The role of primary oral healthcare clinicians in the detection and diagnosis of oral and oropharyngeal cancer in New Zealand

Donna T Kennedy Langley

A thesis submitted for the degree of

Master of Community Dentistry

At the University of Otago

Dunedin, New Zealand

December 2016

Abstract

Background

Oral and oropharyngeal cancer (commonly referred to collectively as oral cancer, or OC) is the sixth most common cancer. Cancer Registry records show that the incidence of OC in New Zealand (NZ) has increased over the last 50 years, and distinct incidence patterns persist by gender, age, ethnicity and anatomical site. Despite advances in treatment, a poor prognosis persists for those diagnosed. Improving survival rates will need better rates of early diagnosis. Little is known about the factors leading to delays in OC diagnosis in NZ or whether clinicians' deficiencies in knowledge contribute to delays in diagnosis. International studies have observed regular dental care to be associated with an earlier stage of OC diagnosis, but whether this holds in NZ is not known.

This study explored factors which may contribute to the stage of diagnosis of OC in NZ. It had two main aims: to assess the OC knowledge, beliefs and practices of NZ dentists and clinical dental technicians (CDTs); and to determine whether regular dental care affects the stage of OC diagnosis in the Canterbury region.

Methods

A self-administered questionnaire was developed and sent to all general dentists and CDTs registered with the Dental Council of NZ. The questionnaire data were compared with those from the NZ Cancer Registry (cases diagnosed with OC from 1 January 2012 until 31 December 2013), to determine whether clinicians have adequate knowledge to enable early detection of suspicious oral lesions. Data from the OC cases from the Canterbury District Health Board (CDHB) were analysed for associations of tumour extent by regular dental attendance.

Results

Dental clinicians were found to be knowledgeable about many aspects of OC, but differences in knowledge exist among clinicians, suggesting that some are more able to detect early OCs than others. Time from graduation, the type of clinician and the graduation country may influence some beliefs and practices about OC, thereby affecting clinicians' ability to detect malignant lesions. Most clinicians reported providing OC screening (OCS) examinations for all patients, but one-third identified barriers to doing so. Consequently, it is likely that a proportion of dentists and CDTs do not provide routine OCS examinations.

Non-smokers and those of higher socio-economic status were more likely than others to be routine users of dental care. However, there was a lack of data on the dental history of cases, and so, whether differential access to dental care impacts on stage of diagnosis of OC could not be explored in this study. It was noteworthy that general medical practitioners (GMPs) continue to detect most of the OC in NZ, but their knowledge, beliefs and practices in respect of OC have yet to be explored.

Conclusion

Missed opportunities for early diagnosis of OC may result from identified deficiencies in dental clinicians' knowledge of OC, their failure to provide an OCS examination for all patients, and high-risk patients not seeking regular dental care. A better understanding of these is required to increase rates for early diagnosis of OC and ultimately improve patient outcomes.

Acknowledgements

I am most grateful for all the guidance, encouragement and support I have received during the planning, research and completion of this thesis. To my supervisors; Professors Murray Thomson and Alison Rich, and Associate Professors Brian Cox and Lyndie Foster Page, I very much appreciate your expertise, support and encouragement, without which I would not have been able to produce this thesis.

Thank you to the dentists and clinical dental clinicians who participated in this research, as without you this study would not have been possible. I would also like to thank my dental colleagues at the Nelson Marlborough and Canterbury District Health Boards, for their input and encouragement along the way, and, my fellow MComDent student, Geoff Hunt, who provided encouragement, support and much-needed humour throughout my study.

Finally, I would like to thank my husband, Adam and my daughters, Gemma and Mia, who have been very supportive during my study, which has enabled me to complete this thesis. I am very much looking forward to having more free time to spend with you.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AIDS	Acquired immunodeficiency syndrome
ASR	Age-standardised incidence rate
AR	Age-specific incidence rate
AUDIT	Alcohol Use Disorders Identification Test
CDHB	Canterbury District Health Board
CDC	Centres for Disease Control and Prevention
CDT	Clinical dental technician
CI	Confidence interval
COE	Conventional oral examination
COPD	Chronic obstructive pulmonary disease
CSC	Community services card
CT	Computed tomography
DALY	Disability-Adjusted Life-Years
DCNZ	Dental Council of New Zealand
DHB	District Health Board
EBV	Epstein-Barr virus
FCT	Faster cancer treatment
GDP	General dental practitioner
GMP	General medical practitioner
GP	General practitioner
HCU	Health care user
HDEC	Health and Disability Ethics Committee
HIV	Human immunodeficiency virus
HHV	Human herpes virus
HNC	Head and neck cancer
HPV	Human papillomavirus
HR	Hazards ratio
HRQoL	Health-related quality of life
HSV	Herpes Simplex virus
IARC	International Agency for Research on Cancer
ICD-O	International Classifications of Diseases in Oncology
ICO	Information Centre on HPV and Cancer
IMRT	Intensity modulated radiation treatment
INHANCE	International Head and Neck Cancer Epidemiology
IQR	Inter-quartile range

LEC	lymphoepithelial carcinoma
MRI	Magnetic resonance imaging
MDT	Multidisciplinary team
MoH	Ministry of Health
MTR	Malignant transformation rate
NBI	Narrowband illumination
NHC	National Health Committee
NHI	National Health Index number
NICE	National Institute for Clinical Excellence
NMDHB	Nelson-Marlborough District Health Board
NPV	Negative predictive values
NZ	New Zealand
NZCR	New Zealand Cancer Registry
OC	Oral cancer
OCC	Oral cavity cancers
OCS	Oral cancer screening
OLP	Oral lichen planus
OPC	Oropharyngeal cancers
OPG	Orthopantomogram
OPMD	Oral potentially malignant disorder
OPML	Oral potentially malignant lesion
OPSCC	Oro-pharyngeal squamous cell carcinoma
OR	Odds ratio
ORL	Otorhinolaryngology
OSCC	Oral squamous cell carcinoma
OSF	Oral submucous fibrosis
PAR	Population attributable risk
PPV	Positive predictive values
PVL	Proliferative verrucous leukoplakia
QoL	Quality of life
SCC	Squamous cell carcinoma
SEER	Surveillance, Epidemiology and End Results
SRR	Standardized relative risk
STI	Sexually transmitted infection
TNM	Tumour Node Metastases
UICC	Union for International Cancer Control

UK	United Kingdom
US	United States of America
UV	Ultraviolet
WHO	World Health Organization
WUHNCI	Washington University Head and Neck Co-morbidity Index
YLL	Years of life lost
YLD	Years lost due to disability

1 Introduction

Oral and oropharyngeal cancer (commonly referred to as mouth cancer) is the sixth most common cancer worldwide, with an estimated annual incidence of over 442,000 cases (Ferlay et al., 2015). Distinct geographic incidence patterns exist, reflecting the prevalence patterns of known risk factors for oral cancer (OC) and oropharyngeal cancer (OPC) (Sankaranarayanan et al., 2015). Historically, high incidence rates of OC and OPC have been reported in South and South-East Asia, and in parts of Central Europe and South America (Chaturvedi et al., 2013).

Review of the New Zealand Cancer Registry has shown the incidence of OC and OPC has increased over the last fifty years (Cox et al., 1996; Elwood et al., 2014). It is noteworthy that the incidence of OPC in males has increased rapidly since 2005 (Chelimo and Elwood, 2015). Distinct patterns of OC and OPC in New Zealand have been demonstrated with respect to age, gender, ethnicity, anatomical site and social deprivation (Chelimo and Elwood, 2015; Cox et al., 1996). Overall, incidence rates are highest among older, New Zealand European men but rates are increasing for both genders in deprived areas (Chelimo and Elwood, 2015).

Despite major advances in the treatment of OC and OPC and some improvement in quality of life for those affected, the overall 5-year survival rate has not significantly improved (Rapidis et al., 2009). Worldwide, there are an estimated 242,000 deaths annually from OC and OPC (Ferlay et al., 2015). Substantial ethnic and socioeconomic inequalities in OC and OPC survival are known to exist in New Zealand (Soeberg et al., 2012). The factors contributing to disparity in survival rates have not been fully explained, but have been, at least partly, attributed to a later stage of diagnosis for Māori and those of lower socioeconomic status (Robson et al., 2010; Soeberg et al., 2012). It is widely accepted that the key to improving survival rates lies in improving the rates of early diagnosis of oral malignant and potentially malignant disorders (van der Schroeff and Baatenburg de Jong, 2009).

Delays in the diagnosis of OC and OPC have been largely attributed to late-stage presentation (Goy et al., 2009). The factors contributing to diagnostic delay are multifactorial and related to patient, provider and healthcare system factors (Gómez et al., 2010). Whether New Zealand patients delay seeking medical care prior to diagnosis of OC and OPC (and how this may impact on stage of diagnosis) has not been reported to date.

It is generally accepted that whole-population screening for OC and OPC is unlikely to be cost-effective in low prevalence populations, however there is evidence that screening of

high-risk individuals can improve survival rates (Brocklehurst et al., 2013). The Ministry of Health's *New Zealand Cancer Plan: Better, faster cancer care 2015–2018* identifies primary healthcare workers as crucial to enable an improvement in early cancer detection rates in New Zealand (Ministry of Health, 2014). However, primary care clinicians' current understanding of OC and OPC has not been reported. International studies have reported differences in primary healthcare clinicians' knowledge regarding OC and that gaps in clinicians' knowledge can contribute to delays in the diagnosis and treatment (Horowitz et al.,2000; Carter and Ogden, 2007; Brocklehurst et al., 2010; Allen and Farah, 2015;). Whether New Zealand's primary care practitioners have a similar range of understanding of OC is unclear. Therefore, their ability to detect OC and OPC in early stages of presentation is unknown.

International studies have observed regular dental care to be associated with an earlier stage of diagnosis for OC and OPC (Watson et al., 2009; Frydrych and Slack-Smith, 2011;). However, concern has been expressed that at-risk individuals may be less likely to regularly attend the dentist and are therefore less likely to be diagnosed in early stages of disease (Frydrych and Slack-Smith, 2011). The New Zealand Oral Health Survey (2009) reported poorer access to dental care for Māori, Pacific people and those of lower socioeconomic status (Ministry of Health, 2010). Whether irregular dental attendance impacts on the stage of diagnosis in New Zealand is not known. Other factors (such as tobacco use and cancer site) have been associated with the stage of diagnosis internationally (das Neves et al., 2015)**.** However, whether factors such as smoking and cancer site are associated with the stage of presentation of OC and OPC in New Zealand has not been reported to date.

2 Literature review

The published literature on oral and oropharyngeal cancer (commonly referred to as mouth cancer) was reviewed prior to exploring the patterns of diagnosed OC and OPC, in New Zealand, and whether tumour stage at diagnosis may be associated with dental attendance, and affected by the knowledge, beliefs and practices of general dentists and clinical dental technicians. The domains reviewed included the definition of OC and OPC, clinical features, epidemiology, aetiology and the role of primary healthcare clinicians in the diagnosis of OC and OPC. This chapter describes the definition of OC and OPC, incorporating the clinical description and classification of the disease. Epidemiological aspects will be discussed including, incidence rates and risk factors for OC and OPC. Finally, the diagnosis of OC and OPC will be discussed. This will include the internationally accepted standards for diagnosis, the role of primary healthcare providers in diagnosis, and the reasons behind delays in diagnosis that lead to poorer outcomes for people diagnosed with advanced OC and OPC.

2.1 Introduction

The term "oral and oropharyngeal cancer" describes malignant lesions arising from the mucosal surfaces of the oral cavity and/or the oropharynx (Sankaranarayanan et al., 2015). Oral cancer may occur in the following anatomical subsites: the lip, the anterior two-thirds of the tongue, the salivary glands, the buccal mucosa, the gingiva, the floor of mouth, the hard palate, or other unspecified parts of the mouth (Barnes et al., 2005). Lesions of the oropharynx are those that occur within the part of the pharynx bounded superiorly by the soft palate and inferiorly by a hypothetical horizontal line level with the tip of the epiglottis (Barnes et al., 2005). Anatomical subsites within the oropharynx include the posterior third of the tongue, the soft palate, the palatopharyngeal arches and the tonsils, and are distinguished from the nasopharynx, the hypopharynx and the laryngeal pharynx. Collectively, OC and OPC is the sixth most common cancer worldwide, with an annual incidence estimated at 442,000 cases (Warnakulasuriya, 2009; Ferlay et al., 2015).

A cell may undergo malignant transformation leading to a primary malignancy in any of the oral and oropharyngeal tissues. Less commonly, an oral malignancy will occur due to spread from an adjacent local site (such as the maxillary sinus) or a distant site (such as the liver). Primary tumours may arise from epithelial, mesenchymal or haematological tissue (Barnes et al., 2005). Globally, at least ninety percent of all OCs and OPCs arise from oral epithelial cells (Barnes et al., 2005) and these are referred to as oral squamous cell carcinomas (OSCC). Other malignant tumours in the oral cavity and the oropharynx include sarcomas (such as

osteosarcomas and fibrosarcomas), some salivary gland tumours (such as mucoepidermoid carcinoma and adenoid cystic carcinomas) and melanomas. Increasingly, primary oral lymphomas are being diagnosed. The World Health Organization's (WHO) classification of malignant tumours of the oral cavity and the oropharynx, according to the tissue of origin, is presented in Table 2.1.

Table 2.1 WHO's classification of malignant tumours of the oral cavity and oropharynx

	Morphology code[a]
Malignant epithelial tumours	
Squamous cell carcinoma	8070/3
Verrucous carcinoma	8051/3
Basaloid squamous cell carcinoma	8083/3
Papillary squamous cell carcinoma	8052/3
Spindle cell carcinoma	8074/3
Acantholytic squamous cell carcinoma	8075/3
Adenosquamous carcinoma	8560/3
Carcinoma cuniculatum	8051/3
Lymphoepithelial carcinoma	8082/3
Salivary gland carcinomas	
Acinic cell carcinoma	8550/3
Mucoepidermoid carcinoma	8430/3
Adenoid cystic carcinoma	8200/3
Polymorphous low-grade adenocarcinoma	8525/3
Basal cell adenocarcinoma	8147/3
Epithelial-myoepithelial carcinoma	8562/3
Clear cell carcinoma, not otherwise specified	8310/3
Cystadenocarcinoma	8450/3
Mucinous adenocarcinoma	8480/3
Oncocytic carcinoma	8290/3
Salivary duct carcinoma	8500/3
Myoepithelial carcinoma	8982/3
Carcinoma ex pleomorphic adenoma	8941/3
Soft tissue tumours	
Kaposi sarcoma	8982/3
Haematolymphoid tumours	
Diffuse large B-cell lymphoma (DLBCL)	9680/3
Mantle cell lymphoma	9673/3
Follicular lymphoma	9690/3
Extranodal marginal zone B-cell lymphoma of MALT type	9699/3
Burkitt lymphoma	9687/3
T-cell lymphoma (including anaplastic large cell lymphoma	9714/3
Extramedullary plasmacytoma	9751/1
Extramedullary myeloid sarcoma	9930/3
Follicular dendritic cell sarcoma / tumour	9758/3
Mucosal malignant melanoma	8720/3

[a]Morphology code of the International Classification of Diseases for Oncology (ICD-O) and the Systematized Nomenclature of Medicine (http://snomed.org). Behaviour is coded /3 for malignant tumours, and /1 for borderline or uncertain behaviour, as cited in Barnes et al., 2005.

Metastatic OCs and OPCs arise from the haematogenous spread of malignant cells from distant sites such as the breast, the liver, the lungs, the prostate glands and the kidneys (Hirshberg and Buchner, 1995; Hirshberg et al., 2008). Metastatic tumours are rare in the oral cavity and are usually evidence of more widespread disease (Hirshberg et al., 2008). Overall, metastatic spread is more common in bony tissues (the mandible and the maxilla), than in the soft tissues of the mouth (Lim et al., 2006; Hirshberg et al., 2008). For example, oral tumours arising from prostate cancer are ten times more likely to occur in the mandible or the maxilla than in the soft tissues (Hirshberg et al., 2008).

2.2 Classification of oral and oropharyngeal carcinomas

The International Classification of Diseases (ICD) is the standard diagnostic tool for epidemiology and health services research. It is used internationally to monitor the incidence and prevalence of diseases. The ICD-10 is the most recent version of the ICD. The codes for OC and OPC are those from C00 through to C14. The codes refer to the following anatomical sites: the lip and intraoral sites (C00−C06), the minor and major salivary glands (C07−08), the oropharyngeal sites (C09 − 10) and other ill-defined sites within the oral cavity or the oropharynx (C14). Neoplasms of the nasopharynx (C11), the piriform sinus (C12) and the hypopharynx (C13) are considered separately from OC and OPC so are not included in Table 2.2. A complete record of ICD-10 codes is available elsewhere (World Health Organization, 2016).

Table 2.2 ICD Codes for malignancies of the oral cavity, salivary glands and the oropharynx

Site description	ICD codes[a]
External lip	C00—02
Oral cavity carcinomas	
Internal lip	C003—005
Lip unspecified	C006—009
Tongue	C020—23, C028, C029
Floor of mouth	C040—049
Gum and cheek	C030—039, C060-062
Hard and soft palate	C050—C059
Other parts of mouth	C068
Oropharyngeal carcinomas	
Base of tongue, lingual tonsil	C01, C024
Tonsil	C090—C099, C142
Oropharynx	C100—109
Overlapping or unspecified lesion of oropharynx	C140 and C148
Salivary glands carcinomas	
Minor salivary gland	C069
Major salivary gland	C070—C089

[a] ICD-10 Codes for malignant neoplasms of the oral cavity, salivary glands and the oropharynx, available from http://apps.who.int/classifications/icd10/browse/2016/en#/II

2.3 Risk factors for oral and oropharyngeal cancer

In epidemiology, the term 'risk factor' has been used to describe an environmental, behavioural or biologic factor that, if present, directly increases the probability of a disease occurring (Beck, 1998). Likewise, if the factor is absent or removed, the probability of the disease occurring is lower. The risk factors for OC and OPC that have been reviewed in the published literature are discussed in the following section. In particular the role of; oral potentially malignant disorders (OPMD), lifestyle risk factors (such as the use of tobacco, alcohol and betel quid[1]) and oral infections, in the development of OC and OPC, will be discussed.

[1] Betel quid is the term used to describe the combination of the areca nut with various ingredients including tobacco, lime and *P. betle* leaf (World Health Organization, 2012).

2.3.1 Oral potentially malignant disorders

Although the natural history of OC and OPC is not fully understood (Napier and Speight, 2008; Scully, 2014), it is widely accepted that many neoplastic lesions are preceded by clinically detectable potentially malignant lesions (Napier and Speight, 2008; van der Waal, 2009; Warnakulasuriya, 2009). Moreover, potentially malignant lesions may not be limited to one anatomical site within the mouth. Abnormal epithelium may be present adjacent to an OSCC (Walsh et al., 2013) or distant from the primary site (Thomson, 2002; Thomson and Hamadah, 2007). The term "OPMD" is now commonly used to describe potentially malignant lesions, and this term reflects the risk of malignant transformation of oral mucosa within, adjacent to or distant from previously detected lesions (Warnakulasuriya et al., 2007). The term "OPMDs" also includes hereditary disorders that have a higher risk of malignant transformation.

The OPMDs identified by the WHO expert working group include: erythroplakia (also known as erythroplasia); oral submucous fibrosis (OSF); leukoplakia (particularly nodular, speckled, proliferative verrucous, candidal, syphilitic and erythro-leukoplakia); oral lichen planus (particularly the non-reticular or erosive type); and actinic cheilitis (mainly on the lower lip). Other rare conditions (such as dyskeratosis congenita, discoid lupus erythematosus, Paterson-Kelly syndrome and Fanconi syndrome), may be associated with a higher risk of developing OPMDs (van der Waal, 2009).

OPMDs differ in their incidence and their potential for malignant transformation (Mithani et al., 2007; Napier and Speight, 2008; Scully, 2014). It is currently not possible to predict which individual OPMDs will progress to OSCC if exposure to risk factors is maintained, or conversely, which individual lesions will resolve if the exposure is removed (Lee et al., 2000; Holmstrup et al., 2007; Scully and Bagan, 2009). Although most OPMDs are chronic conditions with a low susceptibility for malignant transformation (generally less than 5%), the severity of epithelial dysplasia is recognised as a significant prognostic factor for malignant transformation (Warnakulasuriya et al., 2015). In addition, malignant transformation is more likely to occur within the first five years of lesion development (Walsh et al., 2013).

2.3.1.1 Erythroplakia

Erythroplakia has been described as a clinically detected red patch on the oral mucosa that cannot be accounted for by any specific disease entity (Pinborg et al., 1997). Clinically, erythroplakia may present as a flat lesion with a smooth or a granular surface, although it more commonly presents as a mixed red and white lesion, termed "erythro-leukoplakia"

(Warnakulasuriya, 2009). Erythroplakia has been reported predominantly in older age groups (Shafer and Waldron, 1975; Feller et al., 1991; Hashibe, Altini and Slabbert, 2003). However, the global prevalence of erythroplakia is not well reported and the data are limited to studies from South and Southeast Asia. The reported prevalence in these populations ranges between 0.02% and 0.83% (Reichart and Philipsen, 2005).

The highest malignant transformation rate (MTR) for OPMDs is reported for erythroplakia and erythro-leukoplakia, with reported rates ranging from 14.3% to 50.0% (Reichart and Philipsen, 2005). However, it has been suggested that most erythroplakias will undergo malignant transformation (van der Waal, 2009). An early study by Mashberg and Feldman (1988) reported that erythroplakia was evident in 64% of the 263 invasive OCs and OPCs reviewed. While the evidence suggests that the presence of erythroplakia is associated with a higher risk of malignant transformation than other lesions, this is not necessarily a linear process, and lesions may undergo episodes of regression and progression over time (Macey et al., 2015). It is not possible to determine which individual erythroplakia or erythro-leukoplakia lesions will progress to carcinoma but due to the known risk, these lesions should be carefully monitored by a specialist experienced in their management and excised if possible.

2.3.1.2 Oral submucous fibrosis

Oral submucous fibrosis (OSF) is a chronic disorder of the mucosa that causes epithelial atrophy and leads to fibrosis and hyalinization of the underlying lamina propria (van der Waal, 2009; Warnakulasuriya, 2009). It has been proposed that atrophic epithelium increases the exposure to carcinogens, and this in turn, predisposes tissue to malignant transformation (van der Waal, 2009). The prevalence of OSF shows marked geographic variation, with the distribution mainly concentrated in Southeast Asia, Melanesia and Micronesia, consistent with the prevalence of betel (areca) nut chewing. Early studies have reported a MTR for OSF of between 0.5% and 7.6% (Pindborg et al., 1984; Sinor et al., 1990; Murti et al., 1995). Cessation of the betel quid chewing habit has been reported to limit the progression of OSF lesions and reduce the MTR of existing lesions (Barnes et al., 2005; Gupta et al., 1995).

2.3.1.3 Oral leukoplakia

The most prevalent OPMD is leukoplakia, with a global prevalence estimated at between 0.5% and 2% (Petti, 2003; van der Waal, 2009). The reported MTR for oral leukoplakia differs considerably according to the anatomical subsite, leukoplakia type and the populations studied, with annual rates ranging from 0.3% to 1.4% reported (Gupta et al., 1980; Petti, 2003). Proliferative verrucous leukoplakia (PVL), which may begin as a homogeneous

leukoplakia and non-homogeneous leukoplakias have greater malignant potential (Holmstrup et al., 2007). Moreover, hospital-based studies report higher MTRs for leukoplakia than community-based studies (Macey et al., 2015). This is as expected since hospital-based studies would contain more individuals deemed to be at higher risk of developing OC. Although Petti (2003) reported an MTR of 1.4% for oral leukoplakia from global pooled prevalence data, this rate did not match the predicted development of OC in the study populations and greatly exceeded the known incidence of OC. Thereby suggesting the overall MTR for leukoplakia lesions is significantly lower than 1.4%, or conversely, that globally the level of OC is underreported.

2.3.1.4 Oral lichen planus

Oral lichen planus (OLP) is a chronic mucocutaneous inflammatory condition with a reported population prevalence of between 0.1% and 4.0% (Mollaoglu, 2000). OLP is an immunologically mediated condition, although the factors which initiate it are not fully understood (Pol et al., 2015). The malignant potential of OLP lesions has been debated over many years. Whether OLP is potentially malignant or whether OLP-like dysplastic lesions undergo malignant transformation is uncertain (Patil et al., 2015). Pol et al. (2015) have proposed that HPV infections play a role in the pathogenesis of OLP, and they may also contribute to the malignant potential of OLP lesions. OLP has a reported annual malignant transformation rate of less than 1% (van der Waal, 2009).

2.3.1.5 Actinic cheilitis

The association between actinic cheilitis (also reported as solar cheilitis) and squamous cell carcinoma of the lip has been reported for many years International Agency for Research on Cancer, 1992; International Agency for Research on Cancer, 2012a). Actinic cheilitis is a condition which occurs in individuals with a history of chronic exposure to ultraviolet (UV) radiation (de Souza Lucena et al., 2012). Clinically, actinic cheilitis may present as erythema, atrophy, erosion or keratotic plaques and fissures on the epithelium of the external lip. Predominantly, actinic cheilitis occurs on the lower lip, because this is a site with high sun exposure (Pukkala et al., 2009). Infiltration of the lesion across the vermilion border is suggestive of malignant transformation (Nico, Rivitti, and Laurenco, 2007).

The reported prevalence rates of actinic cheilitis range from 0.5% to 2.4%, with middle-aged and light-skinned men whose occupations involve chronic sun exposure having higher rates. Studies based solely in high risk populations have reported prevalence rates as high as 43.2% (da Silva et al., 2006). Whether actinic cheilitis lesions are exacerbated by other known risk factors (such as tobacco use and alcohol consumption) is unclear (Campisi and Margiotta

2001; de Souza Lucena et al., 2012). The rate of malignant transformation of untreated actinic cheilitis has not been reported (van der Waal, 2009).

2.3.2 Tobacco consumption

Tobacco smoking has long been reported as a risk factor for OPMDs as well as OC and OPC (International Agency for Research on Cancer, 2004a; International Agency for Research on Cancer, 2012b). More recently, other forms of tobacco use, such as snuff (ground tobacco leaves inhaled into the nostrils) and chewing tobacco, have also been identified as being carcinogenic to the oral and oropharyngeal tissues (International Agency for Research on Cancer, 2007a; International Agency for Research on Cancer, 2012b). Detailed evaluation of the role and mechanism of tobacco in the development of OC and OPC is contained within the *International Agency for Research on Cancer Monographs* (International Agency for Research on Cancer, 2004a; International Agency for Research on Cancer, 2007a; International Agency for Research on Cancer, 2012b). The *Monographs* review evidence from different populations in differing geographical regions, thereby reinforcing the importance of tobacco as a risk factor for OC and OPC. In addition, tobacco is a dose-dependent risk factor with higher exposure conferring greater risk. Risk among current smokers is consistently greater than among former smokers, with risk reducing as the number of years since quitting increases (International Agency for Research on Cancer, 2004a).

Historically, in industrialised populations, at least 75% of OSCCs and OPSCCs were attributed to alcohol and tobacco use (Hashibe et al., 2007). Since tobacco and alcohol habits frequently co-exist, separating the role of alcohol consumption and tobacco use in the aetiology of OSCC and OPSCC has been challenging. Hashibe et al. (2007) calculated the odds ratio for developing head and neck cancer among users of tobacco who did not drink alcohol. An odds ratio of 2.13 (95% CI 1.52, 2.98) for ‘ever smokers’ was reported. There were clear dose–response relationships for the frequency and the duration of cigarette smoking. The study also concluded that 24% (95% CI 16%, 31%) of head and neck cancers among non-drinkers could have been prevented if those individuals had not smoked cigarettes. In addition, distinct geographical variation has been reported in the population attributable risk (PAR) for developing head and neck cancer among smokers who do not use alcohol. Studies from Europe and Latin America reported greater risk (PAR of 84% and 83%, respectively) than those from North America (PAR 51%) (Hashibe et al., 2009). Whether this variation reflects regional differences in the contents of cigarettes (in particular, variations in

the levels of nitrosamines, polycyclic aromatic hydrocarbons and other tobacco carcinogens), the patterns of smoking, or other risk factors remains unclear.

Extensive research conducted into the joint effects of consumption of tobacco products and alcoholic beverages on OC and OPC concluded that tobacco works both individually and synergistically with alcohol to multiply the risk (International Agency for Research on Cancer, 2004a; International Agency for Research on Cancer, 2007a; International Agency for Research on Cancer, 2012b). The PAR for tobacco or alcohol was calculated by Hashibe et al. (2009) as 72% (95% CI 61%, 79%) for head and neck cancer (33% due to tobacco alone and 35% due to tobacco and alcohol combined). The reported total PAR also differed by anatomical subsite, (64% and 72% for OCC and pharyngeal cancer, respectively), by sex (74% and 57% for males and females, respectively) and by age (33% for those aged less than 45 years; 73% for those aged more than 60 years). The greatest risk was attributable to male smokers and drinkers over the age of 60 years.

In view of the strong evidence for the role of tobacco in the development of OC and OPC, it had been expected that the decline in tobacco consumption in many industrialised countries over the last 30 years would be accompanied by a decline in the incidence of these cancers. However, this expected decline has not been observed. Instead, many countries have recorded an increase in registered OC and OPC cases. Therefore, the role of additional risk factors in the development of OC and OPC is important and continues to be explored.

2.3.2.1 Patterns of tobacco use in New Zealand

Findings from the 2014/2015 New Zealand Health Survey show that the prevalence of tobacco smoking continues to decline, with 16.6% of the population aged over 15 years being current smokers, down from 25.0% in 1996/1997 (Ministry of Health, 2015). However, much higher rates of tobacco smoking are reported in Māori (38.1%) and Pacific peoples (24.8%). Moreover, those living in the most deprived areas were 3.1 times more likely to smoke than those living in less deprived areas, after adjusting for age, sex and ethnicity (Ministry of Health, 2015). Tobacco smoking remains slightly more prevalent in males than females (adjusted rate ratio of 1.2 for the former).

2.3.2.2 Marijuana consumption

The evidence for marijuana use as a risk factor in the development of OC and OPC remains weak (Rosenblatt et al., 2004; Aldington et al., 2008). A review of cases of head and neck cancer cases in those aged under 55 years in New Zealand concluded that, while it is biologically plausible for cannabis use to be associated with a higher risk of head and neck

cancer, it has not yet been demonstrated (Aldington et al., 2008). In addition, marijuana and tobacco use habits frequently co-exist, complicating the task of differentiating the risk associated with either habit.

2.3.3 Alcohol consumption

Alcoholic beverage consumption has long been recognised as playing a key role in oral and oropharyngeal carcinogenesis. Evidence has been reported from differing geographical regions and populations (International Agency for Research on Cancer, 2010; International Agency for Research on Cancer, 2012b). As discussed in Section 2.3.2, extensive research has been conducted into the synergistic effects of co-existing tobacco and alcohol habits in the development of OC and OPC. Hashibe et al. (2009) reported that a PAR of 4% for developing head and neck cancer was due to alcohol use alone. In addition, alcoholic beverage consumption has also been reported to be associated with a higher risk of developing a second primary OC lesion (Day et al., 1994; Dikshit et al., 2005).

The exact mechanisms by which alcohol consumption exerts its carcinogenic effects on the oral and oropharyngeal tissues are not fully understood. Acetaldehyde, the first metabolite of ethanol, is accountable for at least part of the carcinogenicity (Boffetta and Hashibe, 2006). Disruption of the oral epithelium may also result from alcohol use, thereby enabling the more ready absorption of carcinogens across the epithelium (Howie et al., 2001). Additional theories suggest that alcohol-related immunodeficiency and immunosuppression may facilitate carcinogenesis (Watson et al., 1994).

A significant dose-response relationship (for both the frequency and the duration of alcoholic beverage consumption) in the development of OPC has been reported (International Agency for Research on Cancer, 2010). Heavy drinkers have 5.1 times the risk of non-drinkers or occasional drinkers of developing OPC (Bagnardi et al., 2015). Hasibe et al. (2009) reported an increasing odds ratio for developing OC with increasing daily alcohol consumption. An OR of 1.7 (95% CI 1.2, 2.3) was reported for 1–2 alcoholic drinks per day, 2.3 (95% CI 1.4, 4.0) for 3–4 alcoholic drinks per day and 5.5 (95% CI 2.3, 13.4) for five or more drinks per day.

Further studies have reported that the risk attributable to alcohol use differs according to anatomical subsite. Sigvardsson et al. (1996) reported a 12-fold (95% CI 1.6, 92) higher risk of oral cavity cancer, an 8.5-fold (95% CI 2.0, 3.7) higher risk of tongue cancer, and an 11-fold (95% CI 1.4, 8.5) higher risk of tonsillar cancer associated with alcoholic beverage

consumption. In contrast to the studies on quitting tobacco, the relative risk for OC for quitters of alcohol is initially higher than current drinkers, and becomes similar to that of non-drinkers after 10 to 20 years of abstinence (Castellsagué et al., 2004; Hayes et al., 1999).

2.3.3.1 New Zealand patterns of alcohol use

Surveys of New Zealand adults suggest that most adults drink alcohol (79.5% of those aged over 15 years), and one-third drink regularly (defined as 3-4 times per week) (Ministry of Health, 2015). Hazardous[2] drinking patterns are reported for 17.7% of the population, although the proportion of hazardous drinkers is higher in Pacific males (52% of those who have consumed alcohol in the past year are hazardous drinkers) and tobacco users (40% of tobacco smokers who had consumed alcohol in the past year had a hazardous drinking pattern, while it was only 14% in non-smokers) (Ministry of Health, 2013a; Ministry of Health, 2015).

2.3.4 Areca (betel) nut use

The use of areca nut has been associated with OC for many years (Orr, 1933; Eisen, 1946, as cited in World Health Organization, 21012). However, whether the association was due to the areca nut alone or the products used alongside it has been contested. The manner in which areca nut is used is culturally determined (World Health Organization, 2012). Frequently, it is used alongside tobacco: either both are chewed together as a quid, or a smoking habit co-exists alongside an areca nut chewing habit (World Health Organization, 2012). Moreover, the betel quid may be immersed in alcohol before it is chewed. An extensive review of the available literature that has linked OC to the use of betel quid with and without tobacco, and OPC to betel quid use with tobacco is available in the *IARC Monographs* (International Agency for Research on Cancer, 2004b; International Agency for Research on Cancer, 2012b). There is also strong evidence that betel quid use is the main aetiological factor in the OPMD, oral submucous fibrosis (International Agency for Research on Cancer, 2004b; International Agency for Research on Cancer, 2012b).

Estimates of the global use of areca nut in some form range from 10 to 20% of the world's population, or at least 600 million people (Gupta and Warnakulasuriya, 2002). However, marked geographic variation exists, with high rates of usage among sub-continental Indian, South and South-East Asian, Melanesian and Micronesian populations, as well as in migrant populations resident in the United Kingdom, South Africa, Australia and the United States (World Health Organization, 2012; Petti et al., 2013). In countries where areca nut use is

[2] The NZ MoH defines hazardous drinking as an established drinking pattern that carries a risk of harming physical or mental health, or having harmful social effects to the drinker or others. It is measured as a score of 8 or more on the 10-question Alcohol Use Disorders Identification Test (AUDIT). (Ministry of Health, 2013a)

common, up to 50% of reported OC cases in males and up to 90% of OC cases in females have been attributed to betel nut use (Balaram et al., 2002).

2.3.4.1 Use of areca nut in New Zealand

Despite areca nut being commonly available in Asian and other small grocery stores in New Zealand, its use is not a common practice and appears to be limited to a cultural practice within sub-continental Indian, South-East Asian and some Western Pacific migrant populations (Yoganathan, 2002). However, neither the prevalence of areca nut use nor the incidence of OC or OPC which may be attributed to its use, has been reported in New Zealand.

2.3.5 Dietary factors

Recently, the role of diet and nutrition in the aetiology of OC has been highlighted in the literature. Some of the early research stemmed from the observed association of a higher risk of OC in women with the iron-deficiency condition Plummer-Vinson syndrome (Larsson et al., 1975; Boyle et al., 1990). Recent studies have reported on the salutogenic effects of diets high in fruit and vegetables. The International Head and Neck Cancer Epidemiology (INHANCE) consortium reported diets high in fruit and vegetables and low in red meat were associated with a lower risk of head and neck cancer (per score increment OR 0.90; 95% CI 0.84, 0.97) (Chuang et al., 2012). Further support for high consumption of fruit and vegetables reducing the risk of head and neck cancer comes from the Netherlands Cohort Study, which reviewed participants' consumption of fruit and vegetables prospectively over two decades (Maasland et al., 2015). Total fruit and vegetable consumption was found to be inversely associated with the risk of head and neck cancer overall, with the strongest risk "reduction" for OC (Maasland et al., 2015).

Pavia et al. (2006) undertook a meta-analysis of the available studies in an attempt to quantify the reduction in OC risk per daily serving of fruit and vegetables. Using combined adjusted odds ratio estimates, they reported a reduction in OC risk by 49% for each portion of fruit (OR 0.51; 95% CI 0.40, 0.65) and 50% for each portion of vegetable (OR 0.50; 95% CI 0.38, 0.65) consumed per day. However, isolating the effects of dietary factors from other behavioural risk factors (such as smoking and alcohol consumption) is difficult. Some studies suggest that cigarette smokers are less likely to consume high amounts of fruit and vegetables (Dallongeville et al., 1998). It has been proposed that using a "multiple risk factor model" is more appropriate for assessing the overall risk of developing OC, rather than attempting to isolate the risks pertaining to separate behavioural (lifestyle) factors (Conway et al., 2008).

2.3.6 Human papillomavirus

Infection with certain types of human papillomavirus (HPV) may be sexually transmitted and have been linked to the development of cervical cancer and other anogenital cancers (Feller et al., 2010; International Agency for Research on Cancer, 2007b). While there are more than 100 HPV genotypes, the HPV-16 and HPV-18 genotypes are designated as high-risk types and have played the major role in the development of HPV-associated cervical cancers (Feller et al., 2010). In Australasia, 76.2% of cervical cancer cases have been attributed to these two HPV genotypes (World Health Organization, 2010).

Prevalence rates for HPV infection are commonly available only for women. A recent global estimate suggests that 11.4% of women are infected with HPV at any given time (World Health Organization/Information Centre on HPV and Cancer, 2010). Reported prevalence rates of HPV oral infection in the United States are significantly greater in males (10.1%) than females (3.6%) (Gillison et al., 2012). There is no treatment for HPV infection *per se* and, typically, it is cleared by the body's immune system within two years of infection. However, in 10% of cases, infection may persist (Centres for Disease Control and Prevention, 2016). A higher frequency of persistent HPV infection has been linked to tobacco smoking and older age (D'Souza et al., 2007). It has been proposed that tobacco-mediated and age-related genetic and immune factors may increase the tissues' susceptibility to HPV infection (D'Souza et al., 2007).

More recently oral HPV infection has been linked to OPC (D'Souza et al., 2007, Gillison et al., 2012, International Agency for Research on Cancer, 2012a). Oral HPV infection is associated with orogenital sex practices, with a greater risk of infection associated with an earlier age of sexual initiation and multiple sexual partners (Feller et al., 2010; Osazuwa-Peters et al., 2015). Other acquired transmission routes have been proposed, including open-mouth kissing, autoinoculation and vertical birth-transmission (Kreimer et al., 2005; D'Souza et al., 2007; Syrjanen, 2007). The majority of HPV-associated OPSCCs (85-90%) arise from the HPV-16 genome type (Kreimer et al., 2005; D'Souza, 2007; Marur et al., 2010). Evidence for the role of HPV-16 in the pathogenesis of OPSCC arises from three areas: the presence of HPV genomic sequences and expression of oncoproteins in the nuclei of malignant tumours and their metastases; integration of the HPV DNA in to the cellular genome; and confirmation of a higher HPV DNA copy-number within tumours (Feller et al., 2012). However, HPV-16 seropositivity is not recognised as strongly associated with an increased risk of developing an HPV-positive OPSCC. It is unclear whether other proven risk factors (such as alcohol and

tobacco) act synergistically with oral HPV infection in the development of OPSCCs (Feller et al., 2012).

Studies report considerable variation in the proportion of HPV-attributable cancers among the different sites of the oropharynx and the oral cavity (Kreimer et al., 2005; Parkin and Bray, 2006; Gillison et al., 2007). The systematic review by Kreimer et al. (2005) calculated the average HPV-DNA positivity rate to be 35.6% for OPC and 23.5% for oral OC. However, the presence of HPV-DNA in a tumour does not confirm causation, and substantially fewer OC and OPC cases have been attributable to HPV than tumours determined to be HPV-DNA positive. The multinational study conducted by Parkin and Bray (2006) estimated that only 12% of OPCs and 3% of OCs were HPV-attributable. However, over the last three decades, many studies have reported a two-to three-fold increase in the prevalence of HPV-attributable OPSCC. This pattern has been reported particularly in the developed countries of Australia, Northern Europe and North America (Hong et al., 2010; Chaturvedi et al., 2011; Brotherton et al., 2012; Chenevert and Chiosea, 2012; Garnaes et al., 2015). The incidence of HPV-attributable OPSCC in New Zealand has also been increasing (Chelimo and Elwood, 2015). Gillison et al. (2007) have reported that the percentage of HPV-attributable OPCs may be up to 60% in the United States.

Tonsillar SCC is the condition shown to be most strongly associated with HPV infection (Ryerson et al., 2008). However, the exact mechanism for this site predilection remains unclear (Pai, 2013). HPV-OPSCC is now recognised as a distinct disease entity (Gillison and Lowy, 2004; Fakhry and D'Souza, 2013) with distinct epidemiological features. For example, many of those affected are non-smokers, and younger than those with non-HPV OPSCC (Anderson et al., 2014). Recognition of the role of HPV in the aetiology of OPSCC has significant implications for national OPSCC prevention strategies (Ryerson et al., 2008). Many countries have implemented HPV vaccination programmes to reduce the incidence of cervical and other anogenital cancers. HPV vaccination programmes available for both boys and girls are likely to provide the best opportunity to reduce the incidence of HPV-OPSCC, although the efficacy of HPV vaccines in preventing OPSCC has yet to be evaluated (Fakhry and D'Souza, 2103). OPSCC is more prevalent in New Zealand males over forty years of age, and therefore the impact of the national HPV vaccination programme (introduced in 2008, and Government-funded for girls) on the prevalence of HPV-OPSCC is uncertain. Recent proposals suggest the Government-funded vaccination programme will be available for both boys and girls from January 2017 (Ministry of Health, 2016).

