

A five-year retrospective observational study of dental presentations to Waikato Hospital's emergency department

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ABSTRACT

AIM: Within New Zealand (NZ) there is limited research concerning demographics and utilisation of the Emergency Department (ED) for dental-related conditions. The aim of this research was to identify the prevalence of dental presentations to Waikato Hospital ED, defining patient demographics, discharge diagnoses, management, and re-presentation rates.

METHODS: Patients who presented to the Waikato Hospital ED from 2015 to 2019 with ICD-10 dental diagnoses were included in the study. Data collected included patient demographics, discharge diagnosis and management of these presentations. Statistical analysis was completed using IBM SPSS Statistical Version 26.0.

RESULTS: Over the five-year study period, 4030 presentations to Waikato Hospital ED were dentally related, making up 0.98% of all ED presentations. Patients were primarily male (54%), NZ European (45%) or Māori (42%), from regions of high deprivation, presenting outside of work hours (68%). Seventy-three percent of dental presentations were non-traumatic. Ninety percent of patients were discharged with symptomatic management. Of patients admitted only 4% required management under general anaesthesia (GA). Representation occurred in 6% of patients, primarily for non-traumatic dental disease (89%). Fifty-one percent of re-attenders were male, 42% Māori and 50% of patients had a deprivation index of 9 or 10. Forty-one percent of patients re-presented within a week.

CONCLUSION: At Waikato Hospital, males, NZ European, and patients of high deprivation most commonly presented to ED for dental related presentation, which were primarily non-traumatic in origin. Many patients did not require hospital care, and were managed by ED and discharged. Few patients re-presented to ED for further care. Dental presentations to ED are potentially preventable, and may be related to barriers such as cost, access or health knowledge, or an increased need. Further research is required on strategies to reduce ED presentations for dental conditions.

Within New Zealand (NZ) there is limited research concerning the demographics and utilisation of the Emergency Department (ED) for dental-related conditions. Media reports and anecdotal evidence suggests that a large number of patients are presenting to NZ ED with non-traumatic dental disease, believed to be associated with accessibility barriers and the cost of oral health care in NZ.¹ International literature has found that dental presentations account for 1–3% of all ED presentations, with 80–90% not requiring hospital level care.^{2–5} The most common ED dental presentations are for pain, infections, and dental trauma. These are associated with a reduced level of education, unemployment, lack of municipal water fluoridation, and chronic disease.^{4,6–8}

Significant oral health disparities exist in NZ. NZ Māori, Pasifika people, and individuals of low socio-economic status (SES) have higher rates of

untreated decay, periodontal disease, and missing teeth.⁹ ED is a well-recognised point of entry into the healthcare system, particularly for individuals who have difficulty accessing routine preventative services.^{10,11} However, in NZ, hospital dental provisions are limited, and medicine and dentistry exist largely as entities independent from one another.¹⁰ Emergency physicians have reported low levels of training and confidence in the management oral health. Commonly symptomatic treatment strategies are implemented such as analgesics and antibiotics.^{6,12} Due to the lack of definitive dental care, patients may re-present to ED due to deterioration on outpatient antibiotics, spread of infection and/or airway compromise.⁴

This study aims to describe the demand experienced in Waikato Hospital ED for dental-related conditions. We aim to identify patients' epidemiology, management and re-presentation rates

for dental related ED presentations. The authors' hypothesis based off anecdotal findings and experience, is that individuals of high deprivation, and Māori and Pasifika peoples' ethnicity, will be over-represented. Furthermore, the authors believe there will be high rates of non-traumatic dental disease that is managed symptomatically, with high rates of recidivism.

Methods

The authors present a retrospective observational study assessing dental presentations to Waikato Hospital ED, Hamilton, NZ from 1 January 2015 to 31 December 2019. Waikato Hospital is an urban tertiary referral centre, with the Dental and Oral and Maxillofacial Surgery (OMS) department serving a population of up to 500,000 people, with 82,000 ED presentations on average annually. The study was granted ethics exemption and approved in writing by the NZ Health and Disability Ethics Committee, Waikato District Health Board (DHB), with Māori Health and Research consent.

