

Peer reviewed paper; submitted March 2021; accepted October 2021

Publicly funded emergency dental services during COVID-19 Lockdown Levels 3 and 4: The Taranaki COVID-19 oral health plan. A review of adults presenting with acute dental problems, sociodemographic parameters and service delivery strategies.

Antunovic DM, McInerney M, Jarman J, Penlington G

Abstract

Background: To provide emergency dental service continuity in a safe and managed environment during New Zealand's COVID-19 National Level 3 and 4 lockdown periods, the Dental Department of the Taranaki District Health Board (TDHB) implemented a temporary free-of-charge oral health service plan for the people of the Taranaki district.

The purpose of this study is to document the process and provide a review of adult patients seen by this free-of-charge service in Taranaki during the national seven week COVID-19 lockdown in 2020. It provides a unique opportunity to describe adult oral dental health conditions and patient socio-demographics for those requiring emergency dental care in a health district.

Method: Triage and treatment records were collected on paper clinical notes during the Service and later transcribed in an Excel spreadsheet. These records were linked via NHI (National Health Index number) from the TDHB's patient management system (WebPAS) to determine ethnicity and domicile deprivation score. The results and treatment categories were described and stratified by Māori versus Non-Māori ethnicity and domicile deprivation score.

Results: There were 739 patient interactions from which 447 records were included. Compared to the Taranaki population, Māori and those in higher deprived domiciles were overrepresented. Most complaints were for pain and/or swelling (75.4%), the most frequent diagnosis was dental abscess (38.6%) and extraction the most common treatment (72.2%). Significant associations between Māori ethnicity and odds of extraction were attenuated after adjustment for domicile deprivation quintile. Compared to the lowest domicile deprivation quintile, the highest quintiles were significantly associated with odds of extraction and the magnitude of the association increased with greater deprivation [quintile 4: OR 2.47 (95%CI 1.03,6.09); quintile 5 OR 2.74(95%CI 1.06,7.50)].

Conclusion: This retrospective observational study provides a unique opportunity to describe adult oral health conditions and patient socio-demographics for those requiring emergency dental care in a regional

health district, during the global Coronavirus pandemic. It has highlighted the unmet need in the region's adult population, the underlying problem of oral health inequity and shows the overrepresentation of Māori and those from higher deprivation domiciles when accessing the Taranaki COVID-19 oral health service plan.

Introduction

The COVID19 pandemic, caused by the novel coronavirus SARS-CoV-2, originated in China in late 2019 (WHO 2020). To reduce person-to-person transmission of COVID-19, extensive measures including restricting social movements, isolation, contact tracing, and alternative health service delivery were recommended (WHO 2020; Rothan and Byrreddy 2020) and actioned in New Zealand (NZ) (Jefferies et al. 2020). The New Zealand Government COVID-19 Alert System, with progressive levels of restrictions, was introduced in March 2020 to manage and minimise the risk of COVID-19 within NZ (Jefferies et al 2020).

Transmission of SARS-CoV-2 can occur through direct, indirect, or close contact with infected people through infected secretions such as saliva and respiratory secretions or their respiratory droplets (WHO, 2021). The oral and salivary gland epithelial cells have been shown to be large reservoirs and initial sites of infection of the SARS-CoV-2 virus with high viral shedding (Srinivasan, 2021). Previous studies on person-to-person transmission indicated a significant role of bio-aerosols in the transmission of many respiratory viruses similar to SARS-CoV-2 (Kutter et al., 2018; Lakshman and Peiris, 2004; Asadi et al., 2020). Any dental procedure that has the potential to aerosolise saliva can then cause airborne contamination and a significant risk of disease transmission. On March 22, 2020 the Dental Council of New Zealand (DCNZ) and the New Zealand Ministry of Health (MoH) both released guidance strongly recommending that all non-essential and elective dental services, particularly those generating an aerosol, should be suspended immediately to reduce the risk of community spread (DCNZ/MoH 2020).

To provide emergency dental service continuity in a safe and managed environment during the Level 3 and 4 lockdown period, the senior dental team of the Taranaki District Health Board (TDHB) developed a temporary, free-of-charge oral health service plan for the Taranaki district. This Board is responsible for providing or funding the provision of health services in the Taranaki district and serves approximately 125,000 people, of which 19.3% identify as Māori (MoH 2019). Under normal conditions, the Dental Department accepts referrals for patients who are medically compromised, have special needs or are low income adults who qualify with a Community Services Card. The Taranaki COVID-19 oral health plan (TCOHP) was communicated to the local private dentists through their Association Executive which directed private dentists in the district to cease all dental work that created an aerosol. Private practices throughout Taranaki maintained their messaging systems and continued to advise and triage their patients and refer those patients with serious dental problems to the TCOHP Triage team. Dental practices were instructed to provide advice, analgesics and antibiotics—the 3 A's, where appropriate (WHO 2020). Meanwhile, the TDHB Dental Team activated an emergency-only service based at the Base Hospital in New Plymouth, two community

clinics in New Plymouth and a further clinic at Hawera Hospital. One of the emergency clinics in New Plymouth was established for the treatment of adults with serious oro-facial conditions, while children and adolescents were treated in a separate community clinic. A free phone was available and the service was free of charge to everyone. The overriding principle for triaging was triage-defer-prescribe-support-review (Figure 1). While all local TDHB elective treatment was cancelled, acute adult and child dental operating theatres were organised when they were required (Figure 2). Treatment was provided following the DCNZ COVID-19 Guidelines at Level 3 and 4 (DCNZ/MoH 2020).

Methods

This retrospective observational study included records of adult (age 18 years and older at time of interaction) patients who interacted with the TCOHP service between March 25 and May 14, 2020 for a dental purpose.

Triage and treatment records were collected on paper clinical notes during the Service and later transcribed in an Excel spreadsheet. Transcribed records were linked via NHI from the TDHB's patient management system (WebPAS) to determine ethnicity and domicile deprivation score. Records that could not be linked or

Overriding Principals of Triage



Figure 1. The overriding principles for the triaging of patients along with tele-dentistry utilised in this study.

