www.sada.co.za / SADJ Vol. 81 No.1
https://doi.org/10.17159/sadj.v81i01.21559

Design and Implementation of the Oral Medicine South Africa Registry: Epidemiology of Oral Lesions at three tertiary academic facilities in the Western Cape, South Africa

SADJ FEBRUARY 2026, Vol. 81 No.1 P24-P30

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ABSTRACT

Background

There is a dearth of information on the epidemiology of oral lesions in South Africa. Knowledge of the characteristics and distribution of oral lesions in South Africa has many practical and research-related implications.

Methods

This is a cross-sectional, retrospective analysis of patients presenting to the Tygerberg, Mitchells Plain, and Groote Schuur Oral Medicine Clinics from 2010- 2022. Data is obtained from collating histopathological reports and from a review of patients' folders. A REDCap® database was created for the project.

Results

A total of 2021 patients and 2085 biopsy specimens were added to the database. The average age of patients is 42.8 years with a standard deviation of 19.7 (range: 1 month-89 years). Of these, 1087/2021 (53.7%) are women and 786/2021 (38.9%) are men (male: female ratio 1:1.4). The five most observed oral conditions are fibroepithelial hyperplasia 397/2085 (19%), squamous cell carcinoma 285/2085 (13.7%), pyogenic granulomas 199/2085 (9.5%), mucoceles 175/2085 (8.4%), and benign human papilloma virus-induced lesions 120/2085 (12.2%).

Conclusion

This study assisted with the creation of the REDCap®-based database. The reported frequencies of the most prevalent diagnoses are similar to those found in studies from comparable populations. Further research could determine risk factors associated with the diverse pathological diagnoses.

Keywords

Oral lesions; Oral medicine registry; Epidemiology; Public oral health; South Africa; Clinical informatics.

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INTRODUCTION

Oral medicine (OM) is a dental specialty comprising of the clinical diagnosis and treatment of patients presenting with conditions of the oral and maxillofacial region. It includes managing medically complex patients, who present with various benign or malignant oral lesions.[1]

Studies have reported on the prevalence of oral medicine pathology, which ranges between 10-81.3%.[2, 3] Generally, malignant tumours comprise a small portion of lesions, despite, being the most researched. The prevalence rates of OM lesions have significantly varied. Additionally, lesions have often been stratified by aetiology, site or description. The lack of standardization, results in misrepresentation of the prevalence of lesions. There is a dearth of information on lesions in South Africa. Additionally, there are no standardised clinical record forms and electronic platforms.

The primary objective of this project is to develop Oral Medicine Registry of South Africa (ORMSA) database, to record the epidemiology of oral pathology. The second objective is to determine the spectrum of histological diagnoses from OM specimens taken at UWC dental faculty.

LITERATURE

The Fifth World Workshop in Oral Medicine outlined the core clinical competencies of the specialty, which include the diagnosis and management of oral mucosal diseases, salivary gland dysfunction, oral manifestations of dermatologic and systemic conditions (including HIV, gastrointestinal and rheumatologic disorders), as well as the evaluation and treatment of facial pain.[4] However, the scope of OM is geography specific. In South Africa, the scope of OM is the diagnosis and management of diseases, disorders and anomalies affecting the oral and periodontal tissues, and the manifestations of systemic diseases.[5]

https://doi.org/10.17159/sadj.v81i01.21559

Obtaining a diagnosis in OM involves history taking, examinations, and appropriate diagnostic tests.[6] Diagnostic tests used include biopsy, radiographs salivary tests, bacterial and viral cultures, and blood tests.[7] The gold standard of diagnosing pathology is the histopathological examination of biopsies. Oral biopsy techniques include incisional, excisional, punch, and brush biopsies. The choice of technique depends on the size and location of the lesion, accessibility, and the clinician's preference.[8] In incisional biopsies, only a portion of the lesion is removed. This technique, which uses a scalpel or soft tissue punch, is preferred in large lesions or involves a critical structure.[8] In punch biopsies, a small cylindrical piece of tissue is removed.[8]

In excisional biopsies, the entire lesion is removed[8] This technique is used for small, benign and accessible lesions. In brush biopsies, cells are collected from the lesion's surface, and is used for superficial lesions or those that are difficult to access.[8] Fine Needle Aspiration (FNA) is a minimally invasive procedure, which is often done in combination with clinical evaluation, imaging, histopathology, and molecular testing of salivary gland lesions.[9] A thin needle is inserted under anaesthesia into the gland, and cells are aspirated.[9] Recent advancements in biopsy procedures, include laser biopsy and molecular techniques.

