Australian Dental Journal
The official journal of the Australian Dental Association

Australian Dental Journal 2024; 0: 1–7

doi: 10.1111/adj.13013

Lip, oral and oropharyngeal cancer incidence among Aboriginal and Torres Strait Islander Peoples: First report from Australian population-based cancer registry, 1999–2018

S Sethi,* X Ju,* R Logan,† J Hedges,* G Garvey,‡ L Jamieson*

*Australian Research Centre for Population Oral Health, Adelaide Dental School, University of Adelaide, Adelaide, South Australia, Australia.
†Adelaide Dental School, University of Adelaide, Adelaide, South Australia, Australia.
‡Faculty of Medicine, School of Public Health, University of Queensland, Herston, Queensland, Australia.

ABSTRACT

Background: The Australian Burden of Disease Study has shown that cancer is the single most important entity responsible for the greatest cause of health burden in Australia. Unfortunately, Aboriginal and Torres Strait Islander peoples experience a greater burden of this disease, with cancer of the lung, breast, bowel and prostrate being the most common. Lip, oral cavity and pharyngeal cancer incidence is rapidly rising globally and is now the sixth most common cancer in Australia. This paper aims to summarize, for the first time, the incidence and prevalence trends of lip, oral cavity and pharyngeal cancers in Aboriginal and Torres Strait Islander Australians.
Methods: Data were obtained from the Australian Cancer Database (ACD), which is compiled at the Australian Institute of Health and Welfare (AIHW) from 1999 to 2018 to estimate the incidence and prevalence of certain head and neck cancers (ICD-10 codes C00–C10, C14). The other variables requested were age groups and sex.
Results: Results were stratified by ICD-10 code, sex and age group at diagnosis and time period (i.e. grouped years of diagnosis). The total incidence of lip, oral cavity and pharyngeal cancers increased by 1.3 times from 1999 to 2008 (107/100 000) to 2009–2018 (135/100 000). The overall 5-year prevalence of lip, oral cavity and pharyngeal cancers was 0.17% (0.24% for men and 0.09% for women).
Conclusions: The significantly increased incidence of lip, oral cavity and pharyngeal cancers in Aboriginal and Torres Strait Islander peoples in Australia is concerning and should be explored. A targeted, comprehensive and culturally safe model of care for Aboriginal and Torres Strait Islander peoples with lip, oral cavity and pharyngeal cancers is imperative.

Keywords: Head and neck cancer, Aboriginal and Torres Strait Islander Peoples.

Abbreviations and acronyms: ACD = Australian Cancer Database; HPV = human papillomavirus; SCC = squamous cell carcinoma.

(Accepted for publication 28 February 2024.)

CLINICAL RELEVANCE

This is the first ever report of head and neck cancer among Aboriginal and Torres Strait Islander peoples in Australia. Although it reports crude numbers and appropriate statistical analysis was not possible (due to the nature of the data), this report is critical to identifying head and neck cancer trends to optimize medical resources to screen, prevent, diagnose, treat and improve survival outcomes. © 2024 Australian Dental Association.

BACKGROUND

Lip, oral cavity and pharyngeal cancers refer to a diverse group of neoplastic malignant lesions arising from sites within the upper aerodigestive tract. Amongst this group, 90% are histologically classified as squamous cell carcinoma (SCC).[1] These cancers are estimated to be the seventh[2] most common type of cancer worldwide, with approximately 660 000 new cases reported in 2020, resulting in 280 000 deaths.[3,4] Notwithstanding advances in lip, oral cavity and

pharyngeal cancer treatment, later stages of diagnosis and reporting reinforce poor survival outcomes and mortality.[5] Even after diagnosis and initiating treatment, there is an ongoing risk of loco-regional recurrences, metastatic disease and the growth of secondary tumours.[6]