Taranaki DHB Covid-19 Oral Health Service Plan

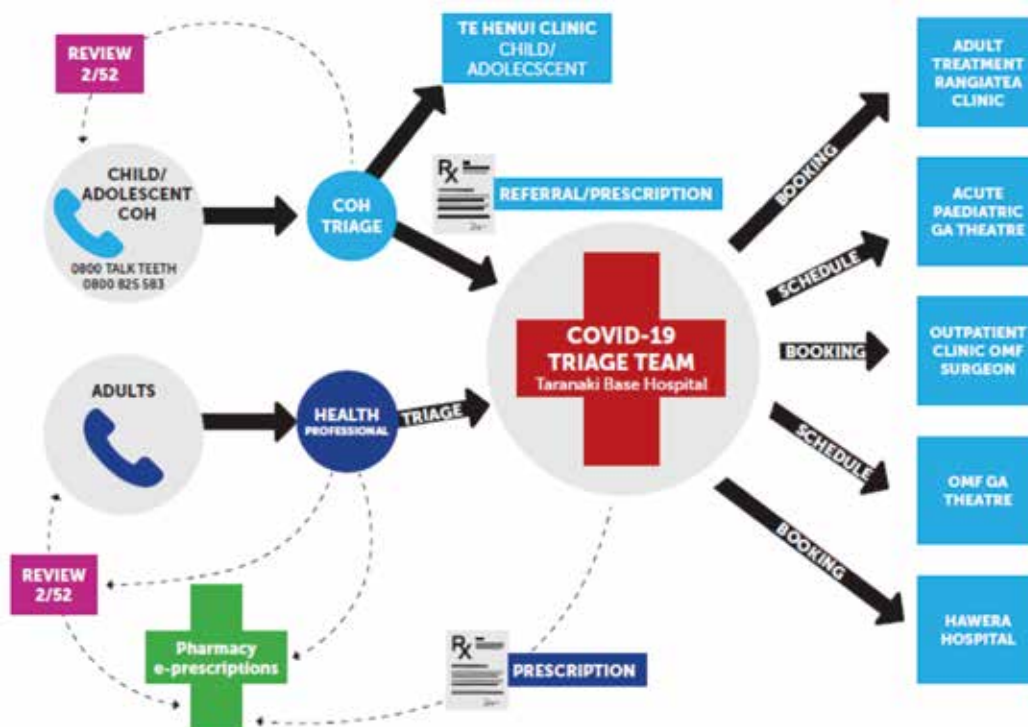


Figure 2. Taranaki District Health Board COVID-19 Oral Health Plan (TCOHP)

records that were clearly indecipherable were excluded. Ministry of Health prioritised ethnicity group (Māori, Pacific Peoples, Asian, European/Other ethnicities) was further categorised to two groups, Māori and Non-Māori, due to low representation of ethnicity groups aside from European/Other and Māori. The average NZDep2013 score, a relative measure of area-level socioeconomic deprivation (Atkinson et al. 2014), for each domicile in the Taranaki region was calculated using population weighted average scores calculated by the Ministry of Health (Atkinson et al. 2014). The TDHB population ethnicity and domicile distributions were estimated using the Statistics New Zealand 2018 forecast using 2013 Statistics New Zealand Census figures as a base.

Triage complaint, treatment type, and diagnosis were documented on the paper notes at the time of treatment by the providing clinician. Complaints, treatment type, and diagnosis categories were coded independently by two reviewers (authors) and a third content expert reviewer mediated differences.

Statistical analyses were performed in R Studio V.1.1093. The alpha for all statistical tests was 0.05. Differences in the ethnicity and domicile deprivation distribution of the study population compared to the estimated TDHB population were calculated using Pearson's chi-square goodness-of-fit tests and percent differences by category were calculated post-hoc to support chi-square interpretation.

The volume (point prevalence) of triage complaints, diagnosis and treatments were described and stratified by Māori versus Non-Māori ethnicity, and domicile deprivation score. Treatment provided was an outcome variable of the study and was further analysed for ethnicity and domicile deprivation differences. Due to low counts for all treatments except for extraction when stratified by ethnicity and domicile deprivation quintile, only extraction was analysed for statistical differences. For patients who had any treatment, primary treatment was re-categorised into a dichotomous variable (extraction versus no extraction) so that prevalence odds ratios (OR) and 95% confidence intervals could be computed using binomial logistic regression in R (aod package). Domicile deprivation quintile was treated as ordinal.

Bivariate (crude) logistic regression models for ethnicity group and domicile deprivation quintile on extraction (prevalence odds of having an extraction as primary treatment versus odds of all other treatment) were calculated. Next, adjusted models were fitted with age (continuous) and sex. A final fully fitted model with age, sex, ethnicity group, and domicile deprivation quintile was computed.

A two-sided Student's t-test was conducted to test for statistical difference in the mean number of extractions between Māori and Non-Māori, and Analysis of Variance (ANOVA) was conducted to test for statistical differences in the mean number of extractions by domicile deprivation quintile. Permission to conduct the research was obtained from the TDHB's Clinical Board. Ethics approval was sought from the New Zealand Ethics Committee but it was deemed that the project did not require formal review as it was classified as a clinical audit.

Results

The records of 739 patient interactions with the TCHOP service were reviewed and of 472 records that met inclusion criteria for the study population 447 were unique adult records.

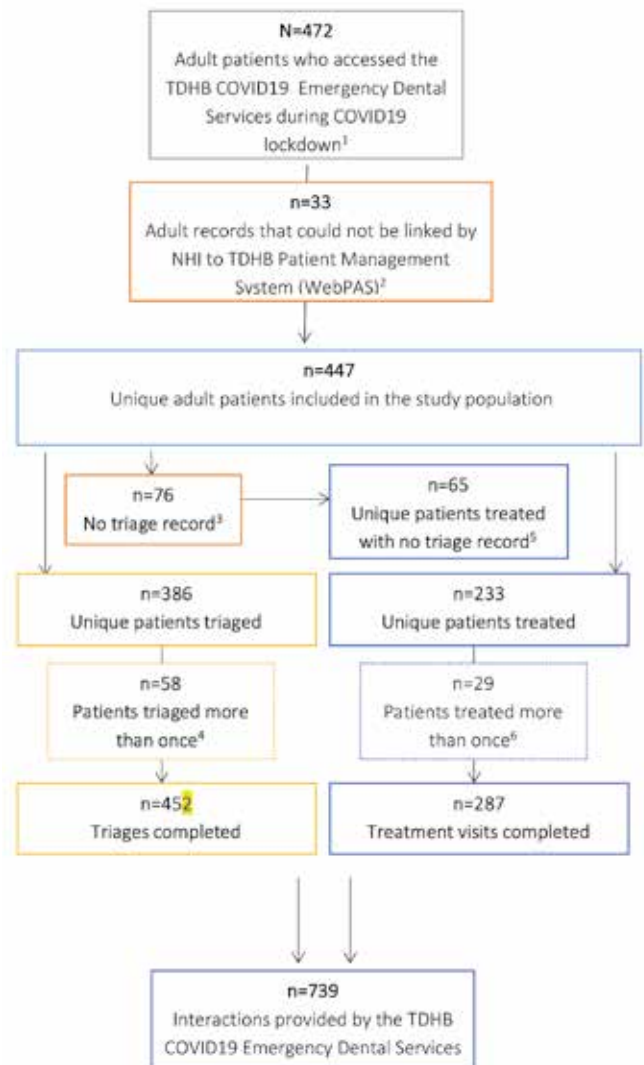


Figure 3. Patient Population and Service Interaction Flow Chart

1. Study population demographics

Females accounted for more than half of the study population (53.7%, Table 1). The mean age of the study population was 46.8 (+/-17.7) years, with little variation in average age between males (46.9 +/-16.6 years) and females (46.8+/- 18.6 years).