All presentations to the Waikato Hospital ED were entered into the ED Information System from 2015 to 2019. The study's inclusion criteria were patients who presented with International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) dental diagnostic codes on discharge.¹³ Patients' discharge diagnoses were allocated by clinical nurse specialists, emergency physicians, paediatricians or from staff within the OMS Department. Patients were excluded if presentations were beyond the general scope of dental practice as outlined by the NZ Dental Council defined as: "The maintenance of health through assessment, diagnosis, management, treatment and prevention of any disease, disorder or condition of the orofacial complex and associated structures."¹⁴ Examples of excluded presentations included facial fractures, orofacial or cervical pathology and non-odontogenic or cervical infection. Data collected included patient sociodemographic details (age, sex, ethnicity), reasons for presentation, consultation and discharge time and date, diagnostic modalities, diagnosis, patient management, and re-presentation. SES was obtained from the patients' residential addresses, which was converted to a Statistics NZ meshblock 2018 number. The meshblock number was then converted to SES using the 2018 NZ Index of Socioeconomic Deprivation. Values are ranked into deciles ranging from one (lowest deprivation) to ten (highest deprivation).¹⁵

All data was de-identified on extraction and was categorised by the research team. Age was classified between 0–18 years (includes patients eligible for the Community and Adolescent Oral Health Services), 18–65 years (NZ's working class) and 65 years and over (patients eligible for superannuation). Ethnicity data was classified as NZ European, Māori and Pasifika people (Individual of Pacific Island heritage) due to their prevalence in the NZ population. Other ethnicities included Asian, Middle Eastern, Latin American and African. Categories included abscess, soft tissue injury, toothache, dental trauma, cellulitis, ulceration and complications referred by community dentists e.g., post-operative bleeding. General anaesthesia (GA) was used as a surrogate marker for severity of the condition. Data underwent descriptive statistical analysis with IBM SPSS Statistics Version 26.0. Normality was assessed with Shapiro–Wilk Tests. An alpha value of $P \leq 0.05$ was considered significant. Normally distributed statistics were represented with parametric statistics including means and 95% confidence intervals (CI). Data not normally distributed was presented with medians and interquartile range (IQR).

Results

Over the five-year study period, there were 409,291 presentations to the Waikato Hospital ED, of which 4030 (0.98%) were for dental presentations. Seventy-two percent (2902/4030) of presentations were non-traumatic in nature. Non-traumatic presentations consisted primarily of toothache (1476/2902, 51%) and dental abscesses (1072/2902, 37%). Traumatic dental presentations (1128/4030, 28%) were composed of soft tissue injury (852/1128, 76%) and dental trauma (276/1128, 24%). Data relating to discharge diagnosis is presented in Table 1.

Fifty-four percent (2185/4030) of patients were male, with a median age of 26 years (IQR=11–39), while 46% (1845/4030) of patients were female, with a median age of 28 years (IQR=19–40). Patients aged 19 to 65 years had the highest incidence of presentation (2694/4030, 67%) and highest rate of non-traumatic dental presentations (2164/2902, 75%). Conversely, patients 0 to 18 years had the highest incidence of traumatic dental presentations (636/1134, 56%). Data relating to age and discharge diagnosis is shown in Table 1.

There were 1841/4030 (45%) NZ European patients and 1679/4030 (42%) Māori patients. The SES Deprivation Index was not normally distrib-

Table 1: Patient demographics, presentation characteristics and management by discharge diagnosis.

