet medical students in Sudan are often undertrained in recognizing oral cancer symptoms. This study aimed to assess the level of knowledge about oral cancer among medical students in three universities in Khartoum, Sudan.

Methods:

A cross-sectional, institutional-based study was conducted among 297 pre-final and final-year medical students from Karary University, Neelain University, and Nile University between September 2021 and July 2022. Data were collected using a self-administered online questionnaire assessing students' knowledge of oral cancer risk factors, clinical presentations, and referral practices. The data were analyzed using descriptive statistics and chi-square tests for associations, with significance set at $p < 0.05$.

Results:

The study revealed that 75% of students had moderate knowledge of oral cancer, while 23% demonstrated poor knowledge and only 2% showed high knowledge. Tobacco and alcohol were correctly identified by 87.9% of students as the primary risk factors for oral cancer. However, critical clinical signs such as lymphadenopathy and induration were poorly recognized by 18.7% and 8.5% of students, respectively. Most students (51.2%) indicated they would refer suspected cases to an oral medicine specialist. A significant proportion (78.8%) admitted to lacking sufficient knowledge about oral cancer prevention and detection.

Conclusion:

The findings highlight a moderate level of knowledge about oral cancer among medical students, with notable gaps in recognizing key clinical signs and referral pathways. Educational interventions, including integrated oral health training and interdisciplinary collaboration, are essential to improve early detection and management of oral cancer. Reforming medical curricula to include comprehensive oral

cancer education is recommended to enhance future healthcare professionals' ability to manage this critical public health issue.

KEY WORDS: Oral cancer, medical students, knowledge assessment, risk factors, clinical presentation, Sudan, referral practices, early detection, oral health education, medical curriculum.

I. INTRODUCTION

ORAL CANCER IS A GLOBAL PUBLIC HEALTH PROBLEM WITH AVERAGE OF TWO THIRD OF THE TOTAL CASES TAKE PLACE IN DEVELOPING COUNTRIES 1,2 , ORAL CANCER INCLUDES CANCERS OF THE LIP, TONGUE AND REST OF THE ORAL CAVITY, AS WELL AS CONSIDERED PREDOMINANT CAUSE OF HIGH MORBIDITY AND MORTALITY RATES WORLDWIDE ESPECIALLY IN DEVELOPING COUNTRIES 3. WITH 14 MILLION NEW CASES INCIDENCE RATE, ORAL CANCER ALONE CLAIMS ABOUT 300.000 DEATHS (2.1%) ANNUALLY WITH 1.8% MORTALITY RATE WORLDWIDE 4, 5. SIGNS OF SEVERAL SYSTEMIC DISEASES AND CONDITIONS CAN BE MANIFESTED IN THE MOUTH, WHICH MAKES THE ORAL CAVITY AN IMPORTANT DIAGNOSTIC TOOL FOR HEALTH PROFESSIONALS, UNFORTUNATELY, ANY CANCER HAS THE POTENTIAL TO SPREAD TO ANY OTHER PART OF THE BODY, THEREFORE CANCER IS SUCH A FRIGHTENING DISEASE. MOREOVER; ORAL CAVITY CANCER TENDS TO SPREAD PRIMARILY TO THE LYMPH NODES OF THE NECK FIRST BEFORE IT SPREADS OR METASTASIZES TO OTHER AREAS 6. ACCORDING TO THE LATEST WHO DATA PUBLISHED IN 2018 ORAL CANCER DEATHS IN SUDAN REACHED 1,230 OR 0.49% OF TOTAL DEATHS. THE AGE ADJUSTED DEATH RATE IS 5.84 PER 100,000 POPULATIONS, ALSO; ORAL CANCER IS CONSIDERED THE THIRD MOST COMMON CANCER IN SUDAN AFFECTING ANNUALLY 3.7% FOR MEN AND 2.6% FOR WOMEN 7 .