The majority of the study population identified as Non-Māori ethnicity (75.6%) with 23.3% of the study population identifying as Māori (Table 2). The distribution of Māori and Non-Māori ethnicity groups differed significantly from the distribution of the Taranaki population $\chi^2(1, N=447) = 4.67, p < 0.05$. The average domicile deprivation score of the study population was 6.2 (SD 2.6). Nearly one half (47.6%) of the study population was from the two most deprived quintiles whereas in the TDHB population this quintile accounts

**Table 1.** Study population demographics by age group and sex

Age Group (yrs)	Total Female		Total Male		Total	
	N	%	n	%	n	%
<20	7	1.6%	*	0.2%	8	1.8%
20-29	49	11.0%	40	8.9%	89	20.0%
30-39	42	9.4%	39	8.7%	81	18.1%
40-49	35	7.8%	37	8.3%	72	16.1%
50-59	43	9.6%	38	8.5%	81	18.1%
60-69	36	8.1%	36	6.7%	72	16.1%
>70	28	6.3%	16	3.4%	44	9.8%
Total	240	53.7%	208	46.3%	447	100.0%

*count under n=5

Table 2. Study population ethnicity group distribution compared to Taranaki population

Ethnicity Group	Study population (n)	Study population (%)	Taranaki Population (n)	Taranaki population (%)	% Difference (study vs Taranaki)
Māori	104	23.3%	23170	19.3%	+18.8%
Non-Māori	338	75.6%	96880	79.5%	-5.0%
Grand total	447	100.0%	120050	100.0%	

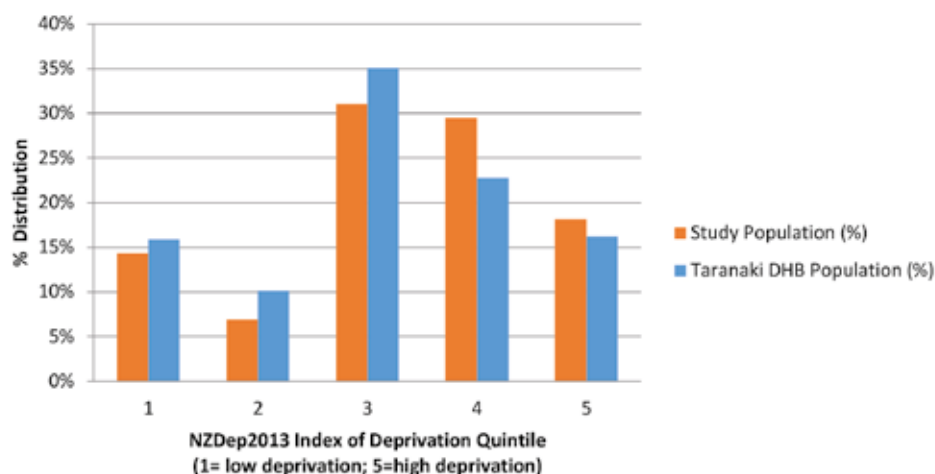
¹ Māori includes all those who self-reported identifying as New Zealand Māori. Non-Māori includes all other non-Māori ethnicities and includes those with unknown ethnicity (n=1) due to the small count.

Table 3. Triage complaint category overall and triage complaint by ethnicity group

Triage Complaint	Total		Māori		Other	
	N	%	%	%	%	
Pain and/or swelling	323	75.4%	78.4%	74.2%		
Follow-up**	35	8.2%	3.9%	9.5%		
Broken tooth	28	6.7%	7.8%	6.8%		
Referral (from GP or Hospital)	29	6.6%	7.8%	6.2%		
Dry socket	7	1.6%	1.0%	1.9%		
Lost filling	6	1.4%	1.0%	1.5%		
Grand Total	427	100%	100%	100%		

*n=28 triaged records excluded for no triage note, non dental triage or could not be determined

**Follow-up includes: Follow-up from existing dental conditions or treatments/therapies including script renewals, denture complaints; and conditions treated by dentists prior to lockdown.

**Figure 4.** NZDep2013 Index of Deprivation Quintiles of the Study Population Compared to Taranaki DHB Population

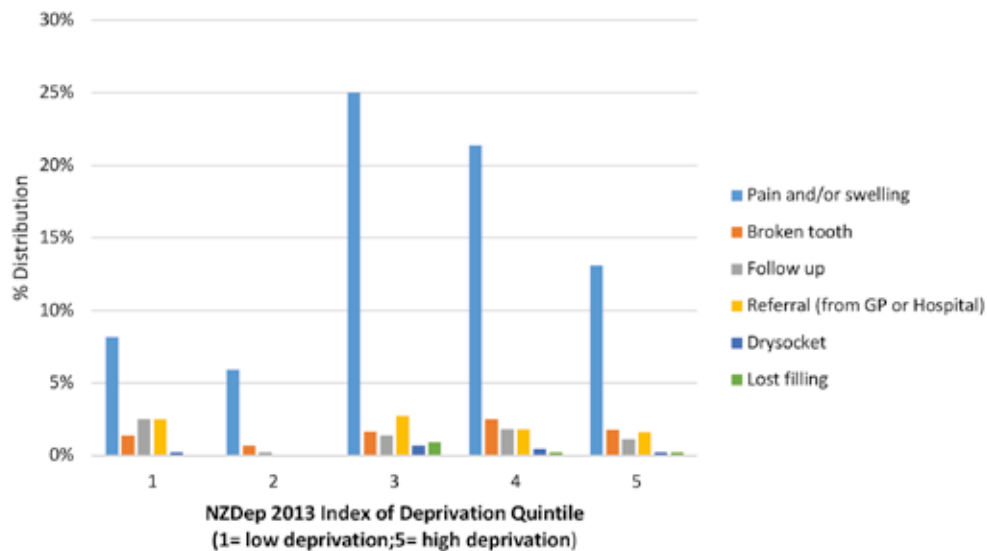


Figure 5. Distribution of triage complaints by domicile deprivation quintile (NZDep2013 Index of Deprivation).