The risk factors commonly associated with lip, oral cavity and pharyngeal cancers incidence are habits related to tobacco and/or alcohol consumption and exposure to oncogenic viruses such as Epstein-Barr virus and human papillomavirus (HPV).[2,7,8] Patients suffering from lip, oral cavity and pharyngeal cancers report higher levels of emotional distress after diagnosis and during treatment relative to other cancers.[9,10] Significant global disparities exist in the incidence and prevalence of lip, oral cavity and pharyngeal cancers, which can be attributed to variations in risk factor exposure amongst different populations and the anatomical complexities of the head and neck region. Global temporal trends from 1990 to 2017 illustrate a decreased incidence of laryngeal and nasopharyngeal carcinomas, but also highlight an upsurge in oropharyngeal carcinomas (OPC). Australia has shown similar trends over the past three decades, presumably due to the increase in oncogenic HPV infections.[11]

In Australia, the onset in the 1980s of widespread population health promotion initiatives witnessed a reduction in the consumption of tobacco and alcohol products, with vigorous public campaigning enforcing sun protection against lip cancer, resulting in an overall decrease in the rates of oral and lip cancer. However, other cancers, notably OPC, experienced an increase in rates.[11] This upsurge reflects global patterns and is linked to the increase in oral HPV infections.

Indigenous peoples, more than 370 million people traversing 70 countries worldwide, are described by the United Nations as peoples with pre-colonial cultures and historical endurance who cogitate themselves diverse from societies currently habituating on their rightful ancestral lands.[12] The global experience of health and well-being for Indigenous peoples is well-recognized. Indigenous peoples have been shown to consistently experience disparities in disease incidence and prevalence,[13] which can be ascribed to the influence of strategic government policies of assimilation and colonization on Indigenous health and well-being.[14–16] The complexities of these health inequalities are influenced by various social, structural, financial and political factors, including dispossession of ancestral land, racism, marginalization, neoliberal policies and detrimental supremacy frameworks.[16–18]

Data specific to the cancer burden in Indigenous populations is not well documented, but recent studies have shown that the disparities are substantive.[19,20] There is evidence that Indigenous populations at a global level experience marked inequities compared with non-Indigenous dominant populations.[19,21–27] This can be due to the amplified pervasiveness of traditional risk factors such as tobacco use, alcohol intake, level of physical inactivity, nutrition and, social determinants including housing, income, employment and education.[28] Poor cancer outcomes for Indigenous populations are also influenced by factors ranging from healthcare systems to socio-political contexts.[28] The United Nations has emphasized and prioritized the rights of Indigenous peoples, including the right to health and well-being, as well as inclusion in population and health data collections.[12,29]

In Australia, Aboriginal and Torres Strait Islander peoples characterize 3.2% of the national population.[30] There is a dearth of evidence at a national level on the incidence of lip, oral cavity and pharyngeal cancers among Aboriginal and Torres Strait Islander peoples. Previous reports suggest that Aboriginal and Torres Strait Islander peoples are 2.1 times more likely to be diagnosed with lip, oral cavity and pharyngeal cancers, and the disability-adjusted life years associated with lip, oral cavity and pharyngeal cancers were 3.8 times worse for these population groups compared to non-Indigenous groups.[11,31,32] Another report suggests that Aboriginal and Torres Strait Islander peoples have a 3.4 times higher risk of metastatic spread for lip, oral cavity and pharyngeal cancers compared to localized spread relative to non-Aboriginal people.[33] With an increased incidence of HNC-associated risk factors (smoking frequency, age of onset of smoking, alcohol consumption[30,34]), and prevalence of oncogenic HPV infections[35,36] among Aboriginal and Torres Strait Islander peoples, it is expected that the incidence and prevalence of lip, oral cavity and pharyngeal cancers will be high.

The objective of this study was to estimate the occurrence of lip, oral cavity and pharyngeal cancers among Aboriginal and Torres Strait Islander populations of Australia, in terms of incidence using data from 1999 to 2018.