The National Health Laboratory Service (NHLS) is the largest South Africa diagnostic pathology service. TrakCare is a laboratory information system (LIS) and DisaLab is an NHLS legacy LIS (10). The Corporate Data Warehouse (CDW), is a national health repository in South Africa; containing data from DISALAB and TrakCare. Our study utilised data from CDW and REDCap® to create a real-time clinical database.

Existing literature on oral medicine epidemiology is limited in its relevance to South Africa, as most studies focus on individual conditions or lesion types, rely on clinical surveys or screening data, and are often restricted to specific age groups. A Kuwaiti study over 18 years, found that the most common diagnostic category was mucosal pathologies 205/ 697 (29.4%), odontogenic cysts 158/ 697 (22.7%) and reactive lesions 97/ 697 (13.9%).[11] The three most common histopathological diagnoses were hyperkeratosis 70/697 (10%), dentigerous cysts 48/ 697 (6.8%), and mucoceles 44/ 697 (6.3%).[11] Twenty-five malignant neoplasms were diagnosed; the majority in males. A significant association was found between the patient's age and the diagnosis ($P \leq 0.001$). The greatest incidence of oral lesions was in patients in the fourth decade and malignant lesions were more common in those >50 years.[11] The study found that the mean age per diagnostic category was (in years): malignant tumour (51), mucosal pathology (45), reactive lesions (40), connective tissue disease (40), dental pathology (36), bone pathology (34), odontogenic cysts (30), odontogenic tumour (24) years and salivary gland disease (28).[11] In a five-year Nigerian study of 242 biopsies; most oral lesions were located peripherally or centrally on the mandible and were mainly benign. The most common benign lesion was ameloblastoma 35/ 242 (14.5%), whereas the most common malignant lesion was squamous cell carcinoma (SCC) 19/ 242 (7.8%).[12]

A 2014 South African Study included 1,258 biopsies of children <16 years in the Maxillofacial and Oral Surgery (MFOS) department.[13] From the maxillofacial pathologies, pathology affecting the jaw bones made up the largest group, with odontogenic cysts and tumours predominating.[13] The remaining pathology affected the oral/perioral soft tissues, salivary glands, and oral mucosa. Of these, 4.1% were malignant, with Burkitt's lymphoma was the most prevalent.[13] In a 2022, self-administered survey of 26 South African OM specialists, respondents estimated the most frequently observed lesions were immune-mediated diseases (29.3%), and benign reactive neoplasms (26.5%). Respondents stated that chemosensory disorders, accounted for 1.5% of daily patients, and oral mucosal disease, accounted for 2.5% of lesions and conditions. There are a dearth and variability of data, within a global and within the SA context.

The primary objective of this article is to develop a REDCap® database for recording OM pathology at clinics managed by UWC. A retrospective, prevalence study will assist clinicians with differential diagnosis, specify the relative prevalence of oral pathology and allow for data extrapolation. Epidemiological information will also guide the academic curriculum and assist with health resource planning and allocation. The findings will contribute to strengthening public health prevention programmes and public health education.

METHODS

Aim

To establish a database and to determine the range and frequency of oral medicine pathology.

Objectives

1. To create an oral medicine database
2. To provide an epidemiological description of oral medicine pathology
3. To compare findings with similar studies

Design

This study was a retrospective cross-sectional analysis of patients presenting to the Oral Medicine and Periodontology department, between 1 January 2010-1 January 2022.

Sampling

The study enrolled all consecutive biopsied patients, presenting to presenting to the Oral Medicine and Periodontology department,1 January 2010-1 January 2022.

Inclusion criteria

All histological reports and patient files were included. The study sites included: Groote Schuur Hospital (GSH), Tygerberg Oral Health Centre (TBOHC) and Mitchells Plain Oral Health Centre (MPOHC) from; 1 January 2010- 1 January 2022.