	Total	Abscess	Soft tissue injury	Toothache	Dental trauma (α)	Cellulitis	Ulceration	Complications (β)
Total patients (n)	4030	1072 (27%)	852 (21%)	1476 (37%)	282 (7%)	207 (5%)	27 (1%)	114 (3%)
Median age (years)	4030	30 (IQR=22–42)	9 (IQR=3–28)	29 (IQR=22–40)	18 (IQR=5–31)	36 (IQR=14–55)	16 (IQR=3–30)	34 (IQR=24–53)
Age (years)								
0–18	1118	193 (17%)	495 (44%)	209 (19%)	141 (13%)	56 (5%)	14 (1%)	10 (1%)
19–65	2694	837 (31%)	310 (12%)	1204 (45%)	122 (5%)	123 (5%)	10 (< 1%)	88 (3%)
65+	218	42 (19%)	47 (22%)	63 (29%)	19 (8%)	28 (13%)	3 (<1%)	16 (7%)
Sex								
Male	2185	542 (25%)	570 (26%)	717 (33%)	176 (8%)	114 (5%)	13 (1%)	52 (2%)
Female	1845	530 (29%)	282 (15%)	759 (41%)	106 (6%)	93 (5%)	14 (<1%)	62 (3%)
Ethnicity								
NZ European	1841	453 (25%)	437 (24%)	629 (34%)	145 (8%)	98 (5%)	10 (<1%)	69 (4%)
Māori	1679	501 (30%)	301 (18%)	662 (39%)	92 (5%)	78 (5%)	12 (<1%)	33 (2%)
Pasifika people	194	58 (30%)	30 (15%)	76 (39%)	14 (7%)	12 (6%)	2 (1%)	2 (1%)
Other (χ)	316	60 (19%)	84 (27%)	109 (34%)	31 (10%)	19 (6%)	3 (<1%)	10 (3%)
Day of presentation								
Weekday	2671	721 (27%)	313 (12%)	998 (37%)	169 (6%)	152 (6%)	17 (<1%)	85 (3%)
Weekend	1359	351 (26%)	539 (40%)	488 (36%)	113 (8%)	55 (4%)	10 (<1%)	29 (2%)
Hours of presentation								
In hours (0700–1630)	1980	661 (33%)	397 (20%)	611 (31%)	125 (6%)	120 (6%)	13 (<1%)	53 (3%)
After hours (1630–0700)	2050	411 (20%)	455 (22%)	865 (42%)	157 (8%)	87 (4%)	14 (<1%)	61 (3%)

Table 1 (continued): Patient demographics, presentation characteristics and management by discharge diagnosis.

	Total	Abscess	Soft tissue injury	Toothache	Dental trauma (α)	Cellulitis	Ulceration	Complications (β)
Treating specialty								
Emergency Department	3056	633 (21%)	722 (24%)	1285 (42%)	208 (7%)	112 (4%)	23 (<1%)	73 (2%)
OMS Department	884	407 (46%)	129 (15%)	176 (20%)	73 (8%)	59 (7%)	0 (0%)	40 (5%)
Paediatrics	90	32 (36%)	1 (1%)	15 (17%)	1 (1%)	36 (40%)	4 (4%)	1 (1%)
Median time to assessment (minutes)	53 (IQR=20–110)	59 (IQR =26–111)	52 (IQR =22–113)	46 (IQR =15–102)	59 (IQR=24–126)	54 (IQR=23–106)	69 (IQR =5–117)	45 (IQR =18–114)
Median time in ED (minutes)	148 (IQR=72–148)	167 (IQR=102–239)	157 (IQR=80–261)	118 (IQR=43–203)	173 (IQR=95–291)	172 (IQR=113–258)	161 (IQR=65–237)	148 (IQR=76–258)
Admission (total)								
Admitted to ward	387	180 (47%)	48 (12%)	66 (17%)	20 (5%)	65 (17%)	2 (<1%)	6 (2%)
Discharged	3643	892 (24%)	804 (22%)	1410 (39%)	262 (7%)	142 (4%)	25 (<1%)	108 (3%)
Management general anaesthetic (total)	169	72 (43%)	38 (22%)	24 (14%)	16 (9%)	15 (8%)	0 (0%)	4 (2%)
Examination								
Bloods	1029	587 (57%)	62 (6%)	263 (26%)	46 (4%)	120 (11%)	6 (<1%)	47 (5%)
Imaging	1341	622 (46%)	122 (9%)	387 (29%)	127 (9%)	49 (4%)	1 (<1%)	33 (2%)
Prescription (δ)	1837	664 (36%)	334 (18%)	504 (27%)	139 (8%)	136 (7%)	7 (5%)	53 (3%)

(α) Physical injury to the enamel, dentine, cementum or surrounding periodontium.

(β) Complication following dental procedure including post-operative bleed, infection, air emphysema and displaced tooth roots.

(χ) Includes Indian, Asian, Middle Eastern, Latin American and African.

(δ) Discharge prescription including analgesia and topical or systemic antibiotics.

uted with a median of 8 (IQR=5–9). Data relating to ethnicity and discharge diagnosis is shown in Table 1. The most deprived patients (Deprivation Index 8–10) comprised 51% (2055/4030) of all patients (Figure 1).