METHODS

Data acquisition

This was a retrospective observational study with a deidentified number of lip, oral cavity and pharyngeal cancer cases obtained from the Australian Institute of Health and Welfare (AIHW). The AIHW compiles the Australian Cancer Database, a collation of all primary malignant neoplasms diagnosed in Australia. This is compiled from data provided by state and territory cancer registries through the Australian Association of Cancer Registries. Population-based cancer registries receive information on cancer diagnoses from a variety of sources: hospitals; pathology laboratories;

radiotherapy centres; and registries of births, deaths and marriages. Requests for data acquisition were made to the cancer registries, and after corresponding with each state cancer data registry and the National cancer registry, the research team was informed that data between the years 1999 and 2018 could be provided. The initial request raised included data regarding age of incidence, sex, site of cancer, Indigenous status and location (metro and rural). But due to low numbers in each category, extensive stratification based on the above-mentioned variables was not possible without allowing a possible risk of identification. Thus, the request was modified, and the data custodian at the national cancer registry collated the data in the best possible manner and had to remove a few variables from the dataset. Although incidence trend analysis and other epidemiological analyses would not be possible with the nature of the data provided, the research team decided that the data were still significant to be published in order to highlight the increasing number of cases and the increasing burden of disease among Aboriginal and/or Torres Strait Islander peoples due to lip, oral cavity and pharyngeal cancers.

The data were segregated by sex, age, Indigenous status and anatomical site based on the World Health Organisation International Classification of Diseases for Oncology, 4th edition (ICD-O-4) ICD-10 codes. Oral cavity cancer includes ICD-10 codes C00-C10 and C14. Pharyngeal cancers are defined according to ICD-10 as cancers of the oropharynx (C10), nasopharynx (C11) and hypopharynx (C12-13); cases related to the hypopharynx and nasopharynx were excluded. For purposes of describing the data, the data were dichotomized at the 55-year age mark.

Ethics approval

Respective permissions from data custodians in each state were consulted independently to seek approval. This included the NT Cancer Registry, the WA Cancer Registry, the Cancer Alliance Queensland and the NSW Cancer Registry. The states of South Australia (SA), Tasmania, Australian Capital Territory (ACT) and Victoria could not sanction the release of data from their specific registries due to unit presentation and the risk of identification.

Statistical analysis

The incidence of the primary, histologically confirmed malignancy was calculated. Numbers of HNC cases, stratified by sex and age group (less than 55 years, 55 years or older), were divided by the estimated resident population (ERP) of Aboriginal and Torres Strait Islander peoples in the same area at those periods. Incidence rates (IR) of HNC were calculated and expressed per 100 000 population. Age-standardized incidence rates (ASIR) were not estimated due to the unit presentation risk and nature of the data.

Sex-specific incidence rates were multiplied by the population size of these specific categories in Australia in the year concerned to provide an estimate of the number of first primary lip, oral cavity and pharyngeal cancer patients in the country as a whole. The ERP was obtained from Australian Demographic Statistics (version 3101.0), released by the Australian Bureau of Statistics (ABS). There is misrepresentation in Australian cancer statistics among smaller population sub-groups, such as Aboriginal and Torres Strait Islander Peoples, which can significantly impact population-based estimates and outcomes of incidence and survival. Hence, the data acquired from the state registries for the purpose of this study were not compared to non-Indigenous population subgroups.

Analyses were performed using SPSS for Windows version 27.0 (SPSS Inc., Chicago, IL, USA) and STATA statistical software version 15.0 (College Station, TX, USA).

RESULTS

A total of 1105 first primary lip, oral cavity and pharyngeal cancer cases were diagnosed among Aboriginal and Torres Strait Islander populations between January 1, 1999, and December 31, 2018. Of these, 789 (71.4%) were men and 316 (28.5%) women; 532 (48.1%) were less than 55 years old (male-to-female ratio of 2.49:1) and 573 (51.8%) were 55 years of or older.