2.3.7 Other infections

There is evidence that chronic inflammation caused by persistent viral, bacterial and chemical agents is a risk factor for many cancers (Porta et al., 2009). Therefore, associations between many viral, bacterial and fungal infections and OCs and OPCs have been proposed. Association with viral infections such as the human immunodeficiency virus (HIV), the herpes simplex virus (HSV) and the Epstein-Barr virus (EBV)[3] have been investigated (Maden et al., 1992; Frisch et al., 2001; Shimakage et al., 2002; Parker et al., 2006). HIV has been associated with several malignancies including non-Hodgkin lymphoma (Hicks et al., 1993) and Kaposi's sarcoma (Beral et al., 1990). However, there is only limited evidence suggesting that HIV and the associated acquired immunodeficiency syndrome (AIDS) are associated with OSCC (Flaitz et al., 1995). Kreimer et al. (2005) reported that HIV-seropositive individuals have a higher prevalence of HPV-16 than HIV-seronegative individuals. Furthermore, a large US study that linked AIDS and cancer registries reported a higher rate of HPV-associated cancers (including tonsil cancer) in persons with HIV/AIDS (Frisch et al., 2001). It is therefore possible that HIV infection confers a greater risk of HPV-attributable OPC on infected individuals.

The EBV has been associated with lymphoepithelial carcinoma (LEC), particularly in the salivary glands (Barnes et al., 2005). However, marked ethnic variation in EBV-positivity in LECs has been reported. LECs are frequently EBV-positive in Chinese populations but commonly EBV-negative in Caucasian populations (Barnes et al., 2005).

Candida albicans causes a range of oral mucosal lesions, including candidiasis. It has been speculated that chronic candidiasis poses a significant risk of malignant transformation due to *C. albicans* being more commonly detected in OSCC sites than control sites (Nagy et al., 1998; Scully, 2002). A case-controlled study by Alnuaimi et al. (2015) reported *C. albicans* was significantly more common in individuals with OCs as well as in individuals who consumed alcohol daily. Genotype variation was also present between the study groups, with significantly more OC patients having genotype A than the matched controls, who were (in turn) more likely to have genotype B. Overall, they concluded that the persistent presence of *C. albicans* should be considered a significant risk marker for OC.

The possible association between OC and poor tooth brushing, periodontal disease and excessive plaque accumulation on dentures has been explored (Tezal et al. 2009; Zeng et al., 2013; Manoharan et al., 2014; Zeng et al., 2015). However, a causative role for chronic

[3] EBV is also known as the human herpes virus 4 (HHV4).

inflammation caused by dental bacterial plaque in the development of oral malignancies is not proven (Feller et al., 2013).

2.4 Epidemiology of oral and oropharyngeal cancer

2.4.1 Incidence

Incidence is the number of new cases diagnosed (or deaths) over a defined period and is usually expressed as an annual rate per 100,000 persons (International Agency for Research on Cancer, 2016). Furthermore, an age-standardised incidence rate (ASR) is the rate of new cases that a population would have if it had the standard age structure. Standardisation is necessary to enable rate comparisons between populations that have differing age distributions. Because age has a strong influence on the risk of developing OC and OPC, ASRs are frequently used when comparing incidence rates in different populations.

Incidence data for OC and OPC are calculated from population-based cancer registries. Registries may cover an entire country or be limited to a particular region or treatment hospital. Comparing incidence rates of OC and OPC across populations can be challenging due to differences in the proportion of the population reported within the Register and the quality of the data collected. Furthermore, different Cancer Registries may have different category criteria. For example, the lesions of the lip may be separately recorded as the external lip (which may be excluded from the Registry) and the internal lip (which may or may not be included). Variations also exist in the reporting of cancers of the tongue. For example, all malignant lesions of the tongue may be reported as OC, or lesions of the base of the tongue may be separately recorded as OPC. In the following discussion on incidence rates, the ICD codes, (if known) have been included to aid cross-population comparisons.

2.4.1.1 Global incidence oral and oropharyngeal cancer

There are an estimated 300,000 cases of cancer involving the lip and oral cavity (C00-08) and 142,000 cases of cancer of the pharynx (C09-10, C12-14) worldwide, comprising 2.1% and 1.0% of all cancers, respectively (Ferlay et al., 2015). However, distinct geographic incidence patterns exist, reflecting the prevalence patterns of known risk factors for OC and OPC (Sankaranarayanan et al., 2015). Historically, high incidence rates of OC and OPC have been reported in South and South-East Asia, and in parts of Central Europe and South America (Chaturvedi et al., 2013). India alone accounts for at least one quarter of the total number of new cases of OC and OPC globally (Warnakulasuriya, 2009). Overall, the highest incidence of OC is reported in Melanesia among both males and females (22.9−36.3 per 100,000 and

16.0−23.6 per 100,000, respectively) (Parkin et al., 2005; Ferlay et al., 2015). Western Europe has the highest reported incidence of OPC (7.5 per 100,000 for men and 1.6 per 100,000 for women), although OPC incidence rates have been increasing over the last 20 years in many regions, including Australasia, North America and parts of East Asia (Chaturvedi et al., 2013; Simard et al., 2014).

Worldwide, there are an estimated 145,000 deaths (1.8% of total cancer deaths) due to OC and a further 97,000 deaths (1.2% of total cancer deaths) due to OPC (Ferlay et al., 2015). At least three-quarters of the deaths occur in less developed regions. Regions with the highest estimated annual number of cancer deaths from OC include Asia (65,000), South-Central Asia (46,900), Europe (17,600) and Eastern Asia (12,200). Similarly, the most estimated annual deaths from OPC are recorded for Asia (51,100), South-Central Asia (37,200) and Europe (15,200) (Ferlay et al., 2015).

2.4.1.2 Incidence of oral and oropharyngeal cancer in New Zealand

Cases of OC and OPC have been recorded in the New Zealand Cancer Registry (NZCR) since 1951. Although the NZCR records show that the incidence of OC and OPC in New Zealand is relatively low, it has increased over the last fifty years (Cox et al., 1995; Elwood et al., 2014). Distinct patterns of OC and OPC have been demonstrated with respect to gender, age, ethnicity and anatomical site.

2.4.1.3 Gender incidence of oral and oropharyngeal cancer

Traditionally, OC and OPC are male-dominated diseases with incidence rates at least two times higher in men than women (Simard et al., 2014). Almost two-thirds of the 267,000 cases of the OC cases registered in the year 2000 were men (Parkin et al., 2005). Males also accounted for nearly two-thirds of global OC cases in 2012 (199,000 of the 300,000 cases) (Ferlay et al., 2015). However, some populations have a more pronounced gender differential. The Slovak Republic and Belarus report incidence rates more than 10-fold greater in males than females (Simard et al., 2014).

The OC incidence ratio in New Zealand during the period 1987−1991 for males to females was 2.6 (95% CI 2.3, 2.9), with all types of OC being more common in males than females (Cox et al., 1995). Elwood et al., (2014) reported that the age-standardised rates in New Zealand from 1981−2010 were nearly two times higher in males (2.68 per 100,000) than females (1.46 per 100,000). Australian studies have reported a similar male-to-female OC incidence ratio, ranging between 1.3:1 and 2.2:1 (Rich and Radden, 1984; Sugerman and Savage, 2002; Hogan et al., 2005; Elwood et al., 2014).

Globally, the incidence of OPC is reported as being two to five times higher in males than females (Simard et al., 2014). Although some countries have a much greater sex difference, with a reported male-to-female OPC incidence ratio of at least 20-fold reported for Belarus and the Slovak Republic (Simard et al., 2014). The difference in gender incidence has been attributed to males having greater exposure to the known risk factors of alcohol and tobacco (Warnakulasuriya, 2009).

In New Zealand, the incidence of OPC is much also higher in males (ASR of 1.87 and 0.47 per 100,000 for males and females respectively) (Chelimo and Elwood, 2015). Of note was the doubling of the male incidence of OPC cases in New Zealand in the years from 1996-2000 to 2006-2010, which resulted in an increase in the male-to-female ratio in OPC cases over time (male-to-female ratio of 3.8:1 and 4.6:1 during the periods from 1981-1985 and 2006-2010, respectively).

2.4.1.4 Age incidence of oral and oropharyngeal cancer

Oral cancer has typically presented in the fifth or sixth decade of life. Internationally only four to six percent of OC cases occur in those under 40 years (Bodner et al. 2014; Llewellyn et al., 2001). New Zealand studies also report that age-specific rates (ARs) for OPC and OC are higher for older age than younger age groups (Cox et al., 1995; Gavidi et al., 2014; Chelimo and Elwood, 2015). Gavidi et al. (2014) reported that for OSCC the ARs were highest among males aged 75−79 years and females aged 85 years and above. The average age at diagnosis during this period was 61 years for males and 67 years for females, with only five of the total cases (0.003%) occurring in people aged between 15 and 25 years. However, the recent rise in the incidence of OPC in New Zealand has been associated with a decrease in average age at diagnosis. The average age at diagnosis decreased from 61.3 years in 1981−1985 to 59.7 years in 2006−2010 for males, and from 64.9 years to 60.0 years for females over the same period (Chelimo and Elwood, 2015).

OC among young people has been suggested to be aetiologically different from OC in older adults. It is more commonly associated with potentially malignant disorders such as Fanconi's anaemia (Bodner et al., 2014; Llewellyn et al., 2001), rather than exposure to known risk factors such as tobacco and alcohol. Moreover, OC in younger people affects males and females similarly rather than being the male-dominated disease of older people (Bodner et al., 2014).

2.4.1.5 Ethnic differences in the incidence of oral and oropharyngeal cancer

The literature has reported on ethnic differences in the incidence of OC (Saman, 2012). These have been attributed to differing patterns of lifestyle risk factors such as tobacco smoking, alcohol consumption and betel nut chewing (Moore et al., 2000). Other factors, including variations in diet and cultural beliefs, may also influence ethnic differences in OC (Goodwin, 2008).

Ethnic differences in the incidence of OC have also been reported in New Zealand. When reviewing data compiled for the 'Cancer Incidence in Five Continents', Moore et al., (2000) reported that the OC and OPC incidence rate for Māori males was double that for non-Māori males (3.6 per 100,000 and 1.8 per 100,000 per annum respectively) in 1997. However, this finding is contrary to those of other studies reporting over longer periods. From 2000 to 2006, Māori adults were diagnosed with OC at a similar rate to non-Māori adults (6.1 Māori and 6.0 non-Māori cases per 100,000) (Robson et al., 2011). Incidence rates were also similar when comparing Māori with non-Māori by sex (with a rate ratio of 1.02 for males and 0.98 for females).

More recent studies of incidence rates of OSCC by ethnicity found New Zealand Europeans had the highest rates in New Zealand. Chelimo and Elwood (2015) reported that Māori had significantly lower rates of OSCC (ASR 1.72) during the period 1981 to 2010, than other ethnic groups (ASRs of 3.09, 2.32 and 2.17 for Pacific people, Asian and European/other ethnic groups, respectively). Gavidi et al. (2014) also reported that New Zealand Europeans had a significantly higher incidence of OSCC during the period of 2000−2010 than other ethnic groups (ASR of 3.5 per 100,000, compared with 0.2 for Māori, and 0.1 for Asian or Pacific peoples). The difference in incidence rates between these two studies may be explained by the difference in the observation periods and in the inclusion criteria for the cases reported. While both studies included only OSCC cases and excluded salivary gland tumours (ICD-10 codes C07-C08), Chelimo and Elwood (2015) also excluded the external lip and other unspecified lip cancers (ICD-10 codes C00-02 and C006-009), whereas these were included by Gavidi et al. (2014).

The incidence of OPC is less commonly reported in New Zealand. Chelimo and Elwood (2015) reported Māori had the highest ASR for OPC (ASR per 100,000 of 1.83 and 1.41 for Māori and European/Other ethnic groups respectively) in the period 1981 to 2010. However, when considering OPC and OCC during the period 1984 to 2004, Meredith et al. (2012) concluded that Pacific males had higher rates of lip, mouth and pharynx cancer than European

and Others (Standardized Relative Risk (SRR) 1.49; CI 1.13, 1.98), which was consistent with the pattern of greater tobacco use in this group.

2.4.1.6 Site incidence of oral and oropharyngeal cancer

The frequency of OSCC at different sites differs substantially among countries (Moore et al., 2000). Lip cancers represent 30% of all OSCC (Scully et al., 2005), of which 90% involve the lower lip. However, when the external lip is excluded, the percentage of OSCC originating in the lips is much lower. For example, Rich and Radden (1984) reported that lip cancer in Melbourne comprised 10% of all OCC, excluding skin cancer of the lip.

In developed countries, the tongue and the floor of the mouth are the most common sites for OCs (25% of all OCs and up to 45% of OCs when the external lip is excluded) (Scully et al., 2005). New Zealand data also support the tongue being a common site for OC. Cox et al. (1995) reported an age-standardised incidence of 0.7 per 100,000 in the total population in the years 1957−1991. A site-related birth-cohort pattern was also reported, with those born from 1922 onwards having a higher incidence of tongue cancer than in other sites (Cox et al., 1995). Gavidi et al. (2014) reported that 42.5% of the New Zealand cases of OSCC from 2000 to 2010 involved the tongue. However, there were variations in site incidence with respect to ethnicity, with a higher percentage of the OSCCs occurring in the tongue for Māori, Pacific people and Asians (64%, 71% and 51% respectively) than for New Zealand Europeans. Moreover, a higher percentage of OSCCs occurred in the buccal mucosa in Asians (24%) than in other ethnic groups (9% for New Zealand Europeans and 7% for both Māori and Pacific people). Although the reasons behind the differences in OSCC site were not explored as part of that study, they may be related to the pattern of risk activities such as betel nut chewing, which has previously been associated with higher rates of lesions of the buccal mucosa (Endican, 2010 as cited in World Health Organization, 2012; Thomas and MacLennan, 1992).

2.4.2 Prevalence

Measures of mortality and morbidity can be used to describe the impact of a disease on a population. Mortality is a measure of the number of deaths occurring in a specified population within a given period. It may be expressed as an absolute number or as a rate per 100,000 persons per year (International Agency for Research on Cancer, 2016). The latter is more useful, because the former cannot really be interpreted without information on the size of the population in which the deaths occur.

Prevalence data for cancer cases records the proportion or number of persons within a defined population who have been diagnosed with that cancer and remain alive at a specified time (Rothman and Greenland, 1998). However, using prevalence rates for cancer can be problematic because 'complete prevalence' represents all people alive on a certain day who have been diagnosed with cancer, and it does not take into account the length of time since diagnosis, whether the person remains under treatment, or whether the individual is considered 'cured' (International Agency for Research on Cancer, 2016). More commonly, the population cancer burden is expressed as 'partial prevalence' and refers to the number of persons alive within a defined period following diagnosis (for example, one year or five years) (International Agency for Research on Cancer, 2016).

2.4.3 Mortality

Despite major advances in the treatment of OC and OPC and some improvement in quality of life for those affected, the global 5-year survival rate has not significantly improved and remains at 55 to 60% (Ries et al. 2007; Rapidis et al., 2009; Huang et al., 2015). Several patient and tumour factors (including gender, lifestyle-related risk factors, socioeconomic and nutritional status, presence of co-morbidities, tumour site, disease stage and expression of key biomarkers) have been proposed as prognostic indicators for OC (Warnakulasuriya et al., 2016). An analysis by Tromp et al. (2005) concluded that the stage of disease was the only independent risk factor influencing OC survival. This view was supported by Warnakulasuriya et al. (2016), who reviewed multivariate analyses from more recently published studies and confirmed that an advanced stage of disease was associated with poor prognosis. A recent review of OC cases in Taiwan reported that the five-year overall survival rates for Stage IV cancers were less than half that of Stage I (5-year survival rates of 79.0%, 69.4%, 54.6% and 36.2% for Stages I, II, III and IV respectively) (Huang et al., 2015). Other studies report five-year survival rates of between 10 and 28% for patients with OC with distant metastases at diagnosis (Sciubba, 2001; Kao et al., 2009; Liao et al., 2011). Large tumour volumes (a measure of tumour advancement) have also been associated with lower overall survival in tongue cancer (Mücke et al., 2015). It is widely accepted that the key to improving survival rates lies in improving the rate of early diagnosis of oral malignant and potentially malignant disorders (van der Schroeff and Baatenburg de Jong, 2009).

When reviewing patterns of OC in New Zealand, Cox et al. (1995) reported mortality rates by gender and subsite. In the years 1954 to 1991, the male-to-female mortality rate ratio was 3.1 (95% CI 2.5, 3.9), with approximately 80 men and 35 women dying each year from OC. The

age-standardised mortality per 100,000 from 1987 to 1991 was highest for men with tongue (0.79) or mouth cancer (0.77) and lowest for lip cancer (0.09 for men and 0.05 for women).

Substantial ethnic and socioeconomic inequalities in OC survival are known to exist in New Zealand (Robson et al., 2011; Soeberg et al., 2012). A review of cancer mortality rate patterns in New Zealand from 1991 to 2004 reported Māori had an excess mortality rate ratio of 1.37 compared with non-Māori (Soeberg et al., 2012). Those from the lowest income quintile had an excess mortality rate ratio of 1.28 over the highest income quintile. A higher mortality rate for Māori males than for non-Māori has also been observed for OC (with age-standardised mortality rates of 2.7 and 1.8 per 100,000 for Māori and non-Māori, respectively)(Robson et al., 2011). The factors contributing to different mortality rates have not been fully explained, although part of the difference has been attributed to higher rates of smoking and a later stage of diagnosis for Māori (Robson et al., 2011; Soeberg et al., 2012). During the period from 1996 to 2006, Māori males had the lowest proportion of OCs diagnosed at a localised stage (15.6% and 30.5% for Māori and non-Māori respectively) and the greatest proportions of OCs diagnosed with both regional (38.3% Māori; 30.3% non-Māori) and distant spread (8.6% Māori; 5.2% non-Māori). However, the overall significance of this finding is difficult to interpret because over one-third of the cases reviewed did not have their tumour stage recorded, and the rates were not adjusted for age. Nevertheless, when controlling for stage and age at diagnosis, the relative risk of dying from OC was 66% higher in Māori males than in non-Māori males (Robson et al., 2011). Other possible explanations for the disparity in mortality rates (such as the role of variation in site incidence or co-morbidities) have yet to be explored in New Zealand.

2.4.3.1 Morbidity

Various post-diagnosis morbidities may arise from the physical and/or psychosocial effects of the tumour, or from the treatment provided. Surgery for tumour removal and the post-radiation therapy sequelae of OC and OPC (including trismus and dry mouth) have detrimental impacts on social functions such as eating, speaking, and swallowing (Rogers 2009). OC and OPC survivors may continue to suffer from these detrimental effects for many years after their treatment is complete. More recently, health-related quality of life (HRQoL) measures have been validated as patient-perspective outcome measures following cancer treatment (Rogers, 2009). Studies have reported a decline in general and mental health, appearance, physical function, employment and social functioning during and immediately following treatment for head and neck cancer (Abendstein et al., 2005; Funk et al., 2012).

HRQoL tends to be poorer with more advanced stages of disease, with those experiencing tumour recurrence having the poorest HRQoL scores (Rana et al., 2015).

Although many studies have shown that patients with head and neck cancer usually experience an improvement in their quality of life in the first two to three years following treatment (Morton and Izzard, 2003), others report significantly poorer HRQoL up to ten years after diagnosis (Mehana and Morton, 2006; Oskam et al., 2013). Conversely, some long-term survivors have reported retaining their quality of life following cancer diagnosis and treatment (Goldstein et al., 2007). A recent study of patients treated at the Auckland Hospital Head and Neck Cancer Clinic reported that those who were assisted to develop general coping skills following diagnosis had improved QoL (Cavell et al., 2015). Greater benefit was demonstrated in those with more advanced disease, those of Māori and Pacific ethnicity and those with poorer baseline QoL. It was suggested that many head and neck cancer patients have substantial unmet needs, and by providing adequate support there is potential to improve their quality of life.

Attempts have been made to quantify the disease burden for a population by combining mortality and morbidity data using the Disability-Adjusted Life-Years (DALY) measure. The DALY score for a disease is calculated using estimates for the Years of Life Lost (YLL) due to premature mortality in the population and the Years Lost due to Disability (YLD) for long-term survivors (Murray and Lopez, 1996). A DALY score of one may be interpreted as one year of "healthy" life lost. Higher DALY scores reflect a higher disease burden for a population. DALY scores have been calculated for many cancers including OC and OPC. Soerjomataram et al. (2012) used a systematic analysis of Globcan 2008 figures to calculate DALY scores for Australasia due to OC (C00-C08) of 43 for men and 18 for women, and for OPC (C09-C14, excluding C11) of 29 for men and 6 for women. These figures were similar to the DALY scores for North America (for men 33 and 28, for women 14 and 7 for OC and OPC respectively). However, these scores are significantly less than those for Oceania (excluding Australia and NZ) of 235 for men and 157 for women for OC and 68 for men and 11 for women for OPC. The difference reflects the high rate of OC in Melanesia. However, interpretation of DALY scores can be problematic, because their calculation relies on the recording of extensive data. Population data, cancer incidence and mortality data, treatment data, standard life expectancy data and disability estimates from disease burden studies are all required to calculate accurate DALY scores (Soerjomataram et al., 2012). The collection of detailed data in all these fields across differing populations remains challenging. In addition, the use of DALY scores remains controversial, as score calculations may include inherent

inequities when assessment of disability (as opposed to life years lost) are included (Wald and Oppenheimer, 2011).

2.5 Diagnosis of oral and oropharyngeal cancer

Accurate diagnosis of OC and OPC first requires a thorough clinical assessment of the oral and oropharyngeal tissues. Clinical assessment includes visual inspection of tissues, as well as palpation of all mucosal surfaces and bimanual manipulation of the floor of the mouth (Barnes et al., 2005). Palpation of the neck is required to assess lymph node involvement. Following clinical assessment of suspicious lesions, malignancy is confirmed by a biopsy and histological diagnosis. Several other tests have been proposed to aid in the diagnosis of OC. These include vital staining (toluidine blue, tolonium chloride), oral cytology (such as brush biopsy), light-based detection and oral spectroscopy. However, these methods are not currently recognised as a replacement for the internationally accepted standard of biopsy and histological diagnosis (Macey et al., 2015)

A wide variety of anatomical and histological subsites make up the oral cavity and the oropharynx. Thus, the clinical manifestations of malignant lesions may differ according to the subsite in which they arise. Since the vast majority (at least 90%) of OC and OPC are squamous cell carcinomas, only the clinical presentation of oral squamous cell carcinomas (OSCC) will be discussed in this section.

2.5.1 Clinical features of oral and oropharyngeal squamous cell cancer

Potentially malignant and early malignant lesions may present as red lesions (termed ‘erythroplasia’ or ‘erythroplakia’), irregular white lesions (termed ‘leukoplakia’) or mixed red and white lesions (termed ‘erythro-leukoplakia’) within the epithelial tissue. Clinically, it may be difficult to distinguish among non-malignant, potentially malignant and early malignant lesions. Although the clinical appearance of malignant lesions will differ according to which subsite is affected, certain features suggest OSCC. These features include induration, non-healing ulcers (particularly those associated with raised or fissured margins), numbness or pain, abnormal blood vessels supplying a lump, a non-healing extraction site, an exophytic growth, enlarged neck lymph nodes, unexplained tooth mobility, and bony expansion of the mandible or the maxilla (Scully and Bagan, 2009). Additional symptoms, such as trismus, or difficulty in either chewing, swallowing or speaking, further suggest an underlying malignant process.

2.5.2 Imaging

For some head and neck sites both intra-oral and extra-oral radiographs such as orthopantomography (OPG) are used to assess whether visually identified lesions involve the underlying bone. Suspicious lesions may be an incidental finding on radiographs taken for other clinical investigations. Three-dimensional imaging, such as computered tomography (CT) or magnetic resonance imaging (MRI), may be utilised to provide additional information on the localised spread of disease as well as lymph node involvement (Barnes et al., 2005).

2.5.3 Histological features of oral squamous cell carcinoma

OSCC occurs following mutations of the DNA of oral keratinocytes; this enables cells to proliferate in an abnormal manner (Scully and Bagan, 2009). The accumulation of cellular atypia and tissue architectural changes within an epithelium is termed 'epithelial dysplasia'. A definition of epithelial dysplasia and its histological description and grading is available elsewhere (Barnes et al., 2005). OSCC is characterised histologically by invasion of the dysplastic cells across the basement epithelial membrane leading to local, regional and (ultimately) distant spread (Barnes et al., 2005).

2.6 Staging of oral and oropharyngeal carcinomas

The extent of a tumour at the time of diagnosis is an important prognostic indicator and a crucial factor in determining the appropriate treatment regime (Edge and Compton, 2010). The staging of tumours is also an important tool in epidemiology and health services research. Two cancer staging systems will be discussed; these are the Tumour Node Metastases (TNM) and the Surveillance Epidemiology and End Results (SEER) staging systems.

2.6.1 Tumour Node Metastases staging of oral and oropharyngeal carcinomas

The classification of malignant tumours into different stages began in 1905 by Steinthal and was developed further by Paterson in 1940 (van der Schroeff and Baatenburg de Jong, 2009). The TNM system for recording the extent of malignant disease at the time of diagnosis was developed by oncology surgeon Pierre Denoix over a ten-year period from 1943 to 1952 (van der Schroeff and Baatenburg de Jong, 2009). The TNM system classifies tumours according to the anatomic extent of the primary tumour (T1─4), regional lymph node involvement (N0─3) and the absence or presence of distant metastases (M0─1). There are 32 possible TNM combinations, which may be further grouped as cTNM (TNM code based on clinical examination and radiologic imaging) or pTNM (TNM code based on histolopathological

examination of the tumour and/or regional lymph nodes). The TNM system has been used internationally in the staging of cancer for treatment and epidemiological purposes since 1982. The Union for International Cancer Control (UICC) publishes the TNM system guidelines which is currently in its sixth edition (Union for International Cancer Control, 2009).

TNM staging is specified according to anatomical site (Barnes et al., 2005). Tumours of the oral cavity and the oropharynx that have similar TNM combinations are thought to behave similarly (van der Schroeff and Baatenburg de Jong, 2009). This allows simplification of the possible TNM combinations into grouped stages: Stages I−IV, with Stage I being the least, and Stage IV the most advanced. Stage IV tumours are further classified according to therapeutic subcategories in the following manner: tumours likely to respond to surgical resection (Stage IVa); tumours requiring locoregional control with chemotherapy (Stage IVb); or incurable tumours suitable only for palliative treatment (Stage IVc). However, the TNM stage alone is not considered sufficient to determine the prognosis and individual risk factors and existing co-morbidities play a crucial role in survival (Yung and Piccirillo, 2008).

Pugliano et al. (1999) recorded cancer symptoms along with TNM stage and patient factors (such as age, comorbidities, symptom severity and alcohol use) in a proportional hazards model to predict head and neck cancer survival. The severity of cancer-related symptoms alongside the TNM code was used as a measure of the aggressiveness of the tumour, whereas patient factors reflected the individual's ability to deal with the tumour. They estimated that the 5-year survival rates using TNM stage alone were 72%, 54%, 37% and 29% for stages I, II, III and IV respectively. However, when clinical factors were included the estimated survival rates for stages I, II and III rose, but halved for Stage IV (survival rates of 77%, 56%; 42% and 14% for stages I, II, III and IV respectively).

Similarly, the Washington University Head and Neck Co-morbidity Index (WUHNCI) developed by Piccirillo et al. (2004) is a head and neck cancer-specific index that identifies seven co-morbidities (such as congestive heart failure and previous cancer history) that impact on either the primary tumour or the cancer treatment provided. It is designed to be used alongside tumour classification and staging information to improve individual patient management. It is also intended for epidemiological use.

2.6.2 Surveillance Epidemiology and End Results system

The primary role of population Cancer Registries is the systematic collection and recording of all cancer cases within a defined population. Such a registry includes personal details of the cancer patients and the clinical and pathological characteristics of the tumour. The existence of a register enables analysis of patterns of incidence over time and of the characteristics of specific cancers. Registries are also used to record cancer-related deaths. Registries are crucial for epidemiological research to inform population cancer control programmes (Parkin, 2008).

The SEER system was developed as a staging system for utilisation in databases including Cancer Registries. It was developed in the 1970s by the US National Cancer Institute (Division of Cancer Control and Population Sciences, United States) from two earlier programs (the End Results Program and the Third National Cancer Survey) (Hankey et al., 1999). The SEER system is frequently used in population studies and contains the clinical stages of tumours at diagnosis (tumours are classified as *in situ*, localised, regional or distant) (Carvalho et al., 2005).

2.6.3 The New Zealand Cancer Registry (NZCR)

The NZCR is a population-based cancer register administered by the New Zealand Ministry of Health. The NZCR became operational in 1951, with some records from as early as 1948. The main source of cancer data for the NZCR comes from pathology laboratories, which have been by law since 1 July 1994 (as per the Cancer Registry Regulations, 1994) to report any new diagnosis of cancer. Cases of carcinoma *in situ* and non-melanoma skin cancer are not recorded routinely in the NZCR.

The NZCR collects detailed information (including demographic data) on the individual diagnosed, as well as descriptive data on the tumour found (including site (ICD-code), morphology and extent) to ensure that each new diagnosis is recorded only once. The data recorded for all cancers in the NZCR are summarised in Table 2.3. Further information is collected for cases of melanoma, as well as breast, cervical and colorectal cancers. The incidence counts from the NZCR may be based on either the number of primary tumours diagnosed or the individuals diagnosed, and the NZCR does record multiple registrations at different sites of different histological types for the same individual according to ICD codes.

Table 2.3 Table of available data recorded within the New Zealand Cancer Registry (Ministry of Health, 2013b)

Data items for cancers	Notes
Health care user HCU) number	Unique patient identifier, also known as National Health Index (NHI) number. Restricted access.
Name	Restricted access.
Date of birth	Day, month, year
Date of death	Day, month, year
Address	Restricted access.
Domicile code	A code based on Statistics New Zealand Census Area Unit.
Sex	Male, female, indeterminate, unknown
Ethnicity	Ethnicity information is sourced from the NHI, the Mortality Collection and the National Minimum Dataset (containing hospitalisations).
Age	Age in years at date of diagnosis.
Diagnosis date	Sourced from pathology reports, hospital admission date (from the National Minimum Dataset) and the Mortality Collection.
Registration source code	A code identifying the initial source of the registration. Introduced in 2001.
Site code	ICD-10-Australian Modification code identifying the site of origin of the tumour.
Morphology code	ICD-O code identifying the histology (cell type) of the tumour.
Behaviour code	A code identifying how the tumour acts within the body: in situ, primary invasive or metastatic malignancy. Introduced in September 2008.
Grade of tumour code	A code specifying the differentiation of the tumour: how much or how little it resembles the normal tissue from which it arose. Introduced in 1998.
Basis of diagnosis code	A code specifying the source of the diagnosis, e.g. death certificate, clinical diagnosis, histology or cytology.
Extent of disease code	A code describing the stage of development reached by the tumour at diagnosis.
Laboratory code	A code identifying the laboratory diagnosing and reporting the cancer event.
Facility code	A code identifying the healthcare facility where the cancer was diagnosed or treated.
Laterality code	This code is only relevant for paired organs. It indicates which side of the body the affected organ is located on. Introduced in 1998 for the breast, and in September 2008 for other paired organs.
TNM codes	TNM codes indicate the presence, or absence, of distant metastases, as classified by TNM (a staging system including Tumour size, Nodes, and Metastases which are specific to the site). Introduced in 2001.
Nodal status fields	Several fields which together indicate whether lymph nodes were tested and how many nodes were found to have metastases. Introduced in 2001 for colorectal cancers and in September 2008 for other cancers.
Multiple tumours flag	A flag indicating cancer events considered mulitple tumours according to the WHO recommended classification.
Clinical notes	Text field containing supplementary information about the cancer registration. Introduced 2001
Cancer group code	A code identifying the specialty group to which the cancer event belongs. Introduced in 2001.

2.7 Oral cancer screening

Screening is defined by the WHO as the application of a test (or tests) to people who appear to be free from disease in order to distinguish between those that have the disease from those who probably do not (Wilson and Jungner, 1968). Rather than being a diagnostic test, screening is performed on individuals perceived to be at risk of a particular disease, in order to identify those who would benefit from a diagnostic test for that disease (National Screening Unit, 2016). To justify a screening programme, the target disease should be relatively common, with high associated preventable morbidity or mortality (Scully and Boyle, 2005). In addition, the natural history of the disease should be completely defined, with a recognised latent phase (Scully and Boyle, 2005). The criteria used by the National Health Committee of New Zealand to assist in the decision to implement a screening programme are based on aspects of the condition, the screening technique, treatment for the condition and the screening programme itself (Table 2.4).

Table 2.4 National Health Committee criteria for a screening programme (NHC, 2003)

The condition	
	The condition is suitable for screening
The screening technique	
	There is a suitable test
	The potential benefit of the test should outweigh potential harm
The treatment for the condition	
	There is an effective and accessible treatment or intervention for the condition
The screening programme	
	There is high-quality evidence that a screening programme is effective in reducing death and illness
	There is consideration of social and ethical issues and of cost-benefit issues
	The health sector should be capable of supporting diagnosis, follow-up and programme evaluation

In addition, the screening technique of choice should have a high degree of sensitivity (the effectiveness of a test in detecting disease that will progress in those who have the disease), a high degree of specificity (the extent to which a test gives negative results in those that are

free of the disease or for those in whom disease would not progress), have a high positive predictive value (the extent to which individuals have the disease in those that give a positive test result), and a high negative predictive value (the extent to which individuals are free of the disease in those with a negative test result) (Hakama et al., 2007).

OC and OPC continue to have a high mortality rate and significant morbidity for those affected. Survivors report significant physical disfigurement and disability, as well as negative social and psychological impacts (Rogers, 2009). High rates of depression (ranging from 33 to 92%) have been reported for those diagnosed and treated with head and neck cancer (Cavell et al., 2015). It is widely accepted that OC and OPC is frequently preceded by clinically detectable potentially malignant disorders (Napier and Speight, 2008; van der Waal, 2009; Warnakulasuriya, 2009) which may exhibit various stages of dysplasia (Scully and Bagan, 2009). The premise of oral cancer screening (OCS) is to detect OPMDs early and provide treatment to resolve the lesion, thereby preventing, or at least reducing, the risk of malignant transformation. However, the process of malignant transformation is complex. The clinical presentation of lesions does not reliably predict early malignant disease (McGurk and Scott, 2005). The risk of malignant transformation may remain even after OPMDs are excised, since the clinically evident lesion may not represent the full extent of the potentially malignant tissue (Holmstrup et al., 2007; Holmstrup, 2009). Another essential component of screening is to identify those individuals with OPMDs who may benefit from risk-reduction interventions, (for example, leukoplakia lesions in tobacco users may resolve following smoking cessation).

Screening may be undertaken using three different approaches: a population-based approach (screening all those in the identified at-risk population); an opportunistic approach (screening those who present for primary care for an unrelated issue); or a targeted approach (screening those deemed to be at high risk of the disease). Population screening programmes are recognised as important for detecting early lesions in other cancers such as breast and bowel cancer (NHC, 2015). However, it is widely accepted that population screening for OC is unlikely to be a cost-effective method of detecting early lesions, particularly in populations with relatively low incidence rates (Brocklehurst et al., 2013). To date, only one randomised control trial of a population-screening programme for OC has been conducted (Brocklehurst et al., 2013). The trial was conducted over a 15-year period in a high-risk population in the province of Kerala, India. A visual oral examination was performed by non-medical university graduates trained to identify oral tissue as normal, a tissue lesion not requiring further investigation, or a tissue lesion requiring further investigation. Participants with

lesions requiring further investigation were referred to a dentist or physician for definitive diagnosis (Sankaranarayanan et al., 2005). The review supported the study's findings that screened individuals with a high-risk profile (users of tobacco or alcohol or both) had a lower mortality rate from OC and had fewer cancers diagnosed as late stage disease (Stage III or higher). However, the study did not adequately account for possible bias. The review concluded that currently there is insufficient evidence to recommend a whole-population approach in screening for OC but that there is evidence to suggest a targeted approach could reduce mortality and enable earlier diagnosis. Opportunistic visual screening by dentists and trained health practitioners is still the recommended approach to enable prompt diagnosis and treatment for OC, particularly for those who use tobacco and alcohol (Brocklehurst et al., 2013).

A recent systematic review conducted by Walsh et al. (2013) compared screening techniques for OC and OPMDs. Conventional oral examination (COE) by a primary healthcare clinician were assessed alongside other screening methods, such as the use of toluidine blue rinse, mucosal illumination with special lights, and self-examination by the individual. The review concluded that COE remains the most valid method of oral screening and enabled detection of between 59% and 99% of all OCs. However, some false positives will be produced with a COE, and the accuracy differs according to the skill of the primary health care clinician.

Further studies have utilised a COE by primary healthcare clinicians to investigate the utility of invitational and opportunistic screening for OCs and OPDMs (Monteiro et al., 2015; Nagao et al., 2000). Nagao et al. (2000) invited all adults aged over 40 years living in Tokoname (Japan) to present for a free general health screen. The oral screening component was performed by dentists. Oral mucosal lesions were detected in 783 (4.1%) of the 19,056 study participants. The detected lesions were further investigated by specialists and the accuracy of the original oral screen was evaluated. The sensitivity, specificity, positive predictive values (PPV) and negative predictive values (NPV) of the original visual examination were 92%, 64%, 78% and 86% respectively, suggesting that the Japanese dentists involved in the study were satisfactory at performing oral mucosal screening. A higher sensitivity (96%), specificity (98%), PPV (96%) and NPV (98%) were reported for the oral screening of those participating in an invitational and opportunistic OCS trial in Portugal, with significantly more positive cases (3.4%) detected among those aged over 54 years (Monteiro et al., 2015).

Within the last 25 years, two New Zealand studies have utilised COEs for oral mucosal screening in adults. Thomson et al. (1992) screened institutionalised older people and found that one-third of paticipants had oral mucosal lesions, however none had malignant lesions. A

low incidence of suspected oral malignant lesions (0.3% of those aged over 18 years) was also reported in the most recent New Zealand Oral Health Survey (Ministry of Health, 2010). However, those aged 65 years or over were significantly more likely to have an oral mucosal lesion, although no differences were apparent by ethnic group or level of deprivation. The low prevalence of suspicious malignant lesions reported in these studies adds weight to the belief that population screening is unlikely to be a cost-effcetive method of screeing for OC in New Zealand.

Speight et al. (2006) used a decision-analytic computer model to demonstrate that OCS programmes that target high-risk groups in low-incidence populations can significantly increase the QALYs for those individuals identified. Screening was shown to be more cost-effective within a general dental practice than in a general medical practice. In addition, significant cost savings to the health system were identified by enabling treatment at earlier disease stages. The positive impacts on broader society associated with earlier-stage diagnosis of OCs have been identified by other studies (Jacobson et al., 2012; Short et al., 2011).

2.8 Delays in the diagnosis of oral and oropharyngeal cancer

Despite therapeutic advances, a poor prognosis persists for those diagnosed with OC and OPC. The global 5-year survival rate has not significantly improved and remains at 55−60% (Chan et al., 2015; Rapidis et al., 2009). The poor prognosis has largely been attributed to late stage diagnosis of OC and OPC (van der Schroeff and Baatenburg de Jong, 2009). The literature suggests that both tumour aggressiveness and diagnostic delay can impact on the stage at which OC and OPC are diagnosed (Goy et al., 2009). Biologically aggressive tumours are likely to progress rapidly and may not be clinically apparent until they are well advanced (Scott et al., 2005; Seoane et al., 2010). An exploration of the possible mechanisms impacting on tumour aggressiveness is beyond the scope of this study, and so only the role of diagnostic delay will be discussed in the following sections.

2.8.1 Definition of diagnostic delay

Diagnostic delay has been described as the time elapsing between an individual first noticing an abnormal symptom of a condition and the commencement of treatment for that condition (Teppo and Alho 2008; Yu et al., 2008). Gomez et al. (2010) represented the total diagnostic delay schematically (Figure 2.1) by dividing the time taken into three stages, depending on who was chiefly responsible for the delay.

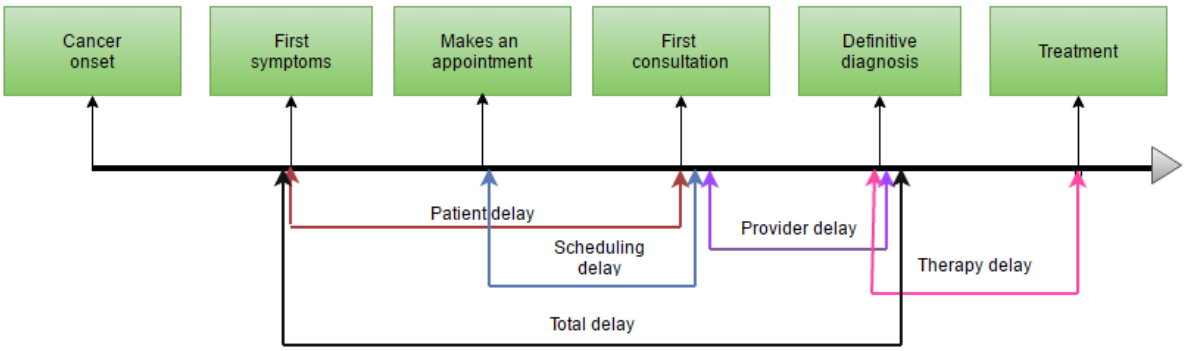

Figure 2.1 Types of diagnostic delay in oral cancer (Gómez et al., 2010)

Patient delay is defined as the time from the discovery of a symptom until consultation with a primary healthcare clinician. Provider (also known as professional or referral) delay is defined as the time taken from consultation with a primary healthcare clinician until the first specialist consultation and establishment of a definitive diagnosis. Treatment (or therapy) delay is the subsequent time taken from diagnosis to initiation of definitive treatment. Irrespective of the subtype, diagnostic delay is common in cases of OC and OPC (Goy et al., 2009). The causes of each type of diagnostic delay will be discussed in the following sections.

2.8.2 Patient delay

Patient-related delay is common in cases of OC and OPC, with at least half of those who experience a potentially malignant oral symptom delaying seeking professional help (Pinholt et al., 1997; Scott et al., 2008). Studies suggest that patient-related delay is responsible for the greatest proportion of total diagnostic delay (Groome et al., 2011; Onizawa et al., 2003), with head and neck cancer patients typically having waited longer to present to medical practitioners than those with other cancers (such as lung, colorectal or breast) (Baughan et al., 2009). Patient delay has been linked to a more advanced disease stage, with patients who seek professional help more than one month after noticing an oral symptom being twice as likely to present with late-stage disease as those who seek help more promptly (Brouha et al., 2005). While the exact measurement of patient delay is problematic (due to recall bias and errors in measurement), at least one third of patients will delay seeking medical advice for three months or more following the discovery of an oral symptom (Allison et al., 1998; Scott et al., 2008). In a large German study, Friedrich et al. (2010) reported that 9.3% of those subsequently diagnosed with OC waited more than a year before seeking professional advice.