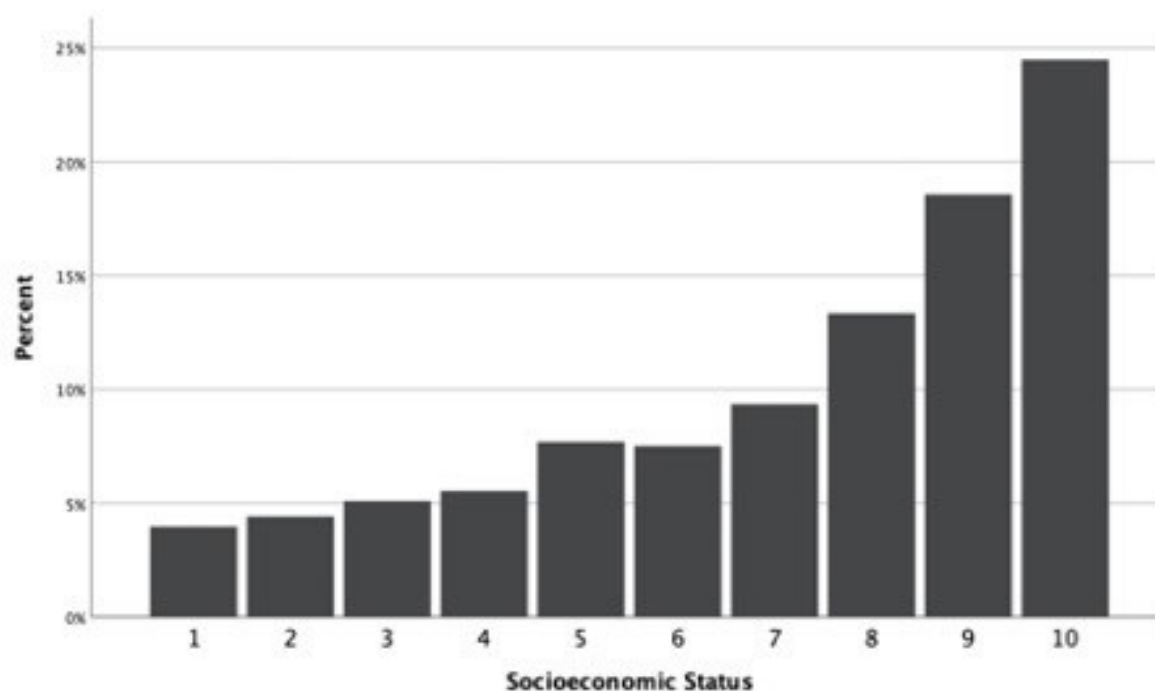
The time patients waited in ED to see a clinician was not normally distributed with a median time of 53 minutes (IQR=20–110 minutes). The total time patients spent in ED was not normally distributed with a median time of 148 minutes (IQR=72–236 minutes). Patients with ulceration (median=69 minutes, IQR=5–117 minutes) and abscess (median=59 minutes, IQR=26–111 minutes) waited the longest for a clinician. Patients with dental trauma (median=173 minutes, IQR=95–291 minutes) and ulceration (median=161 minutes, IQR=65–237 minutes) spent the longest total time in ED. Time spent in ED ranged from 1 minute to 1346 minutes (22 hours), for a patient who required intravenous antibiotics and fluids for dental pain. Seventy-six percent (3056/4030) of patients were seen by emergency physicians, the OMS Department reviewed 22% (884/4030) and pediatricians reviewed 2% (90/4030). The OMS Department primarily reviewed dental abscesses (407/1072, 38%), soft tissue injuries (129/852, 15%), and toothache (176/1476, 12%). Investiga-

tions used in ED included blood tests (1029/4030, 26%) and radiographs (1341/4030, 36%), comprising of plain films (1243/1341; 93%) and computer tomography (CT) (98/1341, 7%). Data relating to wait times, treating specialty and investigations is shown in Table 1.

The total number of ED presentations per year had a mean of 806, ranging from 749 in 2015 to 877 in 2017. January (460/4030, 11%) was the most common month of presentation, August (298/4030, 7%) was the least common. Summer (1154/4030, 29%) was the most common season of presentation, with winter (920/4030, 23%) the least common. Sixty-eight percent (2740/4030) of patients presented outside of working hours, combining both weekends (1359/2740, 50%) and after hours (1630 to 0730) on weekdays (1381/2740, 50%).