Exclusion criteria

Records were excluded only when they contained almost no usable clinical information, meaning that key diagnostic, treatment, and demographic fields were missing. Records that had partial but still analysable information, for example, where at least one of the primary variables of interest was available, were retained to preserve the completeness and representativeness of the dataset. The study excluded duplicate entries.

Database/registry creation and data collection and validation
Study data were managed using UWCs REDCap® electronic data capture tool. The REDCap® platform registered the project, and the online designer tool customized the data capturing tools, as a collection of forms. These records were used to capture the required data elements once role-based access was assigned and input data was verified.

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Data Analysis

Data were exported to Microsoft Excel, and were cleaned and analysed on STATA 14 *(StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.* Descriptive statistics were primarily used to summarize and present the data. Measures such as percentages, ratios, and proportions were calculated to describe the demographic characteristics, biopsy techniques, lesion types, and anatomical distribution of biopsies.

RESULTS

A total of 2021 patients were included, which was less than the total number of investigations (2085), indicating that in some cases more than one biopsy was taken for a patient. The average age of patients was 42.8 years, SD of 19.7 (range: 1 month-89 years). From the sample, 1087/2021 (53.7%) were women and 786/2021 (38.9%) were men (male: female ratio 1:1.4). The average age for females was 42.7 ± 19.6 (SD), and the average age for males was 43.3 ± 20.3 (SD). **Figure 1** shows the number of males, females and sex not recorded in the study. From the population; 1276/ 2021 (63.1%) of biopsies were taken at TBOHC, 545/ 2021 (26.9%) at GSH, and 200/ 2085 (9.9%) presented to MPOHC.

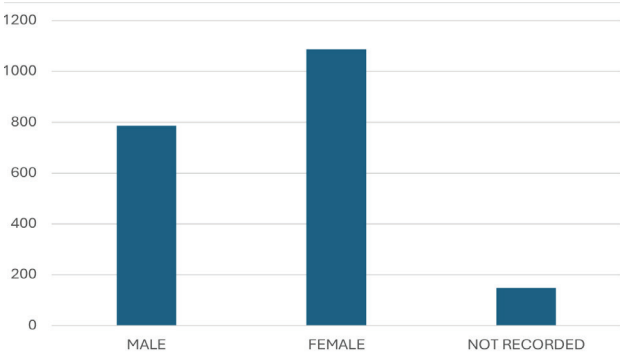

Figure 1. Males, females and sex not recorded in the study (N=2021)

The most common biopsy technique was excisional biopsy 1283/ 2085 (61.5%). The most frequent lesions observed were fibrous hyperplasia, 374/ 2085 (17.9%); and SCC 284/ 2085 cases (13.6%), pyogenic granuloma 191/ 2085 (9.1%), and mucoceles, 167/ 2085 (8%). The prevalence of the lesions according to diagnostic categories is demonstrated in **Table 1.** The majority of OM conditions were classified as inflammatory/ reactive lesions 1208/ 2085 (57.9%). Epithelial and soft tissue neoplasms constituted 388/ 2085 (18.6%) specimens and normal tissue was observed in 223/ 2085 (10.7%) specimens. Inflammatory periapical lesions were found in 11/ 2085 (0.5%) specimens, developmental lesions 6/ 2085 (0.3%), and benign bone lesions 4/ 2085 (0.2%).

Table 1. Distribution of the lesions according to diagnostic categories, N=2085

Diagnostic Category	No	%
Inflammatory/ Reactive lesions	1208	57.9
Epithelial and soft tissue neoplasms	388	18.6
Normal tissue	164	7.8
Potentially malignant lesions	123	5.8
Autoimmune lesions	87	4.2
Odontogenic tumours	54	2.6
Odontogenic cysts	24	1.2
Pigmented/ melanotic lesions	16	0.8
Inflammatory periapical lesions	11	0.5
Developmental lesions	6	0.3
Benign bone lesions	4	0.2
TOTAL	**2085**	**100%**

In our study, the gingiva 547/ 2085 (26.2%), the tongue 495/ 2085 (23.7%) and the buccal mucosa 326/ 2085 (15.6%) were the most frequently biopsied sites. The floor of the mouth was the least frequently biopsied site 31/ 2085 (1.5%) and 103/ 2085 (4.9%) biopsies did not have a site specified.