The duration of patient delay has not consistently been associated with patient demographic characteristics (such as age or sex), lifestyle behaviours (such as smoking tobacco or high alcohol consumption), or clinical factors (such as lesion site or type) (Noonan, 2014; Scott et al., 2008; Stefanuto et al., 2014). However, living alone has been associated with delay in seeking medical care (Brouha et al., 2005; Rozniatowski et al., 2005; Tromp et al., 2005), as has the use of allied health practitioners such as community pharmacists and herbalists (Grant et al., 2010; Varea-Centelles et al., 2012). A review of the literature conducted by Noonan (2014) suggested that the reasons for patient delay are multifactorial and both barriers in accessing primary healthcare and a lack of knowledge or awareness of the signs and symptoms of OC play a role. Poor accessibility of healthcare has been associated with longer patient delays, particularly for groups experiencing higher levels of deprivation (Llewellyn et al., 2004; Scott et al., 2006; Scott et al., 2007; Scott et al., 2009; Güneri and Epstein, 2014).

A lack of public awareness about OC─and the misinterpretation of OC symptoms as minor conditions─have been reported as contributing towards patient-related delay (Brouha et al., 2005; Scott et al., 2006; Scott et al., 2007; Scott et al., 2008; Rogers, 2009; Scott et al., 2009; Grant et al., 2010). A study of patients attending the Oral Health Centre of Western Australia reported that, while all had heard of lung cancer, only 72% had heard of "mouth or throat cancer" (Park et al., 2011). Scott et al. (2007) suggested most patients do not consider common OC symptoms to be associated with cancer, and instead attribute them to other causes. Grant et al. (2010) also found that while most of Scottish OC patients had symptoms which prompted a consultation with a healthcare worker they did not associate them with OC. Moreover, early OC and OPC lesions may be asymptomatic or cause only subtle signs (Yu et al., 2008), with symptoms developing only when tumours are advanced (Scott et al., 2005). Although the mouth is readily accessible, the ability of the general public to perform mouth self-examinations (MSE) to detect early OC lesions and thereby, promptly seek treatment has been questioned (Elango et al., 2011).

The public's knowledge of OC and OPC had been expected to improve following the introduction of public awareness campaigns. This, however, has yet to be demonstrated (Scott et al., 2006), although, in an Australian study, Kaing et al. (2016) observed the average duration of patient delay was less than for an earlier Australian study conducted by Dimitroulis et al. (1992) (average patient delay of 1.8 months and 4.5 months, respectively). They suggested that the difference may be attributed to greater public awareness of OC. While large-scale public OC awareness campaigns have yet to be conducted in Australia, risk-reduction strategies such as the National Tobacco Campaign may have had some effect.

Likewise, New Zealand does not have specific public health OC awareness campaigns, although some information is in the public domain (such as the inclusion of photographic images and the message "Smoking causes mouth cancer," which are mandatory on tobacco packaging). Studies to determine the level of public awareness of OC and OPC in New Zealand have yet to be conducted.

2.8.3 Provider (professional or referral) delay

The ability of primary healthcare clinicians to promptly detect and refer suspicious oral lesions for definitive diagnosis is crucial to patient outcome (McGurk and Scott, 2010; Ministry of Health, 2014). Professional delay in OC diagnosis was associated with advanced stage of disease in British and Canadian studies (Pitchers and Martin, 2006; Groome et al., 2011) and a higher risk of death in a Finnish study (Alho et al., 2006). In particular, the risk of dying for those with tongue or glottis tumours was highest for those whose symptoms had been disregarded by primary healthcare clinicians (adjusted hazards ratio (HR) 4.3, 95% CI 1.6, 11.4) (Alho et al., 2006). Studies suggest that some patient groups (including females, non-smokers and those from lower socio-economic groups) experience longer provider delays (Yu et al., 2008). Clinician factors that contribute to provider delay include the failure to recognise the signs and symptoms of oral potentially malignant lesions, a lack of knowledge of the risk factors for OC and OPC, and not providing a thorough OCS examination for at-risk patients. These will be discussed in the following sections.

2.8.3.1 Lack of understanding of the signs and symptoms of OC and OPC

Considerable heterogeneity has been reported among primary healthcare clinicians in detecting oral cancerous lesions (Brocklehurst et al., 2013). A Finnish study that reviewed the outcomes of the initial primary healthcare consultation for patients subsequently diagnosed with OC suggested that over half (53%) of the patients received specialist referrals at their first appointment, with a further 24% having a follow-up appointment before referral, and 20% receiving neither (Alho et al., 2006). These findings were similar to those from a UK study that reported that 53% of patients subsequently diagnosed with OC were referred to a specialist after their initial consultation, while 22% were referred for special tests, 12% were advised their symptom was not serious, and 12% were given treatment for another condition (Crossman et al., 2016). The English National Audit of Cancer Diagnosis in Primary Care reported that 22% of patients who were subsequently diagnosed with OC or OPC had more than three primary care consultations before being referred for specialist care (Lyratzopoulos et al., 2013). Morelatto et al. (2007) explored the types of therapies given to patients prior to

their diagnosis of OSCC and reported that most (80%) had received some prescription medicine prior to diagnosis, with 26% prescribed mouthwashes and 20% prescribed antibiotics or anti-inflammatories. Nearly one-third of patients (30%) had been prescribed multiple medications.

Regular professional dental care is associated with an earlier stage of diagnosis for OC (Groome et al., 2011; Holmes et al., 2003; Watson et al., 2009; Yu et al., 2008). Holmes et al. (2003) reported that cases of OSCC and OPSCC referred by a dental practitioner were at an earlier stage than those referred by medical practitioners. However, those with OC and OPC are more likely to be referred for specialist care by medical than dental practitioners (Crossman et al., 2016; Kaing et al., 2015). Concern has been expressed that at-risk individuals have poorer access to dental care and are therefore less likely to be diagnosed in the early stages of disease (Frydrych and Slack-Smith, 2011). While OC is more common in those aged over 60 years, older adults and edentulous patients are less likely to visit dentists (Haughney et al., 1998). A British study reviewing patterns of dental attendance over a ten-year period reported that males aged over 40 years and tobacco smokers were less likely to be regular dental attenders (Yusof et al., 2006). Poorer access to dental care for Māori, Pacific people and those of lower socioeconomic status was also observed in the latest New Zealand Oral Health Survey (Ministry of Health, 2010). These groups have been identified as more likely to present with late-stage OC or OPC (Robson et al., 2011; Soeberg et al., 2011).

2.8.3.2 Knowledge of the risk factors for OC and OPC

A number of international studies have reported that primary healthcare clinicians' lack of knowledge of the risk factors for OC and OPC contributes to delays in diagnosis and treatment (Allen and Farah, 2015; Brocklehurst et al., 2010; Carter and Ogden, 2007; Horowitz et al., 2000). Carter and Ogden (2007) explored general medical and dental practitioners' knowledge about risk factors for OC. While smoking tobacco was identified by both practitioner types, dentists were significantly more likely than their medical colleagues to identify alcohol consumption as a risk factor (87.2% of dentists and 43.3% of medical practitioners). In addition, dentists were more likely than medical practitioners to regularly advise patients of the risk factors for OC. Seoane et al. (2006) reported that most (84.4%) of Spanish dentists informed patients of the benefits of avoiding excessive alcohol and quitting tobacco, yet only half of the Australian dentists surveyed believed they could influence patients to reduce or quit smoking or drinking alcohol (Allen and Farah, 2015). Even so, dentists may not routinely attempt to do this. A survey of Scottish dentists found that nearly half (49%) occasionally asked patients about their smoking habits, but only 19% routinely did

so (Macpherson et al., 2003). Very few practitioners (3%) routinely asked about alcohol consumption, with discomfort in enquiring about drinking habits cited as the primary reason for not doing so. Daley et al. (2011) explored Florida dentists' and dental hygienists' knowledge of HPV as a risk factor for OC and OPC. They identified a lack of awareness by practitioners of the role of HPV in the development of OC and OPC. Practitioners also expressed discomfort in discussing HPV as a risk factor for OC and OPC with their patients.

Several studies have reported on dentists' awareness of older age being associated with OC. Decuseara et al. (2011) found that 55% of Irish dentists identified older age as a risk factor for OC. Likewise, Mahalaha et al. (2009) reported that fewer than one-third (30.3%) of the US rest home dentists interviewed knew that most OCs were found in persons aged over 60 years, and fewer than half (47.1%) knew that older age was associated with a high risk of OC. Notably, dentists who had graduated within ten years of the survey had better knowledge about OC than older graduates.

While many studies have highlighted the differences in knowledge among clinicians and have identified the need for improved awareness among practitioners in order to enable early detection of OC and OPC (Horowitz et al., 2000; Carter and Ogden, 2007; Brocklehurst et al., 2010), knowledge gaps clearly persist. Maybury et al. (2012) reported that Maryland (US) dentists' knowledge of OC risk factors had remained relatively unchanged over fourteen years despite educative efforts. Whether New Zealand dental practitioners have adequate knowledge of the risk factors for OC and OPC to enable them to identify patients at higher risk of disease has not been explored.

2.8.3.3 Oral cancer screening practices of primary care practitioners

The opinions and practices of dental professionals of oral cancer screening (OCS) have been reported on internationally. Farrand et al. (2003) found UK dentists generally reported high levels of confidence in their clinical ability to detect OC, whereas Macpherson et al. (2003) reported that only 37.8% of the Scottish dentists surveyed were either confident or very confident. A study of Australian dentists found that most practitioners (93.1%) believed they would encounter OC within their practising career, and most (98.6%) had referred patients to a specialist for a suspicious oral lesion (Allen and Farrah, 2015). When asked about performing OCS examinations, most dentists reported checking all new patients (94.5%) and all recall patients (85.7%) for oral mucosal pathology. However, nearly half (49.4%) of the dentists who had been practising for more than ten years targeted OCS examinations only to individuals deemed to be at high-risk. These findings compared favourably with a study of nursing home dentists in the US which found 83.3% of dentists undertake OCS examinations

at all initial examinations, with 72.7% doing so at recall examinations (Mahalaha et al., 2009). The OCS practices of general medical practitioners (GMPs) is less well reported, although Carter and Ogden (2007) found that 65.1% of GMPs were not screening the oral mucosa of high-risk patients.

The barriers to routinely performing OCS examinations for patients (as identified in the literature) are summarised in Table 2.5. At least 43% of the dental professionals surveyed cited at least one barrier to routinely performing OCS examinations (Macpherson et al., 2003). General medical practitioners also report a lack of training in OC detection and a lack of confidence in performing OCS examinations as significant barriers to routinely conducting OCS examinations (Macpherson et al., 2003; Nicotera et al., 2004).

Table 2.5 Practitioner-identified barriers to performing oral cancer screening examinations

Barrier to performing oral cancer screening examination	Studies
Inadequate training or confidence to perform OCS exam	Laronde et al., 2008 Brocklehurst et al., 2010 Decuseara et al., 2011 Allen and Farah, 2015
Lack of clinical time	Macpherson et al., 2003 Laronde et al., 2008 Saleh et al., 2016
Lack of remuneration	Macpherson et al., 2003 Mahalaha et al., 2009
Concern about causing patients undue anxiety	Macpherson et al., 2003 Noonan, 2014
Lack of patient compliance to screening and referral	Saleh et al., 2016
Low incidence of detection	Brocklehurst et al., 2010

Understanding primary care clinicians' barriers to performing OCS examinations is crucial to developing strategies to improve the rate of screening examinations provided in the primary care setting (Ford and Farah, 2013). Dentists' fears of causing patients undue anxiety by performing OCS examinations may be unfounded, with 91.6% of patients in a private practice survey wanting their dentist to inform them when they perform an OC check, and only 1% reporting being extremely anxious about having this done (Awojobi et al., 2012). A study of British Columbian dental professionals found that commonly cited barriers could be overcome with improved knowledge about OC (Laronde et al., 2008). Whether dental

professionals experience barriers to providing OCS of their patients is yet to be explored in New Zealand.

2.8.4 Treatment Delay

Treatment delay encompasses the delays which occur within the healthcare care system once diagnosis has been confirmed. Groome et al. (2011) reported that treatment delay was less common than provider or patient delay for patients diagnosed with OC in Ontario (Canada) and was only experienced by 1.6% of the patients reviewed. However, treatment delay is largely dependent on the available healthcare resources (both treatment facilities and clinician resources), so will vary among countries. As well as being identified as a cause of undue psychological stress for patients (Rapport et al., 1993), treatment delay is generally regarded as impacting negatively on disease progression. Although a Dutch study reported no adverse effects on tumour progression or survival rate with longer wait times for head and neck cancer (HNC) (van Harten et al., 2014), other studies have reported poorer survival rates for HNC patients who experience longer waiting times for radiotherapy (Chen et al., 2008) or combined therapies (van Harten et al., 2015). In studies which did not identify negative clinical consequences for treatment delay, the impact of waiting times on survival rates may be confounded by the 'waiting time paradox', whereby patients with severe symptoms from advanced and rapidly progressing tumours are fast-tracked to receive treatment sooner (Neal, 2009). Thereby, a poorer survival rate may be found in those with the shortest treatment waiting time (van Harten et al., 2014). In addition, the role of co-morbidities (which may increase treatment delay) on mortality should be considered when interpreting the relationship between treatment delay and overall survival rates (van Harten et al., 2015).

Despite some conflicting reports, it is widely accepted that treatment delay is likely to be a significant prognostic factor for OC and OPC, with greater time from diagnosis to treatment associated with disease progression, more extensive treatment and poorer survival (van Harten et al., 2015). Government-initiated fast-track cancer programs (often dictating a specialist appointment within 2 weeks of referral if malignancy is suspected) have been introduced in many countries, including New Zealand, to minimize the time from diagnosis to treatment and improve patient outcomes (NICE 2004; National Head and Neck Cancer Tumour Standards Working Group, 2013; Sorensen et al., 2014). However, to date, the impact of fast-track cancer programs on patient outcomes for OC and OPC has yet to be established (Langton et al., 2016).

2.9 Summary

Oral and oro-pharyngeal cancer is the sixth most common cancer worldwide, with an estimated annual incidence of over 442,000 cases (3.1% of the total cancer cases). Distinct geographic patterns exist in incidence, reflecting the prevalence patterns of known risk factors for OC and OPC. Review of the NZCR data has shown the incidence of OC and OPC has increased over the last fifty years particularly in men. Most notably, the incidence of OPC in males has increased rapidly since 2005. Distinct patterns of OC and OPC have been demonstrated in New Zealand with respect to age, gender, ethnicity and social deprivation. Overall, incidence rates are highest among older men, but rates are increasing for both genders in deprived areas. This is consistent with international findings.

Worldwide, there are an estimated 145,000 deaths (1.8% of total cancer deaths) due to OC and a further 97,000 deaths (1.2% of total cancer deaths) due to OPC. Despite significant advances in the treatment of OC and OPC, the overall 5-year survival rate has not significantly improved. It is widely accepted that the key to improving survival rates lies in improving the rates of early diagnosis of oral malignant and potentially malignant disorders. Moreover, substantial ethnic and socioeconomic inequalities in OC and OPC survival have been recorded internationally. Likewise, ethnic and socioeconomic inequalities in OC and OPC survival are known to exist in New Zealand, with poorer survival rates for Māori and those of lower socioeconomic status. The factors contributing to these inequalities have not been fully explained, but the difference has been, at least partly, attributed to a later stage of diagnosis for Māori and those of lower socioeconomic status.

Late-stage presentation has been attributed to delays in the diagnosis of OC and OPC. Delays may occur due to patient, provider and healthcare system factors. Patient-related delay is common in cases of OC and OPC. The factors contributing to delays in seeking medical care are multifactorial and include both barriers in accessing primary healthcare and a lack of knowledge or awareness of the signs and symptoms of OC and OPC. Whether New Zealand patients delay seeking medical care prior to diagnosis of OC (and how this may impact on stage of diagnosis) has not been reported to date.

It is generally accepted that whole-population screening for OC and OPC is unlikely to be cost-effective in countries such as New Zealand, where incidence is relatively low. However, there is evidence that screening of high-risk individuals can improve survival rates. Tobacco and excess alcohol use have long been highlighted as important risk factors for OC and OPC. More recently, the role of other factors ─ such as infection with high-risk HPV (particularly

in relation to oropharyngeal tumours) ─ has been emphasised. International studies have found that deficiencies in primary healthcare clinicians' knowledge can contribute to delays in the diagnosis of OC and OPC. Most identified a need for improved awareness among practitioners of the risk factors for OC and OPC, and the clinical presentation of OC and OPC to enable early detection. The level of understanding of the risk factors for OC and OPC among primary care clinicians in New Zealand, (and thus their ability to identify at-risk individuals) is not known. This means that the feasibility and utility of routine screening of at-risk individuals by clinicians is unclear.

International studies have observed regular dental care to be associated with an earlier stage of diagnosis for OC, but there is concern that at-risk individuals may be less likely to regularly visit dentists and are therefore less likely to be diagnosed in the early stages of disease. The New Zealand Oral Health Survey (2009) reported poorer access to dental care for Māori, Pacific people, older adults and those of lower socioeconomic status (Ministry of Health, 2010). Whether irregular dental attendance impacts on the stage of diagnosis in New Zealand has not been investigated.

3 Methods

3.1 Study Overview

Quantitative research was undertaken to explore factors which may contribute to the stage of diagnosis of OC and OPC in New Zealand. The research objectives were: to assess the knowledge, beliefs and practices of New Zealand primary dental care clinicians about OC and OPC and whether this impacts on the stage of diagnosis; and to determine whether differential access to dental care impacts on the stage of diagnosis of OC and OPC in the CDHB region of New Zealand.

A self-administered questionnaire was developed to gather information from general dentists and clinical dental technicians (CDTs). In New Zealand, the provision of full or partial dentures may be undertaken by dentists or clinical dental technicians (CDTs). It is possible that edentulous people may be more likely to seek such treatment from a CDT than from a dentist. Given that edentulism and OC and OPC are more common in older people, CDTs were included in this study alongside general dental practitioners as it can expected CDTs may encounter OC and OPC during their routine practice.

A cross-sectional observational study was undertaken using descriptive data from the NZCR of all new cases of OC and OPC registered in New Zealand within the study period. The hospital records of those cases diagnosed and/or treated at CDHB were reviewed and data collected to assess patterns of dental attendance.

3.2 Ethical Approval

Ethical approval for the research was obtained on 2 September 2015 from the Central Health and Disability Ethics Committee (HDEC) (Appendix A). The HDECs ensure that health and disability research conducted within New Zealand meets ethical standards and that approved research has the potential to provide health benefits to the New Zealand population. A post-approval adjustment to the original application was obtained on 14 December 2015 (Appendix B) to enable additional information to be sought from the New Zealand Cancer Registry (NZCR) on diagnosed OC and OPC cases. Locality approval was obtained from the Canterbury District Health Board (CDHB) and the Nelson-Marlborough DHB (NMDHB) to enable study data to be collected from the hospital medical and dental files of those identified from the NZCR records. Approval was granted from these organisations on 20 March 2016 and 19 April 2016, respectively.

The Ngāi Tahu Research Consultation Committee (Te Komiti Rakahau ki Kai Tahu) at the University of Otago was consulted prior to ethical approval being sought. Support for the research was received on the 19 May 2015 (Appendix C). Consultation also occurred with both Te Komiti Whakarite (CDHB Research Consultation with Māori) and the NMDHB Iwi Health Board prior to locality approval being sought for the study within the CDHB and NMDHB regions (Appendices D and E).

3.3 Questionnaire Methods

Review of the published literature identified studies exploring primary healthcare clinicians' knowledge, beliefs and practices that might impact on the detection and diagnosis of OC and OPC (Allen and Farah, 2015; Brocklehurst et al., 2010; Carter and Ogden, 2007; Daley et al.2011; Decuseara et al., 2011; Horowitz et al., 2000; Mahalaha et al., 2009; Seoane et al., 2006; Nicotera et al., 2004; Yellowitz et al., 2000). No previous New Zealand studies were identified, and so international studies were used to create a 30-item self-administered questionnaire to assess practitioners' knowledge of the patterns of OC and OPC in New Zealand, the clinical presentation and risk factors for mouth cancer, and practitioners' referral practices for suspicious lesions (Appendix F). The questionnaire content was pre-tested by experts in oral pathology, and dental and cancer epidemiology.

The names and contact details of all New Zealand registered general dental practitioners and clinical dental technicians (CDTs) were requested from the Dental Council, New Zealand (DCNZ). Practitioners for whom neither an email address nor postal address was available were excluded from the study, along with all DCNZ registered dental specialists except those deemed to still practise general dentistry on adult patients as part of their routine practice. Dental specialists in this category were hospital dental specialists and special care dentists. Workforce data were also requested from the DCNZ to enable comparison between the respondents to the questionnaire and the general dentist and CDT workforce in New Zealand.

One hundred and thirty-six CDTs and 1,840 general dentists were identified as potential study participants. All were sent the 30-item questionnaire and cover letter (Appendix G). Practitioners with a unique email address were contacted via an email containing the cover letter and a link to directly access the questionnaire online (using Survey Monkey^{TM}). Practitioners for whom a unique email address was not available were mailed the cover letter, a paper-copy questionnaire and a self-addressed stamped envelope for return of the questionnaire. Participation was encouraged with two prize draws of Prezzy cards worth $100 for those who responded prior to 14 December 2015. Respondents were given a unique study

code to enable participation in the prize draws, while allowing the questionnaire responses to remain anonymous. The unique code also ensured that multiple responses were not included from the same respondent.

Initial email requests were sent to 1,842 practitioners on 9 November 2015. A reminder email was sent on 1 December 2015 to 1,534 non-responding practitioners (30 opted out of the survey and a further 30 had non-working email addresses). The final reminder email was sent on 26 January 2016 to 1,431 practitioners (2 opted out of the survey and a further 5 had non-working email addresses). The postal questionnaires were sent during the second week of November, 2015 to 165 practitioners who did not have a unique email address this included 30 practitioners for whom an invalid email address was recorded, but a postal address was available. A further copy of the questionnaire was sent to the 86 non-responders who had not responded to the initial mailed questionnaire (excluding the 18 questionnaires returned unopened) during the first week of December 2016. A third wave was not used because the expected low return rate would have made it uneconomic. The final sample size of eligible practitioners was 1953 (1,817 dentists and 136 CDTs).

3.3.1 Statistical analysis of questionnaire data

The responses to the online questionnaires were downloaded from the Survey Monkey^{TM} program as an Excel spreadsheet. Hard copy responses were coded and transferred to the Excel spreadsheet containing the online responses. Quantitative analysis was undertaken to describe clinicians' knowledge of, and referral practices for, mouth cancer using the R $^{(GNU\ GPL)}$ statistical program. Frequency tests were conducted and differences in proportions were tested for statistical significance using Chi square and Fisher's exact tests (as appropriate). P values of less than 0.05 were deemed to represent a statistically significant difference in proportions.

Graduation year was used to allocate respondents to ordinal categories representing graduation cohorts (before 1976, 1976-1985, 1986-1995, 1996-2005 and 2006-2015). The countries of graduation were clustered into the following three groups: New Zealand, Asian (including South East Asian and Sub-continental Indian countries) and Other (all remaining countries). The grouping of Asian countries, as distinct from other countries was made to explore whether the responses of graduates from countries with a high incidence of OC and OPC differed from those of New Zealand graduates or those from other parts of the world. The postcode regions of the respondents' main work location were divided into nine postcode regions using the New Zealand Post Regional Postcode Directory (Northland, Auckland,

Waikato, Gisborne, Hawke's Bay and Bay of Plenty, Taranaki, Manawatu and Whanganui, Wellington and Wairarapa, Nelson, Marlborough and Tasman, Canterbury and West Coast, and Otago and Southland).

3.4 Descriptive study using NZCR data

3.4.1 Data Sources

The NZCR collects detailed information (including demographic details) of individuals newly diagnosed with cancer, as well as descriptive data on the tumour, including site (ICD-10), morphology and extent, to ensure non-duplication of each new diagnosis. Application was made to the NZCR to supply information about the diagnosis of all new cases of OC and OPC (ICD-0-10 C00-14 codes, excluding codes C11, C12 and C13) registered in New Zealand between 1st January 2012 and 31st December 2013 (Appendix H) and mortality data for those who had died from OC and OPC (ICD-0-10 C00-14 codes, excluding codes C11, C12 and C13) within the same period. Identified cases who were not New Zealand residents were excluded from the study. The study was carried out to describe the incidence, extent of tumour spread at diagnosis, clinical features and mortality rates of the identified OC and OPC cases.

The variables of interest were age, sex, ethnicity (using priority ethnic group), DHB of domicile, year of diagnosis, anatomical site affected, morphological description of the cancer, extent of the tumour at diagnosis and mortality data. Population data by DHB from the New Zealand Census 2013 were utilized to calculate age-specific incidence and mortality rates of OC and OPC (Statistics NZ, 2014). Comparison was made between the World Standard Population for 2000−2025 (World Health Organization, 2001) and the NZ Census population 2013 using the age groups utilised by both WHO and the NZ Census. The structure of the New Zealand population is older than the World Standard Population (Figure 3.1). Also, the New Zealand population had a greater percentage of females (51.3%) than the World Standard Population (50.0%). The sex disparity increased in older age groups with 1.1% of the NZ population being female aged 85 years and older, but only 0.3% of the World Standard Population being in this group. Therefore, it was decided to utilise age-specific rather than age-standardisation for the presentation of incidence rates. Mortality rates were presented as crude rates.

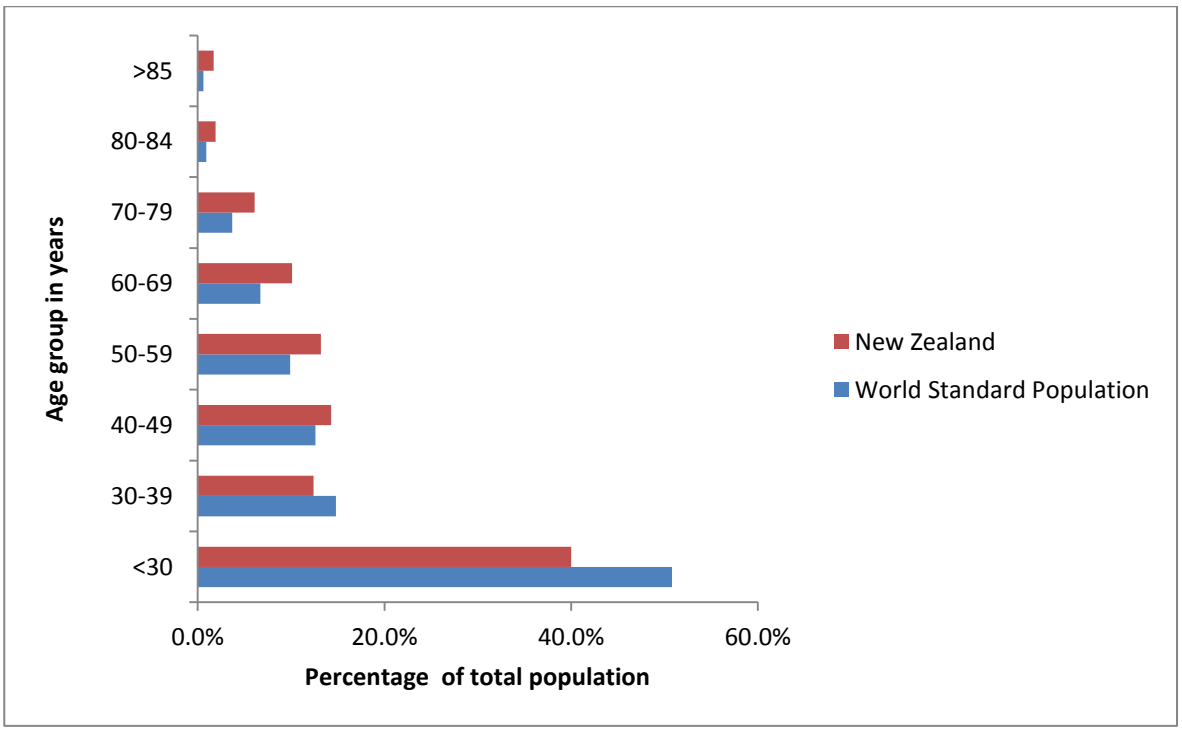

Figure 3.1 Percentage of population by age group

New Zealand Census criteria for ethnicity enables individuals to identify with more than one ethnic group. Māori are identified as a priority ethnic group, therefore all individuals identifying themselves as Māori are identified as Māori within the NZ Census data, which enabled identification of individuals as either Māori or non-Māori, but did not enable Census data for other ethnic groups to be compared. The calculation of age-specific and mortality rates could therefore only be achieved for Māori and non-Māori ethnic groups. The group identified as non-Māori contains the ethnic groups of New Zealand European, Pacific people, Asian and 'Other', which are identified from the NZCR data.

3.5 Observational study of medical and dental records

A retrospective observational study was undertaken using data from patients' existing hospital medical and dental records. Cases identified from the NZCR data that were diagnosed and/or treated within the CDHB were selected for further study. Cases treated at CDHB facilities included those who resided in the regions of the Canterbury, the Nelson Marlborough, the West Coast and the South Canterbury DHBs. The National Health Index (NHIs) of diagnosed individuals were used to access their hospital medical and dental files. Information was extracted from the hospital files in order to determine whether attending a dental practitioner in the years prior to diagnosis was associated with an earlier stage of diagnosis. Information collected included age, sex, ethnicity (using priority ethnic group), referring clinician

(medical or dental practitioner), presenting signs or symptoms, duration of symptoms or signs, tumour type, tumour site, disease stage (based on the NZCR classification), time since last dental visit (measured in months) and best available information pertaining to their usual pattern of dental attendance. For many, only a general description was available and adjunct information about being dentate (according to OPG radiographs) at the time of diagnosis and whether teeth were extracted during the cancer treatment was collected to help inform assumptions on dental attendance. Additional information on co-morbidities and employment status including whether cases had a Community Services Card (CSC)[4] was also sought. Once collected, information was de-identified prior to data analysis.

3.5.1 Statistical analysis of NZCR diagnosed OC and OPC cases 2012-2013

Information received from the NZCR was in the form of a Microsoft Excel (2013) spreadsheet and converted to an R data-set for analysis. Quantitative analysis was conducted using the R (GNU GPL) statistical program for the OC and OPC cases diagnosed in New Zealand residents during the study period. The information collected from the hospital medical and dental files for the cases diagnosed or treated within the CDHB was coded and transferred to an Excel spreadsheet. The data were then converted to an R data-set for statistical analysis. The analyses tested for associations between stage of diagnosis, tumour site, risk factors, referring clinician and pattern of previous dental attendance. Frequency tests were conducted and differences in proportions were tested for statistical significance using Chi square and Fisher's exact tests (as appropriate). P values of less than 0.05 were deemed to be significant.

[4] Community services card (CSC) is available to New Zealand citizens and permanent residents who meet low income criteria outlined by the government. Those eligible for CSCs are eligible for subsidised services and benefits including reduced costs healthcare.

4 Results

4.1 Results from the dental clinician questionnaires

4.1.1 Response rate

Two hundred and forty-seven responses to the initial email invitation were received (response rate 13.6%), 30 emails bounced back, and a further 30 practitioners opted out of the study. A further 108 responses (7.1%) were received from the first reminder email and 92 responses (6.4%) from the final email reminder. The total number of respondents to the online questionnaire was 447 (24.7%). Sixty-one practitioners responded to the initial postal questionnaire (41.5%), and a further 23 (26.7%) responded after the repeat mailing. The total number of postal questionnaire responses received was 84 (56.5%). When combined with the online questionnaire responses, the total number of responses received that met the inclusion criteria was 527 (27.0%).

4.1.2 Demographic characteristics of respondents

Participants' responses to demographic questions including their scope of practice, their sex, the country and year of graduation and their work region are listed in Table 4.1. Most respondents identified themselves as general dentists or dental specialists who met the study inclusion criteria. The questionnaire response rate was 27.1% for dentists and 24.3% for CDTs.

Table 4.1 Demographic characteristics of respondents by practitioner type (brackets contain column percentages)

Characteristic	CDTs	Dentists	Both combined
Sex			
Male	23 (69.7)	272 (55.1)	295 (56.0)
Female	10 (30.3)	222 (44.9)	232 (44.0)
Graduation year			
Before 1976	3 (9.1)	47 (9.5)	50 (9.5)
1976-1985	6 (18.2)	117 (23.7)	123 (23.3)
1986-1995	4 (12.1)	114 (23.1)	118 (22.4)
1996-2005	13 (39.4)	88 (17.8)	101 (19.2)
2006-2015	7 (21.2)	128 (25.9)	135 (25.6)
Work region			
Northland	3 (9.1)	18 (3.6)	21 (4.0)
Auckland	6 (18.2)	118 (23.9)	124 (23.5)
Waikato	6 (18.2)	61 (12.3)	67 (12.7)
Gisborne/HBay/BOP	0 (0.0)	20 (4.1)	20 (3.8)
Taranaki/Manawatu	0 (0.0)	24 (4.9)	24 (4.5)
Wellington/Wairarapa	7 (21.2)	61 (12.4)	68 (12.9)
Nelson Marlborough	3 (9.1)	30 (6.1)	33 (6.3)
Canterbury/West Coast	5 (15.1)	55 (11.1)	60 (11.4)
Otago-Southland	1 (3.0)	59 (11.9)	60 (11.4)
No region listed	2 (6.1)	48 (9.7)	50 (9.5)
Graduation country			
New Zealand	27 (81.8)	356 (72.1)	383 (72.7)
Asian	3 (9.1)	38 (7.7)	41 (7.8)
Other	3 (9.1)	100 (20.2)	103 (19.5)
Total	**33 (6.2)[a]**	**494 (93.7)[a]**	**527 (100.0)**

[a]Row percentages

More than half of the respondents were male. A greater proportion of CDTs than dentists were male. Respondents had graduated over a 90-year span (1925[5] to 2015). The graduate year cohort with the fewest respondents (50) was the earliest one (those graduating before 1976), while that with the most respondents (135) was the most recent (2006 to 2015). Fewer than one in ten respondents chose not to answer the question on work location. Of those who

[5] One response from a CDT stated his graduation year as 1925 but this was considered a mistake.

answered, just over one-quarter were from the greater Auckland region. Most respondents were New Zealand graduates. Of the 144 graduates from other countries, 40 (7.6%) had graduated in the United Kingdom and one-quarter were from India or Pakistan. In total, nearly one-fifth of respondents were from 'Other' countries and over one in thirteen were from Asian countries.

Data on the sex of respondents by graduation year and country are presented in Table 4.2.

Table 4.2 Sex of practitioner by graduation year and country (brackets contain row percentages)

	Sex of Practitioner		
Graduation groups	**Male**	**Female**	**Total**
Graduation year			
Before 1976	46 (92.0)[a]	4 (8.0)[a]	50
1976-1985	81 (65.9)	42 (34.1)	123
1986-1995	64 (54.2)	54 (45.8)	118
1996-2005	51 (50.5)	50 (49.5)	101
2006-2015	53 (39.3)	82 (60.7)	135
Graduation country			
New Zealand	214 (56.0)	16 (39.0)	383
Asian	25 (61.0)	169 (44.1)	41
Other	56 (54.3)	47 (45.6)	103
Total	**295 (56.0)**	**232 (44.0)**	**527 (100)**

[a]P < 0.05

The ratio of male to female respondents varied by practitioner type and graduation year. Only 8% of those graduating before 1976 were female, whereas more than half of respondents from the most recent graduation group (2006-2015) were female. No significant difference in the sex ratio of respondents was found by graduation country. The graduation country of respondents by graduation year is shown in Table 4.3.

Table 4.3 Practitioners' graduation country by graduation year (brackets contain row percentages)

	Graduation Country			
	New Zealand	Asian	Other	Combined
Graduation year				
Before 1976	42 (84.0)	0 (0.0) [a]	8 (16.0)	50
1976-1985	83 (67.5)	7 (5.7)	33 (26.8)	123
1986-1995	87 (73.7)	6 (5.1)	25 (21.2)	118
1996-2005	63 (62.4)	18 (17.8)	20 (19.8)	101
2006-2015	108 (80.0)	10 (7.6)	17 (12.6)	135
Total	**383 (72.7)**	**41 (7.8)**	**103 (19.5)**	**527 (100)**

[a]P < 0.05

No graduates from Asian countries had graduated before 1976. No significant differences were found for country of graduation or work region by graduation year.

4.1.3 Practitioners' impressions of mouth cancer

Participants were asked about the sex of those commonly diagnosed with mouth cancer in New Zealand (Table 4.4). Most respondents identified mouth cancer as more commonly found in males than females, but more than one-fifth were unsure whether there was a sex difference.

Table 4.4 Sex identified as more commonly affected by mouth cancer (brackets contain row percentages)

	More common in which sex			
Practitioner characteristic	**Females**	**Males**	**Both equally**	**Don't know**
Practitioner Type				
Dentist	16 (3.2)	304 (61.5)	63 (12.8)	111 (22.5)
CDT	0 (0.0)	20 (60.6)	7 (21.2)	6 (18.2)
Graduation year				
Before 1976	1 (2.0)	31 (62.0)	8 (16.0)	10 (20.0)
1976-1985	6 (4.9)	78 (63.4)	12 (9.8)	27 (22.0)
1986-1995	1 (0.8)	74 (62.7)	13 (11.0)	30 (25.4)
1996-2005	4 (4.0)	57 (56.4)	16 (15.8)	24 (23.8)
2006-2015	4 (3.0)	84 (62.2)	21 (15.6)	26 (19.3)
Graduation country				
New Zealand	7 (1.8)	241 (62.9)	53 (13.8)	82 (21.4)[a]
Asian	4 (9.8)	19 (46.3)	5 (12.2)	13 (31.7)
Other	5 (4.9)	64 (62.1)	12 (11.7)	22 (21.3[j]
Total	16 (3.0)	324 (61.5)	70 (13.3)	117 (22.2)

[a] $P < 0.05$

Similar proportions of dentists and CDTs identified males as more commonly affected, but fewer Asian graduates did so. Moreover, respondents from Asian countries were likely to be more unsure of any sex predilection for mouth cancer than those graduating from either New Zealand or 'Other' countries.

Respondents were asked to identify the age groups of those more commonly affected by mouth cancer (Table 4.5).

Table 4.5 Age groups (in years) identified as more commonly affected by mouth cancer (brackets contain row percentages[a])

Practitioner characteristic	Age group in years						
	Under 30	30-40	40-50	50-60	60-70	Above 70	Don't know
Practitioner type							
Dentist	3 (0.6)	12 (2.4)	115 (23.3)	212 (42.9)	172 (34.8)	84 (17.0)	98 (19.8)
CDT	0 (0.0)	0 (0.0)	6 (18.2)	14 (42.2)	12 (36.4)	9 (27.3)	6 (18.2)
Graduation year							
Before 1976	0 (0.0)	0 (0.0)	6 (12.0)	17 (34.0)[b]	19 (38.0)	8 (16.0)	9 (17.3)
1976-1985	1 (0.8)	3 (2.4)	24 (19.5)	38 (30.9)	41 (33.3)	24 (19.5)	22 (17.9)
1986-1995	1 (0.8)	0 (0.0)	25 (21.2)	53 (44.9)	33 (28.0)	15 (12.7)	31 (26.3)
1996-2005	0 (0.0)	1 (1.0)	28 (27.7)	50 (49.5)	38 (37.6)	21 (20.8)	22 (22.2)
2006-2015	1 (0.7)	8 (5.9)	38 (28.1)	68 (50.4)	53 (39.3)	25 (18.5)	20 (14.8)
Graduation country							
New Zealand	2 (0.5)	9 (2.3)	87 (22.7)	173 (45.2)	143 (37.3)[b]	75 (19.6)	80 (20.9)
Asian	1 (2.4)	3 (7.3)	8 (19.5)	12 (29.2)	7 (17.1)	3 (7.3)	10 (24.3)
Other	0 (0.0)	0 (0.0)	26 (25.2)	41 (39.8)	34 (33.0)	15 (14.6)	14 (13.5)
Sex of practitioner							
Male	2 (0.7)	7 (2.4)	63 (21.4)	110 (37.3)	104 (35.3)	49 (16.6)	60 (20.3)
Female	1 (0.4)	5 (2.2)	58 (25.0)	116 (50.0)	80 (34.5)	44 (19.0)	44 (19.0)
Total	3 (0.6)	12 (2.2)	121 (22.9)	226 (42.9)	184 (34.9)	93 (17.6)	104 (19.7)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100
[b] $P < 0.05$

Nearly one in five respondents were unaware of mouth cancer affecting any age groups more commonly in New Zealand. Participants were able to select more than one age group and over three-quarters (77.5%) identified those aged over 40 years as more commonly affected than those younger than 40 years. The age groups 50-60 years, and 60-70 years, were identified by more than one-third of respondents as age groups commonly affected by mouth cancer. Very few respondents identified the youngest age groups as being commonly affected. There were no significant differences in the age groups identified by the type or sex of practitioner. However, differences were observed in the ages selected by both graduation year and graduation country group. The age group 50-60 years was significantly more likely to be identified by more recent graduates than older practitioners. By contrast, fewer Asian graduates than either New Zealand or 'Other' graduates identified those aged 60-70 years as being commonly affected by mouth cancer. One in ten respondents were unable to identify either the sex or age group of those most commonly affected by mouth cancer in New Zealand.

The ethnic groups most commonly identified by respondents as being at high risk of mouth cancer are presented in Table 4.6.

Table 4.6 Ethnic groups identified by practitioners as at high risk of mouth cancer (brackets contain row percentages[a])

Practitioner characteristic	Ethnic group: Sub-continent Indian	NZ Māori	Fijian Indian	South East Asian	Papua New Guinea	NZ European	Don't know
Practitioner type							
Dentist	262 (53.0)	87 (17.6)	87 (17.6)	79 (16.0)	60 (12.1)	46 (9.3)	118 (23.9)
CDT	13 (39.4)	9 (27.3)	7 (21.1)	1 (3.0)	4 (12.1)	6 (18.1)	9 (27.3)
Graduation country							
New Zealand	200 (52.2)	74 (19.3)	73 (19.1)	74 (19.3)	45 (11.7)	36 (9.4) [b]	93 (24.3)
Asian	17 (41.5)	7 (17.1)	7 (17.1)	7 (17.1)	3 (7.3)	11 (26.8)	11 (26.8)
Other	58 (56.3)	15 (14.6)	15 (14.6)	15 (14.6)	16 (15.5)	5 (4.9)	23 (22.3)
Graduation year							
Before 1976	22 (44.0)	9 (18.0)	8 (16.0)	6 (12.0)	8 (16.0)	2 (4.0)	14 (28.0)
1976-1985	61 (49.6)	16 (13.0)	28 (22.8)	19 (15.4)	14 (11.4)	11 (8.9)	27 (22.0)
1986-1995	64 (54.2)	20 (16.9)	15 (16.9)	20 (16.9)	18 (15.3)	9 (7.6)	25 (21.2)
1996-2005	54 (53.5)	17 (16.8)	16 (16.8)	15 (14.9)	12 (11.9)	13 (12.9)	30 (29.7)
2006-2015	74 (54.8)	34 (25.2)	27 (25.2)	20 (14.8)	12 (8.9)	17 (12.6)	31 (23.0)
Total	275 (52.2)	96 (18.2)	94 (17.8)	80 (15.2)	64 (12.1)	52 (9.9)	127 (24.1)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100
[b] $P < 0.05$

Over half the respondents identified Subcontinental Indians as having high risk of mouth cancer. Other ethnic groups identified at higher risk of mouth cancer were Māori, Fijian Indian and South East Asian. Nearly one in ten respondents identified New Zealand Europeans as having a high risk of mouth cancer. In particular, Asian graduates were significantly more likely to identify this group as having high risk of mouth cancer than graduates from New Zealand or Other countries. Nearly one quarter of respondents did not know whether particular ethnic groups are at high risk of mouth cancer.