Several lifestyle risk factors for the development of oral cancer are strongly associated with common social behaviors among Sudanese people like alcohol,

dietary factors and the most commonly associated risk for oral cancer is smokeless tobacco (Tombak) ⁸. Typical signs and symptoms of oral cancer includes: white and red patches on the lining of the oral cavity mucosa, persistent unhealed ulcers, swellings within the mouth, loosening of teeth without obvious cause, pain and stiffness of the joints, difficulty or pain with swallowing, speech difficulties, reduced mobility of the tongue and numbness ⁸. The oral cancer may be identified at an early stage by different means of both visual and tactile clinical examinations by dentists as they considered key role health professionals in counseling patients about early detection of this disease beside their professional potential to identify asymptomatic lesions and to diagnose disease before it starts unfolding with devastating complications ⁹. Meanwhile Sudan demonstrates lack of dentists particularly in peripheral states compared to medical doctors, with average of 23% of medical schools in Sub-Saharan Africa and 10% of that in EMRO Region are placed in Sudan ⁹, therefore many of the patients in distant localities and peripheral states are presented to medical doctors at medical clinics and hospitals with oral cancer signs and symptoms seeking management and consultation due to lack of oral health services and inappropriate referral system and patients factors, hence adequate clinical knowledge about Oral diseases in general and Oral cancer in particular is mandatory for medical students as well as dental students. Furthermore, the strong association between oral cancer and systemic health necessitate that every medical student should have the basic knowledge about oral cancer signs and symptoms, accordingly diminution of potential risk induced by late referral to dental hospitals as result of misdiagnosis and improper management of presented might be ensured, with regard to fact of that Medical practitioners are given much less oral pathology training than dentists and therefore might be expected to have lower level of knowledge about oral cancer and related issues ¹⁰.

This study aimed to assess the level of knowledge among medical students about oral cancer in three faculties of medicine in Khartoum state (Karary University, Neelain University and Nile University), each medical faculty represent different localities in Khartoum state (Omdurman, Khartoum and East Nile localities respectively). The knowledge assessment survey covers set of objectives include knowledge of signs and symptoms, risk factors and consequences, Clinical diagnosis potential, as well as perception of medical students toward their academic needs for basic knowledge about oral cancer to help medical authorities and institution integrate oral health and refine their curriculum.

II. Methodology

Institutional based descriptive cross sectional study was conducted in the period of Sep 2021 – July 2022; a pre tested online self-administered questionnaire (Google forms) was sent to survey medical student's knowledge about Oral cancer, signed consent was

obtained, privacy and confidentiality of the research participants has been guarded and the real purpose and the use of the research data was explained to participants. Moreover, data from incomplete questionnaires (e.g., questionnaires with no consent to participate or left unanswered sections) were erased due to impossible handling and interpreting the data. The assessment survey covered three randomly chosen medical colleges in Khartoum state (Omdurman = Karary University / Khartoum = Neelain University / Bahri (East Nile) = Nile University), all the study participants were required to meet the following criteria: (1) final / Semi-final year medical students from both genders and (2) shouldn't be a previous dental graduate.

Sampling: A sample size of 297 medical students was set using the standard equation For the sample calculation to be scientific and reflect the characteristics of the population using this formula: $n = N / (1 + N(d)^2)$ with equal proportion relative to each medical college students number (Karary University (101) 34% / Nile University (81) 27.3% / Neelain University (115) 38.7%). The sample units were selected conveniently from each college.

Data Collection: The online questionnaire distributed to participants was Composed of Demographic data include; Gender, grade and college in addition to three different sections comprised of close ended questions; **first section** composed of two questions to assess knowledge about risk factors, **Second section** composed of five questions to assess clinical diagnosis skills of medical students by presenting different images of malignant and premalignant lesions/ Conditions, Common form of oral cancer frequently seen, clinical presentation of oral cancer, The referral option and association of oral cancer with general health status, and **the third section** composed of three questions aimed to reflect the self-perception of medical students toward their general knowledge about clinical manifestations of oral cancer, perceived knowledge about oral cancer detection and prevention and the preferred tools to improve their oral cancer knowledge.