The total IR of HNC increased by 1.3 times from 1999 to 2008 (107/100 000) to 2009–2018 (135/100 000). Although most sites show an increase in IR, the most significant surge was observed with the oropharynx (1.8 times, from 8.3 to 14.9 per 100 000) and the base of the tongue (1.8 times, from 13.8 to 24.3 per 100 000).

Sex-specific IR showed an increase in the total number of cases for both men (57%) and women (77%) from 1999 to 2018. Men had higher lip, oral cavity and pharyngeal cancer rates than women for all sites across all age groups (Table 1, Figure 1). Based on age, men over the age of 55 years were 16.7 times more likely to be diagnosed with lip, oral cavity and pharyngeal cancers and women over the age of 55 years were 13.9 times more likely to be diagnosed.

DISCUSSION

This paper sought to examine rates and trends of head and neck cancer among Aboriginal and Torres Strait Islander peoples over the last two decades. The

Table 1. Crude incidence rates per 100 000 of Aboriginal and Torres Strait Islander men and women stratified by age for head and neck cancer by subsite in 2018 in 4 Australian states and territories

Subsite	ICD-10 code	Males		Females	
		0–54 years	55 and above	0–54 years	55 and above
Overall		66.5	1115.6	25.3	352.3
Lip	C00	5.7	105.6	2.7	27.7
Base of tongue	C01	13.7	238.7	6.9	55.4
Tongue	C02	8.8	160.6	4.6	65.0
Floor of the mouth	C04	9.9	151.5	2.7	43.6
Palate	C05	2.6	64.2	–	–
Salivary gland	C07, C08	–	–	1.9	27.7
Tonsils	C09	18.7	238.7	3.5	47.5
Oropharynx	C10	6.8	156.1	3.1	55.4

findings indicate an incidence that is higher than non-Indigenous Australian population rates, particularly for OPC. Infection with HPV, especially high-risk subtypes, is an identified primary etiologic agent causing oropharyngeal cancer.[37,38] Vaccinations against HPV infections provide reasonably high protection against the most common high-risk HPV types associated with cervical cancer (16, 18),[38,39] with some evidence emerging of the protective effect against oral HPV-OPCs also.[40]

The higher incidence of lip, oral cavity and pharyngeal cancers in older men and women is similar to findings in previous studies based on the non-Indigenous Australian population, with the maximum number of cases reported in the age group of 55–69 years.[11] It has been previously postulated that a delayed onset of lip, oral cavity and pharyngeal cancers, especially oropharyngeal cancer, could be explained by the persistent damage caused by tobacco, HPV and/or alcohol cumulating over time and subsequently manifesting into malignant deviations.[8,11] Owing to oral sexual behaviours, males are more likely to acquire an oral HPV infection as compared to females and are at amplified risk of HPV-associated oral cancers (oropharyngeal, tonsillar). This can be explained by the higher viral load within the female genital mucosa, with any unprotected contact able to initiate the transmission of the virus from the genital mucosa to the oral mucosa.[8]

Studies conducted in the United States have explored head and neck cancer in Indigenous peoples using the Surveillance, Epidemiology and End Results (SEER) Program Research Data,[41,42] and have reported decreased survival in American Indians/Alaskan Natives (AI/AN); with a wide discrepancy of incidence in lip, oral cavity and pharyngeal cancers amongst AI/AN based on the site affected and residing location.[42] A study group from Canada compared the incidence, mortality and survival outcomes for lip, oral cavity and pharyngeal cancers between First Nations (FN) peoples and non-FN people, and found no variance in the incidence. However, they observed lower survival of FN compared to non-FN patients with lip, oral cavity and pharyngeal cancers.[43]

Although it has been observed that HPV-associated oral tumours have lower rates of loco-regional recurrences, an increased incidence of distant metastases to non-traditional sites has been reported, which is associated with increased chances of mortality.[44–46] The latest version of treatment strategies also proposes a de-escalated treatment regimen for HPV-associated lip, oral cavity and pharyngeal cancers, but increased caution for metastatic recurrence is recommended.[47]