Figure 2 shows the distribution of biopsy sites.
There were 335/ 2085 (16.1%) malignant lesions of the oral cavity. The majority of malignant lesions were SCC 285/ 2085

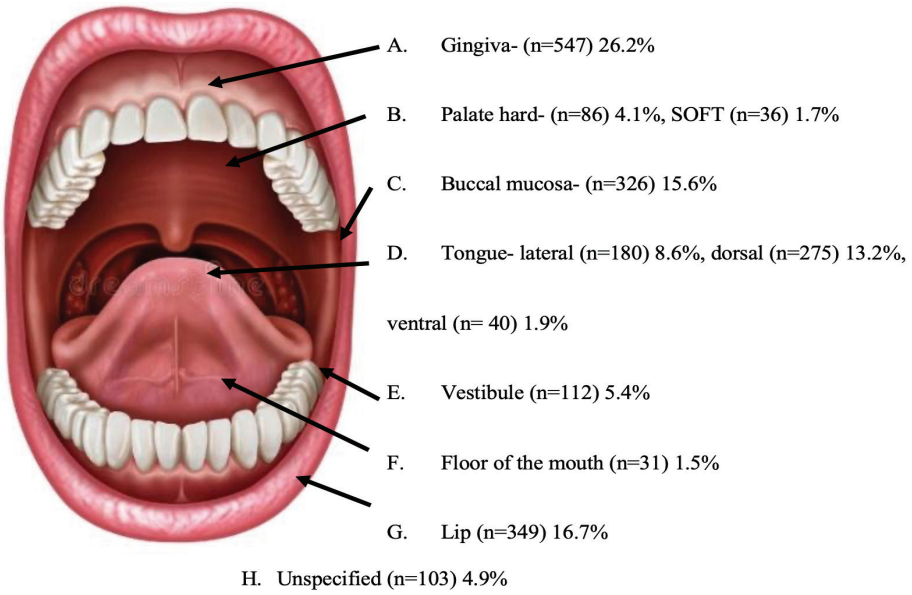

Figure 2. The intra-oral locations of biopsies taken (n = 2085), *Stock image (Luengo, 2023) †

https://doi.org/10.17159/sadj.v81i01.21559

Table 2. Benign lesions of the oral cavity, N=977

Diagnosis	Total (n)	% group (n/N)	%total (n/2085)
Fibroepithelial hyperplasia/ polyp	396	40.5	19.0
Pyogenic granuloma	199	20.4	9.5
Total HPV induced lesions	120	12.3	5.8
Squamous papilloma's/ unspecified	96	9.8	4.6
Focal epithelial hyperplasia	16	1.6	0.8
Verruca vulgaris	7	0.7	0.3
Condyloma acuminatum	1	0.1	0.0
Lipoma	27	2.8	1.3
Peripheral odontogenic fibroma	27	2.8	1.3
Traumatic fibroma	24	2.5	1.2
Ameloblastoma	20	2.0	1.0
Giant cell fibroma	22	2.3	1.1
Haemangioma	13	1.3	0.6
Pleomorphic adenoma	10	1.0	0.5
Benign giant cell tumours	8	0.8	0.4
Post extraction granuloma (granulation tissue)	7	0.7	0.3
Neurofibroma	7	0.7	0.3
Traumatic Ulcerative Granuloma with Stromal Eosinophilia	7	0.7	0.3
Peripheral ossifying fibroma	6	0.6	0.3
Benign vascular neoplasms	5	0.5	0,2
Fibro- osseous lesions	5	0.5	0,2
Leiomyoma	5	0.5	0.2
Seborrheic keratosis	5	0.5	0.2
Cemento-ossifying fibroma	4	0.4	0.2
Melanotic macule	4	0.4	0.2
Oral focal mucinosis	4	0.4	0.2
Three occurrences: Canalicular adenoma, Denture fissuratum, Lymphangioma, Granular cell tumour, Melanotic hyperplasia, Fibromatosis	18	1.8	0.9
Two occurrences: Osteoma, Melanocytic naevus, Odontoma, Oral focal granulomatosis, Cemento osseous dysplasia, Fibrous dysplasia, pigmented incontinence, amalgam tattoo, drug induced gingival overgrowth, Odontogenic myxoma, Traumatic neuroma	22	2.3	1.1
One occurrence: Verruciform xanthoma, Schwannoma, Basal cell adenoma, Benign mesenchymal neoplasm, Myoepithelioma, Smooth muscle neoplasm, Osseous choristoma, Peripheral dentinogenic ghost cell tumour, Hematoma, Graphite tattoo, Frictional keratosis, Basaloid salivary gland neoplasm	12	1.2	0.6
TOTAL	977	100%	46.7%