The overall level of knowledge about oral cancer was assessed via multiple different response options from seven variables (and 32 questions) in the 1st and 2nd sections of the questionnaire as seen in Appendix ²; the original categories recorded into 0 = poor knowledge, 1 moderate knowledge and 2 high knowledge according to correct answers in response options. The maximum score of specific 24 correct answers in response options from the overall relevant questions, therefore Median score of knowledge was set as 12. Score from 0 – 8 is considered poor knowledge 9 – 16 is considered moderate knowledge and 17 – 24 is considered High level of Knowledge.

DATA ANALYSIS: DATA WERE ENTERED AND ANALYSED USING THE STATISTICAL PACKAGE FOR SOCIAL SCIENCE PROGRAM, VERSION 26. DESCRIPTIVE ANALYSES WERE PERFORMED USING FREQUENCIES TABLES AND PERCENTAGES. FOR THE BIVARIATE ANALYSIS CHI-SQUARE TESTS WERE PERFORMED TO EVALUATE THE CATEGORICAL VARIABLES; THE LEVEL OF SIGNIFICANCE WAS SET AT $P < 0.05$ WITH 95% CONFIDENCE INTERVALS (95% CI)

III. RESULTS:

The survey involved 297 medical students from Karary University, Neelain University, and Nile University, with 47.5% of participants in their fifth year of study. The majority (87.9%) identified tobacco and alcohol as the most common causes of oral cancer in Sudan, with 75% of respondents demonstrating a moderate level of knowledge about oral cancer. Only 2% exhibited high knowledge, while 23% had poor knowledge. Regarding the clinical presentation of oral cancer, 47.9% of students identified ulceration and swelling as the most common manifestations, though only 18.7% considered lymphadenopathy, and a small fraction (14.3%) thought numbness and induration were potential signs. Additionally, 19.1% believed malodor could be a manifestation of oral cancer.

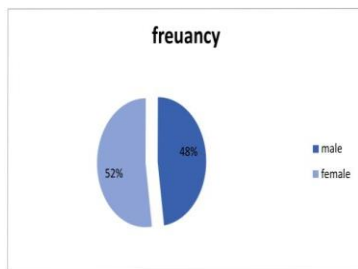


Figure No (1): gender of medical students participate

Figure 1: show females more than males

Table No(1): frequency of student from Karary university , Alnile university ,Alnelien university

| University | | | |
|------------|---------------------|-----------|---------|
| | | Frequency | Percent |
| Valid | Karary university | 101 | 34% |
| | Alnile university | 81 | 27.3% |
| | Alnelien university | 115 | 38.7% |
| | Total | 297 | 100% |

Table:1 show most students from alnelien university, the least ones from alnile.

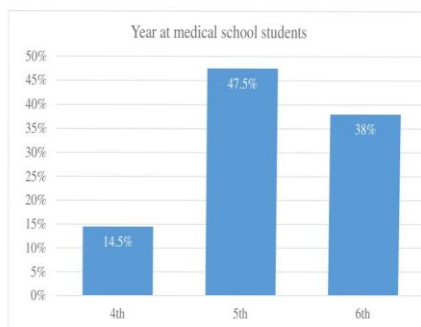


Figure No (2): proportion of year at medical student

Table No (2): student knowledge about most common cause of oral cancer in Sudan

| most common cause of oral cancer in Sudan | | | |
|---|---------------------|-----------|---------|
| | | Frequency | Percent |
| Valid | Tobacco and Alcohol | 261 | 87.9% |
| | Radiation | 10 | 3.4% |
| | Spicy food | 3 | 1% |
| | Poor Oral hygiene | 23 | 7.7% |
| | Total | 297 | 100% |

Table:2 The table show that most students think tobacco and alcohol the most common cause of oral cancer

While some students think poor oral hygiene and very few students choose spicy food