Table 4. Diagnosis category overall and by ethnicity group

Triage Complaint	Total		Māori	Non-Māori
	N	%	n	n
Dental Abscess	99	38.5%	45.0%	35.9%
Caries	40	15.6%	18.3%	14.7%
Minor/Follow up**	33	12.8%	5.0%	15.7%
Periodontal Infection	30	11.7%	16.7%	10.1%
Fractured Tooth	27	10.5%	3.3%	13.1%
Dry Socket	13	5.0%	3.3%	5.5%
Trauma	11	4.3%	6.7%	3.5%
Lost Filling	<5	**	1.7%	1.5%
Grand Total	257	100%	100%	100%

*Minor complaints includes: sensitivity, gingivitis and follow-up previous treatments. **redacted, associated absolute value less than 5.

for only 39% of the population (Figure 4). There was a statistically significant difference in the domicile deprivation distribution in the study population compared to the TDHB population $\chi^2(4, N=447) = 17.06, p < 0.01$.

2. Triage Complaints

Complete data were available for 427 (94.4%) of the triage records. Three quarters (75.4%) of triage complaints were for pain and/or swelling. The proportion of Māori who presented with pain and/or swelling was slightly higher than the proportion of Non-Māori ethnicity group (78.4% vs 74.2%). Conversely, the proportion of Māori who presented for follow-up of pre-existing dental treatment/follow-up was lower than the proportion of Non-Māori (3.9% vs 9.5%). Presentation for other triage complaints with lower counts were similar between Māori and Non-Māori (Table 3).

Approximately 45% of all triage cases were from patients who had an address in a domicile with a deprivation score in the two most deprived quintiles

(Figure 5). For pain and/or swelling, nearly one half (46%) of triage cases were from patients in the two most deprived domicile quintiles. For follow-up of existing conditions, less than one third (27%) of triage presentations were from the two most deprived quintiles.

3. Diagnosis

There were 257 records with a complete diagnosis note. Abscess was the most common diagnosis, accounting for over one third of all diagnoses, followed by dental caries and minor complaints. Māori patients had a higher prevalence of dental abscess, caries, periodontal infection and trauma compared to Non-Māori patients (Table 4).

Approximately 48% of all diagnoses of dental abscess, 70% of all caries, and 63% of all trauma were diagnosed in patients who had an address with a domicile deprivation score in the top two quintiles (Figure 6). The diagnosis of minor complaints was most prevalent in patients from the two least deprived domiciles.

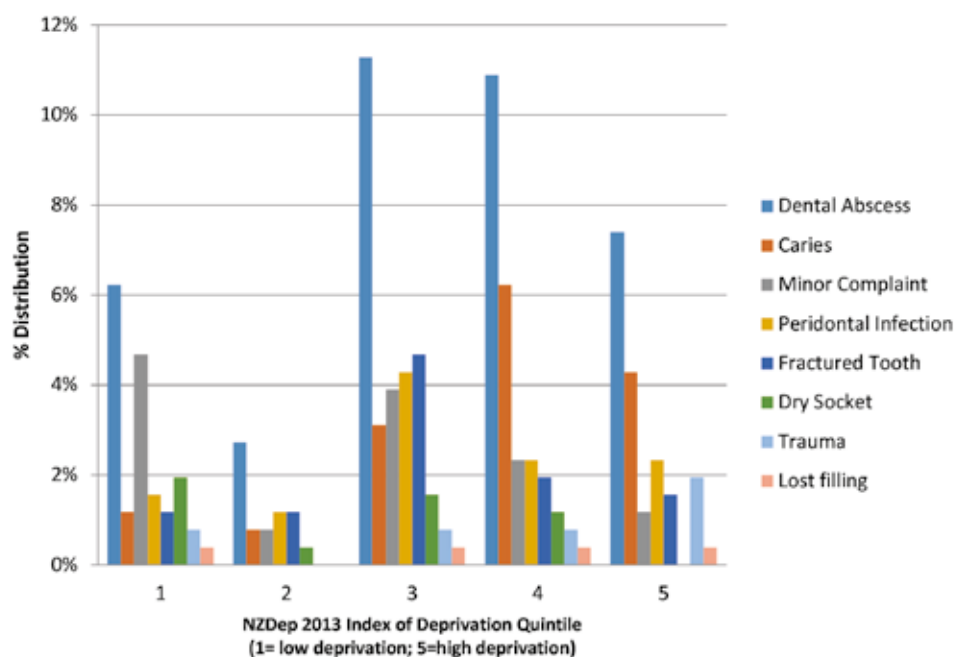


Figure 6. Distribution of diagnoses by domicile deprivation quintile (NZDep2013 Index of Deprivation).

Table 5. Primary Treatment Categories distribution and prevalence by ethnicity and domicile deprivation *

Primary Treatment Category	n	Total %	> 1 Treatment Type	Ethnicity Group		Domicile Deprivation Quintile				
				Māori %	Other %	1 %	2 %	3 %	4 %	5 %
Extraction	184	72.2%	14	84.2%	68.7%	57.8%	63.2%	70.9%	79.7%	81.3%
Temporary Filling	27	10.6%	3	7.0%	11.6%	8.9%	21.1%	10.1%	10.9%	8.3%
Other Treatment	15	5.9%		5.3%	6.1%	8.9%	5.3%	6.3%	3.1%	6.3%
Dry Socket	15	5.9%	1	3.5%	6.6%	15.6%	5.3%	6.3%	3.1%	0.0%
Antibiotics	14	5.5%		0.0%	7.1%	8.9%	5.3%	6.3%	3.1%	4.2%
Grand Total	255	100.0%	18	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Where multiple treatments were provided and included a physical intervention plus antibiotics the physical intervention was counted as the primary treatment.

Table 6. Extraction prevalence and prevalence odds ratios by ethnicity group and domicile deprivation quintile

	N (%)	Model 1 (Crude OR, 95% CI)	Model 2 (Age and Sex Adjusted OR, 95% CI)	Model 3 (Fully Adjusted OR, 95% CI)
Ethnicity				
Other (reference)	136 (73.9)	1	1	1
Māori	48 (26.1)	2.43 (1.17, 5.58)*	2.27 (1.07, 5.27)*	1.97 (0.91, 4.66)
Domicile Deprivation Quintile				
1 (reference)	26 (14.1)	1	1	1
2	12 (6.5)	1.25 (0.42, 3.92)	1.16 (0.38, 0.37)	1.26 (0.41, 4.05)
3	56 (30.4)	1.78 (0.83, 3.84)	1.64 (0.75, 3.61)	1.62 (0.73, 3.57)
4	51 (27.7)	2.87 (1.24, 6.83)*	2.63 (1.10, 6.42)*	2.47 (1.03, 6.09)*
5	39 (21.2)	3.17 (1.27, 8.38)*	3.01 (1.17, 8.21)*	2.74 (1.06, 7.50)*

Age = continuous; odds ratio for one unit (year) increase in age

Fully adjusted = age, sex, domicile deprivation

*Statistically significant at alpha= 0.05

4. Treatment Visits

Data were complete for 255 (88.9%) of the 287 treatment records. Of all other treatment visits the most common treatment provided was tooth extraction ($n=184, 72.2\%$) followed by temporary filling ($n=27, 10.6\%$). Table 5 details treatment categories. Of those who were treated, 18 (5.9%) required more than one treatment type (e.g., physical intervention and antibiotics).