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https://doi.org/10.17159/sadj.v81i01.21559

Table 3. Malignant lesions of the oral cavity, n=335

Diagnosis	Total (n)	% group (n/N)	%total (n/2085)
Squamous cell carcinoma	285	85.1	13.7
Lymphomas	12	3.6	0.6
Kaposi's sarcoma	10	3.0	0.5
Adenoid cystic carcinoma	7	2.1	0.3
Polymorphous low-grade adenocarcinoma	5	1.5	0.2
Basal cell carcinoma	4	1.5	0.2
Clear cell carcinoma	3	1.2	0.2
Carcinoma in situ	2	0.9	0.1
Mucoepidermoid carcinoma	2	0.6	0.1
One occurrence: Malignant melanoma, Malignant epithelial neoplasm, Osteosarcoma, Sarcoma, Verrucous carcinoma	5	0.6	0.1
TOTAL	**335**	**100%**	**16.1%**

(13.7%), which constituted 285/ 335 (85.1%) of malignant lesions. Lymphomas accounted for 12/ 335 (3.6%) and Kaposi sarcoma accounted for 10/ 335 (3%) of malignant lesions. Table 3 presents all malignant lesions identified in the dataset, with squamous cell carcinoma being the most frequently observed diagnosis.

There were 123/ 2085 (5.9%) Oral Potentially Malignant disorders (OMPDs). Of these, 81/ 123 (65.9%) specimens were oral lichenoid disorders. Dysplastic epithelial lesions accounted for 18/ 123 (14.6%) of lesions. Of these; moderate dysplasia accounted for 10/123 (8.1%), severe dysplasia 5/ 123 (4%) and mild dysplasia 3/ 123 (2.4%). Table 4 provides the totals and percentages of OPMD lesions found among the specimens. It was found that 18/ 2085 (1%) of biopsy specimens were labelled as being 'dysplastic'. Although epithelial dysplasia is not considered a malignancy, it is an OPMD. From these: moderate epithelial dysplasia accounted for 10/ 2085 (0.5%), severe epithelial dysplasia 3/ 2085 (0.1%) and mild epithelial dysplasia 3/ 2085 (0.1%).

There were 235/ 2085 (11.3%) cysts of the jaw and oral tissue. Of this 175/ 235 (74.5%) were mucoceles, 11/ 235 (4.7%) were radicular cysts, 8/ 235 (3.4%) were ranulas and there were 8/ 235 (3.4%) unspecified odontogenic cysts of inflammatory origin. There were 175/ 2085 (8.4%) inflammatory lesions. Non-specific ulcers accounted for 67/ 175 (38.3%) of inflammatory lesions, 33/ 175 (18.9%) were chronic inflammation and 12/ 165 (6.9%) were subacute inflammation. There were 164/ 2085 (7.8%) specimens that were normal mucosa or non-diagnostic specimens. Of this, 110/ 164 (67.1%) had a non-specific histology. There were 36/ 164 (21.9%) lesions that were classified as normal, and 18/ 164 (11%) specimens had no results.

DISCUSSION

In 12-years, 2085 specimens were biopsied OM department at three surveillance sites (174 specimens/ year). This indicates that a high volume of oral biopsies was submitted when compared with another study (64 specimens/ year). [14] The male to female ratio (1:1.4) of the study is comparable to a UK study of 44, 007 biopsies over 30 years.[15] The mean age was 42.8 years, SD of 19.7 (range: 1 month-89 years). Forty-three records were omitted due to missing clinical and TrakCare data.