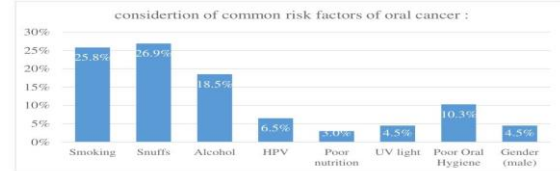


Figure No (3): knowledge about consideration of common risk factors of oral cancer
Figure:3 show that Most students considered smoking and snffus are the most risk factors followed by alcohol while the poor nutrition was chosen by 3% of student

Table No (3): The knowledge of student about clinical presentation for oral cancer

| Multiple Response Frequencies | | | |
|--|----------------------|-----------|---------|
| | | Responses | |
| | | N | Percent |
| Regarding clinical presentation for oral cancer: | Swelling | 187 | 23.5% |
| | Ulceration | 194 | 24.4% |
| | Lymphadenopathy | 149 | 18.7% |
| | Numbness | 46 | 5.8% |
| | Malodor (bad breath) | 152 | 19.1% |
| | Induration | 68 | 8.5% |
| Total | | 796 | 100.0% |

Table: 3 The table show that Ulceration and swelling were high percentages of oral cancer presentation ,malodor and lymphadenopathy have moderately percentages while induration and numbness have low percentages.

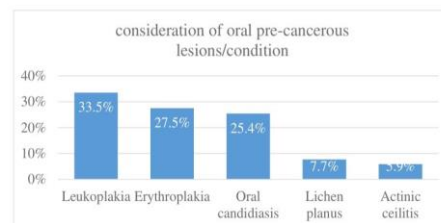


Figure No(4): consideration of oral pre-cancerous lesion/condition

Figure: 4 show leukoplakia was the high rate, while Erythroplakia and oral candidiasis were moderate rate , lichen planus and actinic cheilitis were the low rate

Table No (4): Having enough information about oral cancer

| importance for having enough information about oral cancer | | | |
|--|-------|-----------|---------|
| | | Frequency | Percent |
| Valid | Yes | 246 | 82.8% |
| | No | 51 | 17.2% |
| | Total | 297 | 100% |

Table:4 show high percentage of students who think it's important for them to get enough formation about oral cancer , few students think it's not important

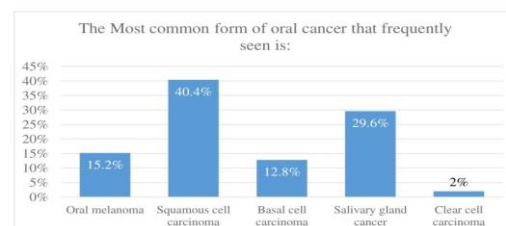


Figure:5 knowledge about the most common form of oral cancer that frequently seen

Figure:5 show that high value was found for squamous cell carcinoma while clear cell carcinoma has least value.

Regarding precancerous lesions, leukoplakia was the most recognized (33.5%), followed by erythroplakia (27.5%) and oral candidiasis (25.4%). The most common form of oral cancer identified by the students was squamous cell carcinoma (40.4%), while clear cell carcinoma was the least recognized (2%). When it came to referral preferences, 51.2% of the participants indicated they would refer patients suspected of having

Table No(5): Common cause of oral cancer in Sudan

| | | Tobacco and Alcohol | Radiation | Spicy food | Poor Oral hygiene | total |
|------------------------|-----|---------------------|-----------|------------|-------------------|--------|
| Year at medical school | 4th | 30 | 4 | 0 | 9 | 43 |
| | | 10.1% | 1.3% | 0.0% | 3.0% | 14.5% |
| | 5th | 124 | 5 | 2 | 10 | 141 |
| | | 41.8% | 1.7% | 0.7% | 3.4% | 47.5% |
| | 6th | 107 | 1 | 1 | 4 | 113 |
| | | 36.0% | 0.3% | 0.3% | 1.3% | 38.0% |
| Total | | 261 | 10 | 3 | 23 | 297 |
| | | 87.9% | 3.4% | 1.0% | 7.7% | 100.0% |