4.1.4 Commonly affected anatomical sites and OPMLs

Participants were asked which anatomical sites are more commonly affected by mouth cancer. Fifty two (10.5%) respondents did not know which sites were more commonly affected. All these respondents were dentists and nearly half (24 respondents) had graduated in the years 1976-1985 (19.5% of respondents in this graduate group). It was noteworthy that one in thirty respondents knew neither the age nor sex of those more commonly affected by mouth cancer, nor the sites more commonly affected. The sites identified by more than one in ten are presented in Table 4.7. Seven out of ten respondents identified the floor of the mouth and the lateral border of the tongue as common sites for mouth cancer, while fewer than half selected the base of the tongue. A significantly higher proportion of newer graduates than the oldest graduates selected the floor of the mouth as a common site.

Table 4.7 Most frequent sites selected by practitioners as affected by mouth cancer (brackets contain row percentages[a])

Practitioner characteristic	Anatomical site affected: Floor of mouth	Lateral border of tongue	Tongue base	Buccal mucosa	Soft palate	Salivary glands (major)	Hard palate
Practitioner type [b]							
Dentist	355 (71.9)	352 (71.3)	234 (47.4)	146 (29.6)	91 (18.4)	63 (12.8)	51 (10.3)
CDT	25 (75.8)	25 (75.8)	26 (78.8)	14 (42.4)	11 (33.3)	5 (15.2)	13 (39.4)
Graduation year group							
Before 1976	29 (58.0)[b]	38 (76.0)	20 (40.0)	23 (46.0)	9 (18.0)	9 (18.0)	6 (12.0)
1976-1985	80 (65.0)	79 (64.2)	56 (45.5)	34 (27.6)	23 (18.7)	19 (15.4)	14 (11.4)
1986-1995	83 (70.3)	85 (72.0)	59 (50.0)	38 (32.2)	27 (22.9)	15 (12.7)	16 (13.6)
1996-2005	82 (81.2)	71 (70.3)	57 (56.4)	31 (30.7)	21 (20.8)	8 (7.9)	14 (13.9)
2006-2015	106 (78.5)	104 (77.0)	68 (50.4)	34 (25.2)	22 (16.3)	17 (12.6)	14 (10.4)
Graduation country group							
New Zealand	282 (73.6)	271 (70.8)	197 (51.4) [b]	113 (29.5)	79 (20.6)	44 (11.5)	50 (13.1)
Asian	29 (70.7)	30 (73.2)	23 (56.1)	17 (41.5)	3 (7.3)	7 (17.1)	6 (14.6)
Other	69 (67.0)	76 (73.8)	40 (38.8)	30 (29.1)	20 (19.4)	17 (16.5)	8 (7.8)
Total	373 (70.8)	372 (70.6)	256 (48.6)	158 (30.0)	102 (19.4)	66 (12.5)	63 (12.0)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100
[b] $P < 0.05$

Two sites were selected by fewer than five percent of the respondents; these were the minor salivary glands (4.7%) and the epiglottis (4.2%). Significant differences in the selected sites were apparent by practitioner type, with CDTs more likely than dentists to identify the alveolar bone, the tongue base, the buccal mucosa, the hard and soft palate, the minor salivary glands and the tonsils. Moreover, significant differences in the identified sites were recorded by graduation country for the base of the tongue and the tonsils. Over half of the graduates from New Zealand and Asian countries identified the base of the tongue as a common mouth cancer site, whereas it was identified by fewer than two in five 'Other' graduates. The tonsils were selected by ten percent of New Zealand graduates, but rarely by Asian and not at all by 'Other' graduates.

The oral lesions considered by at least one in ten respondents to be potentially malignant are presented in Table 4.8.

Table 4.8 Lesions identified by at least ten percent of clinicians to have malignant potential (brackets contain row percentages[a])

	Oral potentially malignant lesions						
Practitioner characteristic	**Erythro-leukoplakia**	**Leuko-plakia**	**Erythro-plakia**	**Oral lichen planus**	**Submucous fibrosis**	**Candidiasis**	**Don't know**
Practitioner type[b]							
Dentist	361 (73.1)	337 (68.2)	306 (61.9)	256 (51.8)	168 (34.0)	70 (14.2)	38 (7.7)
CDT	19 (57.6)	20 (60.6)	20 (60.6)	10 (30.3)	13 (39.3)	6 (18.2)	9 (27.2)
Graduation year							
Before 1976	26 (52.0)[b]	35 (70.0)	20 (40.0)[c]	21 (42.0)	16 (32.0)	9 (12.0)	9 (18.0)[b]
1976-1985	81 (65.9)	86 (70.0)	62 (50.4)[c]	61 (50.0)	33 (26.8)	21 (13.8)	17 (13.8)
1986-1995	90 (76.2)	92 (78.0)	80 (67.8)[c]	68 (57.6)	49 (41.5)	14 (8.5)	7 (5.9)
1996-2005	74 (73.3)	69 (68.3)	65 (64.4)[c]	52 (51.5)	34 (33.7)	15 (7.9)	11 (11.0)
2006-2015	109 (80.7)	75 (55.6)	99 (73.3)[c]	64 (47.4)	49 (36.3)	17 (9.6)	3 (2.2)
Graduation country							
New Zealand	270 (70.5)	253 (66.1)	221 (57.7)[b]	198 (51.7)	114 (29.8)[b]	36 (9.4)	37 (9.7)
Asian	33 (80.5)	29 (70.7)	31 (75.6)	20 (48.8)	25 (61.0)	4 (9.8)	1 (2.4)
Other	77 (74.8)	75 (72.8)	74 (71.8)	48 (46.6)	42 (40.8)	14 (13.6)	9 (8.7)
Total	380 (72.1)	357 (67.7)	326 (61.9)	266 (50.5)	181 (34.3)	76 (14.4)	47 (8.9)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100
[b] $P < 0.05$

Most respondents identified erythro-leukoplakia, leukoplakia, erythroplakia and oral lichen planus (OLP) as OPMLs, but only one-third identified oral submucous fibrosis (OSF) as an OPML. Fewer than one in eleven respondents were unsure about which of the listed oral conditions had substantial malignant potential. Significant differences were observed by practitioner type. More CDTs than dentists were unsure of which oral conditions are considered potentially malignant, and fewer CDTs considered erythro-leukoplakia and OLP to be OPMLs. However, more than one-quarter of CDTs identified fibro-epithelial polyps as potentially malignant; these lesions were identified as such by only one in twenty dentists.

Significant differences in the identification of OPMLs were also observed by graduation year and graduation country. The most recent graduates had the lowest proportion of 'Don't know' responses, while the oldest graduates had the highest proportion. Also, older graduates were less likely to identify both erythro-leukoplakia and erythroplakia as OPMLs than younger practitioners, but the most recent graduates were less likely to identify leukoplakia as an OPML. More than half of the graduates from Asian countries identified OSF as an OPML, while OSF was identified by more than one-third of Other and one-quarter of New Zealand graduates. While more than half of the respondents identified erythroplakia as an OPML, New Zealand graduates were significantly less likely to do so. Only six respondents felt that none of the listed oral conditions had significant malignant potential. Of these practitioners, all were dentists who had graduated from either New Zealand or Asian countries.

4.1.5 Practitioner-identified signs and symptoms of mouth cancer

Participants were asked about the signs commonly associated with mouth cancer. The most frequently identified signs are presented in Table 4.9. Most respondents selected ulceration, lumps in the mouth, neck swelling, leukoplakia, erythro-leukoplakia and erythroplakia as signs associated with mouth cancer.

Additional signs of mouth cancer identified by at least half of the respondents are presented in Table 4.10. Over half of the respondents selected all of the listed signs, as associated with mouth cancer. Dentists were more likely than CDTs to identify mouth ulcers, non-healing extraction sites, and loose teeth as being associated with mouth cancer, but the difference was not significant. However, significant differences were recorded by graduation year cohort, with the oldest graduates being less likely than more recent graduates to identify mouth ulcers, bad breath, and mouth lumps as signs of mouth cancer.

Table 4.9 Practitioner-identified signs as commonly associated with mouth cancer (brackets contain row percentages[a])

	Signs of mouth cancer					
Practitioner characteristic	**Ulcers**	**Mouth Lumps**	**Neck Swelling**	**Leukoplakia**	**Erythroleukoplakia**	**Erythroplakia**
Practitioner type[b]						
Dentist	466 (94.3)	432 (87.4)	413 (83.6)	406 (82.2)	400 (81.0)	393 (79.6)
CDT	25 (75.8)	29 (87.9)	26 (78.8)	27 (81.8)	25 (75.8)	23 (69.7)
Graduation year						
Before 1976	46 (92.0)	38 (76.0)[b]	38(76.0)	39 (78.0)	29 (58.0)	32 (64.0)
1976-1985	117 (95.1)	107 (87.0)	102 (82.9)	107 (87.0)	105 (85.4)	97 (78.9)
1986-1995	112 (94.9)	109 (92.4)	104 (88.1)	100 (84.7)	98 (83.1)	95 (80.5)
1996-2005	89 (88.1)	84 (83.2)	78 (77.2)	77 (76.2)	79 (78.2)	79 (78.2)
2006-2015	127 (94.1)	123 (91.1)	117 (86.7)	110 (81.5)	114 (84.4)	113 (83.7)
Total	491 (93.2)	461 (87.5)	439 (83.3)	433 (82.2)	425 (80.6)	416 (78.9)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100
[b] $P < 0.05$

Table 4.10 Further practitioner-identified signs of mouth cancer (brackets contain row percentages[a])

Practitioner characteristic	Signs of mouth cancer: Soft tissue necrosis	Non-healing extraction site	Loose teeth	Mouth bleeding	Bad breath
Practitioner type[b]					
Dentist	392 (79.4)	369 (74.7)	338 (68.4)	310 (62.8)	278 (56.3)
CDT	24 (72.7)	18 (54.5)	15 (45.5)	21 (63.6)	15 (45.5)
Graduation year					
Before 1976	36 (72.0)	36 (72.0)	29 (58.0)[b]	28 (56.0)	24 (48.0)[b]
1976-1985	102 (82.9)	97 (78.9)	92 (74.8)	88 (71.5)	80 (65.0)
1986-1995	97 (82.2)	90 (76.3)	87 (73.7)	75 (63.6)	73 (61.9)
1996-2005	73 (72.3)	63 (62.4)	54 (53.5)	54 (53.5)	47 (46.5)
2006-2015	108 (80.0)	101 (74.8)	91 (67.4)	86 (63.7)	69 (51.1)
Total	416 (78.9)	387 (73.4)	353 (67.0)	331 (62.8)	293 (55.6)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100
[b] $P < 0.05$

The practitioners who had graduated between 1996 and 2005 were significantly less likely to identify loose teeth as a sign associated with mouth cancer than other graduates. The six respondents who felt none of the listed lesions were OPMLs also did not identify any of the listed further signs as associated with mouth cancer. Very few (0.7%) respondents were unsure of the signs associated with mouth cancer. No statistically significant patterns in the signs of mouth cancer identified by graduation country were apparent.

The participants' responses to the question asking for symptoms associated with mouth cancer are presented in Table 4.11.

Table 4.11 Practitioner-identified symptoms associated with mouth cancer (brackets contain row percentages[a])

	Numbness or paraesthesia	Difficulty swallowing	Mouth pain	Difficulty chewing	Difficulty speaking	Loss of taste	Bleeding
Practitioner type[b]							
Dentist	462 (93.5)	452 (91.5)	415 (84.0)	411 (83.2)	412 (83.4)	409 (82.8)	393 (79.6)
CDT	25 (75.8)	27 (81.8)	27 (81.8)	21 (63.6)	20 (60.6)	20 (60.6)	23 (69.7)
Graduation year group							
Before 1976	42 (84.0)	44 (88.0)	36 (72.0)[b]	37 (74.0)	37 (74.0)	37 (74.0)	34 (68.0)
1976-1985	115 (93.5)	114 (92.7)	110 (89.4)	104 (84.6)	104 (84.6)	104 (84.6)	106 (86.2)
1986-1995	112 (94.9)	112 (94.9)	103 (87.3)	103 (87.3)	105 (89.0)	103 (87.3)	96 (81.4)
1996-2005	93 (92.1)	88 (87.1)	81 (80.2)	80 (79.2)	79 (78.2)	80 (79.2)	77 (76.2)
2006-2015	125 (92.6)	121 (89.6)	112 (83.0)	108 (80.0)	107 (79.3)	105 (77.8)	103 (76.3)
Total	487 (92.4)	479 (90.9)	442 (83.9)	432 (82.0)	432 (82.0)	429 (81.4)	416 (78.9)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100
[b] $P < 0.05$

Most respondents identified numbness or paraesthesia, difficulty swallowing and mouth pain as symptoms associated with mouth cancer. More than two-thirds of respondents indicated all of the symptoms listed as being associated with mouth cancer. CDTs generally identified fewer symptoms of mouth cancer than dentists, with dentists being more likely to identify all the listed symptoms. The oldest graduates were significantly less likely than newer graduates to identify mouth pain as associated with mouth cancer.

4.1.6 Identified risk factors for mouth cancer

Participants were asked to identify the risk factors for mouth cancer. The most frequently identified risk factors are presented in Table 4.12.

Table 4.12 Risk factors for mouth cancer identified by practitioners (brackets contain row percentages[a])

Practitioner characteristic	Risk factor							
	Chewing betel nut	Chewing tobacco	Smoking tobacco	Heavy alcohol use	Family history	HPV infection	Sun exposure	Older age
Practitioner type								
Dentist	478 (96.8)	481 (97.4)	466 (94.5)	464 (93.9)	405 (82.0)	390 (78.9)	368 (74.5)	336 (68.0)
CDT	28 (84.8)	31 (93.9)	21 (84.0)	29 (87.9)	27 (81.8)	22 (66.7)	25(75.8)	17 (51.5)
Graduation year								
Before 1976	47 (94.0)	46 (92.0)	46 (92.0)	47 (94.0)[b]	39 (78.0)	36 (72.0)	28 (56.0)	37 (74.0)
1976-1985	119 (96.7)	120 (97.6)	113 (91.9)	114 (92.7)	97 (78.9)	101 (82.1)	90 (73.2)	86 (69.9)
1986-1995	115 (97.4)	115 (97.5)	114 (96.6)	116 (98.3)	93 (78.8)	95 (80.5)	92 (78.0)	76 (64.4)
1996-2005	95 (94.0)	100 (99.0)	94 (93.1)	88 (87.1)	82 (81.2)	77 (76.2)	77 (76.2)	62 (45.9)
2006-2015	130 (96.3)	131 (97.0)	127 (94.1)	128 (94.8)	121 (89.6)	103 (76.3)	106 (78.5)	92 (68.1)
Graduation country								
New Zealand	368 (96.1)	370 (96.6)	364 (95.0)	364 (95.0) [b]	312 (81.5)	301 (78.6)	285 (74.4)	267 (69.7)
Asian	37 (90.2)	39 (95.1)	34 (82.9)	32 (78.1)	32 (78.1)	32 (78.1)	27 (65.9)	21 (51.2)
Other	101 (98.1)	103 (100)	96 (95.1)	97 (96.0)	88 (87.1)	79 (78.2)	81 (78.6)	65 (63.1)
Total	506 (96.0)	512 (97.1)	494 (93.7)	493 (93.5)	432 (82.0)	412 (78.2)	393 (74.6)	353 (67.0)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100

[b] $P < 0.05$

More than nine out of ten respondents identified chewing tobacco, chewing areca nut, smoking tobacco and heavy alcohol use were risk factors for mouth cancer (Tables 4.12 and 4.13). Most respondents also identified a family history of oral cancer, previous HPV infection, sun exposure, older age and smoking marijuana as risk factors for mouth cancer. CDTs were less likely than dentists to recognise smoking tobacco or previous HPV infection as risk factors for mouth cancer, although the differences were not significant.

The oldest graduates were significantly less likely than newer graduates to identify sun exposure as a risk factor for mouth cancer. Practitioners who had graduated from 1996 to 2005 were the least likely to identify heavy alcohol use as a risk factor for mouth cancer. Asian graduates were also significantly less likely than other graduates to identify heavy alcohol use and older age as risk factors for mouth cancer.

CDTs were more likely than dentists to identify denture stomatitis, recurrent cold sores, poor oral hygiene and ill-fitting dentures as risk factors for mouth cancer. On average, respondents chose ten risk factors, with over one-quarter selecting all 15 risk factors listed. No differences were found by type of practitioner, graduation year or graduation country and mean number of risk factors chosen.

Table 4.13 Further risk factors for mouth cancer identified by practioners (brackets contain row percentages[a])

Practitioner Characteristics	Risk factor: Smoking marijuana	EBV infection	Poor diet	Poor oral hygiene	Ill-fitting dentures	Denture stomatitis	Recurrent cold sores
Practitioner type							
Dentists	311 (63.0)	256 (51.8)	250 (50.6)	231 (46.8)	201 (40.7)	193 (39.1)	158 (32.0)
CDTs	22 (66.7)	13 (39.4)	16 (48.5)	21 (63.6)	18 (54.5)	19 (57.6)	14 (42.4)
Graduation year							
Before 1976	29 (58.0)	25 (50.0)	24 (48.0)	26 (52.0)	28 (56.0)	26 (52.0)	18 (36.0)
1976-1985	77 (62.6)	62 (50.4)	63 (51.2)	69 (56.1)	55 (44.7)	51 (56.1)	39 (31.7)
1986-1995	77 (65.3)	51 (43.2)	60 (50.8)	53 (44.9)	47 (39.8)	45 (44.9)	37 (31.4)
1996-2005	63 (62.4)	54 (53.5)	48 (47.5)	46 (45.5)	37 (36.6)	38 (45.5)	36 (35.6)
2006-2015	87 (64.4)	77 (74.8)	71 (68.9)	58 (43.0)	52 (38.5)	52 (43.0)	42 (31.1)
Graduation country							
New Zealand	247 (64.5)	188 (49.1)	193 (50.4)	182 (49.1)	153 (39.9)	312 (39.2)	127 (33.2)
Asian	23 (56.1)	27 (65.9)	20 (48.8)	24 (58.5)	24 (58.5)	22 (53.7)	16 (39.0)
Other	63 (62.4)	54 (52.4)	53 (51.5)	46 (44.7)	42 (40.8)	88 (38.8)	29 (28.2)
Total	333 (63.2)	269 (51.0)	266 (50.5)	252 (47.8)	219 (41.5)	212 (40.3)	172 (32.6)

[a] Respondents were able to select more than one option, so that percentages do not sum to 100
[b] $P < 0.05$

4.1.7 Discussing mouth cancer risk factors with patients

Participants were asked about whether they discussed the risk factors for mouth cancer with their patients (Table 4.14).

Table 4.14 Discussion of risk factors for mouth cancer with patients (brackets contain row percentages[a])

Practitioner characteristic	Advise patients on risk factors	Risk factor discussed			
		Current tobacco use	Past tobacco use	Current alcohol use	Past alcohol use
Practitioner type					
Dentist	254 (51.4)	402 (81.3)	234 (47.4)	116 (23.4)	66 (13.4)
CDT	18 (54.5)	22 (66.7)	15 (45.4)	8 (24.2)	6 (18.2)
Sex of practitioner					
Males	154 (52.2)	224 (75.9)	141 (47.8)	70 (23.7)	43 (14.5)
Females	118 (51.1)	200 (86.2)	108 (46.6)	54 (23.2)	29 (12.5)
Graduation year					
Before 1976	21 (42.0)[b]	27 (54.0)[b]	19 (38.0)	5 (10.0)[b]	5 (10.0)
1976-1985	63 (51.2)	100 (81.3)	59 (48.0)	24 (19.5)	12 (9.8)
1986-1995	71 (60.2)	99 (83.9)	57 (48.3)	33 (28.0)	19 (16.1)
1996-2005	56 (55.4)	84 (83.1)	51 (49.5)	23 (22.8)	18 (17.8)
2006-2015	61 (58.1)	114 (84.4)	63 (46.7)	39 (28.9)	18 (13.3)
Graduation country					
New Zealand.	179 (46.7)	299 (78.0)[b]	164 (42.8)[b]	75 (19.6)[b]	41 (10.7)[b]
Asian	24 (58.5)	32 (78.0)	26 (63.4)	16 (39.0)	12 (29.3)
Other	69 (67.0)	93 (90.3)	59 (57.3)	33 (32.0)	19 (18.4)
Total	272 (51.6)	424 (80.5)	249 (47.2)	124 (23.5)	72 (13.7)

[a] Rows contain responses to different questions, therefore row percentages do not sum to 100
[b] $P < 0.05$

More than half of the respondents routinely advised patients about risk factors for mouth cancer. However, New Zealand graduates were significantly less likely to advise patients than graduates from other countries. Most practitioners routinely asked patients about their current tobacco use, whereas fewer than half the practitioners routinely asked about past tobacco use and even fewer asked about current or past alcohol use. Those who had graduated prior to 1976 were significantly less likely than more recent graduates to ask about current tobacco and alcohol use. There were also significant differences in responses by graduation country.

'Other' country graduates were the most likely to ask about current tobacco use and advise patients on the risk factors for mouth cancer, but Asian graduates were the most likely to ask about previous tobacco use, current alcohol and past alcohol use.

4.1.8 Detection of oral mucosal lesions

The responses to the questions relating to the detection of oral mucosal lesions and oral cancer screening practices are displayed in Table 4.15.

Table 4.15 Detection of oral mucosal lesions and oral screening examinations (brackets contain row percentages[a])

Practitioner characteristic	Has detected an oral lesion	Patients can self detect lesions	Screen all patients	Screen only high risk patients
Practitioner type				
Dentist	433 (87.7)	173 (35.0)	442 (90.1)	84 (17.1)
CDT	32 (97.0)	9 (27.2)	30 (89.7)	3 (9.1)
Graduation year				
Before 1976	45 (90.0)[b]	18 (36.0)[b]	38 (82.0)[b]	8 (16.0)
1976-1985	111 (90.2)	41 (33.3)	117 (95.1)	14 (11.6)
1986-1995	114 (96.6)	36 (30.5)	108 (91.5)	23 (19.4)
1996-2005	88 (87.1)	25 (24.8)	86 (89.0)	17 (17.0)
2006-2015	107 (79.3)	62 (45.9)	114 (86.7)	25 (18.5)
Graduation country				
New Zealand	338 (88.3)	132 (34.5)[b]	339 (88.7)	64 (16.7)
Asian	35 (85.4)	8 (19.5)	39 (95.1)	9 (22.5)
Other	92 (89.3)	42 (40.1)	94 (91.2)	14 (13.9)
Sex of practitioner				
Male	268 (90.8)	109 (36.9)	268 (91.1)	44 (15.1)
Female	197 (84.9)	73 (31.5)	204 (87.9)	43 (18.5)
Total	465 (88.2)	182 (34.5)	472 (89.6)	87 (16.5)

[a] Rows contain responses to different questions, therefore row percentages do not sum to 100
[b] $P < 0.05$

Most respondents had previously detected a suspicious oral mucosal lesion, but there were significant differences by graduation year. Nearly all practitioners who graduated from 1986 to 1995 had previously detected a suspicious oral lesion, while one in ten of the oldest graduates had never done so. Just over one-third of respondents thought patients were able to detect lesions themselves, but Asian graduates were significantly less likely to believe that

patients could self-detect lesions. Significant differences by graduation year were recorded, with a higher proportion of newer graduates believing that patients could detect oral mucosal lesions themselves. Most participants (86.7%) responded to the open question asking for patient-identified signs or symptoms that would alert practitioners to a suspicious oral lesion. Nearly three-quarters of respondents identified non-healing ulceration as a sign of a suspicious lesion.

Most practitioners checked all patients for oral mucosal lesions, with only one in six respondents specifically checking those patients deemed to be at high risk of mouth cancer. The proportion of practitioners checking all patients and those targeting OCS were similar when reviewed by practitioner type, country of graduation and sex of practitioner. However, significant differences were found for graduation year, with the oldest practitioners being the least likely to screen all patients for oral mucosal lesions, and those who graduated from 1976 to 1985 being most likely to do so.

When asked about their level of confidence in detecting potentially malignant oral lesions (Table 4.16), over two-thirds of respondents were confident or very confident about detecting OPMLs. No significant patterns in the level of confidence in detecting OPMLs by practitioner type, graduation year, or country were observed.

Table 4.16 Confidence level in detecting potentially malignant lesions (brackets contain row percentages)

Practitioner characteristic	Confidence		
	Very confident	Confident	Not confident
Practitioner type			
Dentist	30 (6.1)	325 (65.8)	139 (28.1)
CDT	4 (12.1)	16 (48.5)	13 (39.4)[a]
Graduation year			
Before 1976	2 (4.0)	34 (68.0)	14 (28.0)
1976 to 1985	8 (6.5)	82 (66.7)	33 (26.8)
1986 to 1995	11 (9.3)	77 (65.3)	30 (25.4)
1996 to 2005	6 (5.9)	58 (57.4)	37 (36.6)
2006 to 2015	7 (5.2)	90 (66.7)	38 (28.1)[a]
Graduation country			
Asian	4 (9.8)	25 (61.0)	12 (29.3)
New Zealand	24 (6.2)	244 (63.7)	115 (30.0)[a]
Other	6 (5.8)	72 (70.0)	25 (24.3)
Total	34 (6.5)	341 (64.7)	152 (28.8)[a]

[a]one response of "very unconfident" was received and was combined with the not confident responses for analytical purposes.

4.1.9 Oral cancer screening examinations

The responses to the question about the types of procedures that constitute an oral cancer screening (OCS) examination are presented in Table 4.17.

Table 4.17 Procedures involved in screening for mouth cancer (brackets contain row percentages[a])

Practitioner characteristics	Type of procedure					
	Visual examination	Palpate lymph nodes	Palpate floor of mouth	Radiography	Salivary flow	Special tests
Practitioner type						
Dentist	476 (96.4)	395 (80.0)	324 (65.6)	290 (58.7)	187 (37.9)	167 (33.8)
CDT	30 (90.9)	19 (57.6)	22 (66.7)	13 (39.4)	17 (51.5)	11 (33.3)
Graduation year						
Before 1976	45 (90.0)	35 (70.0)	37 (74.0)	29 (58.0)	22 (44.0)[b]	22 (44.0)
1976-1985	118 (95.9)	99 (80.5)	83 (67.5)	79 (64.2)	54 (43.9)	46 (37.4)
1986-1995	113 (95.8)	89 (75.4)	76 (64.4)	75 (63.6)	58 (49.2)	43 (36.4)
1996-2005	98 (97.0)	79 (78.2)	62 (61.4)	56 (55.4)	39 (38.6)	36 (35.6)
2006-2015	132 (97.8)	112 (83.0)	88 (65.2)	64 (47.4)	31 (23.0)	31 (23.0)
Graduation country						
New Zealand	372 (97.1)	292 (76.2)	243 (63.4)	226 (59.0)	145 (37.9)	126 (32.9)
Asian	36 (87.8)	36 (87.8)	31 (75.6)	23 (56.1)	16 (39.0)	16 (39.0)
Other	98 (95.1)	86 (83.5)	72 (69.9)	54 (52.4)	43 (41.7)	36 (35.0)
Total	506 (96.0)	414 (78.6)	346 (65.7)	303 (57.5)	204 (38.7)	178 (33.8)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100
[b] $P < 0.05$

Nearly all practitioners felt that a visual examination of all oral mucosal soft tissues was part of an OCS examination, and more than three-quarters identified that palpation of lymph nodes was also necessary. More than half of participants identified palpation of the floor of the mouth and radiographic examination of the alveolar bone as necessary for an OCS examination. Very few practitioners (3%) were unsure of what an OCS examination involved. No differences were recorded in responses by practitioner type, with over one-quarter of both dentists and CDTs identifying all the listed factors as necessary for an OCS examination. However, some significant differences by graduation year were observed. The youngest practitioners were less likely than older graduates to identify checking salivary flow as part of an OCS examination. Likewise, the youngest practitioners were the least likely to identify all the listed factors as part of an OCS examination.

The participants were asked which types of health practitioner should screen individuals for mouth cancer. The health practitioners identified by respondents are presented in Table 4.18.

Table 4.18 Practitioners who should screen for mouth cancer (brackets contain row percentages[a])

	Practitioner type								
Practitioner characteristic	**CDT**	**Dental hygienist**	**ENT surgeon**	**General dentist**	**GMP**	**Nurses**	**OMF surgeon**	**Oral medicine specialist**	**Pharmacist**
Practitioner type									
Dentist	291 (58.9)	383 (77.5)	389 (78.7)	480 (97.2)	304 (61.5)	142 (28.7)	432 (87.4)	423 (85.6)	19 (3.8)
CDT	21 (63.6)	21 (63.6)	29 (87.9)	27 (81.8)	22 (66.7)	8 (24.2)	29 (87.9)	25 (75.8)	4 (12.1)
Graduation year									
Before 1976	28 (56.0)	36 (72.0)	38 (76.0)	48 (96.0)[b]	28 (56.0)	15 (30.0)	39 (78.0)	36 (72.0)[b]	2 (4.0)
1976-1985	78 (63.4)	92 (74.8)	97 (78.9)	116 (94.3)	75 (61.0)	38 (30.9)	105 (85.4)	100 (81.3)	7 (5.7)
1986-1995	69 (58.5)	86 (72.9)	96 (81.4)	115 (97.5)	77 (65.3)	32 (27.1)	108 (91.5)	105 (89.0)	4 (3.4)
1996-2005	52 (51.5)	72 (71.3)	73 (72.3)	93 (92.1)	60 (59.4)	25 (24.8)	87 (86.1)	85 (84.2)	4 (4.0)
2006-2015	85 (63.0)	118 (87.4)	114 (84.4)	135 (100.0)	86 (63.7)	40 (29.6)	122 (90.4)	122 (90.4)	6 (4.4)
Graduation country									
New Zealand	246 (64.2)[b]	307 (80.2)[b]	316 (82.5)[b]	374 (97.7)	246 (64.2)	108 (28.2)	344 (89.8)	333 (86.9)	20 (5.2)
Asian	14 (34.1)	26 (63.4)	25 (61.0)	37 (90.2)	25 (61.0)	15 (36.6)	32 (78.0)	32 (78.0)	0 (0.0)
Other	52 (50.5)	71 (68.9)	77 (74.8)	96 (93.2)	55 (53.4)	27 (26.2)	85 (82.5)	83 (80.6)	3 (2.9)
Total	312 (59.2)	404 (76.7)[b]	418 (79.3)	507 (96.2)	326 (61.9)	150 (28.4)	461 (87.4)	448 (85.0)	23 (4.3)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100
[b]$P < 0.05$

More than three-quarters of respondents identified general dentists, oral and maxillo-facial surgeons, oral medicine specialists, ENT surgeons and dental hygienists as practitioners who should screen for mouth cancer, while more than half also identified general medical practitioners and CDTs. Few suggested pharmacists for this role. No significant difference in response proportions was found by practitioner type. However, nearly all dentists thought general dentists should screen for mouth cancer, but fewer than two-thirds of CDTs thought CDTs should screen for mouth cancer. New Zealand graduates were significantly more likely than Asian or 'Other' country graduates to identify CDTs, dental hygienists and ENT surgeons as practitioners who should screen for mouth cancer. The oldest graduates were less likely than more recent graduates to identify oral medicine specialists as practitioners who should screen for mouth cancer

4.1.9.1 Barriers to performing oral cancer screening examinations

Practitioners were asked to identify factors that prevent them screening all patients for mouth cancer (Table 4.19). Nearly half felt that there were no barriers, but a lack of time and a lack of training were identified by more than one-quarter as barriers to routinely doing so.

Table 4.19 Perceived barriers to performing oral cancer screening examinations (brackets contain row percentages[a])

Practitioner characteristic	Lack of training	Lack of time	Lack of confidence	Difficult to charge	Patient resistance	Specialists only	Outside my scope	Not necessary
Practitioner type								
Dentists	148 (30.0)	138 (27.9)	108 (21.9)	100 (20.2)	51 (10.3)	11 (2.2)	13 (2.6)	11 (2.2)
CDTs	9 (27.3)	7 (21.2)	8 (24.2)	5 (15.2)	5 (15.2)	9 (27.3)	7 (21.2)	2 (6.1)
Graduation year group								
Before 1976	21 (42.0) [b]	14 (28.0)	16 (32.0) [b]	13 (26.0)	6 (12.0)	3 (6.0)	6 (12.0) [b]	4 (8.0)
1976-1985	26 (21.1)	27 (22.0)	21 (17.1)	21 (17.1)	11 (8.9)	7 (5.7)	3 (2.4)	3 (2.4)
1986-1995	39 (33.1)	37 (31.4)	22 (18.6)	29 (24.6)	16 (13.6)	1 (0.8)	1 (0.8)	1 (0.8)
1996-2005	33 (32.7)	28 (27.7)	24 (23.8)	19 (18.8)	12 (11.9)	5 (5.0)	6 (5.9)	1 (1.0)
2006-2015	38 (28.1)	39 (28.9)	33 (24.4)	23 (17.0)	11 (8.1)	4 (3.0)	4 (3.0)	4 (3.0)
Graduation country group								
New Zealand	116 (30.3)	104 (27.2)	88 (23.0)	71 (18.5)	39 (10.2)	14 (3.7)	16 (4.2)	13 (3.4)
Asian	15 (36.6)	16 (39.0)	11 (26.8)	13 (31.7)	8 (19.5)	3 (7.3)	1 (2.4)	0 (0.0)
Other	26 (25.2)	25 (24.3)	17 (16.5)	21 (20.4)	9 (8.7)	3 (2.9)	3 (2.9)	0 (0.0)
Total	157 (29.8)	145 (27.5)	116 (22.0)	105 (19.9)	56 (10.6)	20 (3.8)	20 (3.8)	13 (2.5)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100
[b]$P < 0.05$

More than one-fifth identified a lack of confidence and ten percent of practitioners felt patient resistance to OCS examinations was also a barrier. A few practitioners responded that OCS was outside their ‘scope of practice’, a ‘specialist only procedure’ or was ‘not necessary’. However, those from the earliest graduation group were significantly more likely than younger graduates to identify lack of training, lack of confidence and outside scope of practice, as barriers to performing OCS examinations routinely.

4.1.10 Specialist referral for identified suspicious oral lesions

Practitioners were asked to which practitioner or secondary service they would usually refer patients with suspicious lesions for review (Table 4.20). Over half referred patients to oral and maxillo-facial surgeons. Very few practitioners referred to ENT surgeons, general dentists or general medical practitioners, but nearly one-quarter of CDTs would refer to general dentists.

Table 4.20 Practitioner's usual referral pathway (brackets contain row percentages[a])

Practitioner characteristics	Referred to health care practitioner					
	OMF surgeon	Hospital dental unit	Oral medicine specialist	ENT surgeon	General dentist	General medical
Practitioner type						
Dentist	298 (60.3)	96 (19.4)	75 (15.2)	18 (3.6)	1 (0.2)	2 (0.4)
CDT	16 (48.5)	1 (3.0)	1 (3.0)	2 (6.1)	8 (24.2)	4 (12.1)
Graduation year						
Before 1976	28 (56.0)	14 (28.0)	6 (12.0)	2 (4.0)	0 (0.0)	0 (0.0)
1976 to 1985	73 (59.3)	25 (20.3)	15 (12.2)	4 (3.3)	1 (0.8)	3 (2.4)
1986 to 1995	78 (66.1)	17 (14.4)	15 (12.7)	3 (2.5)	3 (2.5)	0 (0.0)
1996 to 2005	68 (67.3)	14 (13.9)	11 (10.9)	4 (4.0)	4 (4.0)	0 (0.0)
2006 to 2015	67 (49.6)	27 (20.0)	29 (21.5)	7 (5.2)	1 (0.7)	3 (2.2)
Graduation country						
New Zealand	234 (61.1)	66 (17.2)	53 (13.8)	16 (4.2)	7 (1.8)	4 (1.0)
Asian	21 (51.2)	11 (26.8)	5 (12.2)	3 (7.3)	1 (2.4)	0 (0.0)
Other	59 (57.3)	20 (19.4)	18 (17.5)	1 (1.0)	1 (1.0)	2 (1.9)
Total	314 (59.6)	97 (18.4)	76 (14.4)	20 (3.8)	9 (1.7)	6 (1.1)

[a]Respondents were able to select more than one option, so that percentages do not sum to 100

The responses to questions about patients' attendance at referral appointments are presented in Table 4.21.

Table 4.21 Practitioners views on attendance at referral appointments (brackets contain row percentages[a])

Practitioner characteristics	Agree that referred patient will attend appointment	Responsibility for specialist appointment		
		Practitioner	Patient	Referred to service
Practitioner type				
Dentist	410 (83.0)	305 (61.7)	123 (24.9)	41 (8.3)
CDT	29 (87.9)	19 (57.6)	9 (27.2)	4 (12.1)
Graduation year				
Before 1976	45 (90.0)	36 (72.0)	6 (12.0)	6 (12.0)
1976 - 1985	107 (87.0)	80 (65.0)	32 (26.0)	6 (4.8)
1986 - 1995	102 (86.4)	67 (56.8)	36 (30.5)	9 (7.6)
1996 - 2005	79 (78.2)	51 (50.4)	29 (28.7)	15 (14.9)
2006 - 2015	106 (78.5)	90 (66.7)	29 (21.5)	9 (6.7)
Graduation country				
New Zealand	321 (83.8)	24 (58.5)	12 (29.3)	5 (12.2)
Asian	34 (82.9)	232 (60.6)	97 (25.3)	35 (9.1)
Other	84 (81.6)	68 (66.0)	23 (22.3)	5 (4.9)
Total	439 (83.3)	324 (61.5)	132 (25.0)	45 (8.5)

[a]Rows contain responses to different questions, therefore row percentages do not sum to 100

Most respondents felt that patients would usually attend a specialist appointment for review of a suspicious oral lesion. However, more than one in ten were unsure about whether patients would attend a specialist appointment. No significant difference was apparent by practitioner type, graduation year or country. When asked who should be responsible for checking whether patients present to their specialist review appointment, most practitioners felt that the referring practitioner was responsible, but one-quarter felt that the responsibility remained with the referred patient. Fewer than one in twelve felt that the onus of ensuring that a patient attended a specialist appointment should be on the service receiving the referral.

4.2 Results from NZCR data on diagnosed OC and OPC cases 2012-2013

There were 761 new cases of OC and OPC (ICD-10 codes C00-C14.8, excluding C11, 12 &13) diagnosed in New Zealand residents from 1 January 2012 until 31 December 2013, and

these were 1.8% of all registered malignancies during this time. The crude cancer incidence rates (per 100,000) by anatomical site were; 1.0, 1.1, 2.8 and 4.1 for external lip, salivary gland, oropharynx and oral cavity, respectively. Three individuals each had two registered tumours.

4.2.1 Anatomical and morphological characteristics of cases

The cases of OC and OPC by anatomical site (according to the ICD-10 codes) are presented in Table 4.22.

Table 4.22 Registered oral and oropharyngeal cancers in 2012─2013 by anatomical site (brackets contain column percentages).

Site description	ICD codes	Number
External lip	C00—02	82 (10.8)
Oral cavity carcinomas		
Internal lip	C003—005	16 (2.1)
Lip unspecified	C006—009	3 (0.4)
Tongue	C020—23, C028, C029	152 (20.0)
Floor of mouth	C040—049	46 (6.0)
Gum and cheek	C030—039, C060-062	89 (11.7)
Hard and soft palate	C050—C059	35 (4.6)
Other parts of mouth	C068	5 (0.7)
	Total Oral Cavity Cancers	346 (45.5)
Oropharyngeal carcinomas		
Base of tongue, lingual tonsil	C01, C024	79 (10.4)
Tonsil	C090—C099, C142	117 (15.4)
Oropharynx	C100—109	27 (3.5)
Overlapping or unspecified lesion of oropharynx	C140 and C148	13 (1.7)
	Total OPCs	236 (31.0)
Salivary glands carcinomas		
Minor salivary gland	C069	18 (2.4)
Major salivary gland	C070—C089	79 (10.4)
	Total salivary gland cancers	97 (12.8)
Total	**C00—C148**	**761 (100.0)**

The tongue was the most frequent cancer site (one-fifth of the tumours were in the oral tongue), followed by the tonsils (nearly one in six cases). Tumours of the salivary glands represented one in eight cases, with most of these in the major salivary glands.

The morphology of the registered tumours is summarised in Table 4.23.

Table 4.23 Morphology of registered oral and oropharyngeal carcinomas (brackets contain the column percentage).

Morphology code	Description	Number of cases
8000 & 8010	Unspecified morphology	22 (2.9)
8051-8076, 8083-8094	Squamous cell carcinomas	628 (82.5)
8013-8046, 8082, 8140-8982, 9041, 9270 and 9581	Non-epithelial neoplasms	111 (14.6)
Total		**761 (100.0)**

Most of the OC and OPC were squamous cell carcinomas, with about one in seven derived from non-squamous cell tissue. The most frequently registered type of non-epithelial neoplasms were mucoepidermoid (30 cases), adenoid cystic (18 cases), acinar cell (16 cases) and adenocarcinomas (14 cases). A few cases had no specific morphology recorded.

4.2.2 Demographic characteristics of cases

Summary data on the sex of those diagnosed with OC and OPC is presented in Table 4.24 by the year, and age group at diagnosis and ethnic group.

Table 4.24 Sex of registered cases by year of diagnosis, age and ethnic group (brackets contain row percentages, except where indicated)

	Sex		
	Male	**Female**	**Total** [a]
Year of diagnosis			
2012	232 (63.7)	132 (36.3)	364 (47.8)
2013	241 (60.7)	156 (39.3)	397 (52.2)
Age group at diagnosis (in years)			
Less than 30	9 (69.2)	4 (30.8)	13 (1.7)
30-39	16 (59.3)	11 (40.7)	27 (3.5)
40-49	50 (65.8)	26 (34.2)	76 (10.0)
50-59	138 (68.7)	63 (31.3)	201 (26.4)
60-69	128 (71.9)	50 (28.1)	178 (23.4)
70-79	76 (52.4)	69 (47.6)	145 (19.1)
80-84	33 (53.2)	29 (46.8)	62 (8.1)
Over 85	23 (39.0)	36 (61.0)	59 (7.8)
Ethnic group			
Non-Māori	440 (93.0)	263 (91.3)	703 (92.4)
Māori	33 (7.0)	25 (8.7)	58 (7.6)
Total	**473 (62.2)**	**288 (37.8)**	**761 (100.0)**

[a]Column percentage

Over one-third of the registered cases in each year were female (overall male:female ratio of 1.6:1). However, the sex ratio of cases differed by age group, with half of the cases aged over 70 years being female. The crude incidence rates per 100,000 were 12.1 and 7.0 for males and females, respectively. The age at diagnosis ranged from 2 to 100 years, with the age group 50−59 years having the highest number of diagnosed cases. The median age at diagnosis was 63 years (interquartile range 54−75 years), but the median age differed by sex with a median age of 61 years for males and 67 years for females.