Ten percent (387/4030) of dental presentations were admitted to hospital, with 4% (169/4030) requiring treatment under GA. Eighty-eight percent (342/389) of patients admitted were diagnosed with non-traumatic disease, staying a mean of three nights. One patient stayed for 37 days with necrotising fasciitis of odontogenic cause. Fourteen percent (53/387) of patients presented with life-threatening odontogenic infections with deep neck space involvement and airway com-

Figure 1: Total patient presentations stratified by socio-economic status.



promise. All of these patients (53/53, 100%) were managed under GA, 46% (24/53) were of Māori or Pasifika descent. Post-operatively, 92% (49/53) remained intubated with transfer to the ICU, 8% (4/53) were extubated and transferred to the high dependency unit (HDU). Patients spent a mean of three nights in ICU/HDU.

Ninety percent (3643/4030) of patients were discharged from ED with a discharge summary and instructions to follow up with their general dental practitioner regarding definitive management of their dental condition. Thirty-six percent (1311/4030) were discharged with a prescription. Six percent (256/4030) re-presented, comprising 14% (562/4030) of presentations. Eighty-six percent (219/256) re-presented once, and one patient presented 13 times with dental pain. The majority of patients that re-presented were male (51%), Māori (42%) with a median age of 31 years (IQR=23–48). Non-traumatic dental disease accounted for 89% (228/256) of re-presentations. At re-presentation, 11% (29/256) of patients required admission and 9% (23/256) required a procedure under a GA. All patients on re-presentation that were admitted and required management under GA had the discharge diagnosis of dental abscess. Management under GA involved incision and drainage. The median time between presentations was 22 days (IQR=2–286) following discharge from ED. Forty-one percent (104/256) of re-presentations occurred, within a week of discharge. Eighteen percent (19/104) of patients who re-presented within a week were admitted, with 57% (11/19) requiring a GA. No patients required post-operative care in HDU or ICU. Fifty percent (128/256) of patients who re-presented were SES Deprivation Index 9 or 10. Data relating to representation is shown in Table 2.

Discussion

This research was undertaken to give an objective measure of dental presentations to Waikato Hospital ED, their discharge diagnoses, patient epidemiology, management and representation. In total, dental presentations comprised 0.98% of all ED presentations. Dental presentations to ED are considered avoidable through appropriate preventative and primary care. Patients presenting to ED for dental disease represent health inequalities, poor functioning of primary health care, or inappropriate use of the hospital system due to greater need (Yap et al, 2018). Although dental presentations to ED represent a small proportion of

hospital presentations, they should not be underestimated, as they are resource intensive, and can cause significant morbidity, and potential mortality to patients. Within our study, 4030 patients spent cumulatively 497 days in ED, with 842 days of admission, requiring 169 GA procedures. Fifty-three patients were admitted and treated under GA for life-threatening non-traumatic odontogenic disease, requiring inpatient stay in HDU and ICU. These resources could have been better utilized for emergent health concerns, and funding better distributed to primary care of dental disease.

Confirming the authors hypothesis, the majority of patients presenting to ED had a discharge diagnosis of non-traumatic dental presentations (72%) from areas of high deprivation (51%, SES Deprivation Index 8–10). Patients were most commonly NZ European (45%) and Māori (42%), with few Pasifika patients (5%). Presentation for Māori were over-represented, when compared to 2018 census data, where 28% of the population identified as Māori.¹⁶ High presentation rates for Māori may be related to lack of dental health policy addressing oral health and a maldistribution of dental practitioner in Māori communities.^{17,18} Further barriers to seeking dental care include cost, access, prioritisation, and the lack of oral health knowledge.¹⁴ In NZ the cost of oral health services is high, with adults paying a fee for service. Many adults report the cost of private dental care as prohibitive, yet are not financially eligible for funding.⁹ Low-income adults may be eligible for \$300 of government funding through Work and Income NZ (WINZ) for emergency dentistry yearly. However, based on the NZ Dental Association Fee Survey 2020, \$300 would not cover the cost of an examination and simple extraction.¹⁹ Cost and access barriers are reflected in this study's findings, with the majority of ED presenters living in areas of high deprivation and presenting out of hours.