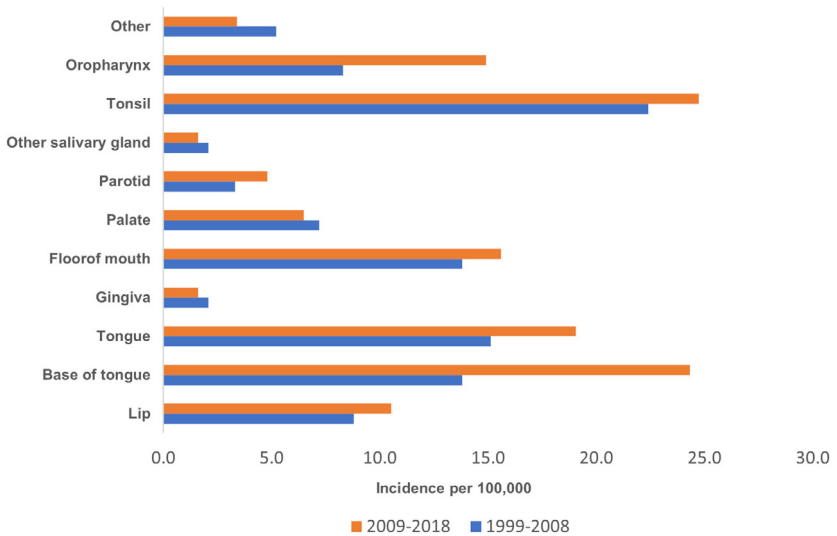

Fig. 1 Site-specific incidence trends (per 100 000) of head and neck cancer in Aboriginal and Torres Strait Islander peoples (1999–2018).

Given the increasing incidence of high-risk HPV oral infections[35] and head and neck cancer in Aboriginal and Torres Strait Islander Peoples, a dedicated national head and neck cancer and oral HPV infection screening programme is suggested.

There is a need to increase research, screening and surveillance in order to gather evidence directly supporting the burden of lip, oral cavity and pharyngeal cancer among Aboriginal and Torres Strait Islander peoples. A standardized, data-driven disease model that can be integrated within an Aboriginal community-controlled health care setting could improve understanding and expectations whilst estimating the disease burden.

Systemic barriers to participation in cancer treatment-related clinical trials for Aboriginal and Torres Strait Islander cancer patients have been identified.[48] Aboriginal patients generally have fewer opportunities to participate in clinical trials due to many residing in geographically remote locations, rare forms of cancer, and overall general health status and comorbidities.[28,48]

The limitations of the study include data from only four (out of eight) Australian states and territories included. The estimates are thus not national. It is important to note; however, that states with the country's highest numbers of Aboriginal communities and residents (NSW, QLD, WA and NT) were included.

CONCLUSIONS

Although an exact estimate of the increasing trends in incidence of lip, oral cavity and pharyngeal cancers could not be estimated by the study due to the nature of the data, it can be suggested that there has been a definite rise in the number of reported cases. Access to healthcare, especially in remote regions of Australia, may lead to a delay in diagnosis, treatment and evaluation. Environmental, social and economic factors could potentially lead to higher incidence, lesser screening, delayed diagnosis and lower survival outcomes in Aboriginal and Torres Strait Islander patients, but there is a deficiency in substantial research specific to this area. With the increase in lip, oral cavity and pharyngeal cancer incidence and the known links with HPV infection, there is an increasing need for its consideration as a public health priority. The need for a targeted, comprehensive and culturally secure model of care to support Aboriginal and Torres Strait Islander peoples with lip, oral cavity and pharyngeal cancers is imperative.