Most of the OC and OPC cases occurred in non-Māori (n=703, 92.4%), the majority of whom were New Zealand Europeans (n=628, 82.5%). Few cases were Pacific people (n=27, 3.5%), South East Asian (n=18, 2.4%) or Sub continental Indian (n=13, 1.7%). The crude incidence rates per 100,000 were 10.3 and 4.8 for non-Māori and Māori respectively. The crude incidence rate per 100,000 for non-Māori males was more than double that for Māori males (13.3 and 5.7 respectively), but less than double for females (7.5 and 4.0 for non-Māori and Māori respectively).

The age-specific rates for OC and OPC by sex are presented in Figure 4.1.

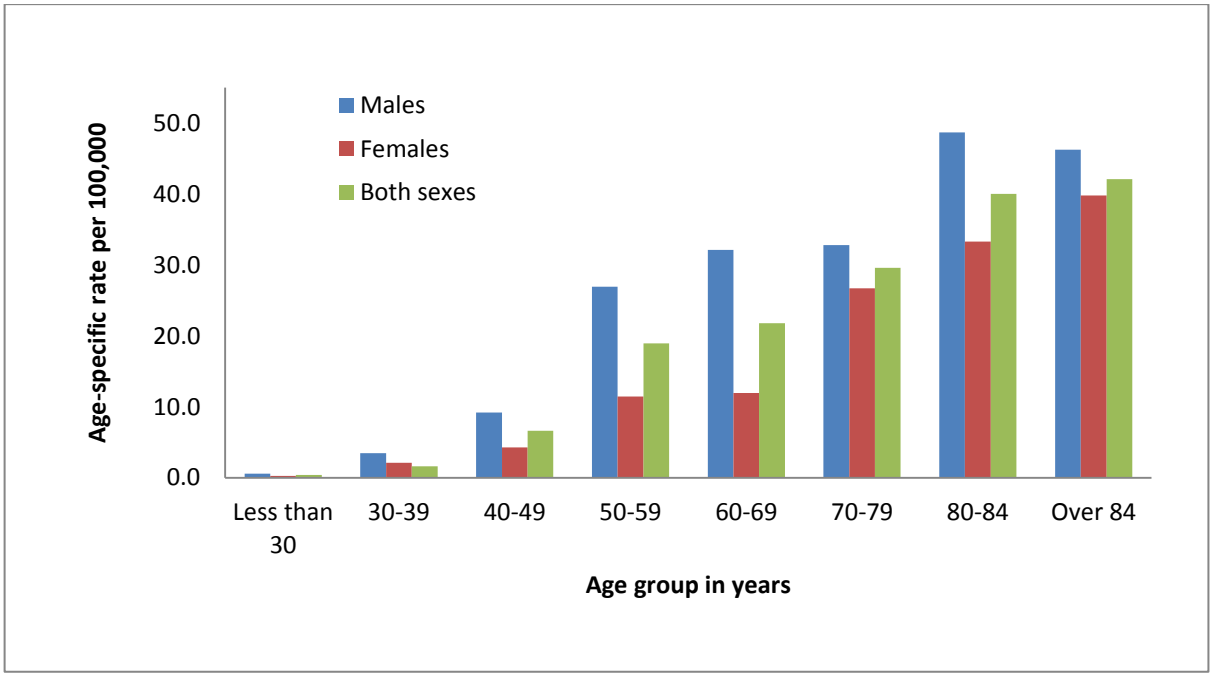

Figure 4.1 Age-specific rates of oral and oropharyngeal cancer per 100,000 for 2012–2013.

The age-specific OC and OPC rates for both sexes were lowest in those younger than 30 years (0.4 per 100,000). The incidence rate showed a consistent age gradient which increased with age in women, but, for males, the highest age-specific rate (48.7 per 100,000) was in the 80─84 year age group.

The age-specific rates by sex and ethnicity are presented in Figure 4.2.

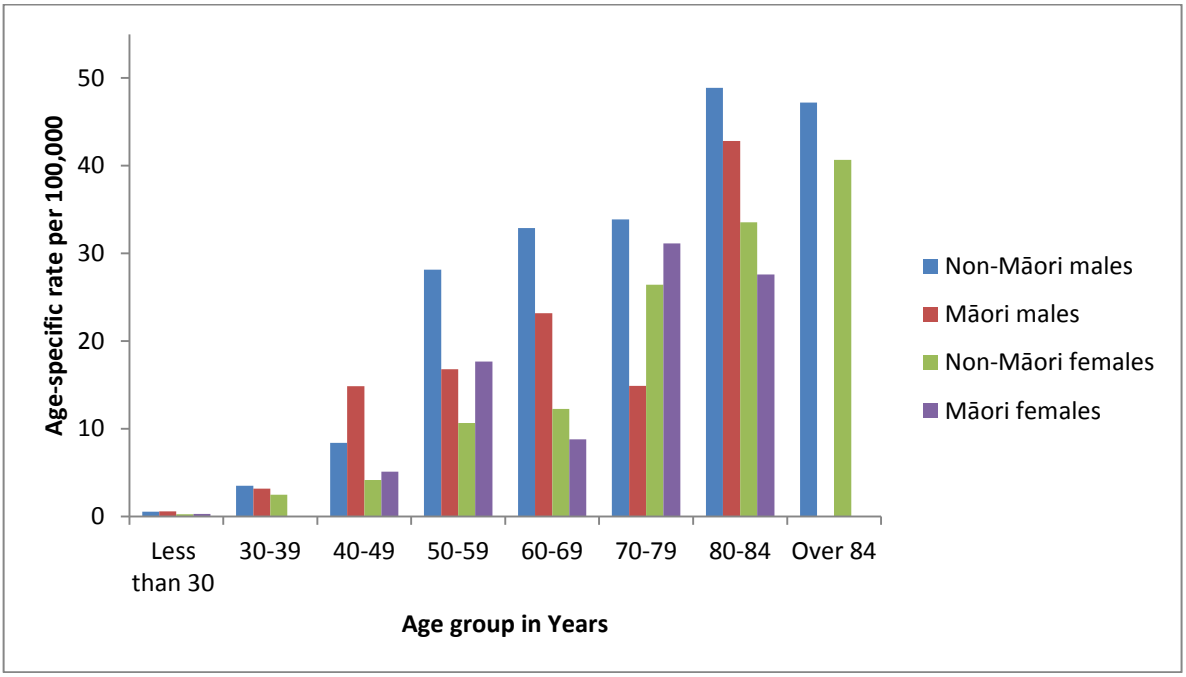

Figure 4.2 Age-specific rates of oral and oropharyngeal cancer by sex and ethnicity.

Non-Māori males 80 or more years of age had the highest age-specific rates per 100,000 (48.9 and 47.2 for 80─84 years and over 84 years, respectively). The age-specific rates by sex for Māori were lower than for non-Māori, except for Māori males aged 40─49 years and Māori females aged 50─59 years and 70─79 years. There were no Māori cases aged over 84 years.

The extent of the OC and OPC by sex is presented in Table 4.25.

Table 4.25 Extent of tumours by sex (brackets contain column percentages, except where indicated).

	Sex		
Extent of tumour	**Male**	**Female**	**Total**
Localised to organ of origin	134 (28.3)	108 (37.5)[b]	242 (31.8)
Invasion of adjacent tissue	29 (6.1)	16 (5.6)	45 (5.9)
Regional lymph nodes	158 (33.4)	55 (19.1)	213 (28.0)
Distant metastases	32 (6.8)	14 (4.9)	46 (6.0)
Unknown	120 (25.4)	95 (33.0)	215 (28.3)
Total [a]	**473 (62.2)**	**288 (37.8)**	**761 (100.0)**

[a]Row percentage
[b] Test of difference in proportions (not adjusted for age or ethnicity) P<0.05

The extent of the tumour was not recorded for over one-quarter of the cases. A greater proportion of females than males were registered with either localised tumours or tumours of unknown extent. One-third of males had regional lymph node involvement at diagnosis, whereas fewer than one-fifth of females did.

The extent of the tumour at diagnosis is shown by anatomical site and type in Table 4.26.

Table 4.26 Extent of tumour at diagnosis by the anatomical site and type (brackets contain column percentages, except where indicated).

	Anatomical site and type				
Extent of Tumour	**External lip**	**OCC**	**OPC**	**Salivary[a]**	**Total**
Localised	67 (81.7)	134 (38.7)	14 (5.9)	27 (27.8)[c]	242 (31.8)
Localised invasion	2 (2.4)	31 (9.0)	3 (1.3)	9 (9.3)	45 (5.9)
Regional nodes[d]	1 (1.2)	69 (19.9)	127 (53.8)	16 (16.5)	213 (28.0)
Distant metastases	0 (0.0)	18 (5.2)	17 (7.2)	11 (11.3)	46 (6.0)
Unknown	12 (14.6)	94 (27.2)	75 (31.8)	34 (35.1)	215 (28.3)
Total[b]	82 (10.8)**[b]**	346 (45.5)**[b]**	236 (31.0)**[b]**	97 (12.7)**[b]**	761 (100.0)

[a]Tumours arising within minor and major salivary glands

[b]Row percentages
[c]P<0.05
[d]Regional lymph node involvement

Significant differences were observed in tumour extent by anatomical site. Most malignancies of the external lip were localised, whereas few oropharyngeal malignancies were localised. Also, fewer tumours of the external lip were of unknown extent. Over half of the OPCs had spread to the regional lymph nodes, whereas one-fifth of the OCCs had done so. A greater proportion of salivary gland tumours than other types had distant metastases at the time of diagnosis.

The extent of the tumour was assessed for different ages at diagnosis (Table 4.27).

Table 4.27 Extent of tumour by age group in years at diagnosis (brackets contain column percentage).

	Age in years								
Extent of tumour	**<30**	**30—39**	**40—49**	**50—59**	**60—69**	**70—79**	**80—84**	**Over 84**	**Total**
Localised	8 (61.5)	10 (37.0)	23 (30.2)	51 (25.4)	62 (34.8)	43 (29.7)	20 (32.2)	25 (42.4)[b]	242 (31.8)
Regional or distant spread	2 (15.4)	10 (37.0)	37 (48.6)	97 (48.3)	66 (37.1)	59 (40.6)	21 (33.9)	12 (20.4)	304 (39.9)
Unknown	3 (23.1)	7 (25.9)	16 (21.1)	53 (26.4)	50 (28.1)	43 (29.7)	21 (33.9)	22 (37.3)	215 (28.3)
Total	13 (1.7)	27 (3.5)	76 (10.0)	201 (26.4)	178 (23.4)	145 (19.1)	62 (8.1)	59 (7.8)	761 (100.0)

[a] Row percentages
[b] P<0.05

Differences existed in the extent of the tumour by age at diagnosis. A greater proportion of those under 30 years than older age groups had localised disease and a greater proportion of those aged 80 or more years had tumours of unknown extent. Nearly half of those aged from 40 to 59 years had tumours which had invaded either regionally (including to lymph nodes) or had metastatic spread at diagnosis.

The extent of the tumour at diagnosis by ethnic group is presented in Table 4.28.

Table 4.28 Extent of tumour at diagnosis by ethnic group (brackets contain column percentage unless indicated).

	Ethnic Group		
Extent of Tumour	**Non-Māori**	**Māori**	**Total[b]**
Localised to organ of origin	229 (32.6)	13 (22.4)[a]	242 (31.8)
Invasion of adjacent tissue	42 (6.0)	3 (5.2)	45 (5.9)
Regional lymph nodes	186 (26.5)	27 (46.6)	213 (28.0)
Distant metastases	43 (6.1)	3 (5.2)	46 (6.0)
Unknown	203 (28.9)	12 (20.7)	215 (28.3)
Total[a]	703 (92.4)	58 (7.6)	761 (100.0)

[a]Row percentage
[b]Test of difference in proportions (not adjusted for age or sex) P<0.05

Māori had a lower proportion than non-Māori of tumours diagnosed at the localised stage, and a greater proportion of tumours with regional lymph node involvement. Non-Māori had a higher proportion (than Māori) of tumours with unrecorded extent.

The anatomical site and type of oral and oropharyngeal tumour is shown by ethnic group in Table 4.29.

Table 4.29 Anatomical site and type of cancer by ethnic group (brackets contain column percentage)

	Ethnic Group		
Anatomical site & type	**Non-Māori**	**Māori**	**Total[c]**
External lip	79 (96.3)	3 (3.7) [c]	82 (10.8)
OCC	331 (95.7)	15 (4.3)	346 (45.5)
OPC	209 (88.6)	27 (11.4)	236 (31.0)
Salivary[a]	84 (86.6)	13 (13.4)	97 (12.7)
Total[b]	703 (92.4)	58 (7.6)	761 (100.0)

[a]Tumours occurring within minor and major salivary glands
[b] Row percentages
[c]Test of difference in proportions (not adjusted for age or sex) P<0.05

Most of the diagnosed cancers of the external lip were found in non-Māori (96.3%). The proportion of Māori with either OPC or salivary gland tumours was greater than for the other types of cancer.

4.2.3 Mortality

The NZCR mortality records from 2012 and 2013 for individuals who had previously been registered OC and/or OPC were reviewed. In total, 109 individuals had died during this period (33 and 77 during 2012 and 2013, respectively), 88 (80.7%) of whom died from OC or OPC. For a further seven cases (6.4%), OC or OPC was recorded as a contributing cause of death. Other causes of death included other cancers (8 cases, 7.3%) and heart disease (6 cases, 5.5%). The median age at death from OC and OPC is presented by sex and ethnic group in Table 4.30.

Table 4.30 Age at death from oral and oropharyngeal cancer by ethnic group and sex (brackets contain age range in years except where indicated).

	Number of deaths		Median age (in years) at death		
Ethnic group	**Males**	**Females**	**Males**	**Females**	**Overall**
Non-Māori	46 (92.0)[a]	35 (92.1)[a]	69 (35−96)	80 (51−100)	72 (35−100)
Māori	4 (8.0)	3 (7.9)	65 (48−79)	59 (45−64)	62 (45−79)
Total	50 (100.0)	38 (100.0)	69 (35−96)	78 (45−100)	70 (35−100)

[a]Column percentages

Overall, the median age at death was 70 years (range 35−100 years). However, the median age at death was younger for males than females (69 and 78 years, respectively). Also, the median age at death was younger for Māori than non-Māori (62 and 72 years, respectively). Data on the mortality rate by sex and ethnicity are presented in Table 4.31.

Table 4.31 Mortality rate per 100,000 by ethnicity and sex.

	Sex		
Ethnicity	**Male**	**Female**	**Overall rate**
Non-Māori	1.4	1.0	1.2
Māori	0.7	0.5	0.6
Overall rate	1.3	0.9	1.1

The overall crude mortality rate per 100,000 was 1.1. Non-Māori males had the highest crude mortality rate (1.4) and the rates for non-Māori were double that of Māori for both males and females. Deaths from OC and OPC by anatomical site are presented in Table 4.32.

Table 4.32 Deaths from oral and/or oropharyngeal cancer by anatomical site.

	Death from oral and/or oropharyngeal cancers	
Anatomical site and type	**Number**	**Percentage of deaths**
External lip	1	1.1
OCC	42	47.7
OPC	28	31.8
Salivary gland	17	19.3
Total	**88**	**100.0**

Oral cavity cancer accounted for nearly half of deaths, with a further one-fifth from salivary gland tumours. Only one individual died from external lip cancer. The date of diagnosis is not contained within the mortality data. Therefore is it not possible to determine the mortality rate (neither overall nor site specific) within a defined period following diagnosis, from the mortality database.

Of the 758 individuals who were diagnosed with OC and OPC within the study period, 223 (29.4%) had died by 31 December 2015. The cause of death was available only for the 99 individuals who died between 1 January 2012 and 31 December 2013, of whom 80 (10.6%) had died from OC or OPC. Accordingly, 10.6% (80 of 758) of the diagnosed cases had died from OC and/or OPC within two years of diagnosis. For the 20 who had died from other causes, the most common causes of death were other cancers (10 cases) and heart disease (5 cases). Data on death from OC and/or OPC are presented in Table 4.33 by tumour extent, anatomical site and type.

Table 4.33 Cause of death by tumour extent for years 2012─2013 **(brackets contain column percentages).**

Extent of tumour	Death from OC /OPC	Total cases
Localised to organ of origin	5 (6.2)[a]	242 (31.9)
Invasion of adjacent tissue	2 (2.5)	44 (5.8)
Regional lymph nodes	29 (36.3)	213 (28.1)
Distant metastases	11 (13.8)	46 (6.1)
Unknown	33 (41.2)	213 (28.1)
Anatomical site and type		
External lip	1 (1.2)[a]	82 (10.8)
Oral cavity cancer	39 (48.8)	344 (45.4)
OPC	23 (28.8)	235 (31.0)
Salivary gland	17 (21.3)	97 (12.8)
Total	80 (10.6)	758 (100.0)

[a]$P < 0.05$

For the three individuals diagnosed with two primary tumours, the site and type of tumour were the same, therefore only the first diagnosed tumour is represented in Table 4.33. Fewer than one in ten of those who died from OC or OPC had been diagnosed with either a localised tumour or with localised spread, whereas half of those with either regional lymph node involvement or distant metastases had died. The extent of tumour at diagnosis was not recorded for four out of ten individuals who died from OC or OPC. Oral cavity cancer was the primary cause of death for nearly half of those who died, and more than one-fifth of deaths were due to salivary gland tumours. Only one individual with cancer of the external lip had died. A greater proportion of Māori than non-Māori died from their OC or OPC within the study period (7 (12.1%) and 73 (10.4%) respectively).

4.3 The observational study of hospital records of the CDHB cases

There were 177 newly diagnosed cases of OC and OPC in 176 individuals diagnosed and/or treated in the CDHB from 1 January 2012 until 31 December 2013.

4.3.1 Demographic characteristics of cases

The number of cases of OC and OPC and crude incidence rate per 100,000 are presented by anatomical site, sex and ethnic group in Table 4.34.

Table 4.34 CDHB cases by anatomical site, sex, age and ethnic group (brackets contain column percentages)

	Number of cases	Crude incidence rate[a]
Anatomical site		
External lip	33 (18.6)	2.3
Oral cavity	72 (40.7)	5.1
Oropharynx	52 (29.4)	3.7
Salivary gland	19 (10.7)	1.3
Sex		
Males	106 (59.9)	18.8
Females	71 (40.1)	12.3
Age group at diagnosis (in years)		
Less than 30	3 (1.7)	0.6
30–39	6 (3.4)	3.8
40–49	22 (12.4)	11.0
50–59	37 (20.9)	19.2
60–69	41 (23.2)	26.9
70–79	34 (19.2)	37.0
80–84	17 (9.6)	56.0
Over 85	17 (9.6)	61.0
Ethnic group		
Non-Māori	164 (92.7)	12.6
Māori	13 (7.3)	11.3
Total	177 (100.0)	12.4

[a] Rate per 100,000

At the time of diagnosis, most of the cases resided in the CDHB region (108 cases), with a further one-quarter residing in the NMDHB region (45 cases). The anatomical site with the highest incidence rate was the oral cavity. More than half of the cases were male and the incidence rate per 100,000 was higher in males than females. The cases ranged in age from 6 years (for an acinar cell carcinoma of the parotid[6]) to 95 years, with a median age of 64 years. Few cases were younger than 40 years and the incidence rate was higher in older age groups, with the highest rate for those 85 or more years. Most of the cases were non-Māori and the crude incidence rate per 100,000 was higher for non-Māori than Māori. The incidence rate per 100,000 for non-Māori males was more than double that for Māori males (16.0 and 6.9

[6] Acinar cell carcinomas are the second most common malignant epithelial tumours in paediatric patients and have been associated with familial predisposition and previous radiation therapy (Al-Zaher et al., 2009)

respectively). However, the incidence was higher for Māori females than non-Māori females (15.8 and 9.4, respectively).

4.3.2 Anatomical site and HPV-16 status of cases

A proportion of the tumours were tested for the presence of the oncogene HPV-16. The median age at diagnosis and anatomical site and type of tumours are presented by HPV-16 status in Table 4.35.

Table 4.35 HPV status of tumour by median age at diagnosis and tumour site (brackets contain row percentages unless indicated)

	HPV-16 status of tumour			
Characteristic	**P16-positive**	**P16-negative**	**Not recorded**	**Overall**
Median age (in years)	56	67	66	64
Anatomical site				**Total**
External lip	0 (0.0)	3 (9.1)	30 (90.9)	33 (18.8)
Oral cavity	2 (2.8)	25 (34.7)	45 (62.5)	72 (40.9)
Oro-pharyngeal	28 (53.8)	8 (15.4)	16 (30.8)	52 (29.5)
Salivary gland	0 (0.0)	4 (21.1)	15 (78.9)	19 (10.8)
Total number	30 (17.1)	40 (22.7)	106 (60.2)	176 (100.0)

The medium age at diagnosis was similar for those with either HPV-negative tumours or tumours with unrecorded HPV-status, but was at least ten years younger for those with HPV-positive tumours. Most of the HPV-positive tumours were OPCs, and over half of the OPCs were HPV-positive. Few of the OCCs and no external lip or salivary gland tumours were HPV-positive.

4.3.3 Presenting signs and symptoms of OC and OPC

The presenting signs or symptoms were not recorded in the hospital records for 21 (11.9%) cases. The most frequently observed signs included swelling or lump in the mouth, the neck or the submandibular area (66 cases, 22.0%), and a lesion in the mouth or lip (13 cases, 7.4%). The most frequently reported symptoms were a non-healing ulcer (31 cases, 17.6%), pain (28 cases, 15.9%), persistent sore throat (12 cases, 6.8%) and difficulty swallowing (5 cases, 2.8%). Incidental findings which prompted further investigation included mucosal change or lesion (5 cases, 2.8%) and an ulcer (2 cases, 1.1%). The full list of recorded signs

and symptoms is contained in Appendix I. Data on the recorded duration of signs noticed or symptoms experienced are presented in Table 4.36.

Table 4.36 Duration of recorded signs and symptoms of OC and OPC (brackets contain column percentages).

Sign/symptom duration	Number of cases
1 month or less	17 (9.7)
2─3 months	59 (33.5)
3─6 months	30 (17.0)
7─11 months	8 (4.5)
1─2 years	20 (11.4)
2─5 years	4 (2.3)
No information	38 (21.6)
Total	**176 (100.0)**

More than one-fifth of the cases lacked any recorded information on the duration of signs or symptoms prior to diagnosis. For the remaining 138 cases, the median duration of signs or symptoms was 4 months (range of 4 days up to 22 years). However, when considered by anatomical site of tumour, OCC and OPC had a shorter median duration (3 months). More than one in eight had been aware of a sign or symptom for more than twelve months prior to diagnosis. The tumour extent and anatomical site are presented by the recorded duration of signs and symptoms in Table 4.37.

Table 4.37 Extent and site of tumour by duration of signs and/or symptoms of OC (brackets contain column percentages unless indicated).

Tumour features	Duration of signs and symptoms						
	Incidental	1 month or less	2–6 months	7–11 months	At least 12 months	Unknown	Total
Extent of Tumour							
Localised	6 (54.5)	5 (29.3)	26 (32.9)	9 (45.0)	8 (34.8)	19 (73.1)	73 (41.5)
Regional or distant spread	3 (27.3)	10 (58.8)	34 (43.0)	8 (40.0)	10 (43.5)	1 (3.8)	66 (37.5)
Unknown	2 (18.2)	2 (11.8)	19 (24.1)	3 (15.0)	5 (21.7)	6 (23.1)	37 (21.0)
Anatomical site of tumour							
External lip	1 (9.1)	1 (5.9)	10 (12.7)	1 (5.0)	2 (8.7)	18 (69.2)	33 (18.8)
Oral cavity	6 (54.5)	8 (47.1)	26 (32.9)	15 (75.0)	9 (39.1)	8 (30.8)	72 (40.9)
Oro-pharyngeal	3 (27.3)	7 (41.2)	32 (40.5)	2 (10.0)	8 (34.8)	0 (0.0)	52 (29.5)
Salivary gland	1 (9.1)	1 (5.9)	11 (13.9)	2 (10.0)	4 (17.4)	0 (0.0)	19 (10.8)
Total[a]	11 (6.3)	17 (9.7)	79 (44.9)	20 (11.3)	23 (13.1)	26 (14.8)	176 (100.0)

[a] Row percentage

A higher proportion of the tumours found incidentally than those with a recorded duration of a sign or symptom were localised stage tumours. More than half of the incidental findings were for OCC, with a further one-quarter for OPC. No consistent gradient was seen for tumour extent by the duration of signs or symptoms. The latter information of the tumours was not known for more than one in seven cases and more than half of the external lip cancers. The proportion of tumours by extent at diagnosis is presented by the recorded duration of signs and symptoms (Table 4.38).

Table 4.38 Extent of tumour by duration of signs and/or symptoms of oral cancer (brackets contain row percentages unless indicated).

Extent of Tumour	Duration of signs and symptoms						
	Incidental	1 month or less	2–6 months	7–11 months	At least 12 months	Unknown	Total[a]
Localised	6 (8.2)	5 (6.8)	28 (35.6)	9 (12.3)	8 (11.0)	19 (26.0)	73 (41.5)
Regional or distant spread	3 (4.5)	10 (15.2)	34 (51.5)	8 (12.1)	10 (15.2)	1 (1.5)	66 (37.5)
Unknown	2 (5.4)	2 (5.4)	19 (51.4)	3 (8.1)	5 (13.5)	6 (16.2)	37 (21.0)
Total	11 (6.3)	17 (9.7)	79 (44.9)	20 (11.3)	23 (13.1)	26 (14.8)	176 (100.0)

[a] Column percentage

A higher proportion of tumours with regional or distant spread, than localised tumours had either the shortest (one month or less), or longest sign or symptom duration (more than 12 months) recorded. The duration of signs or symptoms of the tumours was not known for a higher proportion of tumours with either localised or unknown extent, than those with regional or distant spread.

4.3.4 Referral information

The referring practitioner and the service referred to was recorded for all but five cases. Most cases (n=139, 79.0%) were referred by GMPs, and fewer than one in twelve cases (n=15 cases, 8.5%) referred by GDPs. Other referrers included other medical specialists (n=14 cases, 7.9%) and Emergency Department doctors (n=3 cases, 1.7%). Of the cases referred by dentists, most were later diagnosed with OCC (n=14 cases, 7.9%), with the remaining case being an OPC. Nearly half of the cases detected incidentally had been referred by dentists (n=5 cases, 45.5%). The extent of OCC at diagnosis is presented by referring practitioner in Table 4.39.

Table 4.39 Extent of tumour for oral cavity cases by original referring practitioner (brackets contain column percentages unless indicated)

Extent of Tumour	Dental referral	Medical referral[a]	Total
Localised	6 (42.8)	27 (46.5)	33 (45.9)
Regional or distant spread	4 (28.6)	16 (27.6)	20 (27.7)
Unknown	4 (28.6)	15 (25.9)	19 (26.4)
Total[b]	14 (19.4)	58 (80.6)	72 (100.0)

[a] Includes 3 cases where referrer was not known
[b] Row percentage

A higher proportion of the medically referred than dentally referred cases were localised tumours, whereas a higher proportion of dentally referred than medically referred cases were of either regional or distant spread, or were of unknown extent. The tumour extent was not known for more than one-quarter of the cases of OCC.

The service to which cases were referred for treatment is presented by anatomical site and type of cancer in Table 4.40.

Table 4.40 Referred to service by anatomical cancer site and type (brackets contain column percentage unless indicated)

Service referred	Lip	Oral Cavity	OPC	Salivary	Total
ENT/ Head & Neck	4 (12.1)	39 (54.2)	47 (90.4)	17 (89.5)	107 (60.8)
OMFS	1 (3.0)	19 (26.4)	2 (1.1)	1 (5.3)	23 (13.1)
Plastics/Dermatology	20 (60.6)	3 (4.2)	0 (0.0)	0 (0.0)	23 (13.1)
Hospital Dental	0 (0.0)	10 (13.9)	0 (0.0)	1 (5.3)	11 (6.3)
General Surgery	8 (24.2)	1 (1.4)	3 (5.8)	0 (0.0)	12 (6.8)
Total[a]	33 (18.8)	72 (40.9)	52 (29.5)	19 (10.8)	176 (100.0)

[a] Row percentage

More than half of cases were referred to ENT or Head and Neck specialists; however, the proportion of cancers referred to the specialist services differed by anatomical site. Most of the OPC and the salivary gland cancers (as well as over half the OCCs) were referred to ENT. Most of the external lip cancers were referred to Plastics or Dermatology, and nearly one-quarter to General Surgery. More than one-quarter of the OCCs were referred to OMFS and nearly one in seven were referred to Hospital Dental departments.

4.3.5 Existing co-morbidities

The medical records were not available for 25 cases (14.2%). For the 151 cases with medical records, only four (2.6%) had no additional medical conditions recorded. More than half of the cases (n=94, 62.3%) had some form of heart disease (such as hypertension, ischaemic heart disease, valve replacement or atrial fibrillation), whereas one in eight (n=19, 12.5%) had co-existing respiratory illness (such as COPD). More than one-quarter (n=40, 26.5%) had previously been diagnosed with some form of cancer, of which lung cancer (8 cases), melanoma (6 cases) and other skin SCCs not occurring on the head or neck (6 cases), were the most frequently recorded. More than one-fifth of cases (n=32, 21.2%) had had a prior head or neck cancer; of those, 21 (13.9%) were SCCs.

The tumour extent by smoking history is presented in Table 4.41.

Table 4.41 Tumour extent by smoking history (brackets contain row percentages unless indicated).

	Smoking history			
	Non-smoker	**Ever-smoker**	**Not recorded**	**Total[ab]**
Extent				
Localised	31 (42.5)	28 (38.4)	14 (19.2)	73 (41.5)
Regional or distant spread	23 (34.9)	41 (62.1)	2 (3.0)	66 (37.5)
Unknown	11 (29.7)	21 (56.8)	5 (13.5)	37 (21.0)
Total	65 (36.9)	90 (51.1)	21 (11.9)	176 (100.0)

[a] Column percentages
[b] Test of difference in proportions P<0.05

Over half of the cases were current or ex-smokers. Significant differences in tumour extent by smoking history were recorded. A higher proportion of smokers than non-smokers had tumours of regional or distant spread.

4.3.6 Dental history of cases

The number of patients who had a regular dentist by tumour extent, smoking history and employment status are presented in Table 4.42.

Table 4.42 CDHB cases by tumour extent, sex, ethnic group, smoking history and employment status (brackets contain row percentages unless indicated)

	Has a regular dentist			
Characteristic	**Yes**	**No**	**Not recorded**	**Total[a]**
Extent				
Localised	14 (30.4)	21 (45.6)	11 (23.9)	46 (32.2)
Regional/distant spread	26 (40.0)	34 (52.3)	5 (7.7)	65 (45.4)
Unknown	6 (18.8)	20 (62.5)	6 (18.8)	32 (22.4)
Sex				
Male	29 (35.4)	40 (48.8)	13 (15.8)	82 (57.3)
Female	17 (27.9)	35 (57.4)	9 (14.7)	61 (42.7)
Ethnic group				
Non-Māori	44 (33.8)	65 (50.0)	21 (16.2)	130 (90.9)
Māori	2 (15.4)	10 (76.9)	1 (7.7)	13 (9.1)
Smoking history				
Non-smoker	25 (50.0)	17 (34.0)	8 (16.0)	50 (35.0)[b]
Ever-smoker	20 (24.7)	52 (64.2)	9 (11.1)	81 (56.6)
Not recorded	1 (8.3)	6 (50.0)	5 (41.7)	12 (8.4)
Employment status				
Working or no CSC	16 (47.1)	15 (44.1)	3 (8.8)	34 (23.8) [b]
Retired	24 (34.3)	36 (48.0)	10 (14.3)	70 (49.0)
CSC holder	2 (12.5)	14 (87.5)	0 (0.0)	16 (11.1)
Not recorded	4 (17.4)	10 (43.5)	9 (39.1)	23 (16.1)
Total	**46 (32.2)**	**75 (52.4)**	**22 (15.4)**	**143 (100.0)**

[a] Brackets contain column percentages
[b] Test of difference in proportions P<0.05

Nearly one-third had a regular dentist prior to their cancer diagnosis. No information about having a regular dentist had been recorded for more than one in seven cases. A lower proportion of those with localised tumours had a regular dentist than those without. However, the converse was observed for those with either tumours that had spread (regionally or distantly) or tumours of unknown extent. Half of non-Māori cases did not have a regular dentist, whereas three-quarters of the Māori cases did not. A higher proportion of males than females had a regular dentist, although the differences were not statistically significant. Also, a higher proportion of non-smokers than ever-smokers had a regular dentist. Alcohol consumption was recorded for nearly two-thirds of cases (91 cases, 63.6%). Fewer than one in

ten did not drink alcohol (14 cases, 9.8%), nearly one-quarter occasionally drank alcohol (35 cases, 24.5%) and less than one-third (42 cases, 29.4%) were recorded as moderate or heavy drinkers. More than two-thirds were either 'ever smokers' or alcohol drinkers (101, 70.6%) and more than one-third of cases were both 'ever smokers' and alcohol drinkers (53 cases, 37%). Only one in five who were both 'ever smokers' and alcohol drinkers had a regular dentist (11 of 53 cases, 20.8%). Few of those with a Community Services Card (CSC) had a regular dentist, while more than one-third of those retired had a regular dentist.

Nearly one-third of cases (44 cases, 30.8%) had no date recorded since their last dental visit. The time since last dental visit ranged from 1 month up to more than 40 years. One in six (24 cases) had been to the dentist within 3 to 12 months of diagnosis, but more than one-quarter (36 cases) had not been to the dentist for at least five years. One-third of patients that were dentally referred for their mouth cancer treatment were edentulous.

The OPG radiographs revealed that most of the cases were dentate at the time of diagnosis; however, 8 (5.6%) had no available records. More than one-third of patients required dental extractions as part of their cancer therapy, with 24 (16.8%) having five or more teeth extracted. Twelve (8.4%) patients became edentulous as part of their cancer therapy. Data on being dentate at time of diagnosis and pre-cancer therapy extractions are presented by employment status in Table 4.43.

Table 4.43 Dentate status and pre-cancer therapy extractions by employment status (brackets contain row percentages unless indicated)

Employment status	Dentate	Dental extractions[a]	Total[b]
Working or no CSC	28 (82.4)	19 (55.9)	34 (23.8)
Retired	36 (51.4)	17 (24.3)	70 (49.0)
CSC holder	12 (75.0)	13 (81.3)	16 (11.1)
Not recorded	1 (4.3)	4 (17.4)	23 (16.1)
Total	89 (62.2)	53 (37.1)	143 (100)

[a] Pre-cancer therapy dental extractions required
[b] Column percentages

Most of those either working or with a CSC were dentate at the time of cancer diagnosis, while just over half of those retired were so. Most CSC holders required extractions as part of their OC or OPC treatment, whereas fewer than one-quarter of retired people did so.

5 Discussion

Although many international studies have reported on the knowledge, beliefs and practices of primary dental care clinicians concerning OC, this is the first to explore the OC awareness of New Zealand dental clinicians. Quantitative data from the survey of general dentists and CDTs were compared with the descriptive data collected from the NZCR (cases diagnosed with OC and OPC from 1 January 2012 until 31 December 2013) to assess whether New Zealand general dentists and CDTs have adequate knowledge to enable early detection and referral of suspicious oral lesions. Moreover, the descriptive data from OC and OPC cases diagnosed within the CDHB during the study period were analysed for associations of tumour extent by regular dental attendance.

The NZCR records show that the incidence of OC and OPC in New Zealand has increased over the last fifty years (Chelimo and Elwood, 2015; Cox et al., 1995). Examination of the OC and OPC cases from 2012–2013 suggests that the incidence remains highest for oral cavity cancer (crude incidence rates per 100,000 by anatomical site of 1.0, 1.1, 2.8 and 4.1 for external lip, salivary gland, oropharynx and oral cavity, respectively). Likewise, the distinct incidence patterns by gender, age, and ethnicity reported in earlier studies were also demonstrated in this study. Males were affected more commonly than females (with a ratio of males to females of 1.6:1). The median age at diagnosis was 63, and the age-specific rates were higher in older age groups (the highest AR of 48.7 per 100,000 recorded for males aged 80─84 years). Most cases were New Zealand European (82.5% of cases), and the most common sites were the tongue (for OC) and the tonsils (for OPC).

Most general dentists and CDTs identified OC and OPC as a male-dominated disease, with those over 40 years as more commonly affected and the tongue as a common site for OC. However, people aged over 60 years were less commonly identified (particularly those over 70 years), and New Zealand Europeans were identified as at highest risk by comparatively few respondents (9.9%). Likewise, the tonsils as a common site for mouth cancer was identified by only 10% of New Zealand graduates, and few Asian and no graduates from other countries.

The common signs and symptoms of mouth cancer (neck, submandibular or mouth lumps, non-healing ulcers and oral lesions) and the OPMLs (erythroleukoplakia, leukoplakia and erythroplakia) identified by most dentists and CDTs were consistent with those reported in the literature (Napier 2008; Scully and Bagan, 2009; van der Waal 2009; Warnakulasuriya 2009).

However, fewer of the oldest graduates identified red lesions (erythro-leukoplakia and erythroplakia) as OPMLs.

Most dentists and CDTs identified the proven risk factors for OC and OPC (areca nut, tobacco use, heavy alcohol consumption and HPV infection), but most also identified putative risk factors which are not fully supported by the literature (such as family history and marijuana use). Dentists and CDTs reported asking patients about their tobacco use, but less commonly asked about alcohol consumption.

Fewer than one in ten (8.5%) of the OC and OPC cases diagnosed or treated at the CDHB during the study period had been referred by dentists. More than half of the cases were diagnosed within six months of becoming aware of a sign or symptom, while more than one in eight had a sign or symptom for at least 12 months before diagnosis. The pattern of dental attendance or duration of signs and symptoms was not consistently associated with tumour extent. However, factors that were associated with having a localised (rather than a more advanced) tumour included being a non-smoker and the tumour being an incidental finding.

The CDHB cases were significantly less likely to have a regular dentist if they were either a smoker or had a CSC. Before cancer treatment, a higher proportion of those who were either working or with a CSC than those who were retired were dentate. Likewise, pre-cancer therapy extractions were more common for those who either had a CSC or were working than for those who were retired.

During the study period, 88 people (50 males and 38 females) had died from OC or OPC. The annual number of deaths from OC and OPC is fewer than the 80 men and 35 women per annum reported by Cox et al. (1995) and suggests that the male-to-female ratio of OC and OPC deaths has reduced. Overall, the median age at death was 70 years, but sex and ethnic differences were observed (the median age was younger for males than females, and for Māori than non-Māori). In contrast to the findings of Robson et al. (2011), the mortality rate was twice as high for non-Māori than that of Māori (1.2 and 0.6 per 100,000 for non-Māori and Māori, respectively). Of those diagnosed with OC and OPC in the study period, 10.6% had died from their cancer within two years of diagnosis.

The data gathered during this study will be discussed in the following section. First the strengths and limitations of the study will be discussed, and then the findings themselves will be considered.

5.1 Strengths and limitations of the study

It is important to discuss the strengths and limitations of the study before discussing how its findings add to the understanding of the whether primary dental clinicians' knowledge and patient factors impact on the stage of diagnosis of OC and OPC in New Zealand. The study's strengths and weaknesses will be discussed in the following sections: study design, representativeness of the responding sample; NZCR data for OC and OPC cases 2012─2013; and retrospective data from the hospital records of OC and OPC cases treated at CDHB.

5.1.1 Study design

The response rate of a survey determines the strength of the quantitative data collected, with the strength of the data increasing along with the response rate. The study response rate (27.0%) seems low when viewed alongside some similar international studies surveying the knowledge of general dentists about OC (response rates of 49to 84.7% for postal surveys (Carter and Ogden, 2007; Mahalaha et al., 2009; Allen and Farah, 2015), although it is higher than the 18.1% response rate obtained in an online survey of Irish dentists (Decuseara et al., 2011). Two recent online surveys conducted with New Zealand dentists on other matters had response rates of 18.8% (Pulp capping practices: Friedlander et al., 2015) and 39.6% (Community water fluoridation; Grant et al., 2013). One recent online survey of dental technicians exploring general issues of dental technology in New Zealand (not restricted solely to CDTs) achieved a response rate of 49.6% (Alameri et al., 2014). No comparable international studies of CDT's knowledge of OC could be found, making it difficult to determine an expected response rate from this group. The survey upon which this study is based used two response methods (online and postal), and that may have affected the response rate (with 24.7% and 56.5% for online and postal responses, respectively). It is difficult to assess whether the use of two response methods increased the sample coverage and response rate. Using an online method only would have excluded those without an individual email address and it is possible this may have introduced a bias in the responses. Using postal questionnaires only would have increased increased the effort required to contact all reistered practitioners and process the response data. Therefore only a random sample of practitioners may have been able to participate in the study. This may have introduced some response bias into the study. Overall, however, the survey response rate is within the range which would be expected given those obtained in similar surveys.

Several factors may have impacted on the response rate, including: the timing of the survey, the length of the survey, and the type of questions asked. Traditionally, the months of

November and December are busy months for dentists and CDTs (before the summer holiday season in December and January), so participating in a questionnaire at this time of year may have been a low priority for many clinicians. Moreover, potential respondents may have been dissuaded from participating due to the length of the questionnaire (feeling it would take too long to answer) or by its depth. The mouth cancer knowledge of New Zealand's primary healthcare clinicians has not been explored previously, and so some clinicians may have been reluctant to respond due to a fear of not providing the 'correct answers'. Although the length of the survey may have contributed to a lower-than-hoped for response rate, the range of questions asked enabled a variety of topics on knowledge and practices concerning mouth cancer to be explored, thereby aiding identification of areas which may be further investigated in the future.

The design of the survey may have led to a degree of bias in responses. Respondents were asked to select response options rather than being asked open questions. The checklist supplied may have influenced respondents' answers and not accurately tested their knowledge (as may have been the case if more open-ended questions had been asked). However, the checklist answer format enabled the results to be more easily quantified. Five questions (pertaining to OPMLs, signs and symptoms of mouth cancer, risk factors for mouth cancer and OCS examinations) had the option of an 'All of the above' answer, which may have prompted respondents to identify more of the variables than they would otherwise have done if given the option of identifying variables separately. Moreover, the postal respondents were able to select as many responses to the questions as desired, whereas the online respondents were restricted in many cases to one answer only (unless specifically indicated), and so some differences between the online and postal respondents may exist. This possibility was not explored. It is possible that the length of the questionnaire and the specific nature of some of the questions may have resulted in a higher response rate from those who were confident in answering questions about OC.