Table: 5 the table show that a significant relationship of 000 between grade of medical student and knowledge about common cause of oral cancer in Sudan

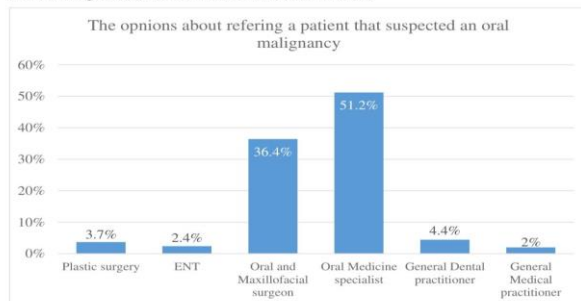


Figure No (6): The option about referring a patient that suspected an oral malignancy

Figure (6): show all answers shows mostly will refer to oral medicine specialist and some of them will refer to oral maxillofacial surgeon few will refer to plastic surgery or ENT, and very few to general practitioner.

Oral cancer to an oral medicine specialist, while 36.4% preferred referring to an oral and maxillofacial surgeon. Only 2% would refer patients to a general practitioner, reflecting a reasonable understanding of referral protocols for oral cancer. Finally, 82.8% of students expressed the importance of having sufficient information about oral cancer, and 78.8% admitted that they lacked sufficient knowledge about its prevention and detection. There was also a significant correlation between the students' year of study and their level of knowledge about the association of oral cancer with general health ($p = 0.01$).

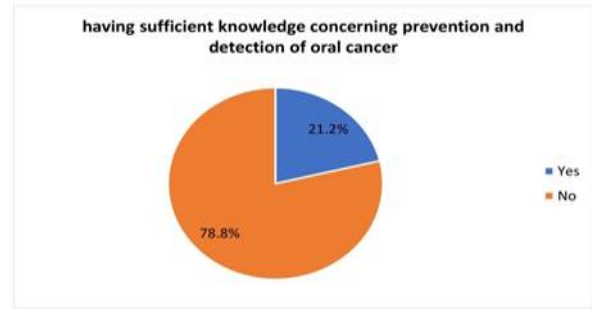


Figure No (7): assessment of student about having sufficient knowledge concerning prevention and detection of oral cancer

Figure: 7 show that student mostly don't have sufficient knowledge concerning prevention and detection of oral cancer

Table No (6): Common form of oral cancer that frequently seen

| | | Oral melanoma | Squamous cell carcinoma | Basal cell carcinoma | Salivary gland cancer | Clear cell carcinoma | Total |
|------------------------|-----|---------------|-------------------------|----------------------|-----------------------|----------------------|--------|
| Year at medical school | 4th | 5 | 24 | 5 | 8 | 1 | 43 |
| | | 1.7% | 8.1% | 1.7% | 2.7% | 0.3% | 14.5% |
| | 5th | 26 | 63 | 14 | 34 | 4 | 141 |
| | | 8.8% | 21.2% | 4.7% | 11.4% | 1.3% | 47.5% |
| | 6th | 14 | 33 | 19 | 46 | 1 | 113 |
| | | 4.7% | 11.1% | 6.4% | 15.5% | 0.3% | 38.0% |
| Total | | 45 | 120 | 38 | 88 | 6 | 297 |
| | | 15.2% | 40.4% | 12.8% | 29.6% | 2.0% | 100.0% |

Table: 6 The table show that a significant relationship of .005 between grade of medical student and common form of oral cancer that frequently seen