ACKNOWLEDGEMENTS

We thank the Australian Institute of Health and Welfare and the population-based cancer registries of New South Wales, Queensland, Western Australia and the Northern Territory for the provision of data from the Australian Cancer Database. We would also like to acknowledge the special efforts of Mark Short, Manager, Australian Cancer Database, for access to the database, his advice on cancer registration procedures and, his efforts in putting the data request together. We would also like to acknowledge the Australian Dental Research Fund, which graciously agreed to provide funding for this study. Open access publishing facilitated by The University of Adelaide, as part of the Wiley - The University of Adelaide agreement via the Council of Australian University Librarians.

AUTHOR CONTRIBUTIONS

S Sethi: Conceptualization; methodology; data curation; validation; formal analysis; funding acquisition; project administration; writing – original draft. **X Ju:** Methodology; formal analysis; writing – review and editing; writing – original draft; validation. **R Logan:** Investigation; methodology; formal analysis; supervision; resources; writing – review and editing. **J Hedges:** Conceptualization; data curation; supervision; validation; writing – review and editing; funding acquisition. **G Garvey:** Project administration; formal analysis; visualization; validation; methodology; writing – review and editing; supervision. **L Jamieson:** Supervision; writing – review and editing; methodology; conceptualization; investigation; funding acquisition; resources; project administration; formal analysis.

FUNDING INFORMATION

None.

CONFLICTS OF INTEREST

None.

ETHIC STATEMENT

Approvals for the study were obtained from the Human Research Ethics Committees of the University of Adelaide.

REFERENCES

1. Klein JD, Grandis JR. The molecular pathogenesis of head and neck cancer. Cancer Biology and Therapy 2010;9(1):1–7.
2. Mody MD, Rocco JW, Yom SS, Haddad RI, Saba NF. Head and neck cancer. Lancet (London, England) 2021;398 (10318):2289–2299.
3. Fitzmaurice C, Abate D, Abbasi N, *et al*. Global, Regional, and National Cancer Incidence, Mortality, Years of Life Lost, Years

Lived With Disability, and Disability-Adjusted Life-Years for 29 Cancer Groups, 1990 to 2017: A Systematic Analysis for the Global Burden of Disease Study. JAMA Oncol 2019;5(12):1749–1768.