The use of the term 'mouth cancer'─rather than the more specific terms of oral cancer, oral cavity cancer and oropharyngeal cancer─may have been confusing for some respondents. The term 'mouth cancer' has been used in previous studies and is reported in the literature (Hassona et al., 2015; Parkin et al., 2005). It is also the term used in public health initiatives (such as 'Smoking causes mouth cancer' messages on tobacco products and 'Mouth Cancer Awareness' programmes), but its use have resulted in respondents failing to consider some anatomical sites of the oropharynx when considering variables such as common sites for mouth cancer. This may have reduced the proportion of participants who identified the tonsils

as a common site for mouth cancer and also those which identified HPV as associated with mouth cancer.

5.1.2 Representativeness of the responding sample

The demographic characteristics of the respondents were compared with those of the Dental Council Workforce Analysis 2010 (the latest workforce analysis available publicly). There were a higher proportion of female respondents than females registered with the DCNZ (44% and 34% of female respondents and registered dentists and CDTs, respectively). The higher proportion of females may have simply reflected the age distribution of respondents, with fewer of the oldest and more of the youngest graduates responding than registered, roughly correlating with the age-gender distribution among registered practitioners. However, no differences were apparent in the responses by sex of practitioner. Accordingly, a high response rate from female clinicians was unlikely to impact on the generalisability of the survey findings.

Comparison was made between the respondents and the DCNZ-registered practitioners by geographic distribution. Although the measurement tool used to map the distribution was different (postcode for the survey, and DBH of work region for the DCNZ data), it was still possible to make broad comparisons. The geographic distribution was similar for both respondents and registered dentists, whereas some differences were noted in the geographic distribution of the CDTs. It is possible that there are some differences in the knowledge and practices about OC among clinicians from differing geographic locations. However, whether differences exist among these groups was not explored as views of non-responders were not gathered as part of this study.

The age structure of respondents in the middle graduation cohorts (1976-1985, 1986-1995 and 1996-2005) was similar to the age structure of DCNZ registered clinicians, whereas fewer older graduates and more recent graduates responded to the survey than are DCNZ registered (9.5% and 25.9% of respondents and 18.8% and 13.6% of registered dentists, for oldest and youngest cohorts respectively). The DCNZ data for CDTs were recorded by age (in years) rather than graduation cohorts, and so direct comparison of CDT age data was not made.

The proportion of respondent dentists who graduated overseas (27.9% and 7.7% for overseas and specifically Asian graduates, respectively) is similar to the proportion of registered dentists (31.5% and 7.5% for overseas and Asian graduates, respectively). Therefore, it is likely the respondents are representative of the practising New Zealand dentists in this regard.

However, information was not available for graduation country of registered CDTs (the graduation country was available only for those CDTs who first gained New Zealand registration in 2010), so the representativeness of the CDT respondents by country of graduation was not explored.

Non-responders have not been surveyed subsequently to determine whether their responses would differ significantly from responders. Thus, it is difficult to say with certainty that the findings are generalisable to general dentists and CDTs in New Zealand. However, since the responders have a similar demographic profile to registered dentists and CDTs in New Zealand, it is not unreasonable to assume that the survey findings may be generalisable to the broader population of New Zealand dental clinicians.

5.1.3 NZCR data for OC and OPC cases 2012 −2013

The use of NZCR data to describe the epidemiological patterns of the identified OC and OPC cases in New Zealand is consistent with previous studies (Cox et al., 1995; Gavidi et al., 2014; Chelimo and Elwood, 2015), and it enabled capture of all the diagnosed cases in New Zealand residents within the study period. However, direct comparisons between this and previous studies are difficult because of differences in study inclusion criteria and duration. It should be noted that the study period was restricted to two years, rather than the longer timeframes in other studies (35, 11 and 30 years for the studies of Cox et al., 1995; Gavidi et al., 2014; and Chelimo and Elwood, 2015, respectively). In addition, the cause of mortality data were available only for those who had died within the study period. Therefore, using the study data, it was not possible to calculate mortality rates for OC and OPC beyond one or two years from diagnosis. However, since the NZCR data enabled capture of all the diagnosed New Zealand OC and OPC cases within the study period, the findings may be interpreted as a snapshot in time.

The NZCR data contained complete records for most variables, including demographic characteristics such as age, sex, ethnicity and DHB of residence, and tumour characteristics such as anatomical site and morphology of tumour. However, the tumour extent at diagnosis had not been recorded for 215 cases (28.3%). Accordingly, the tumour extent findings must be viewed with this in mind.

Incidence rates for OC and OPC by ethnicity (including crude, age-specific and mortality rates) could be achieved only for Māori and non-Māori groups, due to the use of the NZ Census data for baseline population statistics. This meant that more detailed exploration of

patterns of OC and OPC by ethnicity was not explored, and the matching of the incidence rates with all the ethnic groups identified by respondents as at high risk of OC and OPC was not achievable.

5.1.4 Retrospective data from the CDHB records of cases

Identification of the full set of diagnosed OC and OPC cases was achievable by utilising the NZCR data. However, much of the desired information was not recorded. Data were collected from hospital medical and dental records, but only general descriptions were available about dental attendance for many cases. No patients were interviewed to provide details about dental attendance, and no dental records from private dental practitioners were reviewed; accordingly adjunct information (such as being dentate at the time of diagnosis and whether dental extractions were required before cancer therapy) was used to inform assumptions about dental visiting patterns. This reliance on assumptions may have introduced a degree of bias and compromised the study findings about dental attendance prior to OC and OPC diagnosis. Few cases were dentally referred (8.5%), and so exploration of patterns of tumour extent by referring clinician type was limited.

Data about having a regular dentist were available for most of the cases (84.6%), but a definition for 'regular dentist' was not applied. Whether having a regular dentist necessarily translated into visiting a dentist for routine care or episodic relief of pain was not clear. No timeframe was associated with the concept of 'regular dentist', and so it is open to interpretation how frequently an individual may visit the dentist but still consider him or herself to have a regular dentist. Consequently, the opportunities for general dentists to incidentally detect early OC or OPC lesions may be fewer than indicated by the proportion of diagnosed cases recorded as having a regular dentist. Likewise, data on the time elapsed since the last dental visit relied on estimates, because many records were missing. Many edentulous cases had notes about when their current dentures were made (such as 'present dentures made 20 years ago'). It was assumed that the individual had not consulted a dentist or CDT since the dentures were made. However, whether individuals had visited a clinician for denture adjustments was not recorded. Only general descriptions were recorded for the time since last dental visit.

The accurate measurement of the duration of OC and OPC signs and/or symptoms prior to consulting a primary healthcare clinician is challenging due to patient recall bias and errors in measurement, and it may have resulted in the duration being underestimated (Allison et al., 1998; Scott et al., 2008). A range of time (such as 2-3 months) was often noted in the medical

records, which limited the exploration of tumour extent by the duration of signs and symptoms.

For those patients who required high-dose radiation therapy (60Gy or above) involving the maxilla or mandible as part of their cancer therapy, the accurate assessment of the health of the dentition is an important consideration in planning pre-radiation-therapy dental extractions. This meant that, for many of these patients, detailed records on previous dental care were obtainable. However, for those individuals who did not receive high dose radiation in the maxilla or mandible ─ or for those who were edentulous (or edentulous in the planned radiation field) ─ records on patterns of previous dental care were less available. Pre-radiation dental extractions were used in this study as an indicator of active dental disease (and therefore non-regular attendance); however, all dental extractions undertaken during the study period may not have strictly arisen from active dental disease. Early treatment protocols required all teeth within the planned field of high-dose radiation (frequently 60Gy or above) to be removed prior to radiation, to reduce the possibility of post-treatment osteo-necrosis of the jaw (ORN). While this regime is no longer recognised as best practice, it is possible that some of those in this study may have received such treatment and had otherwise healthy teeth extracted.

Information on co-morbidities was available for most of the cases (bar one in seven). Only digital medical and dental records were reviewed. Further information may have been available if original hard copy files were reviewed. However, as DHBs transition into digital medical files, many of the hard copy files are difficult to obtain and attempts were not made to access them.

The HPV-status of all tumours could not be reported. It is not usual to test external lip tumours for HPV status: however, nearly one-third of OPC did not have an HPV-status recorded even though tumours of the oropharynx are reported to be commonly associated with HPV infection (D'Souza et al., 2008; Gillison et al., 2012; International Agency for Research on Cancer, 100B, 2012). Accordingly, only limited exploration of the study data by HPV status could be achieved.

Smoking history was available for most cases (91.6%), but it was unclear from some records whether those recorded as 'non-smoker' could be interpreted as 'not currently smoking' or 'never smoked', and so the term 'non-smoker' was used in the assessment rather than the term 'never-smoker'. Data on alcohol consumption were listed for most of the cases (70.7%), but records on levels of consumption varied and included the descriptive terms of 'heavy',

‘moderate’, ‘not at abuse levels’ and ‘occasional’. It was difficult to know whether the use of these descriptive terms was applied consistently across clinicians, and so opportunities to explore the data for patterns by alcohol consumption were limited.

Data on employment status were difficult to use and interpret. One in six did not have any information on employment status recorded and nearly half of the cases were retired. Employment status data may be entered in medical records for social history rather than as a measure of social-economic status. Eligibility for a CSC is commonly used in New Zealand as a measure of low income, and a CSC is available to both those who are working and those who are not working. Consequently, only those with a CSC recorded in this study were interpreted as low income. The CSC status of those who were working or retired may not have been recorded. It was not possible to measure the number of cases who may have been in this category from their medical records, and so patterns of dental attendance and tumour extent by socio-economic status could not be analysed in this study.

5.2 Does the clinicians’ knowledge of mouth cancer match the true pattern?

The responses of dentists and CDTs were reviewed alongside the NZCR data on diagnosed OC and OPC cases and the data collected for those diagnosed and/or treated at the CDHB. The responses will be discussed in the following sections: demographic characteristics of cases of OC and OPC; risk factors for mouth cancer; anatomical sites commonly affected by mouth cancer and OPMLs; detection of oral mucosal lesions; oral cancer screening examinations; and the referral practices of dental clinicians for mouth cancer cases.

5.2.1 Knowledge of the demographic characteristics of cases

Males accounted for 62.2% of those diagnosed with OC and OPC in the study. This finding is consistent with previous New Zealand studies (Cox et al., 1995; Gavidi et al., 2014; Chelimo and Elwood, 2015). However, fewer than two-thirds of respondents knew that mouth cancer is more common in men, and more than one-fifth of respondents did not know of any sex predilection for mouth cancer.

The study findings of OC and OPC being more common in older age groups (overall median age 63 years and the highest age-specific rate (48.7 per 100,000) for men in the 80−84 year age group) are consistent with findings from both international and New Zealand studies (Cox et al., 1995; Llewellyn et al., 2001; Bodner et al., 2013; Gavidi et al., 2014; Chelimo and Elwood, 2015). However, only one-third of respondents identified those aged 60-70 years and

fewer than one in six identified those over 70 years as more commonly affected by mouth cancer. This suggests that most New Zealand dentists and CDTs may not view the age group with the highest age-specific rates of OC and OPC as at high risk. A substantial proportion of respondents (one in five) were not aware of an age group more commonly affected by mouth cancer. However, this compares favourably with a study of Ohio rest home dentists, where 33.3% were not aware of age group more commonly affected by OC (Mahalaha et al., 2009).

Nearly one-quarter of respondents were not aware of any ethnic groups at higher risk of developing mouth cancer, and, the ethnic groups identified by the remaining respondents at highest risk of OC and OPC did not match those with the highest incidence. Fewer than one in ten respondents identified New Zealand Europeans as having high risk of mouth cancer, yet most of those diagnosed in the study period were New Zealand Europeans (82.5% of those diagnosed). This group was also identified by Gavidi et al. (2014) as the ethnic group most commonly affected in New Zealand. Māori were identified by less than one-fifth of respondents as at high risk of mouth cancer. In this study, Māori accounted for only 7.6% of the cases, and the overall age-specific rates for Māori were lower than for non-Māori. However, age-specific rates for Māori males aged 40−49 years and Māori females aged 50−59 years and 70−79 years, were higher than for non-Māori in these groups. Chelimo and Elwood (2015) also reported a higher ASR for OPC for Māori than European/Other ethnic groups and so, it is not unreasonable for some respondents to identify Māori at high risk of mouth cancer. That more than half the respondents identified sub-continental Indians as at high risk of mouth cancer, which is more likely to reflect the high rates of OC and OPC globally rather than specifically New Zealand cases.

It is noteworthy that a substantial proportion of the youngest graduates (those with fewer than 10 years since graduation) were not aware of the demographic characteristics of those at high risk of mouth cancer (19.3%, 14.8%, and 22.3% of the youngest graduates were unaware of a difference in mouth cancer risk by sex, age group and ethnicity respectively). Although a lower proportion of the newest graduates than older graduates did not know the sex or age group of those at highest risk of mouth cancer, the differences were not significant. This suggests that undergraduate training about mouth cancer risk may be quickly forgotten for a number of dentists and CDTs. The fact that the 1986−1995 graduation cohort had the highest proportion of ‘Don’t know’ responses to the questions about the sex and age groups more commonly affected by mouth cancer adds weight to the finding that time since graduation is not a valid measure of the knowledge of the demographic characteristics of those at highest risk of mouth cancer.

5.2.2 Clinicians' knowledge of the risk factors for mouth cancer

That few respondents did not identify areca nut use, tobacco use (both smoked and chewed) and heavy alcohol use as risk factors for OC is consistent with the findings from international studies that most clinicians are aware of the common oral cancer risk factors (Carter and Ogden, 2007; Mahalaha et al., 2009; Saleh et al., 2016). However, most respondents also identified family history and smoking marijuana as risk factors, neither of which are fully supported by the literature (Moore et al., 2001; World Health Organization, 2005; Aldington et al., 2008). Other risk factors not supported by the literature (but identified by four out of ten respondents) were ill-fitting dentures and denture stomatitis.

Whether this misinterpretation of risk factors affects dental clinicians' ability to identify those most at risk of mouth cancer is unclear. While familial history has not been proven as a risk factor, it may be an indication of lifestyle factors within the family which increase mouth cancer risk (such as patterns of tobacco and alcohol use, and fruit and vegetable consumption), so it may be an indirect marker of mouth cancer risk. Likewise, both edentulism and mouth cancer are more common in older age groups, and so the wearing of dentures (rather than the presence of denture stomatitis or dentures being poorly fitting) is likely an indication of an individual being in an age group which has a higher rate of mouth cancer, (rather than the denture wearing itself conferring a high risk of mouth cancer). More than one-third of the diagnosed CDHB OC and OPC cases were edentulous at the time of diagnosis, whereas half the cases who had retired were also edentulous.

More than two-thirds of the study cases treated at CDHB were either 'ever smokers' or alcohol drinkers, which is consistent with respondents' identification of tobacco and alcohol as risk factors for OC and OPC. Likewise, that more than half of the OPC cases were HPV-positive was consistent with most respondents identifying HPV as a risk factor for mouth cancer. However, despite most respondents being aware of heavy alcohol use as a risk factor, fewer than one-quarter routinely asked patients about their current alcohol use, whereas most asked about tobacco use. Also, fewer New Zealand graduates routinely asked about past tobacco use and alcohol (current or past) use than other graduates. Whether this reflects a difference in undergraduate training between countries or year groups (a lower proportion of non-New Zealand graduates were in the earliest graduate year groups) or other factors (such as cultural differences or previous exposure to public health campaigns raising awareness of mouth cancer) was not explored as part of this study. International studies also found that a higher proportion of dental clinicians routinely ask patients about tobacco, than alcohol use (Decuseara et al., 2011; Horowitz et al., 2000; Macpherson et al., 2003; Nicotera et al., 2004).

Furthermore, fewer records about alcohol consumption than tobacco use were available in the CDHB study data. This suggests that it may not only be dental practitioners who are uncomfortable about discussing alcohol use with patients, or it may reflect a requirement by the MoH for medical practitioners to collect tobacco use data but not alcohol use data for their patients.

Half of the respondents routinely advise patients on risk factors for mouth cancer. However, information on the specific type of advice given to patients was not gathered in the survey. It is likely (given the low proportion of clinicians asking patients about alcohol use) that clinicians may advise patients only of the risks associated with tobacco use, but not heavy alcohol use. Respondents were not asked whether they felt their advice was likely to influence patients' behaviour, so it is difficult to compare this study with studies of Australian and Spanish dentists which found that most dentists (56.7% and 84.4% respectively) believe they can influence patients to reduce/quit smoking or drinking alcohol (Allen and Farah, 2015; Seoane et al., 2006).

Nearly two-thirds of respondents identified older age as a risk factor for mouth cancer, which is similar to findings of studies of Irish and US dentists (53 and 57%, respectively identified age as a risk factor) (Decuseara et al., 2011; Mahalaha et al., 2009). However, while older age is not recognised as a true risk factor for mouth cancer in an epidemiological sense, by identifying it as such, respondents might be indicating that they are more likely to look for mouth cancer in older patients.

5.2.3 Anatomical sites commonly affected by mouth cancer and OPMLs

Consistent with previous New Zealand studies, this study found that OC was more common than OPC, with salivary gland tumours being much less common. Oral cancer cases were 1.5 times more common than OPC cases, whereas Chelimo and Elwood (2015) reported OC to be nearly twice as common as OPC. Moreover, salivary gland tumours were more common in this study than previously reported (12.8% of total OC and OPC, but 2.9% of the tumours reported by Chelimo and Elwood, 2015). It is unclear from the current study whether the rate of salivary gland tumours is an aberrant finding or reflects a recent pattern of a higher prevalence of salivary gland tumours.

The most common sites for diagnosed OC were the tongue, the gingiva or cheek mucosa and the floor of the mouth; this is in accordance with the findings from previous studies (Chelimo and Elwood, 2015; Gavidi et al., 2014). Respondents most commonly identified the floor of

the mouth and lateral border of the tongue as mouth sites affected by cancer, but fewer than one-third identified the buccal mucosa. In accordance with the findings of Chelimo and Elwood (2015), half of the OPCs cases were in the tonsil. However, it is concerning that only ten percent of New Zealand graduates (while few Asian and no 'Other' graduates) identified the tonsil as a common site for mouth cancer. It is possible that clinicians may not have considered the tonsils as part of the mouth. Lack of awareness of the prevalence of tonsil cancer suggests that dentists and CDTs may not consider this region part of their domain and may not assess tonsils when providing an oral examination (or even an OCS examination). With the recent increase in the incidence of OPC in New Zealand (Chelimo and Elwood, 2015), dentists and CDTs should be encouraged to include these regions in their routine examinations in an attempt to detect OPCs (particularly tonsil cancers).

Most practitioners identified erythro-leukoplakia, leukoplakia and erythroplakia as OPMLs. However, only one-third identified OSF as potentially malignant, despite the reported MTR being higher than for leukoplakia (up to the 7.6% reported by Murti et al., 1985). OSF is a condition closely associated with areca nut use, a practice not common among native-born New Zealanders. This means that many dental clinicians may not have seen OSF lesions previously, resulting in a lack of recognition of OSF as an OPML. However, since areca nut is now commonly available in many small stores in New Zealand and is a habit frequently continued by immigrants from parts of the world where its use is common (Yoganathan, 2002), OSF may be encountered by dental clinicians. It is important that clinicians understand this condition's potential for malignant transformation.

The most frequently recorded signs and symptoms of OC and OPC for the CDHB cases were lumps (in the mouth, the neck or the submandibular area), pain, lesions in the mouth or lip, and non-healing ulcers. These matched the survey responses, with most dentists and CDTS identifying ulcers, erythro-leukoplakia, erythroplakia, leukoplakia, pain, and neck lumps as signs or symptoms of mouth cancer. It also compares favourably with a survey of British dentists that found similarly high proportions of respondents identifying ulcers, white patches and red patches, but low responses (less than 10%) for erythroplakia and lymphadenopathy (Carter and Ogden, 2007). The difference in knowledge of the clinicians among the two studies may be, (at least partially) explained by the British survey's utilisation of open questions, rather than the closed items used in this study. The finding does suggest that most New Zealand dentists and CDTs do understand the clinical presentation of mouth cancer and OPMLs.

5.2.4 Detection of oral mucosal lesions

That most practitioners reported routinely checking all patients for oral mucosal lesions is consistent with international findings (Allen and Farah, 2015; Horowitz et al., 2000; Seoane et al., 2006). Likewise, most practitioners reported being 'confident' or 'very confident' in detecting OPMLs. This was consistent with Farrand et al. (2003) who found that most UK dentists had high levels of confidence in their clinical ability to detect oral cancer, but it is in contrast with Macpherson et al. (2003) who reported that only 37.8% of Scottish dentists were either 'confident' or 'very confident' about detecting oral cancer. Suspicious oral lesions had previously been detected by most respondents (88.2%), although it was noteworthy that 10% of those who had been practising for at least 40 years had never detected a suspicious lesion. This proportion is higher than had been expected and differs from the 93.1% of dentists who reported expecting to see a patient with OC in their practising lifetime (Allen and Farah, 2015). It raises the question of whether some of the oldest clinicians routinely undertake OCS examinations, and whether their knowledge of the presentation of OPMLs and early OC enables detection of suspicious oral mucosal lesions. Respondents were asked about whether they felt patients could self-detect oral mucosal lesions as an indication of how reliant they were on symptoms when providing OCS examinations. One-third of respondents felt that patients were able to self-detect oral lesions, although more of the youngest graduates believe so. This is in contrast with just 3.1% of Australian dentists who agreed patients can self-detect oral mucosal pathology (Allen and Farah, 2015), and suggests that New Zealand clinicians may rely more heavily than their Australian counterparts on patient-identified symptoms in the detection of oral lesions.

5.2.5 Oral cancer screening examinations

That most practitioners felt that a visual examination of the oral tissues was integral to an OCS examination is supported by the review of OCS techniques conducted by Walsh et al. (2013). Most respondents also identified that palpation of lymph nodes and the floor of the mouth should be included in an OCS examination. This compares favourably to United States studies, which found that palpation of lymph nodes was performed by only half of dentists during OCS examination (Horowitz et al., 2000; Mahalaha et al., 2009).

Most clinicians reported providing OCS examinations for all patients, however less than half reported there were no barriers to providing OCS examinations. It is unclear whether clinicians felt there were barriers but these were easily overcome, or whether the barriers prevented them from providing OCS examinations for all patients. Also the percentage of

dentists who reported providing OCS examinations to all patients and those who provide them only to high-risk patients sums to more than 100% (526, 106.5%). It is therefore possible that the proportion of dentists who routinely provide OCS examinations for all patients is overestimated in this study.

The types of barriers to performing OCS examinations identified by respondents (such as lack of training, time, confidence, and ability to charge for this service) are similar to those identified in international studies (Macpherson et al., 2003; Laronde et al., 2008; Brocklehurst et al., 2010; Allen and Farah, 2015). The most frequently identified barrier (lack of training) was identified by fewer than one-third of respondents (although by more of the oldest graduates). This compares favourably with international studies in which barriers to routine OCS examinations were identified by at least 40.2% of the dentists surveyed (Macpherson et al., 2003; Allen and Farah, 2015). This suggests that New Zealand clinicians may be more inclined to routinely undertake OCS examinations than other dentists.

Most respondents supported OCS examinations being performed by general dentists, OMFSs, oral medicine specialists, ENT surgeons, dental hygienists, GMPs and CDTs. However, the fact that only two-thirds of respondents suggested GMPs should provide OCS examinations is noteworthy because most of the study cases of OC and OPC were detected by GMPs. Most Australian dentists (90.9%) also reported that oral mucosal screening is appropriately performed by dentists, but fewer than half (48.2%) felt that doctors could fulfil this role (Allen and Farah, 2015). GMPs are less likely to examine the oral mucosa of patients and are less confident in doing so than their dental colleagues (Carter and Ogden, 2007). Perhaps dentists and CDTs recognise this lack of confidence in their medical colleagues, and so fewer dental clinicians support OCS being performed by GMPs. One-third of CDTs did not support CDTs performing OCS examinations, but whether they routinely suggest patients have this service performed by another practitioner was not explored. It is concerning that a substantial proportion of CDTs do not recognise that OCS examinations are an important part of their role, particularly since they are more likely to treat older patients and edentulous patients who may be unlikely to visit the dentist. Few respondents identified pharmacists for this role, but some studies have found that a substantial number of patients subsequently diagnosed with OC have self-treated with pharmacy-bought medication before diagnosis (Grant et al., 2010; Varea-Centelles et al., 2012). Accordingly, pharmacists may be an important group to target when developing OC awareness programmes.

5.2.6 Dental clinicians' referral practices for mouth cancer

It is not surprising that most practitioners would usually refer patients with suspicious oral lesions to dental specialists (either directly to OMFSs, oral medicine specialists or to hospital dental departments). The selection of the particular service to refer to is probably dependent on the locally available service mix, and whether the patient is a private or public referral. Few regions in New Zealand have oral medicine specialists, and, where they exist, they are usually part of hospital dental departments. Notably, few practitioners would refer directly to ENT/Head and Neck surgeons, even though the MDTs that manage public OC and OPC services throughout New Zealand are headed by ENT/Head and Neck surgeons. Whether the lack of direct referral of patients by dentists to ENT/Head and Neck specialists could cause treatment delays for OC and OPC patients has not been explored as part of this study.

The service to which the diagnosed OC and OPC cases were referred was associated with the site of the tumour and the referring practitioner (dental or medical), with dentists more commonly referring to dental specialists. Most OCC, OPC and salivary gland tumours were referred to ENT/Head and Neck specialists, while one-third of OCCs were referred to OMFs or hospital dental departments.

Most respondents (83.3%) believed that patients would attend a specialist appointment when referred: this is higher than reported by Australian dentists (61.5% of whom believed patients would attend an appointment; (Allen and Farah, 2015)). Likewise, while most respondents (61.5%) believed that it was the referrer's responsibility to check whether this occurred, it was fewer than among Australian dentists (89.0%). It was surprising that some practitioners (41 dentists and 4 CDTs) believed the onus of ensuring patients attended a specialist appointment rested with the service referred to, since there would be occasions when services (for whatever reason) may not receive the referral, making it impossible to ensure that it is acted upon. It is possible that over-confidence in patients' attendance at specialist appointments and clinicians not following up on patient referrals may lead to delays in diagnosis for some patients.

5.3 Patterns of dental attendance for the CBHD cases

Data collected from the hospital dental and medical records from the OC and OPC cases (identified from the NZCR) diagnosed and/or treated within the CDHB were analysed to assess whether tumour extent at diagnosis was associated with regular dental attendance, as has been reported in international studies. The study findings will be discussed in the

following sections: tumour stage at diagnosis, regular dental attendance, dental status of diagnosed cancer patients and patterns of co-morbidities.

In accordance with Holmes et al. (2003), the study found that a higher proportion of the tumours found incidentally than those detected due to an identified sign or symptom were localised stage tumours. However, no consistent gradient was apparent for tumour extent by the duration of signs or symptoms, and a higher proportion of tumours with regional or distant spread had either the shortest (one month or less) or the longest sign or symptom duration recorded. This is in contrast with the findings of Brouha et al. (2005), but in accordance with other studies that have reported the duration of diagnostic delay to not be consistently associated with stage of disease at diagnosis (Goy et al., 2009; Kaing et al., 2016; Scott et al., 2004). This finding is difficult to fully explain as it may reflect variability in tumour aggressiveness (with some oral cancers known to arise without an OPML) or it may reflect errors in the measurement of the pre-diagnosis sign/symptom duration (such as recall bias), which have resulted in an underestimation of the duration of the signs and symptoms. However, the finding that duration of diagnostic delay is not consistently related to stage at diagnosis may also suggest that lesions may be present for a period of time without patients being aware of them, which supports the view of many respondents that patients are unable to reliably self-detect oral mucosal pathology. A prospective study of newly diagnosed OC and OPC cases that interviews patients and reviews primary care health records, may help to clarify the relationship between duration of sign/symptom duration and stage at diagnosis in New Zealand.

More males than females were recorded as having a regular dentist, although the differences were not statistically significant. This is in contrast with the most recent NZ Oral Health Survey (Ministry of Health, 2010) and may reflect the lack of dental history data found in the study. Also, edentulism rates by sex, were not explored in this study and, it is possible that more female cases were edentulous (due to the higher median age of females at diagnosis than males), which could result in fewer of them having a regular dentist. Other factors associated with having a regular dentist included: being non-Māori (although not statistically significant), a non-smoker, or not a CSC holder. Poorer access to dental care for Māori and those of high deprivation is consistent with the findings of the NZ Oral Health Survey (Ministry of Health, 2010). However, the study did not find any association between tumour extent and dental attendance and so it is not possible to conclude that poorer access to dental care for these groups resulted in more advanced tumours (leading to a poorer prognosis). The proportion of males and retired people who had a regular dentist suggests that there are

opportunities for dentists to detect OPMLs and early cancerous lesions in these high-risk groups.

Only half of those retired were dentate before their cancer therapy, whereas most of the working and CSC holders were dentate. Most of the CSC holders and over half of the working group required dental extractions as part of their cancer therapy, whereas fewer than one-quarter of those retired did so, probably reflecting a higher prevalence of edentulism in older people.

The high prevalence of medical co-morbidities among the diagnosed OC and OPC CHDB cases is not surprising, since the risk factors and risk markers for OC and OPC are similar to the proven risk factors for other diseases (such as tobacco use, heavy alcohol use, and older age). In accordance with the findings of das Neves et al. (2015), the current study found smokers to be more likely to have a tumour of regional or distant spread than non-smokers. This adds weight to the argument for the opportunistic screening of smokers for mouth cancer when they present for primary healthcare, as well as for engaging in health promotion with tobacco smokers to ensure they do not delay in seeking care if they experience symptoms of oral mucosal pathology. The prevalence of co-morbidities may also prompt more patients to seek treatment for their OCs or OPCs in a medical setting, since they may be already attending their GMPs for treatment of other conditions. It is noteworthy that more than one-fifth of cases had previously been diagnosed with head or neck cancer (most of which were SCCs). This is in agreement with the findings from international studies (Atienza and Dasanu, 2012; Jégu et al., 2015), and reinforces the need for long-term follow-up care for those diagnosed with these tumours to check for both the recurrence of tumours and the development of new primary tumours.

5.4 Study implications

Exploring the mouth cancer knowledge, beliefs and practices of current primary healthcare practitioners is essential to identifying knowledge gaps and thereby developing educational strategies that will improve both clinicians' knowledge and patient outcomes (Decuseara et al., 2011). The present study suggests that, while many clinicians are knowledgeable about many aspects of OC and OPC, differences exist among dental clinicians; this suggests that some are more able to detect OPMLs and early OCs than others. There was some evidence that a longer time from graduation, the type of clinician and the graduation country influences some beliefs and practices about OC and OPC. The causes of the recorded variations in OC and OPC beliefs and practices between different clinician groups have not been explored as

part of this study. The role of factors such as variations in undergraduate curriculum (between year groups and between countries), variations in the patterns of OC and OPC across countries, participation in previous OC professional development activities and exposure to previous public health mouth cancer awareness campaigns, were not explored as part of this study. Therefore, further studies─focusing on recognition of OPMLs and early malignant lesions, OCS practices, participation in continuing education activities, and the manner in which clinicians engage with patients in mouth cancer prevention─would further inform the development of educational strategies to improve OC and OPC early detection rates and, ultimately, OC and OPC outcomes for patients.

General medical practitioners continue to detect most of the OC and OPC in New Zealand, but their knowledge, beliefs and practices in respect of mouth cancer have yet to be explored. The high prevalence of medical co-morbidities among the diagnosed OC and OPC CHDB cases suggests that opportunities exist for opportunistic screening within a primary care setting (particularly for tobacco users) which may enable detection of early stage tumours. Identification of the factors that may contribute to delays in OC and OPC diagnosis by GMPs is needed to gain a better understanding of the opportunities to improve the detection rate for early malignant lesions, and to reduce disparities in OC and OPC survival. Without an understanding of the role of GMPs in the diagnosis of OC and OPC, it will be difficult to fulfil the MoH vision for 'better, faster cancer care' as outlined in the *New Zealand Cancer Plan 2015−2018*.

A lack of data on the dental history of diagnosed OC and OPC cases constrains the possibility of the current study finding associations between attendance at a dentist for regular routine care and the extent of tumours diagnosed. A prospective study of diagnosed OC and OPC cases which collects specific data on dental visiting patterns may enable exploration of whether differential access to dental care (and pre-diagnosis signs and symptoms duration) impacts on stage of diagnosis for OC and OPC in New Zealand. Exploring factors which may impact on the stage of diagnosis of tumours was also restricted by incomplete NZCR data records. Efforts to improve the completeness of the NZCR data may enable better exploration of associations between tumour stage at diagnosis and other factors.

Furthermore, exploration of the general public's knowledge about mouth cancer (including risk factors for and clinical presentation of mouth cancer) is an important area that has yet to be explored in New Zealand. As part of the New Zealand Oral Health Survey, individuals aged 18 years or over had an oral examination which included an oral mucosal screening examination (Ministry of Health, 2010). However, participants were not interviewed about

their knowledge of mouth cancer. There is an opportunity for future New Zealand Oral Health surveys to interview participants about their knowledge of mouth cancer. Findings could then be used to inform future public health campaigns aimed at reducing the rates of OC and OPC, as well as in reducing patient-associated delays in diagnosis.

6 Conclusion

NZCR records from 2012–2013 suggest that the incidence of OC and OPC in New Zealand continues to increase and the distinct incidence patterns by gender, age, ethnicity and anatomical site reported in previous New Zealand studies remain. The current study found that males continue to be more commonly affected by OC and OPC, and higher age-specific rates persist in older age groups. Most cases were NZ Europeans and the most common anatomical sites for tumours were the tongue (for OC) and the tonsils (for OPC).

Dental clinicians were knowledgeable about many aspects of OC and OPC including: the demographic characteristics of those most commonly affected; the risk factors for mouth cancer, and the signs, symptoms and clinical presentation of mouth cancer. However, differences in knowledge exist among dental clinicians, with some dentists and CDTs more able than others to detect OPMLs and early oral cancers. There was some evidence that a longer time from graduation, the clinician type and the graduation country may influence knowledge, beliefs and practices about OC and OPC. However, further studies are required to gain a better understanding of the deficiencies in dentists' and CDTs' knowledge of OC and OPC. These could inform the development of educational strategies to improve early detection rates (and ultimately OC and OPC outcomes) for patients in New Zealand.

Most clinicians reported undertaking OCS examinations for all patients, however one-third identified barriers to doing so. It was noteworthy that a substantial proportion of CDTs do not recognise undertaking OCS examinations as an important part of their role, and most clinicians did not recognise the tonsils as a common site for mouth cancer. Therefore, it is likely that a proportion of dentists and CDTs do not provide routine OCS examinations, or may not thoroughly examine at all risk-sites to enable early detection of OC and OPC. It is suggested that a nationwide OCS educational programme be developed and implemented throughout New Zealand to improve the knowledge of primary oral healthcare clinicians to enable further opportunities for early-stage OC and OPC diagnosis.

General medical practitioners continue to detect most of the OC and OPC in New Zealand, but little is known about their knowledge, beliefs and practices concerning OC and OPC.

Identification of the factors that may contribute to delays in OC and OPC diagnosis by GMPs is needed to gain a better understanding of the opportunities to improve the detection rate of early malignant lesions, and to reduce disparities in OC and OPC survival.

Non-smokers and those of higher SES were more likely to be routine users of dental care than others, and so detection rates of early oral cancers by dental clinicians may be limited by the fact that the groups most at risk of OC may not receive regular dental care. However, there is a lack of data on the dental history of diagnosed OC and OPC cases, and so whether differential access to dental care impacts on the stage of diagnosis for OC and OPC in New Zealand could not be explored in this study. A prospective study of newly diagnosed OC and OPC cases in New Zealand may clarify the association between regular dental attendance and stage of diagnosis.

Furthermore, opportunities to explore the general public's knowledge about mouth cancer (including risk factors for and clinical presentation of mouth cancer) should be sought. Findings could then be used to inform future public health campaigns aimed at reducing the rates of OC and OPC, as well as in reducing patient-associated delays in diagnosis.

References

Abendstein, H., Nordgren, M., Boysen, M., Jannert, M., Silander, E., Ahlner- Elmqvist, M., . . . Bjordal, K. (2005). Quality of life and head and neck cancer: a 5 year prospective study. *The Laryngoscope,* 115(12), 2183-2192.

Alameri, S. S., Aarts, J. M., Smith, M., & Waddell, J. N. (2014). Dental technology services and industry trends in New Zealand from 2010 to 2012. *New Zealand Dental Journal*, 110(2), 65-73.

Aldington, S., Harwood, M., Cox, B., Weatherall, M., Beckert, L., Hansell, A., . . . Respiratory Disease Research, G. (2008). Cannabis use and cancer of the head and neck: case-control study. *Otolaryngology Head and Neck Surgery,* 138(3), 374-380. doi:10.1016/j.otohns.2007.12.002.

Alho, O.-P., Teppo, H., Mäntyselkä, P., & Kantola, S. (2006). Head and neck cancer in primary care: presenting symptoms and the effect of delayed diagnosis of cancer cases. *Canadian Medical Association Journal,* 174(6), 779-784.

Allen, K., & Farah, C. (2015). Screening and referral of oral mucosal pathology: a check- up of Australian dentists. *Australian Dental Journal,* 60(1), 52-58.

Allison, P., Franco, E., Black, M., & Feine, J. (1998). The role of professional diagnostic delays in the prognosis of upper aerodigestive tract carcinoma. *Oral Oncology,* 34(2), 147-153.

Alnuaimi, A. D., Wiesenfeld, D., O'Brien-Simpson, N. M., Reynolds, E. C., & McCullough, M. J. (2015). Oral Candida colonization in oral cancer patients and its relationship with traditional risk factors of oral cancer: a matched case-control study. *Oral Oncology,* 51(2), 139-145.

Al-Zaher, N., Obeid, A., Al-Salam, S., Al-Kayyali, B.S. (2009) Acinic cell carcinoma of the salivary glands: a literature review. *Hematology Oncology and Stem Cell Therapy,* 2(1), 259-64.

Andersen, A. S., Koldjaer Solling, A. S., Ovesen, T., & Rusan, M. (2014). The interplay between HPV and host immunity in head and neck squamous cell carcinoma. *International Journal of Cancer*, 134(12), 2755-2763. doi:10.1002/ijc.28411.

Atienza J.A.S. & and Dasanu C.A. (2012). Incidence of second primary malignancies in patients with treated head and neck cancer: a comprehensive review of literature. *Current Medical Research And Opinion*, 28(12). doi.org/10.1185/03007995.2012.746218.

Awojobi, O., Scott, S. E., & Newton, T. (2012). Patients' perceptions of oral cancer screening in dental practice: a cross-sectional study. *BMC Oral Health*, 12(1), 1.

Bagnardi, V., Rota, M., Botteri, E., Tramacere, I., Islami, F., Fedirko, V., . . . Pasquali, E. (2015). Alcohol consumption and site-specific cancer risk: a comprehensive dose–response meta-analysis. *British Journal of Cancer*, 112(3), 580-593.

Balaram, P., Sridhar, H., Rajkumar, T., Vaccarella, S., Herrero, R., Nandakumar, A., . . . Gajalakshmi, V. (2002). Oral cancer in southern India: The influence of smoking, drinking, paan- chewing and oral hygiene. *International Journal of Cancer*, 98(3), 440-445.

Barnes, L., Everson,J.W., Reichart, P., Sidransky (Eds). (2005). *World Health Organization Classification of Tumours. Pathology and Genetics of Head and Neck Tumours*. Lyon, France: IARC.

Baughan, P., O'Neill, B., & Fletcher, E. (2009). Auditing the diagnosis of cancer in primary care: the experience in Scotland. *British Journal of Cancer*, 101, S87-S91.

Beck, J. D. (1998). Risk revisited. *Community Dentistry and Oral Epidemiology*, 26(4), 220-225.

Beral, V., Peterman, T. A., Berkelman, R., & Jaffe, H. (1990). Kaposi's sarcoma among persons with AIDS: a sexually transmitted infection? *Lancet*, 335(8682), 123-128.

Bodner, L., Manor, E., Friger, M. D., & van der Waal, I. (2014). Oral squamous cell carcinoma in patients twenty years of age or younger–Review and analysis of 186 reported cases. *Oral Oncology*, 50(2), 84-89.

Boffetta, P., & Hashibe, M. (2006). Alcohol and cancer. *Lancet Oncology*, 7(2), 149-156.

Boyle, P., Macfarlane, G., Maisonneuve, P., Zheng, T., Scully, C., & Tedesco, B. (1990). Epidemiology of mouth cancer in 1989: a review. *Journal of the Royal Society of Medicine*, 83(11), 724-730.

Brocklehurst, P. R., Baker, S. R., & Speight, P. M. (2010). Oral cancer screening: what have we learnt and what is there still to achieve? *Future Oncology,* 6(2), 299-304. doi:10.2217/fon.09.163.

Brocklehurst, P., Kujan, O., O'Malley, L. A., Ogden, G., Shepherd, S., & Glenny, A. M. (2013). Screening programmes for the early detection and prevention of oral cancer. *The Cochrane Library*.

Brotherton, J. M. L., Stein, A. N., Conway, E. L., Regan, D. G., Grulich, A., Law, M., & Hocking, J. S. (2012). Human papillomavirus and head and neck cancers: emerging trends and improving survival. *Australian and New Zealand Journal of Public Health*, 36(2), 195-196. doi:10.1111/j.1753-6405.2012.00860.

Brouha, X. D. R., Tromp, D. M., Hordijk, G.-J., Winnubst, J. A. M., & de Leeuw, J. R. J. (2005). Oral and pharyngeal cancer: Analysis of patient delay at different tumor stages. *Head and Neck, 27*(11), 939-945. doi:10.1002/hed.20270.

Campisi G, & Margiotta V. (2001) Oral mucosa lesions and risk habits among men in an Italian study population. *Journal of Oral Pathology and Medicine,* 30(1),22-28. DOI:10.1034/j.1600-0714.2001.300104.

Cancer Registry Regulations, New Zealand Statutes. (1994). Retrieved November 22, 2015 from http://www.legislation.govt.nz/regulation/public/1994/0089/latest/whole.html#DLM190123

Carter, L. M., & Ogden, G. R. (2007). Oral cancer awareness of general medical and general dental practitioners. *British Dental Journal*, 203(5), E10-E10.

Carvalho, A. L., Nishimoto, I. N., Califano, J. A., & Kowalski, L. P. (2005). Trends in incidence and prognosis for head and neck cancer in the United States: A site-specific analysis of the SEER database. *International Journal of Cancer*, 114(5), 806-816. doi:10.1002/ijc.20740.