At Waikato Hospital dental presentations to ED were primarily managed by ED (76%), without the requirement of surgical intervention, indicating low acuity of their presentation. The low acuity of dental presentations to ED in NZ has also been highlighted by Smith et al 2021 where 77.3% of patients recorded an Australasian Triage Score (ATS) of four or five. Within our study, this lack of acuity is further represented with few patients requiring specialist OMS review (22%), admission (10%) or treatment under GA (4%). Patients experienced long wait times for conditions such as dental trauma and ulceration, which would be

Table 2: Patient representation demographics, diagnosis and management.

	Total (n)
Total (n)	256 (100%)
Sex	
Male	123 (48%)
Female	133 (52%)
Ethnicity	
European	103 (40%)
New Zealand Māori	130 (51%)
Pasifika people	11 (4%)
Other	12 (5%)
SES Deprivation Index	
1	5 (2%)
2	8 (3%)
3	9 (3%)
4	14 (6%)
5	25 (10%)
6	20 (8%)
7	19 (7%)
8	27 (11%)
9	51 (20%)
10	76 (30%)
Number of representations	
1	219 (86%)
2	29 (11%)
3	6 (2%)
4	1 (<1%)
5	0 (0%)
6	0 (0%)
13	1 (<1%)

Table 2 (continued): Patient representation demographics, diagnosis and management.

	Total (n)
Presentations	
Abscess	83 (32%)
Soft tissue injury	18 (7%)
Toothache	120 (47%)
Dental trauma	10 (4%)
Cellulitis	16 (16%)
Ulceration	1 (<1%)
Complications	8 (3%)
Admission at repeat presentation	
Yes	29 (11%)
No	227 (89%)
General anaesthetic at repeat presentation	
Yes	23 (9%)
No	233 (91%)

more appropriately managed in a primary dental care setting. Furthermore, international literature highlights concerns that non-urgent dental presentations do not receive definitive treatment in ED.^{2,4,20} Treatment of acute odontogenic disease is primarily through operative intervention such as extraction or pulp therapy. However, in many EDs this cannot be facilitated due to the lack of resources and expertise.¹ This leads to management with pain relief and antibiotics, which can lead to postponement of definitive treatment, potentially contributing to serious odontogenic disease sequelae requiring invasive surgical management.^{2,4,20}

Literature from NZ and Australia further support the findings of this study. Smith et al 2021 conducted a mixed-method study identifying dental presentations and epidemiological data from four urban and provincial EDs within NZ. In accordance with our findings there were high rates of ED attendance for non-traumatic dental disease in males, Māori, and adults. The majority (70%) of patients were treated and then discharged, with few (<10%) requiring specialist management. Health practitioners believed there were high presentation rates of non-traumatic

dental disease to ED with a range of severity, adding further resource strains on ED. Clinicians believed the knowledge and skills in ED for managing non-traumatic dental presentations were limited, and they concluded dental care would be more suitably treated outside the hospital setting, to reduce ED presentations.¹ Verma et al 2014 conducted a one-year retrospective audit of dental presentations in ED in a comparative population of Tasmania, Australia. Similar to our study, dental presentations comprised of 0.91% of all presentations, dental abscesses and toothache was the most common diagnosis (66%), with the majority of patients being male (60%) under 30 years of age and presenting out of hours (68%). Consistent with our study 6% represented to hospital.¹ This low rate of presentation may indicate recidivism outside of the hospital setting or accessing funding for definitive dental management, however this was not ascertained from our or Verma et al 2014 studies.

Although outside the scope of research the authors would encourage research into the effect of relief of pain clinics, established subsidised dental clinics for ED referrals, and primary prevention strategies such as fluoridation and oral

health education programs on ED presentations for dentistry. Reducing dental presentations to ED is going to require a multi-modal approach with changes in policy, funding and the development of services for vulnerable populations. This study provides insight into the patients presenting to ED for dentistry and provides a starting point for discussion and actioning change.

Conclusion

Over the five-year study period, 4030 presentations to Waikato Hospital ED were dental-related, making up 0.98% of all ED presentations. Patients were primarily male, NZ European or Māori, from

regions of high deprivation presenting outside of work hours. Dental presentations were primarily low acuity and non-traumatic in origin, not requiring specialist review, admission or management under GA. Few patients represented to ED. Dental presentations to ED are potentially preventable, and may be related to barriers such as cost, access or health knowledge, or an increased need. Further research is required on strategies to reduce ED presentations for dental conditions.