4. Sung H, Ferlay J, Siegel RL, *et al*. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin 2021;71(3):209–249.
5. Scully C, Bagan J. Oral squamous cell carcinoma overview. Oral Oncol 2009;45(4-5):301–308.
6. Licitra L, Locati LD, Bossi P. Optimizing approaches to head and neck cancer. Metastatic head and neck cancer: new options. Annals of oncology: official journal of the European Society for Medical Oncology 2008;19(7):vii200–vii203.
7. Niaz K, Maqbool F, Khan F, Bahadar H, Hassan FI, Abdollahi M. Smokeless tobacco (paan and gutkha) consumption, prevalence, and contribution to oral cancer. Epidemiology and Health 2017;39:1–11.
8. Pytynia KB, Dahlstrom KR, Sturgis EM. Epidemiology of HPV-associated oropharyngeal cancer. Oral Oncol 2014;50(5):380–386.
9. Jagannathan A, Juvva S. Emotions and coping of patients with head and neck cancers after diagnosis: a qualitative content analysis. J Postgrad Med 2016;62(3):143–149.
10. Wood S, Bisson J. Experience of incorporating a mental health service into patient care after operations for cancers of the head and neck. The British Journal of Oral and Maxillofacial Surgery 2004;42:149–154.
11. Ariyawardana A, Johnson NW. Trends of lip, oral cavity and oropharyngeal cancers in Australia 1982–2008: overall good news but with rising rates in the oropharynx. BMC Cancer 2013;13(1):333.
12. Nations U. *United Nations Declaration on the Rights of Indigenous Peoples Contract No: A/RES/61/295*. 2007.
13. Gracey M, King M. Indigenous health part 1: determinants and disease patterns. Lancet (London, England) 2009;374(9683):65–75.
14. Dudgeon P, Wright M, Paradies Y, Garvey D, Walker I. *The Social, Cultural and Historical Context of Aboriginal and Torres Strait Islander Australians. Working Together: Aboriginal and Torres Strait Islander Mental Health and Wellbeing Principles and Practice* 2010 (Commonwealth of Australia.), 25–42.
15. Purdie NPD. Working together: Aboriginal and Torres Strait islander mental health and wellbeing principles and practice. Barton ACT Australian Government Department of Health and Ageing 2010;1:25–44.
16. Poirier B, Sethi S, Haag D, Hedges J, Jamieson L. The impact of neoliberal generative mechanisms on Indigenous health: a critical realist scoping review. Globalization and Health 2022;18(1):61.
17. Richmond CAM, Ross NA. The determinants of First Nation and Inuit health: a critical population health approach. Health Place 2009;15(2):403–411.
18. Kirmayer LJ, Brass G. Addressing global health disparities among Indigenous peoples. Lancet (London, England) 2016;388(10040):105–106.
19. Moore SP, Antoni S, Colquhoun A, *et al*. Cancer incidence in indigenous people in Australia, New Zealand, Canada, and the USA: a comparative population-based study. Lancet Oncol 2015;16(15):1483–1492.
20. Ellison-Loschmann L, Sporle A, Corbin M, *et al*. Risk of stomach cancer in Aotearoa/New Zealand: A Māori population based case-control study. PloS One 2017;12(7):e0181581.
21. Ministry of Health. Tatau Kahukura: Māori Health Chart Book 2015. 3rd edn. Wellington: Ministry of Health, 2015.
22. Welfare: AIoHa. The Health and Wellbeing of Australia's Aboriginal and Torres Strait Islander peoples *Canberra, Australian Capital Territory, Australia*. Australian Institute of Health and Welfare 2015;147:1–10.
23. Ottawa O. Health Canada: A Statistical Profile of the Health of First Nations in Canada: Vital Statistics for Atlantic and Western Canada, 2003-2007. Canada, Health Canada 2014;2:22–26.
24. Diaz A, Soerjomataram I, Moore S, *et al*. Collection and Reporting of Indigenous Status Information in Cancer Registries Around the World. JCO Global Oncology 2020;6:133–142.
25. Mazereeuw MV, Withrow DR, Diane Nishri E, Tjepkema M, Marrett LD. Cancer incidence among First Nations adults in Canada: follow-up of the 1991 Census Mortality Cohort (1992-2009). Canadian Journal of Public Health = Revue Canadienne de Sante Publique 2018;109(5-6):700–709.
26. Teng AM, Atkinson J, Disney G, *et al*. Ethnic inequalities in cancer incidence and mortality: census-linked cohort studies with 87 million years of person-time follow-up. BMC Cancer 2016;16(1):755.
27. Withrow DR, Pole JD, Nishri ED, Tjepkema M, Marrett LD. Cancer Survival Disparities Between First Nation and Non-Aboriginal Adults in Canada: Follow-up of the 1991 Census Mortality Cohort. Cancer Epidemiol Biomarkers Prev 2017;26(1):145–151.
28. Garvey GCJ. Social inequalities and cancer in Indigenous populations. In: Vaccarella S, Lortet-Tieulent J, Saracci R, eds. Reducing social inequalities in cancer: evidence and priorities for research Lyon (FR): International Agency for Research on Cancer. France: IARC Scientific Publications, 2019, No. 168.
29. L BCaF. Diversity statistics in the OECD: How do OECD countries collect data on ethnic, racial and indigenous identity? *OECD Statistics Working Papers 2018/09, OECD Publishing*2018.
30. Australian Bureau of Statistics (2016-2021/2022). Aboriginal and Torres Strait Islander Peoples, Available at: https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples Accessed 23 December 2023.
31. CS. Head and neck cancers among Indigenous Australians living in Queensland. Cancer Council Queensland (Australia) 1997;1:1–25.
32. The Lowitja Institute. Brisbane: School of Population Health: The burden of disease and injury in Aboriginal and Torres Strait Islander peoples 2003. *The University of Queensland* 2007.
33. Alison Gibberd RS. Anthony Dillon, Bruce K Armstrong and Dianne L O'Connell: Are Aboriginal people more likely to be diagnosed with more advanced cancer? Med J Aust 2015;202(4):195–199.
34. Australia. CC: *National Cancer Prevention Policy 2007-09*.
35. Jamieson LM, Antonsson A, Garvey G, *et al*. Prevalence of Oral Human Papillomavirus Infection Among Australian Indigenous Adults. JAMA Netw Open 2020;3(6):e204951.
36. Sethi S, Ju X, Antonsson A, *et al*. Oral HPV Infection among Indigenous Australians; Incidence, Persistence, and Clearance at 12-Month Follow-up. Cancer Epidemiology, Biomarkers & Prevention: a publicatin of the American Association for Cancer Research, cosposored by the American Society of Preventive Oncology 2022;31(3):604–613.
37. Gillison ML. Human papillomavirus-related diseases: oropharynx cancers and potential implications for adolescent HPV vaccination. The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine 2008;43(4 Suppl):S52–S60.
38. Michels KB, zur Hausen H. HPV vaccine for all. Lancet (London, England) 2009;374(9686):268–270.
39. Taira AV, Neukermans CP, Sanders GD. Evaluating human papillomavirus vaccination programs. Emerg Infect Dis 2004;10(11):1915–1923.
40. Nielsen KJ, Jakobsen KK, Jensen JS, Grønhøj C, Von Buchwald C. Head and neck cancers among Indigenous Australians living in Queensland. Viruses 2021;13(7):1–9.
41. Dwojak S, Deschler D, Sargent M, Emerick K, Guadagnolo BA, Petereit D. Knowledge and screening of head and neck