Among Māori patients, the prevalence of all treatments except for extraction was less than the prevalence for Non-Māori patients. For all patients who received any treatment the prevalence of extraction increased with domicile deprivation quintile, with the highest prevalence among those who lived in domiciles with the greatest deprivation (Table 5).

In the crude and age-sex adjusted analysis the odds of having an extraction for Māori patients compared to Non-Māori patients was over two fold and statistically significant (Table 6). This association was attenuated in the fully adjusted model and the statistical significance diminished (OR 1.97, 95% CI 0.91,4.66). For domicile deprivation, the odds of a patient with an address in the fourth and fifth deprivation quintile (most deprived) compared to patients with an address in the first quintile (least deprived) was significant across all models. For patients living in the most deprived domicile, the odds of having an extraction

compared to patients living in the least deprived domicile was nearly three fold, even after accounting for age, sex and ethnicity (OR 2.7, 95%CI 1.06,7.50).

Two-hundred and sixty tooth extractions were performed during 184 treatment visits of which 64.2% ($n=167$) were molar teeth. The mean number of teeth extracted per patient was 1.14 (SD=0.99). For all patients who received any treatment, the prevalence of extraction increased with domicile deprivation quintile with the highest prevalence among those who lived in a domicile with the greatest deprivation (Table 6). For patients living in the most deprived domicile, the odds of having an extraction compared to patients living in the least deprived domicile was nearly three fold, even after accounting for age, sex and ethnicity (OR 2.7, 95%CI 1.06,7.50). This describes a “gradient of deprivation” with the treatment of dental extraction, correlating with higher domicile deprivation (Figure 7).

Emergency Department (ED) Presentations

Presentations to the ED Department of Taranaki Base Hospital dropped by 21.2% over the period, with a very significant drop at the beginning of the lockdown period. Young children (less than 5 years of age) presenting to ED dropped by 38.75% and for Māori adults the figure was 17.4%. (Figure 8).

Initially, there was a significant drop in dental ED visits at the beginning of the lockdown period, however, mid-way through the lockdown, a rebound was seen.

Discussion

The free-of-charge TCOHP was an innovative collaborative approach between public and private funded dental services to provide an emergency service in a safe and managed environment during a national pandemic lockdown period. Central to the management of all dental patients was the referral of dental cases to a central triage system, at Taranaki Base Hospital, where cases could be assessed and then forwarded via an agreed patient pathway to the appropriate clinic. This focused modest resources and maintained a steady flow of patients for the small group of clinicians. Technological innovations such as tele-dentistry and ePrescriptions allowed dental practice to resume utilising

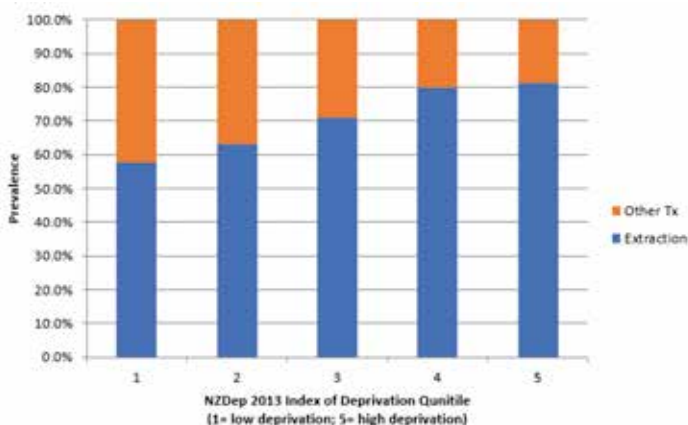


Figure 7. Distribution of extraction versus other treatment by domicile deprivation quintile (NZDep2013 Index of Deprivation).

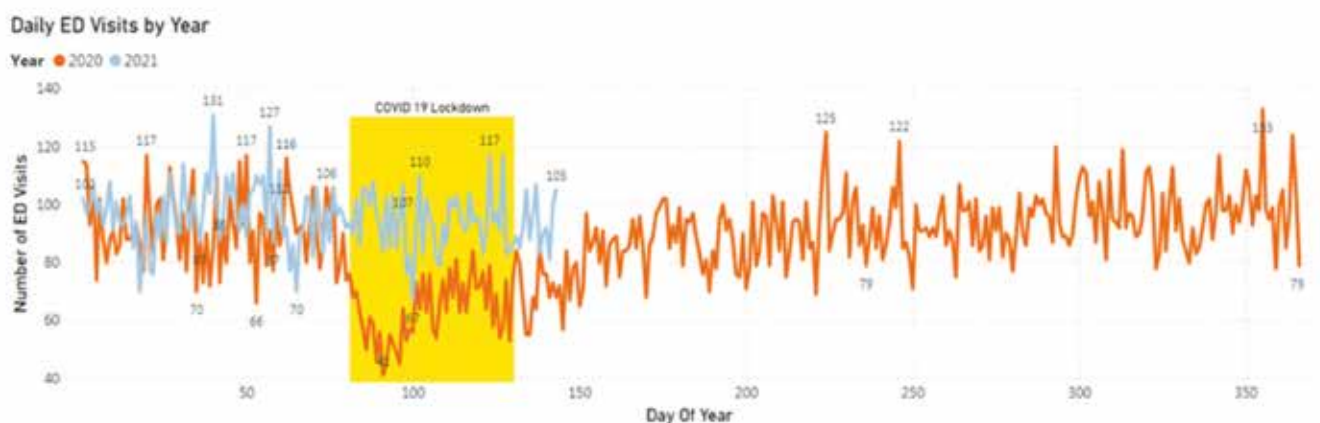


Figure 8. Taranaki data showing Emergency Department Number Occupancy and presentations for the whole of year 2020 and part of 2021 compared to the lockdown period March 25 to May 14, 2020 (yellow)



remote counselling, prescriptions, and advice, while maintaining a virtual distance between patient and health professional. During the seven week lockdown the TCOHP service provided 739 interactions with adult patients that needed to be triaged.