Table No (7): Referral of the patient if suspected an oral malignancy

| | | Plastic surgery | ENT | Oral and Maxillofacial surgeon | Oral Medicine specialist | General Dental practitioner | General Medical practitioner | Total |
|------------------------|-----|-----------------|------|--------------------------------|--------------------------|-----------------------------|------------------------------|--------|
| Year at medical school | 4th | 5 | 1 | 15 | 17 | 1 | 4 | 43 |
| | | 1.7% | 0.3% | 5.1% | 5.7% | 0.3% | 1.3% | 14.5% |
| | 5th | 5 | 4 | 63 | 59 | 9 | 1 | 141 |
| | | 1.7% | 1.3% | 21.2% | 19.9% | 3.0% | 0.3% | 47.5% |
| | 6th | 1 | 2 | 30 | 76 | 3 | 1 | 113 |
| | | 0.3% | 0.7% | 10.1% | 25.6% | 1.0% | 0.3% | 38.0% |
| Total | | 11 | 7 | 108 | 152 | 13 | 6 | 297 |
| | | 3.7% | 2.4% | 36.4% | 51.2% | 4.4% | 2.0% | 100.0% |

Table: 7 The table show that significant relationship of 031 between the grade of medical student and referral of the patient if suspected an oral malignancy



Figure No (8): manifestation of oral cancer and general knowledge of medical student about it Figure: 8show mostly are mildly and poorly informed, less students are moderately informed, and very few students think they well informed.

IV. DISCUSSION:

The findings of this study reveal a moderate level of knowledge about oral cancer among medical students in Khartoum, consistent with prior research conducted in similar settings. The majority of students (75%) exhibited a moderate understanding of oral cancer, with only 2% demonstrating high knowledge. These results align with the study by Gunjal et al. (2020) conducted in Malaysia, which also found that medical students had a lower level of awareness compared to dental students, particularly in recognizing risk factors and clinical signs of oral cancer (11,7).

A significant number of participants correctly identified tobacco and alcohol as the leading risk factors for oral cancer (87.9%), reflecting a sound awareness of the primary causes. However, other crucial clinical presentations, such as lymphadenopathy (18.7%), numbness (14.3%), and induration (8.5%), were less frequently recognized. This gap in knowledge mirrors findings from Carter and Ogden's (2007) study in the UK, where medical students also struggled to identify common oral cancer manifestations such as leukoplakia and erythroplakia (7,12). These deficits suggest a need for enhanced education focused on the clinical presentation of oral cancer to ensure early detection and timely intervention.

The results show that students generally preferred to refer suspected oral cancer cases to oral medicine specialists (51.2%) and oral and maxillofacial surgeons (36.4%). However, a small percentage (3.7%) indicated they would refer patients to plastic surgeons or ENT specialists, highlighting some confusion about the appropriate referral pathways. This confusion could result from insufficient training and collaboration between medical and dental professionals. As seen in the study conducted by Kujan et al. (2013) in Saudi Arabia, where 72% of medical students did not feel confident in performing oral examinations, medical students in this study also exhibited a lack of confidence, with 78.8% stating they did not have sufficient knowledge to prevent or detect oral cancer (13). Another notable finding was that 33.5% of participants identified leukoplakia as a pre-cancerous lesion, but fewer students recognized erythroplakia (27.5%) and oral candidiasis (25.4%). This limited recognition of pre-cancerous conditions is consistent with findings from Carter and Ogden (2007), where medical students were less likely than dental students to identify key oral changes associated with cancer, such as erythroplakia and erythro-leukoplakia (12). This suggests that medical curricula may lack sufficient emphasis on the oral cavity as an important diagnostic tool for systemic diseases, including cancer.

The knowledge gap was also evident in students' understanding of oral cancer's association with systemic health. While 84.2% recognized this link, a significant 15.8% of students were unaware of this association. Oral cancer is strongly connected to general health issues, such as immune system deficiencies and chronic diseases, which can affect the progression and prognosis of the disease. This

emphasizes the need for integrated teaching approaches that connect oral health with broader medical education to prepare medical students for holistic patient care.

The comparison of our findings with studies from other regions further underscores the need for reform in medical education. For instance, in the study by Pokharel et al. (2017) in Nepal, similar deficiencies in knowledge about oral cancer were noted, particularly regarding the examination of patients and the identification of premalignant lesions (14). These findings are not unique to Sudan; they reflect a broader global trend in medical education, where oral health often takes a secondary role compared to other medical conditions.