cancer among American Indians in South Dakota. Am J Public Health 2015;105(6):1155–1160.

42. Reichman ME, Kelly JJ, Kosary CL, Coughlin SS, Jim MA, Lanier AP. Incidence of cancers of the oral cavity and pharynx among American Indians and Alaska Natives, 1999-2004. Cancer 2008;113(5 Suppl):1256–1265.
43. Erickson B, Biron VL, Zhang H, Seikaly H, Côté DWJ. Survival outcomes of First Nations patients with oral cavity squamous cell carcinoma (Poliquin 2014). Journal of Otolaryngology–Head & Neck Surgery 2015;44(1):4.
44. Müller S, Khuri FR, Kono SA, Beitler JJ, Shin DM, Saba NF. HPV positive squamous cell carcinoma of the oropharynx. Are we observing an unusual pattern of metastases? Head Neck Pathol 2012;6(3):336–344.
45. Huang SH, Perez-Ordonez B, Weinreb I, *et al*. Natural course of distant metastases following radiotherapy or chemoradiotherapy in HPV-related oropharyngeal cancer. Oral Oncol 2013;49(1):79–85.
46. Huang SH, Perez-Ordonez B, Liu FF, *et al*. Atypical clinical behavior of p16-confirmed HPV-related oropharyngeal squamous cell carcinoma treated with radical radiotherapy. Int J Radiat Oncol Biol Phys 2012;82(1):276–283.
47. O'Sullivan B, Huang SH, Siu LL, *et al*. Deintensification candidate subgroups in human papillomavirus-related oropharyngeal cancer according to minimal risk of distant metastasis. J Clin Oncol Off J Am Soc Clin Oncol 2013;31(5):543–550.
48. Cunningham J, Garvey G. Are there systematic barriers to participation in cancer treatment trials by Aboriginal and Torres Strait Islander cancer patients in Australia? Aust N Z J Public Health 2021;45(1):39–45.

Address for correspondence:
Sneha Sethi
Australian Research Centre for Population Oral Health
Adelaide Dental School
University of Adelaide
Adelaide
SA 5005
Australia
Email: *sneha.sethi@adelaide.edu.au*