There has been a significant impact on the utilisation of emergency dental services in hospitals in areas affected by the community transmission of COVID-19 during the current pandemic (Guo 2020, Bai 2021). During a pandemic, the distribution of dental problems changes as private practices are restricted in their work and the proportion of those patients seeking urgent treatment because of significant decay and oral infection, can increase (Guo, 2020). The physical and social limitations imposed during a lockdown and the perceived reluctance to have close contact with other individuals means that patients who seek treatment are experiencing a genuine need. In a study by Bai (2021) there were fewer total visits to the Emergency Room of their Stomatology Department, fewer routine visits and fewer children, adolescents and elderly patients presenting during the outbreak of COVID-19. Similarly in Taranaki, there was a sudden reduction in acute presentations to ED (21.2%) over the lockdown period with a very significant drop at the beginning of the lockdown. The increase in dental ED presentations half way through lockdown is surprising considering the existence of the TCOHP. Possible explanations could include a lack of awareness of the service, a growing complacency due to “lockdown fatigue”, acute problems becoming increasingly serious or other barriers stopping people accessing the free service. Levesque et al (2013) defined access (to care) as the opportunity to identify healthcare needs, to seek health care services, to reach, to obtain or use health care services, and to actually have a need for services. Although cost is a very important barrier for those who are marginalised from routine dental care, health service factors such as approachability, acceptability, availability, and appropriateness may be just as important as affordability (Levesque 2013). Because of the relatively low number of presentations per week (between 2 and 17) it is not possible to infer whether any changes in the number of dental presentations were statistically significant nor whether any changes can be attributed to the COVID-19 lockdown.

A key finding in this snapshot of patients seen during the Alert Level 3 and 4 lockdown in March, April and May 2020 was the differences seen based on ethnicity and domicile deprivation. A higher proportion of Māori and people who live in more deprived areas were more likely to seek help from the service, more likely to have a diagnosis of dental abscess, caries or dental trauma, and more likely to need to have a tooth extracted. In contrast, patients from other ethnic groups and who lived in less deprived areas were more likely to present for follow-up of pre-existing dental treatment, more likely to have a diagnosis of fractured tooth or dry socket, and more likely to have treatment for dry socket.

The overrepresentation of Māori and those from higher deprivation domiciles accessing the Taranaki COVID-19 oral health service is contrary to the usual primary health care service utilisation pattern observed in NZ, where Māori and those who are of lower socioeconomic status are typically underrepresented (Ellison-Loschmann 2006), including dental care (Broadbent 2016). Evidence shows that Māori men, women and whānau face particular barriers in accessing oral health services in NZ (Robson et al., 2011). A recent NZ study found that among adults with natural teeth, Māori are more likely than non-Māori to report that they have never visited a dental health care worker at all or usually only visited for problems that would usually require an emergency visit (Hong et al. 2020). The New Zealand Oral Health Survey (2009) found that in adults, poorer oral health and lower dental service attendance rates were found particularly in men, young adults, Māori, Pasifika and people living in areas of higher socioeconomic deprivation. Consistent with Hong et al. (2020) observations, Māori and those who reported living in domiciles with higher deprivation had a lower frequency of presentation for follow-up after previous dental work.

Dental conditions present a significant burden to New Zealanders (MoH 2010, Hong et al. 2020). For adults there is evidence of inadequate access to dental care after publicly funded dental care ceases at 18 years of age (Moffat et al., 2017; Hong et al., 2020). This abrupt shift for young adults, who may not be employed at this age, can result in adverse oral health outcomes such as increased caries and tooth loss (Broadbent et al. 2013). This is shown with a marked drop in both attendance and outcomes for young adults between the ages of 18-26, which then persists throughout most New Zealander's adult lives (Moffat et al., 2017; Hong et al., 2020). Data from the 2014-17 New Zealand Health Survey for the Taranaki DHB show that 57.5% of adults (15 years or older) usually only visit a dental care worker for dental problems or never visit. When analysed by ethnicity 75.1% of Māori adults in Taranaki usually only visit a dental care worker for problems or never visit. For indigenous groups such as Māori and Pasifika, in addition to individuals of lower socioeconomic status, multiple studies have highlighted that this decline in dental attendance is even more marked (Jamieson et al., 2016; Moffat et al., 2017; Elani et al., 2017; Schuch et al., 2017; Mejia et al., 2018; Reda et al., 2018; Hong et al., 2020). An inequitable burden of dental disease among ethnic/racial minority populations and higher deprivation communities is mirrored not solely in NZ but throughout the world, especially in countries which have undergone colonisation (Jamieson et al., 2016; Moffat et al., 2017; Elani et al., 2017; Schuch et al., 2017; Mejia et al., 2018; Reda et al., 2018; Hong et al., 2020). Lack of regular dental care throughout adulthood can lead to more severe yet preventable oral health conditions, requiring emergency intervention (Hong et al., 2020).

Major inequalities in oral health exist, both in NZ and worldwide, and although oral diseases are largely preventable, the global burden of oral disease remains unacceptably high. Oranga waha mō t e iwi Māori katoa – the vision for good oral health for all Māori for life – acknowledges that the Crown and society have an obligation to tackle major access and equity issues that affect Māori whānau with low incomes, kaumātua, and Māori with disabilities, special needs or chronic conditions. The WAI2575 Health Services and Outcomes Kaupapa Inquiry identified multiple examples of failure by the Crown to achieve equity of health outcomes for Māori (Waitangi Tribunal 2019). As stated above, these avoidable, unfair and unjust differences between population groups are also very obvious with oral health. The New Zealand Health and Disability Service Review published in 2020 considered that the immediate priority to improve the equity of oral health outcomes for the next generation needs to be focussed on children and adolescents (Health and Disability System Review, 2020) which could have a flow-on effect into adulthood.

Good oral health is an integral part of overall health, has a direct impact on people's lives and has been described as a 'Cinderella policy' area because it has suffered long-term undeserved neglect by policy makers (Baker 2019). For best outcomes in oral health to occur for Māori, the principles and objectives of the Te Tiriti o Waitangi must be upheld and actively implemented in future policy and oral health service planning in order to achieve overall equity of outcomes. A comprehensive National Māori Oral Health Equity Plan was created in 2020 after extensive consultation in the wider sector. One of the recommendations was to introduce a free oral health programme for Māori mothers (prioritising 18–30 year olds), low income adults and for those with chronic conditions (Māori Oral Health Quality Improvement Group 2020). Jatrana et al (2009) argue for the need to integrate oral health with other primary care services in NZ which may target the unmet oral health needs of the population but this will require a pragmatic, culturally sensitive, targeted and integrated healthcare approach, to reach all New Zealanders.

Limitations

There are several conceptual and technical limitations of the study that need to be considered. The scope of the study represents a single point in time observation of adult patients who presented to the TCOHP service and may not be representative of the NZ, nor Taranaki, adult population as a whole. The reach of the service was not evaluated. Known barriers beyond financial and physical access to the health care system including cultural acceptance and trust of service were still present during the lockdown and could have impacted who presented to the service. It is plausible that this is an underrepresentation of the unmet oral health need in Taranaki. However, this was a unique opportunity to

provide some insight the state of oral health of adults which has largely been neglected and unattainable due to system structure (private) to date.