Castellsagué, X., Quintana, M. J., Martinez, M. C., Nieto, A., Sanchez, M. J., Juan, A., . . . Bosch, F. X. (2004). The role of type of tobacco and type of alcoholic beverage in oral carcinogenesis. *International Journal of Cancer*, 108(5), 741-749. doi:10.1002/ijc.11627.

Cavell, S., Broadbent, E., Donkin, L., Gear, K., & Morton, R. P. (2016). Observations of benefit finding in head and neck cancer patients. *European Archives of Otorhinolaryngology*, 273(2), 479-485. doi:10.1007/s00405-015-3527-7.

Centres for Disease Control and Prevention. (2016). *Human Papillomavirus (HPV) Infection*. Retrieved June 6, 2016 from http://www.cdc.gov/std/tg2015/hpv.htm.

Chan, K. K., Glenny, A. M., Weldon, J. C., Furness, S., Worthington, H. V., & Wakeford, H. (2015). Interventions for the treatment of oral and oropharyngeal cancers: targeted therapy and immunotherapy. *The Cochrane Library*.

Chaturvedi, A. K., Anderson, W. F., Lortet-Tieulent, J., Curado, M. P., Ferlay, J., Franceschi, S., . . . Gillison, M. L. (2013). Worldwide trends in incidence rates for oral cavity and oropharyngeal cancers. *Journal of Clinical Oncology*, 31(36), 4550-4559.

Chaturvedi, A. K., Engels, E. A., Pfeiffer, R. M., Hernandez, B. Y., Xiao, W., Kim, E., . . . Cozen, W. (2011). Human papillomavirus and rising oropharyngeal cancer incidence in the United States. *Journal of Clinical Oncology*, 29(32), 4294-4301.

Chelimo, C., & Elwood, J. M. (2015). Sociodemographic differences in the incidence of oropharyngeal and oral cavity squamous cell cancers in New Zealand. *Australian and New Zealand Journal of Public Health*, 39(2), 162-167. doi:10.1111/1753-6405.12352.

Chen, Z., King, W., Pearcey, R., Kerba, M., & Mackillop, W. J. (2008). The relationship between waiting time for radiotherapy and clinical outcomes: a systematic review of the literature. *Radiotherapy and Oncology*, 87(1), 3-16.

Chenevert, J., & Chiosea, S. (2012). Incidence of human papillomavirus in oropharyngeal squamous cell carcinomas: now and 50 years ago. *Human Pathology,* 43(1), 17-22.

Chuang, S. C., Jenab, M., Heck, J. E., Bosetti, C., Talamini, R., Matsuo, K., . . . Winn, D. M. (2012). Diet and the risk of head and neck cancer: a pooled analysis in the INHANCE consortium. *Cancer Causes and Control,* 23(1), 69-88.

Conway, D. I., Petticrew, M., Marlborough, H., Berthiller, J., Hashibe, M., & Macpherson, L. M. D. (2008). Socioeconomic inequalities and oral cancer risk: A systematic review and meta-analysis of case-control studies. *International Journal of Cancer,* 122(12), 2811-2819. doi:10.1002/ijc.23430.

Cox, B., Taylor, K., & Treasure, E. (1995). Trends in oral cancer by subsite in New Zealand. *European Journal of Cancer Part B: Oral Oncology*, 31(2), 113-117.

Crossman, T., Warburton, F., Richards, M. A., Smith, H., Ramirez, A., & Forbes, L. J. (2016). Role of general practice in the diagnosis of oral cancer. *British Journal of Oral and Maxillofacial Surgery*, 54(2), 208-212. doi:10.1016/j.bjoms.2015.11.003.

D'Souza, G., Kreimer, A. R., Viscidi, R., Pawlita, M., Fakhry, C., Koch, W. M., . . . Gillison, M. L. (2007). Case–control study of human papillomavirus and oropharyngeal cancer. *New England Journal of Medicine,* 356(19), 1944-1956.

Daley, E., DeBate, R., Dodd, V., Dyer, K., Fuhrmann, H., Helmy, H., & Smith, S. A. (2011). Exploring awareness, attitudes, and perceived role among oral health providers regarding HPV- related oral cancers. *Journal of Public Health Dentistry,* 71(2), 136-142.

Dallongeville, J., Marécaux, N., Fruchart, J.-C., & Amouyel, P. (1998). Cigarette smoking is associated with unhealthy patterns of nutrient intake: a meta-analysis. *The Journal of Nutrition*, 128(9), 1450-1457.

das Neves, J. C., Toledano, L. S., Silveira, F. M. M., & de Góes, P. S. A. (2015). Factors Associated with Late Diagnosis of Oral Cancer. *International Journal of Clinical Medicine*, 6(2): 105-111.

da Silva, F.D., Daniel, F.I., Grando, L.J., Calvo, M.C., da Silva Rath, I.B. and Fabro, S.M.L. (2006) Estudo da prevalência de alterações labiais em pescadores da ilha de Santa Catarina; Prevalence of lipspathologies in fishermen of Santa Catarina Island. *Revista Odonto Ciência (Journal of Dental Science)*, 21(5), 37-42.

Day, G. L., Blot, W. J., Shore, R. E., McLauglin, J. K., Austin, D. F., Greenberg, R. S., . . . Schoenberg, J. B. (1994). Second cancers following oral and pharyngeal cancers: role of tobacco and alcohol. *Journal of the National Cancer Institute*, 86(2), 131-137.

Decuseara, G., MacCarthy, D., & Menezes, G. (2011). Oral cancer: knowledge, practices and opinions of dentists in Ireland. *Journal of the Irish Dental Association*, 57(4):209-214.

de Souza Lucena, E., Costa, D., da Silveira, E. & Lima, K. (2012). Prevalence and factors associated to actinic cheilitis in beach workers. *Oral Diseases*, 18: 575–579. doi:10.1111/j.1601-0825.2012.01910.

Dikshit, R. P., Boffetta, P., Bouchardy, C., Merletti, F., Crosignani, P., Cuchi, T., . . . & Brennan, P. (2005). Risk factors for the development of second primary tumors among men after laryngeal and hypopharyngeal carcinoma. *Cancer*, 103(11), 2326-2333.

Dimitroulis, G., Reade, P., & Wiesenfeld, D. (1992). Referral patterns of patients with oral squamous cell carcinoma, Australia. *European Journal of Cancer Part B: Oral Oncology*, 28(1), 23-27.

Edge, S. B., & Compton, C. C. (2010). The American Joint Committee on Cancer: the 7th edition of the AJCC cancer staging manual and the future of TNM. *Annals of Surgical Oncology*, 17(6), 1471-1474.

Elango, K. J., Anandkrishnan, N., Suresh, A., Iyer, S. K., Ramaiyer, S. K., & Kuriakose, M. A. (2011). Mouth self-examination to improve oral cancer awareness and early detection in a high-risk population. *Oral Oncology*, 47(7), 620-624. doi:10.1016/j.oraloncology.2011.05.001

Elwood, J. M., Youlden, D. R., Chelimo, C., Ioannides, S. J., & Baade, P. D. (2014). Comparison of oropharyngeal and oral cavity squamous cell cancer incidence and trends in New Zealand and Queensland, Australia. *Cancer Epidemiol*, 38(1), 16-21. doi:10.1016/j.canep.2013.12.004

Fakhry, C., & D'Souza, G. (2013). Discussing the diagnosis of HPV-OSCC: common questions and answers. *Oral Oncology*, *49*(9), 863-871. doi:10.1016/j.oraloncology.2013.06.002

Farah CS, Simanovic B, Dost F. (2014). Oral cancer in Australia 1982-2008: a growing need for opportunistic screening and prevention. *Australian Dental Journal*, *59*(3):349-59. doi: 10.1111/adj.12198.

Farrand, P., Clover, H., & Hutchison, I. L. (2003). GDPs' Self-perceived Confidence and Anxiety in Their Clinical and Communication Skills Used When Screening for Oral Cancer: UK Variations. *Primary Dental Care*, 10(3), 81-86.

Feller, L., Altini, M., & Slabbert, H. (1991). Pre-malignant lesions of the oral mucosa in a South African sample--a clinicopathological study. *The Journal of the Dental Association of South Africa= Die Tydskrif van die Tandheelkundige Vereniging van Suid-Afrika*, 46(5), 261-265.

Feller, L., Altini, M., Khammissa, R., Chandran, R., Bouckaert, M., & Lemmer, J. (2013). Oral mucosal immunity. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, 116(5), 576-583.

Feller, L., & Lemmer, J. (2012). Oral leukoplakia as it relates to HPV infection: a review. *International Journal of Dentistry*, Article ID 540561, 7. doi:10.1155/2012/540561.

Feller, L., Wood, N. H., Khammissa, R. A., & Lemmer, J. (2010). Human papillomavirus-mediated carcinogenesis and HPV-associated oral and oropharyngeal squamous cell carcinoma. Part 2: Human papillomavirus associated oral and oropharyngeal squamous cell carcinoma. *Head and Face Medicine,* 6(1), 1.

Ferlay, J., Soerjomataram, I., Dikshit, R., Eser, S., Mathers, C., Rebelo, M., . . . Bray, F. (2015). Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. *Interantional Journal of Cancer,* 136(5), E359-E386.

Flaitz, C. M., Nichols, C. M., Adler-Storthz, K., & Hicks, M. J. (1995). Intraoral squamous cell carcinoma in human immunodeficiency virus infection: a clinicopathologic study. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology,* 80(1), 55-62.

Ford, P. J., & Farah, C. S. (2013). Early detection and diagnosis of oral cancer: Strategies for improvement. *Journal of Cancer Policy,* 1(1–2), e2-e7. doi:10.1016/j.jcpo.2013.04.002.

Friedlander, L., McElroy, K., Daniel, B., Cullinan, M., & Hanlin, S. (2015). Direct pulp capping of permanent teeth in New Zealand general dental practice: A practice based research study. *New Zealand Dental Journal*, 111(2), 58-64.

Friedrich, R. E. (2010). Delay in diagnosis and referral patterns of 646 patients with oral and maxillofacial cancer: a report from a single institution in Hamburg, Germany. *Anticancer Research,* 30(5), 1833-1836.

Frisch, M., Biggar, R. J., Engels, E. A., Goedert, J. J., & AIDS-Cancer Match Registry Study Group. (2001). Association of cancer with AIDS-related immunosuppression in adults. *Journal of the American Medical Association,* 285(13), 1736-1745. doi:10.1001/jama.285.13.1736.

Frydrych, A., & Slack-Smith, L. (2011). Dental attendance of oral and oropharyngeal cancer patients in a public hospital in Western Australia. *Australian Dental Journal,* 56(3), 278-283.

Funk, G. F., Karnell, L. H., & Christensen, A. J. (2012). Long-term health-related quality of life in survivors of head and neck cancer. *Archives of Otolaryngology–Head and Neck Surgery*, 138(2), 123-133.

Garnaes, E., Kiss, K., Andersen, L., Therkildsen, M. H., Franzmann, M. B., Filtenborg-Barnkob, B., . . . Lajer, C. B. (2015). A high and increasing HPV prevalence in tonsillar cancers in Eastern Denmark, 2000–2010: The largest registry-based study to date. *International Journal of Cancer,* 136(9), 2196-2203.

Gavidi, R. O., Cox, B., King, T., & Rich, A. M. (2014). Comparing the occurrence of oral squamous cell carcinoma in New Zealand and the Fiji Islands from 2000-2010. *International Journal of Cancer Research,* 48(1), 1212-1225.

Gillison, M., & Lowy, D. (2004). A causal role for human papillomavirus in head and neck cancer. *Lancet,* 363(9420), 1488-1489.

Gillison, M. L. (2007). Current topics in the epidemiology of oral cavity and oropharyngeal cancers. *Head & Neck,* 29(8), 779-792.

Gillison, M. L., Broutian, T., Pickard, R. K., Tong, Z.-y., Xiao, W., Kahle, L., . . . Chaturvedi, A. K. (2012). Prevalence of oral HPV infection in the United States, 2009-2010. *Journal of the American Medical Association,* 307(7), 693-703.

Goldstein, D. P., Hynds Karnell, L., Christensen, A. J., & Funk, G. F. (2007). Health-related quality of life profiles based on survivorship status for head and neck cancer patients. *Head and Neck,* 29(3), 221-229. doi:10.1002/hed.20507.

Gómez, I., Warnakulasuriya, S., Varela-Centelles, P. I., López-Jornet, P., Suárez-Cunqueiro, M., Diz-Dios, P., & Seoane, J. (2010). Is early diagnosis of oral cancer a feasible objective? Who is to blame for diagnostic delay? *Oral Diseases,* 16(4), 333-342. doi:10.1111/j.1601-0825.2009.01642.x.

Goodwin, W. J., Thomas, G. R., Parker, D. F., Joseph, D., Levis, S., Franzmann, E., . . . Hu, J. J. (2008). Unequal burden of head and neck cancer in the United States. *Head and Neck,* 30(3), 358-371. doi:10.1002/hed.20710.

Goy, J., Hall, S. F., Feldman- Stewart, D., & Groome, P. A. (2009). Diagnostic delay and disease stage in head and neck cancer: a systematic review. *Laryngoscope*, 119(5), 889-898.

Grant, S. M., Dawson, S. K., & Thomson, W. M. (2013). New Zealand dentists' views on community water fluoridation. *New Zealand Dental Journal*, 109(2), 69-73.

Grant, E., Silver, K., Bauld, L., Day, R., & Warnakulasuriya, S. (2010). The experiences of young oral cancer patients in Scotland: symptom recognition and delays in seeking professional help. *British Dental Journal*, 208(10), 465-471. doi:10.1038/sj.bdj.2010.450.

Groome, P. A., Rohland, S. L., Hall, S. F., Irish, J., Mackillop, W. J., & O'Sullivan, B. (2011). A population-based study of factors associated with early versus late stage oral cavity cancer diagnoses. *Oral Oncology*, 47(7), 642-647.

Güneri, P., & Epstein, J. B. (2014). Late stage diagnosis of oral cancer: Components and possible solutions. *Oral Oncology*, 50(12), 1131-1136. doi:10.1016/j.oraloncology.2014.09.005.

Gupta, P. C., Mehta, F. S., Daftary, D. K., Pindborg, J. J., Bhonsle, R. B., Jalnawalla, P. N., ... & Shah, H. T. (1980). Incidence rates of oral cancer and natural history of oral precancerous lesions in a 10- year follow- up study of Indian villagers. *Community Dentistry and Oral Epidemiology*, 8(6), 287-333.

Gupta, P.C., Murti, P.R., Bhonsle, R.B., Mehta, F.S., Pindborg, J.J. (1995). 'Effect of cessation of tobacco use on the incidence of oral mucosal lesions in a 10 year follow-up study of 12, 212 individuals users'. *Oral Diseases*, 1, 54-58.

Gupta, P., & Warnakulasuriya, S. (2002). Global epidemiology of areca nut usage. *Addiction Biology*, 7(1), 77-83.

Hakama, M., Coleman, M. P., Alexe, D. M., & Auvinen, A. (2008). Cancer screening: evidence and practice in Europe 2008. *European Journal of Cancer*, 44(10), 1404-1413.

Hankey, B.F., Feuer, E.J., Clegg, L.X., Hayes, R.B., Legler, J.M., Prorok, P.C., Ries, L.A., Merrill, R.M. and Kaplan, R.S., 1999. Cancer surveillance series: interpreting trends in prostate cancer—part I: evidence of the effects of screening in recent prostate cancer incidence, mortality, and survival rates. *Journal of the National Cancer Institute*, 91(12), pp.1017-1024.

Hashibe, M., Brennan, P., Benhamou, S., Castellsague, X., Chen, C., Curado, M. P., . . . Boffetta, P. (2007). Alcohol Drinking in Never Users of Tobacco, Cigarette Smoking in Never Drinkers, and the Risk of Head and Neck Cancer: Pooled Analysis in the International Head and Neck Cancer Epidemiology Consortium. *Journal of the National Cancer Institute,* 99(10), 777-789. doi:10.1093/jnci/djk179.

Hashibe, M., Brennan, P., Chuang, S. C., Boccia, S., Castellsague, X., Chen, C., . . . Boffetta, P. (2009). Interaction between tobacco and alcohol use and the risk of head and neck cancer: pooled analysis in the International Head and Neck Cancer Epidemiology Consortium. *Cancer Epidemiology Biomarkers Prevention,* 18(2), 541-550. doi:10.1158/1055-9965.epi-08-0347.

Hashibe, M., Jacob, B., Thomas, G., Ramadas, K., Mathew, B., Sankaranarayanan, R., & Zhang, Z. (2003). Socioeconomic status, lifestyle factors and oral premalignant lesions. *Oral Oncology,* 39(7), 664-671.

Haughney, M., Devennie, J., Macpherson, L., & Mason, D. (1998). Integration of primary care dental and medical services: a three-year study. *British Dental Journal,* 184(7), 343-347.

Hayes, R. B., Bravo-Otero, E., Kleinman, D. V., Brown, L. M., Fraumeni, J. F., Jr., Harty, L. C., & Winn, D. M. (1999). Tobacco and alcohol use and oral cancer in Puerto Rico. *Cancer Causes Control,* 10(1), 27-33.

Hicks, M. J., Flaitz, C. M., Nichols, C. M., Luna, M. A., & Gresik, M. V. (1993). Intraoral presentation of anaplastic large-cell Ki-1 lymphoma in association with HIV infection. *Oral surgery, Oral medicine, Oral pathology,* 76(1), 73-81.

Hirshberg, A., & Buchner, A. (1995). Metastatic tumours to the oral region. An overview. *European Journal of Cancer B Oral Oncology,* 31b(6), 355-360.

Hirshberg, A., Shnaiderman-Shapiro, A., Kaplan, I., & Berger, R. (2008). Metastatic tumours to the oral cavity–pathogenesis and analysis of 673 cases. *Oral Oncology*, 44(8), 743-752.

Hogan, L. C., Hall, G. M., Chambers, I. G. (2005). Oral cancer at a Tasmanian tertiary referral clinic, the Royal Hobart Hospital 1996-2002. *Australian Dental Journal*, 50(1), 31-6.

Holmes, J. D., Dierks, E. J., Homer, L. D., & Potter, B. E. (2003). Is detection of oral and oropharyngeal squamous cancer by a dental health care provider associated with a lower stage at diagnosis? *Journal Oral and Maxillofacial Surgery*, 61(3), 285-291. doi:10.1053/joms.2003.50056.

Holmstrup P (2009). Can we prevent malignancy by treating premalignant lesions? *Oral Oncology*, 45: 549–550.

Holmstrup, P., Vedtofte, P., Reibel, J., & Stoltze, K. (2007). Oral premalignant lesions: is a biopsy reliable? *Journal of Oral Pathology and Medicine*, 36: 262–266.

Hong, A. M., Grulich, A. E., Jones, D., Lee, C. S., Garland, S. M., Dobbins, T. A., . . . O'Brien, C. J. (2010). Squamous cell carcinoma of the oropharynx in Australian males induced by human papillomavirus vaccine targets. *Vaccine*, 28(19), 3269-3272.

Horowitz, A., Drury, T., & Canto, M. (2000). Dental Practice: Practices of Maryland dentists: oral cancer prevention and early detection- baseline data from 1995. *Oral Diseases*, 6(5), 282-288.

Howie, N. M., Trigkas, T. K., Cruchley, A. T., Wertz, P. W., Squier, C. A., & Williams, D. M. (2001). Short-term exposure to alcohol increases the permeability of human oral mucosa. *Oral diseases*, 7(6), 349-354.

Huang, C. C., Ou, C. Y., Lee, W. T., Hsiao, J. R., Tsai, S. T., & Wang, J. D. (2015). Life expectancy and expected years of life lost to oral cancer in Taiwan: a nation-wide

analysis of 22,024 cases followed for 10 years. *Oral Oncology*, 51(4), 349-354. doi:10.1016/j.oraloncology.2015.01.001.

International Agency for Research on Cancer. (1992). *Solar and Ultraviolet Radiation. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 55*. Lyon, France: IARC.

International Agency for Research on Cancer. (2004a). *Tobacco Smoke and Involuntary Smoking. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 83*. Lyon, France: IARC.

International Agency for Research on Cancer. (2004b) *Betel-quid and Areca-nut Chewing and Some Areca-nut-derived Nitrosamines. Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 85*. Lyon, France: IARC.

International Agency for Research on Cancer. (2007a) *Smokeless Tobacco and Some Tobacco-specific N-Nitrosamines. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 89*. Lyon, France: IARC.

International Agency for Research on Cancer. (2007b). *Human Papilloma Virus IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 90*. Lyon, France: IARC.

International Agency for Research on Cancer. (2010). *Alcohol Consumption and Ethyl Carbamate. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 96*. Lyon, France: IARC.

International Agency for Research on Cancer. (2012a). *Radiation. Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 100D*. Lyon, France: IARC.

International Agency for Research on Cancer. (2012b). *Personal Habits and Indoor Combustions. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 100E*. Lyon, France: IARC.

International Agency for Research on Cancer. (2016). Globocan 2012 Estimated Cancer Incidence, Mortality and Prevalence Worldwide in 2012. Glossary of Terms. Retrieved June 14, 2016 from http://globocan.iarc.fr/Pages/glossary.aspx.

Jacobson, J. J., Epstein, J. B., Eichmiller, F. C., Gibson, T. B., Carls, G. S., Vogtmann, E., . . . Murphy, B. (2012). The cost burden of oral, oral pharyngeal, and salivary gland cancers in three groups: commercial insurance, Medicare, and Medicaid. *Head and Neck Oncology,* 4(1), 1.

Jégu, J., Belot, A., Borel, C., Daubisse-Marliac, L., Trétarre, B., Ganry, O., … Velten, M. (2015). Effect of previous history of cancer on survival of patients with a second cancer of the head and neck. *Oral Oncology,* 51(5), 457-63. doi:10.1016/j.oraloncology.2015.01.010.

Kaing, L., Manchella, S., Love, C., Nastri, A., & Wiesenfeld, D. (2015). Referral Patterns for Oral Squamous Cell Carcinoma in Australia: 20 years progress. *Australian Dental Journal*. doi:10.1111/adj.12314.

Kao, J., Vu, H. L., Genden, E. M., Mocherla, B., Park, E. E., Packer, S., . . . Kostakoglu, L. (2009). The diagnostic and prognostic utility of positron emission tomography/computed tomography-based follow-up after radiotherapy for head and neck cancer. *Cancer*, 115(19), 4586-4594.

Kreimer, A. R., Clifford, G. M., Snijders, P. J., Castellsague, X., Meijer, C. J., Pawlita, M., . . . Franceschi, S. (2005). HPV16 semiquantitative viral load and serologic biomarkers in oral and oropharyngeal squamous cell carcinomas. *International Journal of Cancer*, 115(2), 329-332. doi:10.1002/ijc.20872.

Langton, S., Siau, D., & Bankhead, C. (2016). Two-week rule in head and neck cancer 2000-14: a systematic review. *British Journal of Oral and Maxillofacial Surgery*, 54(2), 120-131.

Laronde, D. M., Bottorff, J. L., Hislop, T. G., Williams, P. M., & Rosin, M. P. (2008). Experiences from the dental office: Initiating oral cancer screening. *Journal of the Canadian Dental Association,* 74(3), 239-241.

Larsson, L.-G., Sandström, A., & Westling, P. (1975). Relationship of Plummer-Vinson disease to cancer of the upper alimentary tract in Sweden. *Cancer Research,* 35(11 Part 2), 3308-3316.

Lee, J. J., Hong, W. K., Hittelman, W. N., Mao, L., Lotan, R., Shin, D. M., . . . Papadimitrakopoulou, V. M. (2000). Predicting cancer development in oral leukoplakia: ten years of translational research. *Clinical Cancer Research,* 6(5), 1702-1710.

Liao, C-T., Lee, L-Y., Huang S-F., Chen, L-H., Kang C-J., Lin, C-Y., Fan K-H., Wang, H-M, Ng, S-H, Yen, T-C. (2011). Outcome Analysis of Patients With Oral Cavity Cancer and Extracapsular Spread in Neck Lymph Nodes. *International Journal of Radiation Oncology Biology Physics*, 81(4), 930-937.

Lim, S. Y., Kim, S. A., Ahn, S. G., Kim, H. K., Kim, S. G., Hwang, H. K., . . . Yoon, J. H. (2006). Metastatic tumours to the jaws and oral soft tissues: a retrospective analysis of 41 Korean patients. *International Journal of Oral and Maxillofacial Surgery,* 35(5), 412-415. doi:10.1016/j.ijom.2005.12.001.

Llewellyn, C. D., Johnson, N. W., & Warnakulasuriya, K. A. (2001). Risk factors for squamous cell carcinoma of the oral cavity in young people — a comprehensive literature review. *Oral Oncology,* 37(5), 401-418. doi:10.1016/S1368-8375(00)00135-4.

Llewellyn, C. D., Johnson, N. W., & Warnakulasuriya, S. (2004). Factors associated with delay in presentation among younger patients with oral cancer. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology,* 97(6), 707-713.

Lyratzopoulos, G., Abel, G., McPhail, S., Neal, R., & Rubin, G. (2013). Measures of promptness of cancer diagnosis in primary care: secondary analysis of national audit data on patients with 18 common and rarer cancers. *British Journal of Cancer,* 108(3), 686-690.

Maden, C., Beckmann, A. M., Thomas, D. B., McKnight, B., Sherman, K. J., Ashley, R. L., . . . Daling, J. R. (1992). Human papillomaviruses, herpes simplex viruses, and the risk of oral cancer in men. *American Journal of Epidemiology,* 135(10), 1093-1102.

Maasland, D. H., van den Brandt, P. A., Kremer, B., Goldbohm, R. A., & Schouten, L. J. (2015). Consumption of vegetables and fruits and risk of subtypes of head–neck cancer in the Netherlands Cohort Study. *International Journal of Cancer,* 136(5), E396-E409.

Macey, R., Walsh, T., Brocklehurst, P., Kerr, A. R., Liu, J. L., Lingen, M. W., . . . Scully, C. (2015). Diagnostic tests for oral cancer and potentially malignant disorders in patients presenting with clinically evident lesions. *The Cochrane Library*.

Macpherson, L., McCann, M., Gibson, J., Binnie, V., & Stephen, K. (2003). The role of primary healthcare professionals in oral cancer prevention and detection. *British Dental Journal,* 195(5), 277-281.

Mahalaha, S. A., Cheruvu, V. K., & Smyth, K. A. (2009). Oral cancer screening: practices, knowledge, and opinions of dentists working in Ohio nursing homes. *Special Care in Dentistry,* 29(6), 237-243.

Manoharan, S., Nagaraja, V. & Eslick, G. D. (2014). Ill-fitting dentures increase the risk of developing oral cancer: A meta-analysis. *Asia-Pacific Journal of Clinical Oncology*, 10, 262.

Marur, S., D'Souza, G., Westra, W. H., & Forastiere, A. A. (2010). HPV-associated head and neck cancer: a virus-related cancer epidemic. *Lancet Oncology,* 11(8), 781-789. doi:10.1016/s1470-2045(10)70017-6.

Mashberg, A., & Feldman, L. J. (1988). Clinical criteria for identifying early oral and oropharyngeal carcinoma: erythroplasia revisited. *The American Journal of Surgery,* 156(4), 273-275.

Maybury, C., Horowitz, A. M., & Goodman, H. S. (2012). Outcomes of oral cancer early detection and prevention statewide model in Maryland. *Journal of Public Health Dentistry,* 72(s1), S34-S38.

McGurk, M., & Scott, S. E. (2010). The reality of identifying early oral cancer in the general dental practice. *British Dental Journal,* 208(8), 347-351.

Mehanna, H. M., & Morton, R. P. (2006). Deterioration in quality-of-life of late (10-year) survivors of head and neck cancer. *Clinical Otolaryngology*, 31(3), 204-211. doi:10.1111/j.1749-4486.2006.01188.x.

Meredith, I., Sarfati, D., Ikeda, T., & Blakely, T. (2012). Cancer in Pacific people in New Zealand. *Cancer Causes Control*, 23(7), 1173-1184. doi:10.1007/s10552-012-9986-x.

Ministry of Health. (2010). The New Zealand Oral Health Survey: Key Findings. Wellington. Ministry of Health.

Ministry of Health. (2013a). Hazardous Drinking in 2011/12: Findings from the New Zealand Health Survey. Wellington: Ministry of Health.

Ministry of Health. (2013b). *New Zealand Cancer Registry - table of available data*. Retrieved February 2, 2016 from http://www.health.govt.nz/nz-health-statistics/national-collections-and-surveys/collections/new-zealand-cancer-registry-nzcr/new-zealand-cancer-registry-table-available-data.

Ministry of Health. (2014). *New Zealand Cancer Plan: Better, faster cancer care 2015–2018*. Wellington: Ministry of Health.

Ministry of Health. (2015). Annual Update of Key Results 2014/15: New Zealand Health Survey. Wellington: Ministry of Health.

Ministry of Health. (2016). *HPV immunisation*. Retrieved September 2, 2016 from http://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/cervical-cancer/hpv-immunisation?gclid=CjwKEAiAjIbBBRCitNvJ1o257WESJADpoUt05RP_EJzxMjq8Yt9glTB_n7Xu6BX1pGBqRPOQIzQWUhoCQRvw_wcB.

Mithani, S., Mydlarz, W., Grumbine, F., Smith, I., & Califano, J. (2007). Molecular genetics of premalignant oral lesions. *Oral Diseases,* 13(2), 126-133.

Mollaoglu, N. (2000). Oral lichen planus: a review. *British Journal of Oral and Maxillofacial Surgery*, 38(4), 370-377.

Monteiro, L. S., Salazar, F., Pacheco, J. J., Martins, M., & Warnakulasuriya, S. (2015). Outcomes of invitational and opportunistic oral cancer screening initiatives in Oporto, Portugal. *Journal of Oral Pathology and Medicine,* 44(2), 145-152. doi:10.1111/jop.12216.

Moore, S. R., Johnson, N. W., Pierce, A. M., & Wilson, D. F. (2000). The epidemiology of mouth cancer: a review of global incidence. *Oral Diseases*, 6(2), 65-74.

Morelatto, R. A., Herrera, M. C., Fernández, E. N., Corball, A. G., & López de Blanc, S. A. (2007). Diagnostic delay of oral squamous cell carcinoma in two diagnosis centers in Córdoba Argentina. *Journal of Oral Pathology and Medicine,* 36(7), 405-408. doi:10.1111/j.1600-0714.2007.00547.x.

Morton, R. P., & Izzard, M. E. (2003). Quality-of-life outcomes in head and neck cancer patients. *World Journal of Surgery,* 27(7), 884-889.

Mücke, T., Mitchell, D. A., Ritschl, L. M., Tannapfel, A., Wolff, K. D., Kesting, M. R. … Kanatas, A. (2005). Influence of tumor volume on survival in patients with oral squamous cell carcinoma. *Journal of Cancer Research and Clinical Oncology*, 141, 1007–1011.

Murray, C. J., & Lopez, A. D. (1996). The incremental effect of age-weighting on YLLs, YLDs, and DALYs: a response. *Bulletin of the World Health Organization,* 74(4), 445.

Murti, P., Bhonsle, R., Gupta, P., Daftary, D., Pindborg, J., & Mehta, F. S. (1995). Etiology of oral submucous fibrosis with special reference to the role of areca nut chewing. *Journal of Oral Pathology and Medicine,* 24(4), 145-152.

Nagao, T., Ikeda, N., Fukano, H., Miyazaki, H., Yano, M., & Warnakulasuriya, S. (2000). Outcome following a population screening programme for oral cancer and precancer in Japan. *Oral Oncology*, 36(4), 340-346.

Nagy, K., Sonkodi, I., Szöke, I., Nagy, E., & Newman, H. (1998). The microflora associated with human oral carcinomas. *Oral Oncology*, 34(4), 304-308.

Napier, S. S., & Speight, P. M. (2008). Natural history of potentially malignant oral lesions and conditions: an overview of the literature. *Journal of Oral Pathology and Medicine*, 37(1), 1-10. doi:10.1111/j.1600-0714.2007.00579.x.

National Head and Neck Cancer Tumour Standards Working Group. (2013). *Standards of Service Provision for Head and Neck Cancer Patients in New Zealand - Provisional. Wellington: Ministry of Health*. Retrieved February 2, 2016 from http://www.health.govt.nz/our-work/diseases-and-conditions/cancer-programme/faster-cancer-treatment-programme/national-tumour-standards.

National Health Committee. (2003). Screening to Improve Health in New Zealand Criteria to assess screening programmes. Wellington: National Health Committee. Retrieved March 14, 2015 from https://www.nsu.govt.nz/system/files/resources/screening_to_improve_health.pdf.

National Institute for Clinical Excellence. (2004). *Guidance on cancer services: improving outcomes in head and neck cancers: the manual*. UK: National Institute for Clinical Excellence.

Neal, R. D. (2009). Do diagnostic delays in cancer matter? *British Journal of Cancer*, 101 Suppl 2, S9-S12. doi:10.1038/sj.bjc.6605384.

Nico MMS, Rivitti EA, & Laurenco SV. (2007). Actinic chelitis: histologic study of the entire vermilion and comparison with previous biopsy. *Journal of Cutaneous Pathology*, 34:309–314.

Nicotera, G., Gnisci, F., Bianco, A., & Angelillo, I. F. (2004). Dental hygienists and oral cancer prevention: knowledge, attitudes and behaviors in Italy. *Oral Oncology*, 40(6), 638-644.

Noonan, B. (2014). Understanding the reasons why patients delay seeking treatment for oral cancer symptoms from a primary health care professional: an integrative literature review. *European Journal of Oncology Nursing*, 18(1), 118-124.

Onizawa, K., Nishihara, K., Yamagata, K., Yusa, H., Yanagawa, T., & Yoshida, H. (2003). Factors associated with diagnostic delay of oral squamous cell carcinoma. *Oral Oncology,* 39(8), 781-788.

Orr, I. M. (1933). Oral cancer in betel nut chewers in travancore. *Lancet*, 222, 575–580.

Osazuwa-Peters, N., Wang, D. D., Namin, A., John, V. M., O'Neill, M., Patel, P. V., & Varvares, M. A. (2015). Sexual behavior, HPV knowledge, and association with head and neck cancer among a high-risk group. *Oral Oncology,* 51(5), 452-456. doi:10.1016/j.oraloncology.2015.01.011.

Oskam, I. M., Verdonck-de Leeuw, I. M., Aaronson, N. K., Witte, B. I., de Bree, R., Doornaert, P., . . . Leemans, C. R. (2013). Prospective evaluation of health-related quality of life in long-term oral and oropharyngeal cancer survivors and the perceived need for supportive care. *Oral Oncology,* 49(5), 443-448.

Pai, S. I. (2013). Adaptive immune resistance in HPV-associated head and neck squamous cell carcinoma. *OncoImmunology, 2*(5), e24065. doi:10.4161/onci.24065.

Park, J., Slack-Smith, L., Smith, A., Frydrych, A., O'Ferrall, I., & Bulsara, M. (2011). Knowledge and perceptions regarding oral and pharyngeal carcinoma among adult dental patients. *Australian Dental Journal,* 56(3), 284-289.

Parker, T. M., Smith, E. M., Ritchie, J. M., Haugen, T. H., Vonka, V., Turek, L. P., & Hamsikova, E. (2006). Head and neck cancer associated with herpes simplex virus 1 and 2 and other risk factors. *Oral Oncology*, 42(3), 288-296.

Parkin, D. M. (2008). The role of cancer registries in cancer control. *International Journal of Clinical Oncology,* 13(2), 102-11. doi: 10.1007/s10147-008-0762-6.

Parkin, D. M., & Bray, F. (2006). Chapter 2: The burden of HPV-related cancers. *Vaccine*, 24(3):S11–25.

Parkin, D. M., Bray, F., Ferlay, J., & Pisani, P. (2005). Global cancer statistics, 2002. *CA: a cancer journal for clinicians*, 55(2), 74-108.

Patil, S., Rao, R. S., Sanketh, D. S., & Warnakulasuriya, S. (2015). Lichenoid dysplasia revisited–evidence from a review of Indian archives. *Journal of Oral Pathology and Medicine*, 44(7), 507-514.

Pavia, M., Pileggi, C., Nobile, C. G., & Angelillo, I. F. (2006). Association between fruit and vegetable consumption and oral cancer: a meta-analysis of observational studies. *American Journal of Clinical Nutrition,* 83(5), 1126-1134.

Petti, S. (2003). Pooled estimate of world leukoplakia prevalence: a systematic review. *Oral Oncology,* 39(8), 770-780.

Petti, S., Masood, M., & Scully, C. (2013). The magnitude of tobacco smoking-betel quid chewing-alcohol drinking interaction effect on oral cancer in South-East Asia. A meta-analysis of observational studies. *PloS one,* 8(11), e78999.

Piccirillo, J. F., Spitznagel Jr, E. L., Vermani, N., Costas, I., & Schnitzler, M. (2004). Comparison of comorbidity indices for patients with head and neck cancer. *Medical Care,* 42(5), 482-486.

Pindborg, J. J., Kui-hua, Z., Ching-ren, K., & Fa-xing, L. (1984). Pilot survey of oral mucosa in areca (betel) nut chewers on Hainan Island of the People's Republic of China. *Community Dentistry and Oral Epidemiology,* 12(3), 195-196.

Pindborg, J. J., Reichart, P.A., Smith, C.J., van der Waal, I. (1997). *World Health Organisation International Histological Classification of Tumours.Histological Typing of Cancer and Precancer of the Oral Mucosa*. (2nd ed). Berlin, Germany: Springer.

Pinholt, E. M., Rindum, J., & Pindborg, J. J. (1997). Oral cancer: a retrospective study of 100 Danish cases. *British Journal of Oral and Maxillofacial Surgery,* 35(2), 77-80.

Pisani, P., Bray, F., & Parkin, D. M. (2002). Estimates of the world- wide prevalence of cancer for 25 sites in the adult population. *International Journal of Cancer,* 97(1), 72-81.

Pitchers, M., & Martin, C. (2006). Delay in referral of oropharyngeal squamous cell carcinoma to secondary care correlates with a more advanced stage at presentation, and is associated with poorer survival. *British Journal of Cancer*, 94(7), 955-958.

Pol, C. A., Ghige, S. K., & Gosavi, S. R. (2015). Role of human papilloma virus 16 in the pathogenesis of oral lichen planus–an immunohistochemical study. *International Dental Journal*, 65(1), 11-14.

Porta, C., Larghi, P., Rimoldi, M., Totaro, M. G., Allavena, P., Mantovani, A., & Sica, A. (2009). Cellular and molecular pathways linking inflammation and cancer. *Immunobiology*, 214(9), 761-777.

Pugliano, F. A., Piccirillo, J. F., Zequeira, M. R., Fredrickson, J. M., Perez, C. A., & Simpson, J. R. (1999). Symptoms as an index of biologic behavior in head and neck cancer. *Otolaryngology-Head and Neck Surgery*, 120(3), 380-386.

Pukkala, E., Martinsen, J.I., Lynge, E., Gunnarsdottir, H.K., Sparen, P., … Kjaerheim, K. (2009). Occupation and cancer—follow-up of 15 million people in five Nordic countries. *Acta Oncologica*, 48, 646–790.

Rana, M., Kanatas, A., Herzberg, P., Khoschdell, M., Kokemueller, H., & Gellrich, N.-C. (2015). Prospective study of the influence of psychological and medical factors on quality of life and severity of symptoms among patients with oral squamous cell carcinoma. *British Journal of Oral and Maxillofacial Surgery*, 53(4), 364-370.

Rapidis, A. D., Gullane, P., Langdon, J. D., Lefebvre, J. L., Scully, C., & Shah, J. P. (2009). Major advances in the knowledge and understanding of the epidemiology, aetiopathogenesis, diagnosis, management and prognosis of oral cancer. *Oral Oncology*, 45(4-5), 299-300. doi:10.1016/j.oraloncology.2009.04.001.

Rapport, Y., Kreitler, S., & Chaitchik, S. (1993). Psychosocial problems in head and neck cancer patients and their change with time since diagnosis. *Annals of Oncology*, 4(1): 69 73.

Reichart, P. A., & Philipsen, H. P. (2005). Oral erythroplakia—a review. *Oral Oncology*, 41(6), 551-561.

Rich, A., & Radden, B. (1984). Squamous cell carcinoma of the oral mucosa: a review of 244 cases in Australia. *Journal of Oral Pathology and Medicine*, 13(5), 459-471.

Ries, L. A. G., Young, J. L., Keel, G. E., Eisner, M. P., Lin, Y. D., & Horner, M-J. (editors).. (2007). *SEER Survival Monograph: Cancer Survival Among Adults: U.S. SEER Program, 1988-2001, Patient and Tumor Characteristics*. National Cancer Institute, SEER Program, NIH Pub. No. 07-6215, Bethesda, MD.

Robson, B., Koopu, P., Gilmour, J., Rameka, R., Stuart, K., Simmonds, S., … 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 Ropu Rangahau a Eru Pomare.

Rogers, S. N. (2009). Quality of life for head and neck cancer patients--has treatment planning altered? *Oral Oncology*, 45(4-5), 435-439. doi:10.1016/j.oraloncology.2008.11.006.

Rosenblatt, K. A., Daling, J. R., Chen, C., Sherman, K. J., & Schwartz, S. M. (2004). Marijuana use and risk of oral squamous cell carcinoma. *Cancer Research*, 64(11), 4049-4054.

Rothman, K.J., & Greenland, S. (editors) (1998). *Modern epidemiology*. 2nd ed. Philadelphia: Lippincott-Raven.

Rozniatowski, O., Reich, M., Mallet, Y., Penel, N., Fournier, C., & Lefebvre, J. L. (2005). Psychosocial factors involved in delayed consultation by patients with head and neck cancer. *Head and Neck*, 27(4), 274-280.

Ryerson, A. B., Peters, E. S., Coughlin, S. S., Chen, V. W., Gillison, M. L., Reichman, M. E., . . . Kawaoka, K. (2008). Burden of potentially human papillomavirus- associated cancers of the oropharynx and oral cavity in the US, 1998–2003. *Cancer*, 113(S10), 2901-2909.

Saleh, A., Kong, Y. H., Haron N., Aripin, S. F., Vadiveloo, M., Hussaini, H., . . . Cheong, S. C. (2016). Oral cancer screening in private dental practices in a developing country: opportunities and challenges. *Community Dentistry and Oral Epidemiology*. doi: 10.1111/cdoe.12266.

Saman, D. M. (2012). A review of the epidemiology of oral and pharyngeal carcinoma: update. Head and Neck Oncology, 4(1), 1.

Sankaranarayanan, R., Ramadas, K., Thomas, G., Muwonge, R., Thara, S., Mathew, B., ... & Trivandrum Oral Cancer Screening Study Group. (2005). Effect of screening on oral cancer mortality in Kerala, India: a cluster-randomised controlled trial. *Lancet*, 365(9475), 1927-1933.