In addition, the self-perception of medical students about their knowledge level was revealing. Most students rated themselves as mildly or poorly informed about the manifestations of oral cancer, and only a small fraction felt well-informed. This self-assessment corresponds with their actual performance in the study and points to the need for more confidence-building measures, such as clinical rotations in dental or oral health departments and interdisciplinary workshops involving both medical and dental students. The fact that 82.8% of the participants believed it was important to have sufficient information about oral cancer suggests a willingness to learn and underscores the role that education can play in improving knowledge. The students' desire for more information through lectures, seminars, and information packs indicates an opportunity for medical schools to address these gaps by offering more structured oral health education, as also recommended by Kujan et al. (13). This study's findings suggest that integrating such educational tools could help bridge the knowledge gap and improve the diagnostic and referral skills of future medical professionals. Ultimately, this study highlights the pressing need to reform medical education to better equip students with the knowledge and skills to diagnose, manage, and refer cases of oral cancer effectively. Strengthening interdisciplinary collaboration between medical and dental schools, and providing hands-on clinical training, could be key strategies in improving awareness and early detection of oral cancer.

Conclusion:

This study underscores the moderate knowledge of oral cancer among medical students in Khartoum. The findings reflect a need for curriculum reform to improve awareness, prevention, and referral systems for oral cancer. Further research is recommended to assess the effectiveness of educational interventions in raising awareness and improving diagnostic skills among medical professionals.

Recommendations

1. Enhance Oral Cancer Education: It is essential to incorporate comprehensive oral cancer education into the medical curriculum, particularly for

pre-final and final-year medical students. This should include detailed information on risk factors, clinical presentations, diagnosis, and management strategies to improve early detection and patient outcomes.

2. **Develop Clinical Training Programs:** Practical, hands-on training programs should be introduced to ensure that medical students gain experience in performing oral examinations, recognizing early signs of oral cancer, and referring patients appropriately. Simulated cases or clinical rotations in dental or maxillofacial departments can help students build confidence in diagnosing and managing oral cancer.

3. **Implement Referral Protocols:** A standardized referral system should be developed and taught to medical students, outlining when and how to refer patients suspected of having oral malignancies to dental or maxillofacial specialists. This will ensure timely and appropriate care for patients with potential oral cancer.

4. **Raise Public Awareness:** Given the high prevalence of oral cancer in Sudan, public health campaigns should be initiated to educate the broader population about the risk factors, early symptoms, and the importance of regular oral checkups. Medical students could be involved in these campaigns as part of their practical training.

5. **Interdisciplinary Collaboration:** Encouraging collaboration between medical and dental schools can foster a more integrated approach to managing oral cancer. Joint seminars, workshops, and interdisciplinary case discussions can help medical students appreciate the role of oral health in overall systemic health.

Limitations

1. **Sample Size and Generalizability:** While the study surveyed 297 students, the sample was drawn from only three universities in Khartoum. The results may not be fully generalizable to all medical students in Sudan or other regions, as different universities may offer varying levels of education and exposure to oral cancer.

2. **Self-Reported Data:** The use of self-administered questionnaires could introduce bias, as students may overestimate or underestimate their knowledge. Additionally, responses may be influenced by social desirability, leading participants to provide answers they believe are expected, rather than reflecting their actual knowledge.

3. **Limited Focus on Other Factors:** The study primarily focused on students' knowledge about oral cancer, without examining other factors such as clinical exposure, prior experience with oral health, or access to dental education. These factors could significantly impact students' ability to identify and manage oral cancer cases.

4. **Lack of Comprehensive Clinical Assessment:** Although the study assessed knowledge about oral cancer, it did not include a practical evaluation of students' skills in diagnosing or managing cases. A clinical assessment might provide a more accurate

picture of the students' capabilities in handling real-world situations.

5. **Cross-Sectional Design:** As a cross-sectional study, this research provides a snapshot of knowledge levels at one point in time. It does not capture changes over time or the impact of different educational interventions that might have occurred before or after the study period.

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