There are important limitations of the data. All records were on paper as written notes so there is a risk of transcription error. Similarly, there is a risk of categorisation bias given that presenting complaints, diagnoses and treatments were not systematically coded against a known dental coding standard. However, double-review of the data entry and categorisation by a clinical expert may have mitigated some of this risk.

The study did not collect data about usual oral health habits, including if the patient had a regular dentist. As such, speculation about the reason for extraction differences observed were made based on other sociodemographic factors. Future studies should consider including questions about oral health habits and dentist visits.

Finally, data about individual level deprivation was not collected and as such domicile deprivation was used as a proxy. This means that no conclusive evidence can be made about the association between individuals oral health presentations or outcomes and individual level socioeconomic status. Instead, only area level estimates can be made. It is possible that individual deprivation may not match domicile deprivation. However, there is evidence for the effects of area level deprivation on health outcomes which merits this approach (Pickett and Pearl 2001). Furthermore, the domicile deprivation index used was from 2013 estimates and domicile gentrification or other change could mean that some scores have changed. Despite these limitations we believe that the results demonstrate important overall patterns that align with existing evidence about deprivation and oral health outcomes and that future studies should include a measure of individual level deprivation so that associations between relative deprivation and oral health outcomes can be articulated accurately.

Conclusion

This study provides valuable insights on the 447 adult patients who accessed a free regional emergency dental health service during a period of COVID-19 lockdown in NZ and highlights differences based on ethnicity and socioeconomic deprivation. The free-of-charge element of the TCOHP during the lockdown in NZ was a deliberate attempt to support an equitable approach by removing the financial barrier to dental care. A higher proportion of Māori and people who live in more deprived areas were more likely to seek help from the service, more likely to have a diagnosis of dental abscess, caries or dental trauma, and more likely to need to have a tooth extracted. These findings mirror other studies on oral health and dental care utilisation in NZ and reinforce that there are unfair and unjust differences between Māori and non- Māori.



References

- Asadi S, Bouvier N, Wexler AS, Ristenpart WD (2020). The coronavirus pandemic and aerosols: Does Covid-19 transmit via expiratory particles? *Aerosol Science and Technology* 54:6 635-638.
- Atkinson J, Salmond C, Crampton P. (2014). NZDep2013 Index of Deprivation User's Manual. Department of Public Health, University of Otago, Wellington.
- Bai J, Xu T, Ji A-P, Sun W, and Huang M-W, Impact of COVID-19 on Oral Emergency Services, *International Dental Journal*, Volume 71, Issue 1, 2021, Pages 27-31, ISSN 0020-6539, <https://doi.org/10.1111/idj.12603>. (<https://www.sciencedirect.com/science/article/pii/S0020653920365060>)
- Baker G. Inequality in dental care is a Treaty issue. 7 October 2019. The Spinoff. <https://thespinoff.co.nz/science/07-10-2019/inequality-in-dental-care-is-a-treaty-issue/>
- Böhm da Costa C, Peralta FDS, Ferreira de Mello ALS. How Has Teledentistry Been Applied in Public Dental Health Services? An Integrative Review. *Telemed J E Health*. 2019. <https://doi.org/10.1089/tmj.2019.0122> [Links]
- Broadbent, J. M. Foster Page L. A., Thomson W. M. and R. Poulton. Permanent dentition caries through the first half of life. *British Dental Journal* 2013; 215: Online article number E12 DOI: 10.1038/sj.bdj.2013.991
- Broadbent J, Theodore R, Te Morenga L, Thomson M, Brunton P. 2016. Ethnic and socioeconomic inequalities in dental treatment at a school of dentistry. 2016. *N Z Dent J*112(2):55-61. Brown RH, Treasure ET. Inequities in oral health: implications for the delivery of care and health promotion. 1992. *The New Zealand Dental Journal*. 88(394):132-138
- Came H, McCreanor T, Manson L, Nuku K. Upholding Te Tiriti, ending institutional racism and Crown inaction on health equity. 2019. *New Zealand Medical Journal* 132; 61-66
- Dental Council of New Zealand and Ministry of Health. Guidelines for oral health services at COVID-19 Alert Levels. 2020. [accessed 2020 Dec 1]. <https://www.dcnz.org.nz/covid-19/guidelines-for-oral-health-services-at-covid-19-alert-levels/>
- Elani HW, Harper S, Thomson WM, Espinoza IL, Mejia GC, Ju X et al. (2017). Social inequalities in tooth loss: A multinational comparison. *Community Dentistry and Oral Epidemiology* 45(3):266-274.
- Ellison-Loschmann L, Pearce N (2006). Improving access to health care among New Zealand's Māori population. *American Journal of Public Health* 96(4):612-617.
- Emami E, de Souza RF, Kabawat M, Feine JS (2013). The impact of edentulism on oral and general health. *International Journal of Dentistry* 2013:498305.
- E-Prescribing in New Zealand MoH website <https://www.health.govt.nz/our-work/digital-health/other-digital-health-initiatives/emedices/new-zealand-eprescription-service>
- FDI (2021) https://www.fdiworlddental.org/sites/default/files/2021-02/Vision-2030-Delivering%20Optimal-Oral-Health-for-All_0.pdf
- Ghai, S Teledentistry during COVID19 pandemic (2020) *Diabetics and Metabolic Syndrome Clinical Research and Reviews* 14 (2020) 933-935 <https://doi.org/10.1016/j.dsx2020.06.029>
- Guo, H., Zhou, Y., Liu, X., Tan, J., 2020. The impact of the COVID-19 epidemic on the utilization of emergency dental services. *J. Dent.Sci.*, 0–3 <https://doi.org/10.1016/j.jds.2020.02.002>.
- Harrel SK, Molinari J (2004). Aerosols and splatter in dentistry: A brief review of the literature and infection control implications. *Journal of the American Dental Association* 135:429-437.
- Health and Disability System Review. 2020. Health and Disability System Review – Final Report – Pūrongo Whakamutunga. Wellington: HDSR. www.systemreview.health.govt.nz/final-report
- Hong CL Broadbent JM Thomson WM and Poulton R 2020 A Review Article The Dunedin Multidisciplinary Health and development study: oral health findings and their implications. *Journal of the Royal Society of NZ* <https://doi.org/10.1080/03036758.2020.1716816>
- Jatrana S, Crampton P. Primary health care in New Zealand: who has access? *Health Policy*. 2009 Nov;93(1):1-10. doi: 10.1016/j.healthpol.2009.05.006. Epub 2009 Jun 16. PMID: 19535163.
- Jamieson L, Elani H, Mejia G, Ju X, Kawachi I, Harper S et al. (2016). Inequalities in Indigenous Oral Health: Findings from Australia, New Zealand, and Canada. *Journal of Dental Research* 95(12):1375-1380.
- Jefferies S, French N, Gilkison C, Graham G, Hope V, Marshall J, McElnay C, McNeill A, Mullener P, et al. COVID-19 in New Zealand and the impact of the national response: a descriptive epidemiological study. 2020. *The Lancet Public Health*. 5(11) E612-E623. DOI:[https://doi.org/10.1016/S2468-2667\(20\)30225-5](https://doi.org/10.1016/S2468-2667(20)30225-5)
- Kawachi I. and B. Kennedy (1997) "Socioeconomic determinants of health: Health and social cohesion: why care about income inequality?" *BMJ*, 314:1037.
- Kutter JS, Spronken MI, Fraaij PL, Fouchier RA, Herfst S (2018). Transmission routes of respiratory viruses among humans. *Current Opinion in Virology* 28:142-151.
- Lakshman PS, Peiris M (2004). Severe acute respiratory syndrome and dentistry: a retrospective view. *Journal of the American Dental Association* 135(9):1292-1302.
- Levesque, JF., Harris, M.F. & Russell, G. Patient-centred access to health care: conceptualising access at the interface of health systems and populations. 2013. *Int J Equity Health* 12, 18. <https://doi.org/10.1186/1475-9276-12-18>
- Māori Oral Health Quality Improvement Group. National Māori Oral Health Equity Action Plan 2020-2023. 2020. Dental Council New Zealand. <https://www.dcnz.org.nz/assets/Uploads/Consultations/2020/Accreditation-standards/Submissions/New-Zealand-stakeholders/QIG-attachment-Māori-Oral-Health-Equity-Action-Plan-2020-2023.pdf>
- Mejia GC, Elani HW, Harper S, Murray Thomson W, Ju X, Kawachi I, et al. (2018). Socioeconomic status, oral health and dental disease in Australia, Canada, New Zealand and the United States. *BMC Oral Health* 18(1).
- Mian M, Teoh L, Hopcraft M. Trends in Dental Medication Prescribing in Australia during the COVID-19 Pandemic. *JDR Clinical & Translational Research*. 2021;6(2):145-152. doi:10.1177/2380084420986766