In our study, the gingiva 547/ 2085 (26.2%), the tongue 495/ 2085 (23.7%) and the buccal mucosa 326/ 2085 (15.6%) were the most frequently biopsied sites. A 10-year Indian study found the most common site of lesions were

Table 4. Potentially malignant disorders, n= 123

Diagnosis	Total (n)	% group (n/N)	% total (n/2085)
Oral Lichenoid Disorders	81	65.9	3.9
Chronic hyperplastic candidiasis	12	9.8	0.6
Moderate epithelial dysplasia	10	8.1	0.5
Actinic keratosis	9	7.3	0.4
Severe epithelial dysplasia	5	4.1	0.2
Mild epithelial dysplasia	3	2.4	0.1
One occurrence: Erythroplakia, Erythroleukoplakia, Proliferative Verrucous Leukoplakia	3	2.4	0.1
TOTAL	**123**	**100%**	**5.9%**

https://doi.org/10.17159/sadj.v81i01.21559

the tongue (18.8%), lips (15.9%) and floor of the mouth (15.5%).[16] The floor of the mouth was the least frequently biopsied site 31/ 2085 (1.5%), this may be because it is an anatomically difficult region.

Inflammatory and reactive lesions comprised 1208/ 2085 (57.9%) of lesions; due to the frequency of soft tissue injuries. A US review of 15,783 oral lesions over a period of 17.5 years found that fibromas, periapical granulomas, mucoceles, and radicular cysts were the most prevalent reactive lesions.[17] The study observed that 77% of lesions were inflammatory or reactive.[17] In a Turkish study, inflammatory hyperplastic lesions constituted 1,000/ 1,198 (57.7%) of lesions. Our proportion of inflammatory and reactive conditions to the sample was similar to other studies.

Epithelial and soft tissue neoplasms accounted for 388/ 2085 (18.6%) of lesions. This was more than was recorded in a Saudi Arabian teaching hospital 106/ 1218(8.7%) (18). This may be due to differences in regional classifications. Normal tissue was observed in 164/ 2085 (7.8%) specimens and autoimmune conditions were found in 87/ 2085 (4.2%) specimens. The prevalence of oral mucosal involvement in immune-mediated disorders varies according to the disease. Oral lichen planus, mucous membrane pemphigoid, erythema multiforme and pemphigus vulgaris were previously found to be the most common immune-mediated disorder affecting the oral cavity.[19] Interestingly, oral medicine specialists estimate that autoimmune disorders (29.3%) and benign reactive neoplasms (26.5%) are managed the most frequently in their clinics.[5] In our study, autoimmune disorders accounted for 4.2% of lesions and reactive lesions accounted for 57.9% of pathology. There could be many reasons for this discrepancy including the inclusion of private practice experiences, recall bias, regional variations and referral patterns.

There are significant regional differences in the prevalence of odontogenic tumours. While they comprise 1% of oral pathology in North America, it is 19% in African countries. [20, 21] The prevalence rates of odontogenic cysts, is region specific and ranges from 3.4%- 54.6%.[22, 23] In our study, odontogenic cysts amounted to 24/ 2085 (1.2%) of lesions. This may not reflect the true prevalence of odontogenic cysts, as lesions are often diagnosed based on clinical presentation and radiology

Pigmented/ melanotic lesions account for 16/ 2085 (0.8%) biopsies. This is similar to a retrospective cross-sectional study conducted in Thailand, where pigmented lesions were .observed in 241/ 45175 (0.5%) of lesions diagnosed over 20 years.[24] Another study found that oral pigmented lesions were present in 386/ 1275 (30.2%) patients.[25]

The relatively low numbers of inflammatory periapical lesions (11/2085; 0.5%), developmental lesions (6/2085; 0.3%), and benign bone lesions (4/2085; 0.2%) reflect the fact that these conditions are primarily diagnosed and managed by the Maxillofacial and Oral Surgery (MFOS) department rather than the Oral Medicine department.

The majority of diagnoses were benign 977/ 2085 (46.8%). Fibroepithelial hyperplasia/ fibroepithelial polyps were the most common lesions 396/ 977 (40.5%); similar to a studies that assessed histologically diagnosed oral lesions.[26] Malignant lesions accounted for 335/ 2085 (16.1%) biopsies. SCC was the most common malignancy, appearing mostly on the tongue and lower lip. In our study SCC amounted to 285/ 335 (85.1%) of malignant lesions (13.7% of total). This was higher than in another study where SCCs accounted for 5.4% in 2675 specimens.[27]

Oral lichen planus and oral lichenoid reactions were grouped as oral lichenoid diseases (OLD). OLDs accounted for 81/ 123 (65.9%) of OPMDs and 81/ 2085 (3.9%) of the total. This finding is similar to 3.5% found in 12068 participants of the Northern Finland Birth Cohort (28). Chronic hyperplastic candidiasis (CHC) was found in 12/ 123 (9.8%) of OPMDs and 12/ 2085 (0.6%) of all biopsies.