Data

Research data used for this research, is available upon request.

COMPETING INTERESTS

Nil.

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REFERENCES

- Smith M, Stroud C, Low M, Gibson C, Ferguson A, Broadbent J. Non-traumatic dental presentations at emergency departments in New Zealand. 2021; 134:105-112.
- Bassey O, Csikar J, Hallam J, Sandoe J, Thompson W, Douglas G. Non-traumatic dental presentations at accident and emergency departments in the UK: a systematic review. *British Dental Journal*. 2020; 14;228: 65-69.
- Chadwick SG. A comparison of patient and dental condition characteristics presenting to a pediatric hospital emergency department versus urgent care with non-emergency dental complaints. 2017; 15:12-18.
- Verma S, Chambers I. Dental emergencies presenting to a general hospital emergency department in Hobart, Australia. *Australian Dental Journal*. 2014; 59: 76-82.
- Brondani M, Ahmad SH. The 1% of emergency room visits for non-traumatic dental conditions in British Columbia: Misconceptions about the numbers. Vol. 108, *Canadian Journal of Public Health*. Canadian Public Health Association; 2017; 23: 279-81.
- Samei H, Weiland TJ, Dilley S, Jelinek GA. Knowledge and confidence of a convenience sample of Australasian emergency doctors in managing dental emergencies: results of a survey. *Emergency Medicine International*. 2015; 32: 12-19.
- Acharya A, Khan S, Hoang H, Bettiol S, Goldberg L, Crocombe L. Dental conditions associated with preventable hospital admissions in Australia: A systematic literature review 11 *Medical and Health Sciences 1117 Public Health and Health Services*. BMC. 2018; 15: 1-12.
- Akinlotan MA, Ferdinand AO. Emergency department visits for nontraumatic dental conditions: a systematic literature review. *Journal of Public Health Dentistry*. 2020; 80: 313-26.
- Haisman RJ, Mason Kylie, Holmes Erin, Haisman RJ, Templeton Robert, Weerasekera Deepa, et al. Our oral health: Key findings of the 2009 New Zealand Oral Health Survey. Ministry of Health. 2010; 1: 1-125. <https://www.health.govt.nz/publication/our-oral-health-key-findings-2009-new-zealand-oral-health-survey>
- Smith MB, Ferguson CA, Thomson WM. Public sector oral health service provision for high needs and vulnerable New Zealanders. 2019; 1: 1-218.
- Lewis C, Lynch H, Johnston B. Dental complaints in emergency departments: A national perspective. *Annals of Emergency Medicine*. 2003; 43: 93-9.
- Parry J, Jiwa M, Krejany C. Bridging the Australian medical-dental divide. *The Journal of Health Design*. 2020; 22: 293-9.
- World Health Organization. International statistical classification of diseases and related health problems. World Health Organization; 2011.
- <https://www.who.int/standards/classifications/classification-of-diseases>
- New Zealand Dental Council. New Zealand Conditions of Practice Handbook. New Zealand Dental Council. 2011; 1: 1-74.
- Atkinson J, Salmond C, Crampton P. NZDep2018 Index of Deprivation. 2019.
- <https://www.otago.ac.nz/wellington/otago730394.pdf>
- New Zealand. Stats NZ. 2018 census report on final content. 2018; 1; 1-53.
- <https://www.stats.govt.nz/assets/Reports/2018-Census-report-on-final-content/2018-census-report-on-final-content.pdf>
- Kruger E, Whyman R, Tennant M. High-acuity GIS mapping of private practice dental services in New Zealand: does service match need? *International Dental Journal*. 2012; 62: 2-10.

21. Lacey K, Murray T, Crampton P, Willing E. Working toward Māori oral health equity: Why te Tiriti o Waitangi needs to underpin the oral health system using evidence from the New Zealand Oral Health Survey. *New Zealand Dental Journal*. 2021;117: 105-10.
22. New Zealand Dental Association. Average New Zealand Dental Practice Prices 2020. 2020; 1: 1-12.
23. https://www.nzda.org.nz/assets/files/Public/Resources/Fee_Survey_2020.pdf
24. Cohen LA. Expanding the Physician's Role in Addressing the Oral Health of Adults. *American Journal of Public Health*. 2013;103: 32-39.