- Ministry of Health.2010. Our Oral Health: Key findings of the 2009 New Zealand Oral Health Survey. Wellington: Ministry of Health
- Ministry of Health.2019. Publically funded health and disability services.2019. [accessed on2020 Dec 4]. <https://www.health.govt.nz/new-zealand-health-system/publicly-funded-health-and-disability-services/visiting-dentist>
- Moffat SM, Foster Page LA, Thomson WM (2017). New Zealand's School Dental Service over the Decades: Its Response to Social, Political, and Economic Influences, and the Effect on Oral Health Inequalities. *Frontiers in Public Health* 5:177.
- New Zealand Health Survey 2014-17 Regional Updates published March 2018 <https://www.health.govt.nz/publication/regional-results-2014-2017-new-zealand-health-survey>
- Petruzzi M, De Benedittis M. WhatsApp: a telemedicine platform for facilitating remote oral medicine consultation and improving clinical examinations. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2016;121(3):248-54. <https://doi.org/10.1016/j.oooo.2015.11.005> [Links]
- Pickett K.E., Pearl M. 2001. Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *Journal of Epidemiology and Community Health.*111-122.
- Reda SF, Reda SM, Thomson WM, Schwendicke F (2018). Inequality in Utilization of Dental Services: A Systematic Review and Meta-analysis. *American Journal of Public Health* 108(2):e1-e7.
- Robson B, Koopu P, Gilmour J, Rameka R, Stuart K, Simmonds S, Purdie G, Davies C, Paine S-J. (2011). Oranga Waha – Oral Health Research Priorities for Māori: low-income adults, kaumātua, and Māori with disabilities, special needs and chronic health conditions. Wellington: Te Rōpū Rangahau Hauora a Eru Pōmar
- Rothan HA, Byrareddy SN (2020). The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. *Journal of Autoimmunity* 109:102433.
- Schuch HS, Haag DG, Kapellas K, Arantes R, Peres MA, Thomson WM, et al. (2017). The magnitude of Indigenous and non-Indigenous oral health inequalities in Brazil, New Zealand and Australia. *Community Dentistry and Oral Epidemiology* 45(5):434-441.
- Srinivasan, M Thyvalikakath T.P., Cook B.N., Zero D.T., COVID-19 and Saliva: A Primer for Dental Health Care Professionals *International Dental Journal*, Volume 71, Issue 1, 2021, Pages 5-8, ISSN 0020-6539, <https://doi.org/10.1111/idj.12606>. <https://www.sciencedirect.com/science/article/pii/S0020653920365096>
- Waitangi Tribunal, Hauora report on stage one of the health services and outcomes inquiry (Wellington: Waitangi Tribunal, 2019).
- World Health Organisation Interim Guidance 3 August 2020 Considerations for the provision of essential oral health services in the context of COVID19 WHO Reference Number: WHO/2019-nCov/Oral_health/2020.1
- World Health Organization, 2020. Report of the WHO-China joint mission on coronavirus disease 2019 (COVID-19).
- World Health Organization. (2020). Transmission of SARS-CoV-2: implications for infection prevention precautions: scientific brief, 09 July 2020. World Health Organization. <https://apps.who.int/iris/handle/10665/333114>

Acknowledgements

Very special thanks to the following dedicated staff of the Taranaki DHB Oral Maxillofacial Department and the Community Oral Health Service.

Notably, Mr Peter Liston, oral and maxillofacial surgeon and Head of Department, TDHB Oral-Maxillofacial Department and co-creator of the Taranaki COVID-19 Oral Health Plan.

The staff of the New Plymouth Clinics: Drs Andrew Lamb, Jono Martin, Steve Gray, Antony Neville-Lamb and Andrea Kelsen. Also Maria Butler (Coordinator), Jean Cook, Paula Rawlinson and the incredible staff of the Rangiatea Community clinic- Corina Fraser, Steph Hinz, Ros Sole and Rachel Travers. At Hawera Hospital: Kathryn Blinkhorne, Tracey Stockman, Melissa Williamson and Tash Potaka. Finally special thanks to the dedicated private dentists of the Taranaki Branch, NZDA.

Author details

David M Antunovic BDS (Otago) Dip Clin Dent (Perio) FRACDS (SND) FFOMP (RCPA) Clinical Leader
Corresponding author: david.antunovic@tdhb.org.nz

Maria McInerney, BScAHN (Hons), MSc (Epidemiology) CIHR PICDP Fellow Population Health Analyst- TDHB

Jonathan Jarman MB ChB (Otago) FNZCPHM Medical Officer of Health-TDHB

George Penlington, BSc MBChB House Officer-TDHB Taranaki Base Hospital, David Street, Westown, New Plymouth 4310