Mucoceles 175/ 235 (74.5%) were frequently observed, representing 175/ 2085 (8.6%) biopsies. A study showed that inflammatory/reactive lesions are the most common category with mucocele being the most frequent pathology. [27, 29] Radicular cysts accounted for 9/ 2085 (3.8%) of cysts; fewer than a Turkish prevalence study, which found that radicular cysts 216/ 475 (45.5%) and dentigerous cysts 77/ 475 (16.2%) were the most prevalent lesions.[30]

Non-specific ulcers accounted for 67/2085 (3.2%), chronic Inflammation 33/2085 (1.6%) and subacute inflammation 12/2085 (0.6%), respectively. There were 18/ 2085 (0.8%) nondiagnostic specimens. Reasons for non-diagnostic samples may include sampling errors, insufficient diagnostic material, obscuring inflammation, artifacts and diagnostic discordance.

Candidiasis accounted for 7/ 19 (36.8%) of cases, tuberculosis 3/ 19 (15.8%), 3/ 19 syphilis cases (15.8%) and 3/ 19 (15.8%) were non-specific fungal diagnoses. The number of candida lesions may be an underrepresented, because lesions are rarely biopsied.

LIMITATIONS

There were many constraints of the study that affected sample generalizability and representativity. We discovered that specimens from the MPOHC were grouped together with specimens from TBOHC, due to logistical arrangements. We thus could not differentiate specimens, limiting our geographic analysis of the distribution of lesions. We were also not able to access physical files from patients who attended the MPOHC and GSH OM clinic. We reported on oral pathology that may lie outside the scope of OM in South Africa, due to the grouping specimens together at facilities. We excluded oral pathology diagnosed by other departments, and other facilities.

The dental faculty keeps files for five years; thereafter files are discarded- thus it was impossible to capture records of patients who presented at the sites. Additionally, due to incomplete and missing data, patient files were excluded from the research during the data gathering procedures.

Direct comparisons of oral lesion prevalence are difficult due to regional differences in classifications, and differences in the scope or OM practitioners and MFOS. Despite the drawbacks, the results of this study are consistent with the literature.

CONCLUSION

This study led to the design of a REDCap®-based ORMSA database. Pilot results indicate that the majority of diagnoses were benign and inflammatory/. The reported frequencies of the most prevalent diagnoses were similar to those

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found in studies, with minor variations. Further research could determine risk factors associated with the diverse pathological diagnoses.

This study advocates implementing the routine use of the REDCap® based ORMSA record system and computerizing patient records. It further recommends the minimum set of variables required to provide a clinic-pathological derived diagnosis.

Supporting Information
Supporting Information is available from the Wiley Online Library or from the author.

Acknowledgements
The project was self-funded. We acknowledge: The University of the Western Cape, The South African Medical Research Council & The National Health Laboratory Services. The authors do not have competing interests.
Ethical Approval

Approval was obtained from UWCs Research and Ethics Committee (BM21/6/25), the National Health Research directorate and the National Health Laboratory Services (PR2225921).

Funding:
None

Conflict of Interest:
The authors declare no conflict of interest.

Ethical Approval:
Ethical clearance for this study was obtained from the following:
- University of the Western Cape Biomedical Research Ethics Committee (BM21/6/25)
- National Health Research Directorate
- National Health Laboratory Services (PR2225921)

Acknowledgements:
We thank the Faculty of Dentistry at the University of the Western Cape, as well as the clinical and administrative teams at Tygerberg, Groote Schuur, and Mitchells Plain hospitals, for their support in registry development and data collection.

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CPD questionnaire on page 52

The Continuing Professional Development (CPD) section provides for twenty general questions and five ethics questions. The section provides members with a valuable source of CPD points whilst also achieving the objective of CPD, to assure continuing education. The importance of continuing professional development should not be underestimated, it is a career-long obligation for practicing professionals.