Sankaranarayanan, R., Ramadas, K., Amarasinghe, H., Subramanian, S., & Johnson, N. (2015). Chapter 5 Oral Cancer: Prevention, Early Detection, and Treatment. Gelband, H., P. Jha, R. Sankaranarayanan, and S. Horton, editors. *Cancer. Disease Control Priorities*, third edition, volume 3. Washington, DC: World Bank. doi:10.1596/978-1-4648-0349-9. License: Creative Commons Attribution CC BY 3.0 IGOC.

Sciubba, J. J. (2001). Oral cancer. The importance of early diagnosis and treatment. *American Journal of Clinical Dermatology*, *2*(4), 239-251.

Scott, S. E., Grunfeld, E. A., Auyeung, V., & McGurk, M. (2009). Barriers and Triggers to Seeking Help for Potentially Malignant Oral Symptoms: Implications for Interventions. *Journal of Public Health Dentistry,* 69(1), 34-40. doi:10.1111/j.1752-7325.2008.00095.x.

Scott, S., Grunfeld, E., & McGurk, M. (2005). The idiosyncratic relationship between diagnostic delay and stage of oral squamous cell carcinoma. *Oral Oncology*, 41(4), 396-403.

Scott, S. E., Grunfeld, E. A., & McGurk, M. (2006). Patient's delay in oral cancer: a systematic review. *Community Dentistry and Oral Epidemiology,* 34(5), 337-343.

Scott, S. E., McGurk, M., & Grunfeld, E. A. (2007). The process of symptom appraisal: Cognitive and emotional responses to detecting potentially malignant oral symptoms. *Journal of Psychosomatic Research,* 62(6), 621-630. doi:10.1016/j.jpsychores.2006.12.020.

Scott, S., McGurk, M., & Grunfeld, E. (2008). Patient delay for potentially malignant oral symptoms. *European Journal of Oral Sciences,* 116(2), 141-147. doi:10.1111/j.1600-0722.2007.00520.x.

Scully, C. (2002). Oral squamous cell carcinoma; from an hypothesis about a virus, to concern about possible sexual transmission. *Oral Oncology,* 38(3), 227-234.

Scully, C. (2014). Challenges in predicting which oral mucosal potentially malignant disease will progress to neoplasia. *Oral diseases,* 20(1), 1-5. doi:10.1111/odi.12208.

Scully, C., & Bagan, J. (2009). Oral squamous cell carcinoma overview. *Oral Oncology,* 45(4-5), 301-308. doi:10.1016/j.oraloncology.2009.01.004.

Scully, C. & Boyle, P. (2005) The role of the dental team in preventing and diagnosing cancer: 1. Cancer in general. *Dental Update*, 32(4), 204-212.

Scully, C. Newman, L. & Bagan, J. (2005) The role of the dental team in preventing and diagnosing cancer: 2. Oral cancer risk factors. *Dental Update,* 32(5), 261-276.

Seoane, J., Pita-Fernández, S., Gómez, I., Vazquez, I., López-Cedrún, J. L., De Agustin, D., & Varela-Centelles, P. (2010). Proliferative activity and diagnostic delay in oral cancer. *Head and Neck,* 32(10), 1377-1384. doi:10.1002/hed.21338.

Seoane, J., Warnakulasuriya, S., Varela-Centelles, P., Esparza, G., & Dios, P. D. (2006). Oral cancer: experiences and diagnostic abilities elicited by dentists in North-western Spain. *Oral Diseases,* 12(5), 487-492. doi:10.1111/j.1601-0825.2005.01225.x.

Shafer, W. G., & Waldron, C. A. (1975). Erythroplakia of the oral cavity. *Cancer,* 36(3), 1021-1028.

Shimakage, M., Horii, K., Tempaku, A., Kakudo, K., Shirasaka, T., & Sasagawa, T. (2002). Association of Epstein-Barr virus with oral cancers. *Human pathology*, 33(6), 608-614.

Short, P. F., Moran, J. R., & Punekar, R. (2011). Medical expenditures of adult cancer survivors aged< 65 years in the United States. *Cancer*, 117(12), 2791-2800.

Sigvardsson, S., Hardell, L., Przybeck, T. R., & Cloninger, R. (1996). Increased cancer risk among Swedish female alcoholics. *Epidemiology*, 7(2), 140-143.

Simard, E. P., Torre, L. A., & Jemal, A. (2014). International trends in head and neck cancer incidence rates: differences by country, sex and anatomic site. *Oral Oncology*, 50(5), 387-403.

Sinor, P., Gupta, P., Murti, P., Bhonsle, R., Daftary, D., Mehta, F., & Pindborg, J. (1990). A case- control study of oral submucous fibrosis with special reference to the etiologic role of areca nut. *Journal of Oral Pathology and Medicine*, 19(2), 94-98.

Soeberg, M., Blakely, T., Sarfati, D., Tobias, M., Costilla, R., Carter, K., & Atkinson, J. (2012). Cancer Trends: Trends in cancer survival by ethnic and socioeconomic group, New Zealand 1991–2004. Wellington: University of Otago and Ministry of Health.

Soerjomataram, I., Lortet-Tieulent, J., Parkin, D. M., Ferlay, J., Mathers, C., Forman, D., & Bray, F. (2012). Global burden of cancer in 2008: a systematic analysis of disability-adjusted life-years in 12 world regions. *Lancet*, 380(9856), 1840-1850.

Sorensen, J. R., Johansen, J., Gano, L., Sørensen, J. A., Larsen, S. R., Andersen, P. B., . . . Godballe, C. (2014). A “package solution” fast track program can reduce the diagnostic waiting time in head and neck cancer. *European Archives of Oto-Rhino-Laryngology*, 271(5), 1163-1170.

Speight, P. M., Palmer, S., Moles, D., Downer, M., Smith, D., Henriksson, M., & Augustovski, F. (2006). The cost-effectiveness of screening for oral cancer in primary care. *Health Technology Assessment*, 10(14), 1-144, iii-iv.

Stefanuto, P., Doucet, J.-C., & Robertson, C. (2014). Delays in treatment of oral cancer: a review of the current literature. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, 117(4), 424-429.

Sugerman, P., & Savage, N. (2002). Oral cancer in Australia: 1983–1996. *Australian Dental Journal*, 47(1), 45-56.

Syrjänen , S. (2007). Human Papillomaviruses in Head and Neck Carcinomas. *New England Journal of Medicine*, 356(19), 1993-1995. doi:doi:10.1056/NEJMe078004.

Teppo, H., & Alho, O. P. (2008). Relative importance of diagnostic delays in different head and neck cancers. *Clinical Otolaryngology*, 33(4), 325-330.

Teppo, H., & Alho, O.-P. (2009). Comorbidity and diagnostic delay in cancer of the larynx, tongue and pharynx. *Oral Oncology*, 45(8), 692-695.

Tezal, M., Sullivan, M. A., Hyland, A., Marshall, J. R., Stoler, D., Reid, M. E., . . . Scannapieco, F. A. (2009). Chronic periodontitis and the incidence of head and neck squamous cell carcinoma. *Cancer Epidemiology Biomarkers and Prevention*, 18(9), 2406-2412. doi:10.1158/1055-9965.epi-09-0334.

Thomas, S., & MacLennan, R. (1992). Slaked lime and betel nut cancer in Papua New Guinea. *Lancet*, 340(8819), 577-578.

Thomson, P.J. (2002). Field change and oral cancer: new evidence for widespread carcinogenesis? *International Journal of Oral and Maxillofacial Surgery*, 31, 262–266.

Thomson, P. J., & Hamadah, O. (2007). Cancerisation within the oral cavity: the use of 'field mapping biopsies' in clinical management. *Oral Oncology*, 43(1), 20-26.

Thomson, W. M., Brown, H. R., & Williams, S. M. (1992). Dental status and treatment needs of a New Zealand institutionalised elderly population. *New Zealand Dental Journal*, *87*, 119-23.

Tromp, D. M., Brouha, X. D., Hordijk, G. J., Winnubst, J. A., & de Leeuw, J. R. (2005). Patient factors associated with delay in primary care among patients with head and neck carcinoma: a case-series analysis. *Family Practice,* 22(5), 554-559. doi:10.1093/fampra/cmi058.

Union for International Cancer Control. (2009) TNM classification of carcinomas of the oral cavity and oropharynx. Retrieved February 2, 2015 from http://www.uicc.org/resources/tnm.

van der Schroeff, M. P., & Baatenburg de Jong, R. J. B. (2009). Staging and prognosis in head and neck cancer. *Oral Oncology,* 45(4), 356-360.

van der Waal, I. (2009). Potentially malignant disorders of the oral and oropharyngeal mucosa; terminology, classification and present concepts of management. *Oral Oncology,* 45(4-5), 317-323. doi:10.1016/j.oraloncology.2008.05.016.

van Harten, M. C., de Ridder, M., Hamming-Vrieze, O., Smeele, L. E., Balm, A. J., & van den Brekel, M. W. (2014). The association of treatment delay and prognosis in head and neck squamous cell carcinoma (HNSCC) patients in a Dutch comprehensive cancer center. *Oral Oncology,* 50(4), 282-290. doi:10.1016/j.oraloncology.2013.12.018.

van Harten, M. C., Hoebers, F. J., Kross, K. W., van Werkhoven, E. D., van den Brekel, M. W., & van Dijk, B. A. (2015). Determinants of treatment waiting times for head and neck cancer in the Netherlands and their relation to survival. *Oral Oncology, 51(*3), 272-278. doi:10.1016/j.oraloncology.2014.12.003.

Varela-Centelles, P., Pedrosa, R., Lopez-Niño, J., Sánchez, M., Gonzalez-Mosquera, A., Mendez, A., & Seoane, J. (2012). Oral cancer awareness at chemist's and herbalist's shops: New targets for educational interventions to prevent diagnostic delay. *Oral Oncology,* 48(12), 1272-1275.

Wald, N. J., & Oppenheimer, P. (2011). Discounting the value of life. *Journal of Medical Screening,* 18(1), 1. doi:10.1258/jms.2010.010136.

Walsh, T., Liu, J. L., Brocklehurst, P., Glenny, A. M., Lingen, M., Kerr, A. R., . . . Scully, C. (2013). Clinical assessment to screen for the detection of oral cavity cancer and potentially malignant disorders in apparently healthy adults. *The Cochrane Library*.

Warnakulasuriya, S. (2009). Global epidemiology of oral and oropharyngeal cancer. *Oral Oncology*, 45(4), 309-316.

Warnakulasuriya, S., Fennell, N., Diz, P., Seoane, J., & Rapidis, A. (2015). LDV Lifelong Learning Programme. An appraisal of oral cancer and pre-cancer screening programmes in Europe: a systematic review. *Journal of Oral Pathology and Medicine*, 44(8):559-70. doi: 10.1111/jop.12267.

Warnakulasuriya, S., Johnson, N. W., & van der Waal, I. (2007). Nomenclature and classification of potentially malignant disorders of the oral mucosa. *Journal of Oral Pathology and Medicine,* 36(10), 575-580. doi:10.1111/j.1600-0714.2007.00582.x.

Watson, J. M., Logan, H. L., Tomar, S. L., & Sandow, P. (2009). Factors associated with early- stage diagnosis of oral and pharyngeal cancer. *Community Dentistry and Oral Epidemiology, 37*(4), 333-341.

Watson, R. R., Borgs, P., Witte, M., McCuskey, R. S., Lantz, C., Johnson, M. I., . . . Earnest, D. L. (1994). Alcohol, immunomodulation, and disease. *Alcohol and Alcoholism*, 29(2), 131-139.

Wilson, J., & Jungner, G. (1968). *Principles and practice of screening for disease*. World Health Organization Chronical Geneva: Public Health Papers 34.

World Health Organization. (2012). *Review of areca (betel) nut and tobacco use in the Pacific: a technical report*. Manila: WHO Regional Office for the Western Pacific.

World Health Organization. (2016). *International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)-WHO,* Retrieved May 14, 2016 from http://apps.who.int/classifications/icd10/browse/2016/en#/II.

World Health Organization/Information Centre on HPV and Cervical Cancer (2010). *New Zealand Human Papillomavirus and Related Cancers, Fact Sheet 2009*. Retrieved March 19, 2016 from https://www.health.govt.nz/system/files/documents/pages/hpv-related-cancers-summary-factsheet.pdf.

Yellowitz, J. A., Horowitz, A. M., Drury, T. F., & Goodman, H. S. (2000). Survey of US dentists' knowledge and opinions about oral pharyngeal cancer. *Journal of the American Dental Association*, 131(5), 653-661.

Yoganathan, P. (2002). Betel chewing creeps into the New World. *New Zealand Dental Journal*, 98(432), 40-45.

Yu, T., Wood, R. E., & Tenenbaum, H. C. (2008). Delays in diagnosis of head and neck cancers. *Journal of the Canadian Dental Association*, 74(1), 61.

Yung, K. C., & Piccirillo, J. F. (2008). The incidence and impact of comorbidity diagnosed after the onset of head and neck cancer. *Archives of Otolaryngology–Head & Neck Surgery*, 134(10), 1045-1049.

Yusof, Z., Netuveli, G., Ramli, A., & Sheiham, A. (2006). Is opportunistic oral cancer screening by dentists feasible? An analysis of the patterns of dental attendance of a nationally representative sample over 10 years. *Oral Health and Preventive Dentistry*, 4(3), 165.

Zeng, X. T., Deng, A. P., Li, C., Xia, L. Y., Niu, Y. M., & Leng, W. D. (2013). Periodontal disease and risk of head and neck cancer: a meta-analysis of observational studies. *PloS one*, 8(10), e79017.

Zeng, X.-T., Leng, W.-D., Zhang, C., Liu, J., Cao, S.-Y., & Huang, W. (2015). Meta-analysis on the association between toothbrushing and head and neck cancer. *Oral Oncology*, 51(5), 446-451.

Appendix A – HDEC Approval

Health and Disability Ethics Committees
Ministry of Health
Freyberg Building
20 Aitken Street
PO Box 5013
Wellington
6011

0800 4 ETHICS
hdecs@moh.govt.nz

02 September 2015

Dr Donna T Kennedy Langley
7 Van Diemen Street
Nelson South
Nelson 7010

Dear Dr Kennedy Langley

Re:	**Ethics ref:**	**15/CEN/90**
	Study title:	Exploring the role of primary healthcare clinicians in the detection and diagnosis of mouth cancer in New Zealand by: 1.Assessing whether differential access to dental care impacts on the stage of diagnosis of mouth cancer in the South Island, New Zealand.2.Assessing the opinions and practices of New Zealand dentists and clinical dental technicians with regards to mouth cancer and whether this impacts on stage of diagnosis.3. Developing an understanding of the awareness of mouth cancer by general medical practitioners in Canterbury and Nelson and whether this impacts on the stage of diagnosis.

I am pleased to advise that this application has been *approved* by the Central Health and Disability Ethics Committee. This decision was made through the HDEC-Expedited Review pathway.

Conditions of HDEC approval

HDEC approval for this study is subject to the following conditions being met prior to the commencement of the study in New Zealand. It is your responsibility, and that of the study's sponsor, to ensure that these conditions are met. No further review by the Central Health and Disability Ethics Committee is required.

Standard conditions:

1. Before the study commences at *any* locality in New Zealand, all relevant regulatory approvals must be obtained.

2. Before the study commences at *a given* locality in New Zealand, it must be authorised by that locality in Online Forms. Locality authorisation confirms that the locality is suitable for the safe and effective conduct of the study, and that local research governance issues have been addressed.

After HDEC review

Please refer to the *Standard Operating Procedures for Health and Disability Ethics Committees* (available on www.ethics.health.govt.nz) for HDEC requirements relating to amendments and other post-approval processes.

Your **next progress report** is due by **01 September 2016**.

Participant access to ACC

The Central Health and Disability Ethics Committee is satisfied that your study is not a clinical trial that is to be conducted principally for the benefit of the manufacturer or distributor of the medicine or item being trialled. Participants injured as a result of treatment received as part of your study may therefore be eligible for publicly-funded compensation through the Accident Compensation Corporation (ACC).

Please don't hesitate to contact the HDEC secretariat for further information. We wish you all the best for your study.

Yours sincerely,

Mrs Helen Walker
Chairperson
Central Health and Disability Ethics Committee

Encl: appendix A: documents submitted
appendix B: statement of compliance and list of members

Appendix A
Documents submitted

Document	*Version*	*Date*
Protocol: Study protocol for research exploring the role of primary healthcare clinicians in the detection and diagnosis of mouth cancer in New Zealand.	1	10 June 2015
CVs for other Investigators: CVs for Prof. Murray Thomson, Dr Lyndie Foster-Page, Assoc. Prof Brian Cox and Prof. Alison Rich	1	10 June 2015
Letter from the Ngāi Tahu Research Consultation Committee confirming Māori consultation for the research proposal.	1	19 May 2015
CV for CI: Statement of relevant professional experience for Dr Donna Kennedy Langley	1	10 June 2015
Survey/questionnaire: Questionnaire for general dentists and clinical dental technicians to explore the second study hypothesis.	2	10 June 2015
Evidence of scientific review: Statement on peer review.	1	11 June 2015
Application		03 July 2015
PIS/CF: Participant Information Sheet and Consent Form for general medical practitioners who will be interviewed as part of the study.	1	24 August 2015
Response to Request for Further Information		24 August 2015

Appendix B
Statement of compliance and list of members

Statement of compliance

The Central Health and Disability Ethics Committee:

- is constituted in accordance with its Terms of Reference
- operates in accordance with the *Standard Operating Procedures for Health and Disability Ethics Committees*, and with the principles of international good clinical practice (GCP)
- is approved by the Health Research Council of New Zealand's Ethics Committee for the purposes of section 25(1)(c) of the Health Research Council Act 1990
- is registered (number 00008712) with the US Department of Health and Human Services' Office for Human Research Protection (OHRP).

List of members

Name	*Category*	*Appointed*	*Term Expires*
Mrs Helen Walker	Lay (consumer/community perspectives)	01/07/2012	01/07/2015
Dr Angela Ballantyne	Lay (ethical/moral reasoning)	01/07/2015	01/07/2018
Dr Melissa Cragg	Non-lay (observational studies)	01/07/2015	01/07/2018
Dr Peter Gallagher	Non-lay (health/disability service provision)	01/07/2015	01/07/2018
Mrs Sandy Gill	Lay (consumer/community perspectives)	01/07/2015	01/07/2018
Dr Patries Herst	Non-lay (intervention studies)	01/07/2012	01/07/2015
Dr Dean Quinn	Non-lay (intervention studies)	01/07/2012	01/07/2015
Dr Cordelia Thomas	Lay (ethical/moral reasoning)	19/05/2014	19/05/2017

Unless members resign, vacate or are removed from their office, every member of HDEC shall continue in office until their successor comes into office (HDEC Terms of Reference)

http://www.ethics.health.govt.nz

Appendix B – HDEC Approval Amendment

Health and Disability Ethics Committees
Ministry of Health
Freyberg Building
20 Aitken Street
PO Box 5013
Wellington
6011

0800 4 ETHICS
hdecs@moh.govt.nz

14 December 2015

Dr Donna T Kennedy Langley
7 Van Diemen Street
Nelson South
Nelson 7010

Dear Dr Kennedy Langley

Re:	**Ethics ref:**	**15/CEN/90/AM02**
	Study title:	Exploring the role of primary healthcare clinicians in the detection and diagnosis of mouth cancer in New Zealand by:1. Assessing whether differential access to dental care impacts on the stage of diagnosis of mouth cancer in the South Island, New Zealand.2. Assessing the opinions and practices of New Zealand dentists and clinical dental technicians with regards to mouth cancer and whether this impacts on stage of diagnosis.3. Developing an understanding of the awareness of mouth cancer by general medical practitioners in Canterbury and Nelson and whether this impacts on the stage of diagnosis.

I am pleased to advise that this amendment has been *approved* by the Central Health and Disability Ethics Committee. This decision was made through the HDEC Expedited Review pathway.

Please don't hesitate to contact the HDEC secretariat for further information. We wish you all the best for your study.

Yours sincerely,

Mrs Helen Walker
Chairperson
Central Health and Disability Ethics Committee

Encl: appendix A: documents submitted
appendix B: statement of compliance and list of members

Appendix A
Documents submitted and approved

Document	Version	Date
Protocol: Updated Study Protocol including additional NZCR data	2	11 November 2015
Post Approval Form	02	-

Appendix B
Statement of compliance and list of members

Statement of compliance

The Central Health and Disability Ethics Committee:

- is constituted in accordance with its Terms of Reference
- operates in accordance with the *Standard Operating Procedures for Health and Disability Ethics Committees*, and with the principles of international good clinical practice (GCP)
- is approved by the Health Research Council of New Zealand's Ethics Committee for the purposes of section 25(1)(c) of the Health Research Council Act 1990
- is registered (number 00008712) with the US Department of Health and Human Services' Office for Human Research Protection (OHRP).

List of members

Name	*Category*	*Appointed*	*Term Expires*
Mrs Helen Walker	Lay (consumer/community perspectives)	01/07/2012	01/07/2015
Dr Angela Ballantyne	Lay (ethical/moral reasoning)	01/07/2015	01/07/2018
Dr Melissa Cragg	Non-lay (observational studies)	01/07/2015	01/07/2018
Dr Peter Gallagher	Non-lay (health/disability service provision)	01/07/2015	01/07/2018
Mrs Sandy Gill	Lay (consumer/community perspectives)	01/07/2015	01/07/2018
Dr Patries Herst	Non-lay (intervention studies)	27/10/2015	27/10/2019
Dr Dean Quinn	Non-lay (intervention studies)	27/10/2015	27/10/2021
Dr Cordelia Thomas	Lay (ethical/moral reasoning)	19/05/2014	19/05/2017

Unless members resign, vacate or are removed from their office, every member of HDEC shall continue in office until their successor comes into office (HDEC Terms of Reference)

http://www.ethics.health.govt.nz

Appendix C – Ngai Tahu response

NGĀI TAHU RESEARCH CONSULTATION COMMITTEE
TE KOMITI RAKAHAU KI KĀI TAHU

Tuesday, 19 May 2015.

Professor William Thomson,
Faculty of Dentistry - Dental Epidemiology and Public Health Group,
DUNEDIN.

Tēnā Koe Professor William Thomson,

The role of primary healthcare clinicians in the detection and diagnosis of mouth cancer in New Zealand

The Ngāi Tahu Research Consultation Committee (the committee) met on Tuesday, 19 May 2015 to discuss your research proposition.

By way of introduction, this response from The Committee is provided as part of the Memorandum of Understanding between Te Rūnanga o Ngāi Tahu and the University. In the statement of principles of the memorandum it states ″Ngāi Tahu acknowledges that the consultation process outline in this policy provides no power of veto by Ngāi Tahu to research undertaken at the University of Otago″. As such, this response is not ″approval″ or ″mandate″ for the research, rather it is a mandated response from a Ngāi Tahu appointed committee. This process is part of a number of requirements for researchers to undertake and does not cover other issues relating to ethics, including methodology they are separate requirements with other committees, for example the Human Ethics Committee, etc.

Within the context of the Policy for Research Consultation with Māori, the Committee base consultation on that defined by Justice McGechan:

"Consultation does not mean negotiation or agreement. It means: setting out a proposal not fully decided upon; adequately informing a party about relevant information upon which the proposal is based; listening to what the others have to say with an open mind (in that there is room to be persuaded against the proposal); undertaking that task in a genuine and not cosmetic manner. Reaching a decision that may or may not alter the original proposal."

The Committee notes this is Southern District Health Board research.

The Committee considers the research to be of importance to Māori health.

As this study involves human participants, the Committee strongly encourage that ethnicity data be collected as part of the research project. That is the questions on self-identified ethnicity and descent, these questions are contained in the latest census.

The Committee suggests dissemination of the findings to relevant Māori health organisations, for example the National Māori Organisation for Dental Health, Oranga Niho and to Professor John Broughton and Mr Malcolm Dacker, who are involved in Māori Dental Health, University of Otago.

The Ngāi Tahu Research Consultation Committee has membership from:

Te Rūnanga o Ōtākou Incorporated
Kāti Huirapa Rūnaka ki Puketeraki
Te Rūnanga o Moeraki

We wish you every success in your research and the committee also requests a copy of the research findings.

This letter of suggestion, recommendation and advice is current for an 18 month period from Tuesday, 19 May 2015 to 19 November 2016.

Nāhaku noa, nā

Mark Brunton
Kaiwhakahaere Rangahau Māori
Research Manager Māori
Research Division
Te Whare Wānanga o Otāgo
Ph: +64 3 479 8738
Email: mark.brunton@otago.ac.nz
Web: www.otago.ac.nz

Appendix D – CDHB Iwi Health Board response

Canterbury
District Health Board
Te Poari Hauora ō Waitaha

30th March 2016

Dr Donna Kennedy
Clinical Leader
Hospital Dental Surgeon
Nelson Marlborough District Health Board

Re: Exploring the role of primary healthcare clinicians in the detection and definitive diagnosis of mouth cancer in New Zealand.

Tena koe Dr Kennedy,

Ka nui te mihi tenei ki a koe me tou roopu o nga Kairapukorero ki te hapai o te kaupapa whakahirahira mou, moku mo tatou katoa. Ko Rapunga Korero te mea nui. No reira tena koe me te roopu o ka Kairangahau, tena koutou katoa.

Thank you for submitting your research to Te Komiti Whakarite. I note that your research is a retrospective, observational study of patients' existing medical and dental records and as such it is always challenging to make comment in terms of achievement for improving Māori Health status.

However as the Māori Consultation committee in the Canterbury region, we would like to outline our general comments for consideration.

It is important to acknowledge the issues pertaining to the accurate collection of ethnicity data in hospital databases.

We appreciate that you acknowledge that your research impacts Māori, with substantial ethnic and socioeconomic inequalities in mouth cancer survival.

As stated in the HRC's Guidelines for Researchers on Health Research Involving Māori it is important that research results contribute to Māori development. Some instances where Māori have been powerless to stop the inappropriate dissemination of information have generated unease within Māori communities.

It is a requirement of the ethics approval process that a final report be submitted when the research is complete. A copy of the report should be provided to me at that time. Te Komiti Whakarite would be willing to assist in the dissemination of your findings once your project has reached a conclusion to the appropriate Māori organisations, Māori health professionals and Māori. . We are committed to building on-going relationships with researchers in the hope of improving Māori health.

I hope this letter will suffice in terms of your application. Please contact me should you need any other information that may not have been included in this letter relevant to your research.

Heoi ano

Eru Waiti
Chairperson Te Komiti Whakarite

Te Komiti Whakarite
245 Antigua Street, Christchurch. Private Bag 4710, Christchurch, New Zealand
Telephone: (64) (3) 364 0640 Ext: 88474 Facsimile: (64) (3) 378 6018

Appendix E – NMDHB Iwi Health Board response

Karake Consultancy
POLICY & RESEARCH

PO Box 50
Blenheim 7240
Mobile: 027 483 0128
Email: melissa.cragg@xnet.co.nz

19th April 2016

Donna Kennedy
Nelson Hospital
Private Bag
Nelson Marlborough DHB
Nelson

Tēnā koe Donna,

Re: Exploring the role of primary healthcare clinicians in the detection and diagnosis of mouth cancer in New Zealand

Your request for support was considered by Karake Consultancy on behalf of the Iwi Health Board after an evaluation of the information that you provided. The Iwi Health Board supports your research proposal, on the condition that progress reports and a copy of the final results/findings will be forwarded to the IHB for their information, specifically any Maori identified data and findings. It is also requested that confirmation of who is listed as the Maori contact for the study on the Patient Information Sheet (PIS) is also provided to the IHB.

The Iwi Health Board understands that the purpose of this research study is to develop a deeper understanding of the role of primary healthcare clinicians in the diagnosis of mouth cancer in New Zealand and that the study has three aims:

1. To assess whether differential access to dental care impacts on the stage of diagnosis of mouth cancer in the South Island, New Zealand;
2. To assess the opinions and practices of New Zealand dentists and clinical dental technicians with regards to mouth cancer and whether this impacts on stage of diagnosis; and
3. To develop an understanding of the awareness of mouth cancer by general medical practitioners in Canterbury and Nelson and whether this impacts on the stage of diagnosis.

The research proposal has explained that the incidence of mouth cancer in New Zealand is increasing. Mouth cancer causes significant morbidity and mortality. Over time, small improvements in survival rates have been reported. However, significant disparities in survival rates persist, with poorer survival rates for Māori and low-income individuals.

Explanation has been provided to state that early diagnosis of mouth cancer is crucial to improve sufferers' quality of life and survival. It requires at-risk individuals to seek

healthcare in the early stages of the disease. It also requires primary healthcare clinicians to be aware of the risk factors for and clinical presentation of malignant and potentially malignant disorders. The information gained will be analysed to assemble a detailed picture of the role of primary healthcare clinicians in diagnosing mouth cancer, as well as to identify gaps in their knowledge which may lead to delays in detection, diagnosis or treatment.

Participants will be invited to be interviewed as part of the study in order to collect data for the third study aim. It is planned that 8-10 GMPs from each region will be interviewed.

Information provided has detailed that the cases of mouth cancer have been recorded on the New Zealand Cancer Registry since 1958. This has allowed reporting on trends in incidence and mortality rates. However, the role of primary care practitioners in the detection and diagnosis of mouth cancer has not been investigated in New Zealand. The stage of diagnosis is crucial to improved morbidity and mortality rates. However, it Is not yet known whether access to primary healthcare or the doctor's knowledge and practices impact on delays in detection of mouth cancer.

The planned outcomes for this study have been described as:
1. It is intended that this research will be an integral part of the MComDent (University of Otago) thesis for Donna Kennedy Langley.

2. At least one academic paper will be submitted for publication. The research outcome will greatly enhance the understanding of the role of primary care clinicians in the detection, definitive diagnosis and treatment of mouth cancer in New Zealand. This will, in turn, inform the development of more effective initiatives aimed at improving earlier mouth cancer detection in New Zealand.

3. The findings of the research are required to inform the development of a national oral cancer control strategy.

The lead investigator on this study is Dr Donna Kennedy Langley, a post-graduate student at the School of Dentistry, Otago University and a senior hospital dentist at the NMDHB. The co-investigators for this study include Professor W. Murray Thomson (Professor of Dental Epidemiology and Public Health, University of Otago), Associate Professor Brian Cox (Director of the Hugh Adam Cancer Epidemiology Unit, School of Medicine, University of Otago), Professor Alison Rich (Head, Department of Oral Diagnostic and Surgical Sciences and Deputy Dean, School of Dentistry, University of Otago) and Dr Lyndie Foster Page (Senior Lecturer in Dental Public Health, University of Otago)

Ethics approval has been granted for this study by the Health and Disability Ethics Committee of NZ. This study has not received funding from any organisation.

It is understood that:

1. Ethnicity data will be collected and analysed as part of the retrospective data audit. Ethnicity data will not be collected from the GMPs, reflecting the low numbers of Maori oral health professionals in NMDHB and CDHB;

2. The research proposal was reviewed and accepted by the Ngāi Tahu Research Consultation Committee. In addition to this Maori will be included through the retrospective patient data audit and any Maori participants that are interviewed as GMPs;

3. Significant disparities in survival rates persist in terms of mouth cancer, with poorer rates for Maori and low-income individuals. This study seeks to help identify the underlying reasons for this disparity. Poorer survival rates may be linked with patient factors and/or primary clinician factors leading to delayed diagnosis. Exploration of the reasons behind poorer survival will hopefully improve mouth cancer survival rates for sufferers;

4. Māori experience higher mortality rates than others from mouth cancer. The NZ Oral Health Survey (2009) reported Maori have reduced access to dental care. An aim of this study is to reduce inequalities in mouth cancer outcomes for Maori by exploring whether reduced access to dental care impacts on the stage of diagnosis of disease, thereby contributing towards poorer survival rates. The document 'Oranga Waha – Oral Health Research Priorities for Maori' (2011) highlights the need to reduce disparitiesin survival rates experienced by Māori with mouth cancer. Whether inequity in access to dental care contributes to inequity of outcome, is identified in this study as an area requiring further research;

5. If differential access to dental care is identified as a barrier to early diagnosis of mouth cancer, strategies may need to be developed to address inequity in dental access for those at high risk of developing mouth cancer;

6. Information about the proposed study has been provided to the Ngāi Tahu Research Consultation Committee and will be provided to the DHBs of domicile of the participants prior to conducting the study;

7. All health information will be treated with respect and process within the study will ensure potentially identifiable health records will not be available to those other than investigators or the research assistants. All information collected as part of the study will only be stored and published as anonymous data;

8. The main cultural issues arising form this study are around accessing health information. Health information is deemed to be a taonga and must be treated with the appropriate respect and wairua. The study's protocol identifies the steps undertaken to ensure access to potentially identifiable health information is restricted to investigators and research assistants. Also, data for statistical analysis, stored data and published data will only ever be in an anonymised form; and

9. Consistent with the suggestions of the Ngai Tahu Research Consultation Committee ethnicity data will be collected as part of the study and the study's findings will be disseminated to the relevant Maori health organisations, including the National Māori Organisation for Dental Health and Oranga Niho.

Thank-you for submitting your research proposal for consultation, please contact Karake Consultancy if any further assistance is required regarding this study.

Please forward updates for the IHB to the NMDHB Director of Maori Health,

Naku na,

Dr Melissa Cragg

Karake Consultancy,
PO Box 143, Ward 7248, Marlborough
Phone: 03 5756446 Cell: 027 4830128 Email: Melissa.Cragg@xnet.co.nz

Appendix F – Questionnaire for dentists/clinical dental technicians

Exploring the role of clinical dental technicians in detecting mouth cancer.

Welcome to my survey on the role of clinical dental technicians in diagnosing mouth cancer in NZ.

For the purposes of this questionnaire, mouth cancer is considered to be oral cancer and oro-pharyngeal cancer.

Thank you for participating in our survey. Your feedback is important.

1

Exploring the role of clinical dental technicians in detecting mouth cancer.

For the purposes of this questionnaire, mouth cancer is considered to be oral cancer and oro-pharyngeal cancer.

* 1. In which area of dentistry do you mainly practice?

- ◯ Clinical dental technician
- ◯ General dentist
- ◯ Other (please specify)

* 2. In which year did you graduate?

* 3. In which country did you gain your original dental qualification?

- ◯ New Zealand
- ◯ Australia
- ◯ Canada
- ◯ Fiji
- ◯ Germany
- ◯ India
- ◯ Malaysia
- ◯ South Africa
- ◯ United Kingdom
- ◯ United States of America
- ◯ Other (please specify)

* 4. What is your sex?

- ◯ Male
- ◯ Female

5. What is the postcode of your main work location?

* 6. In New Zealand, is mouth cancer more commonly found in men or women?

- ( ) More commonly found in women
- ( ) More commonly found in men
- ( ) Found as commonly in women and men
- ( ) Don't know

* 7. Tick which age groups are more commonly affected by mouth cancer in New Zealand.

- [ ] Less than 30years
- [ ] 30-40 years
- [ ] 40-50 years
- [ ] 50-60 years
- [ ] 60-70 years
- [ ] Over 70 years
- [ ] No age group is more commonly affected.
- [ ] Don't know

8. Which of the following groups of people have a higher risk of mouth cancer? (Tick as many as you think apply).

- ○ African
- ○ Chinese
- ○ Eastern European
- ○ European Other
- ○ Fijian
- ○ Fijian Indian
- ○ Japanese
- ○ Maori
- ○ Middle Eastern
- ○ New Zealand European
- ○ Papua New Guinean
- ○ Samoan
- ○ Solomon Island
- ○ South-east Asian
- ○ Subcontinental Indian (includes people from India, Pakistan, Sri Lanka and Bangladesh)
- ○ Tongan
- ○ West European
- ○ Don't know
- ○ Other (please specify)

* 9. Which site or sites, do you think are the most common sites of mouth cancer in New Zealand? (Tick as many as you think apply).

- [ ] Alveolar bone
- [ ] Base of tongue
- [ ] Buccal mucosa
- [ ] Epiglottis
- [ ] Floor of mouth
- [ ] Gingiva
- [ ] Hard palate
- [ ] Lateral border of tongue
- [ ] Major salivary glands
- [ ] Minor salivary glands
- [ ] Soft palate
- [ ] Tonsil
- [ ] Don't know

* 10. Which of the following oral conditions do you consider to have significant malignant potential? (Tick as many as you think apply).

- [ ] Angular cheilitis
- [ ] Candidaisis
- [ ] Erythroleukoplakia
- [ ] Erythroplakia
- [ ] Fibro-epithelial polyps
- [ ] Leukoplakia
- [ ] Lichen planus
- [ ] Oral submucous fibrosis
- [ ] Recurrent cold sores
- [ ] All of the above
- [ ] None of the above
- [ ] Unsure which conditions are potentially malignant
- [ ] Other (please specify)

5

* 11. Which of the following sigs are associated with mouth cancer? (Tick as many as you think apply).

- [ ] Bad breath
- [ ] Bleeding from the mouth
- [ ] Erythroleukoplakia
- [ ] Erythroplakia
- [ ] Leukoplakia
- [ ] Loose tooth or teeth
- [ ] Lumps in the mouth
- [ ] Neck swelling
- [ ] Non-healing extraction site
- [ ] Soft tissue necrosis
- [ ] Ulceration
- [ ] All of the above
- [ ] None of the above
- [ ] Unsure of the signs of mouth cancer
- [ ] Other (please specify)

6

* 12. Which of the following symptoms may be associated with mouth cancer? (Tick as many as you think apply).

- [ ] Bleeding in the mouth
- [ ] Difficulty chewing
- [ ] Difficulty speaking
- [ ] Difficulty swallowing
- [ ] Loss of taste
- [ ] Mouth pain
- [ ] Paraesthesia or numbness
- [ ] All of the above
- [ ] None of the above
- [ ] Don't know
- [ ] Unsure of the symptoms of mouth cancer
- [ ] Other (please specify)

* 13. Which of the following do you consider to be risk factors for mouth cancer? (Tick as many as apply).

- [ ] Chewing betel nut
- [ ] Chewing tobacco
- [ ] Denture stomatitis
- [ ] Family history of oral cancer
- [ ] Heavy alcohol use
- [ ] Older age
- [ ] Poor diet
- [ ] Poor oral hygiene
- [ ] Previous infection with Epstein Barr virus (EBV)
- [ ] Previous infection with human papillomavirus (HPV)
- [ ] Recurrent cold sores
- [ ] Smoking marijuana
- [ ] Sun exposure
- [ ] Tobacco smoking
- [ ] Wearing ill fitting dentures
- [ ] All of the above
- [ ] None of the above
- [ ] Unsure of the risk factors for mouth cancer
- [ ] Other (please specify)

* 14. Do you routinely advise patients about the risk factors for oral cancer?

- ○ Yes
- ○ No
- ○ Don't know

* 15. Do you check all patients for oral mucosal lesions?

- ○ Yes
- ○ No
- ○ Don't know

* 16. Do you target mucosal screenings only for patients at higher risk of mouth cancer?

- ○ Yes
- ○ No
- ○ Don't know

* 17. What do you consider to be involved in screening for mouth cancer? (Tick as many as apply).

- ☐ Checking salivary flow
- ☐ Palpation of cervical and submandibular lymph nodes
- ☐ Palpation of the floor of the mouth
- ☐ Radiographic examination of alveolar bone
- ☐ Use of special tests
- ☐ Visual examination of oral mucosal soft tissues
- ☐ All of the above
- ☐ None of the above
- ☐ Unsure what is involved in screening for mouth cancer
- ☐ Other (please specify, include any special tests used)

* 18. Who should screen patients for mouth cancer? (Tick as many as you feel apply)

- ☐ Clinical dental technicians
- ☐ Dental hygienists
- ☐ Ear, nose and throat specialists(otorhinolaryngologists)
- ☐ General dentists
- ☐ General medical practitioners
- ☐ General practice nurses
- ☐ Oral and maxillo-facial surgeons
- ☐ Oral medicine specialists
- ☐ Pharmacists
- ☐ Don't know
- ☐ Other (please specify)

* 19. Do you think patients are able detect oral mucosal lesions themselves?

- ◯ Yes
- ◯ No
- ◯ Don't know

20. What patient-identified symptoms would alert you to a suspicious oral mucosal lesion? Please list.

* 21. Have you ever detected a suspicious oral mucosal lesion?

- ◯ Yes
- ◯ No
- ◯ Don't know

* 22. How confident do you feel about identifying a potentially malignant mouth lesion by clinical presentation?

Very confident	Confident	Not confident	Very unconfident
◯	◯	◯	◯

* 23. Do you routinely ask patients about their current tobacco use?

- ◯ Yes
- ◯ No

* 24. Do you routinely ask patients about their past tobacco use?

- ◯ Yes
- ◯ No

* 25. Do you routinely ask patients about their current alcohol use?

- ◯ Yes
- ◯ No

* 26. Do you routinely ask patients about their previous alcohol use?

- ◯ Yes
- ◯ No

* 27. What do you perceive to be the barriers to doing an oral cancer screening (OCS) exam for patients? (Tick as many as you feel apply).

- [ ] Difficult to charge patients for this procedure
- [ ] Lack of confidence in doing an OCS exam
- [ ] Lack of time during regular appointments
- [ ] Lack of training for clinicians in doing OCS exam
- [ ] Oral cancer is so rare, that an OCS exam is not necessary
- [ ] OCS exam is outside my scope of practice
- [ ] Resistance from patients
- [ ] Screening should be done only by a specialist
- [ ] No barriers to doing an OCS exam
- [ ] Other (please specify)

* 28. Who would you usually refer a patient to, if you found a suspicious oral lesion?

- ◯ Ear, nose and throat specialist (otorhinolaryngologist)
- ◯ General dentist
- ◯ General medical practitioner
- ◯ Hospital dental department
- ◯ Oral and maxillo-facial surgeon
- ◯ Oral medicine specialist
- ◯ Other (please specify)

* 29. Do you agree or disagree with this statement? Patients referred to specialists for review of oral mucosal lesions will usually attend the appointment.

- ◯ Agree
- ◯ Disagree
- ◯ Don't know

* 30. Should you follow up referrals to ensure that patients have presented to the specialist for review?

- ◯ Yes, it is my responsibility to check the referral has been acted on
- ◯ No, it is the responsibility of the patient
- ◯ No, it is the responsibility of the service the patient is referred to
- ◯ Don't know

31. Please include any additional comments you would like to make about mouth cancer in New Zealand.

Appendix G – Letters to dentists/clinical dental technicians

Covering letter for survey

15 November 2015

Dear Clinical Dental Technician/Dentist

Typically, there are 340-400 new cases of oral cancer and oro-pharyngeal cancer (together referred to as mouth cancer) diagnosed in New Zealand per year. The incidence of mouth cancer in New Zealand is increasing. Mouth cancer causes significant morbidity and mortality, and its early diagnosis is crucial to improving sufferers' quality of life and survival.

As part of my Masters of Community Dentistry thesis, I am exploring the role of primary healthcare clinicians in the diagnosis of mouth cancer in New Zealand. As part of this study, I wish to collect information on the opinions and practices of New Zealand dentists and clinical dental technicians with regards to mouth cancer. Approval for this research has been granted by the Health and Disability Ethics Committee (Reference number: 15/CEN/90).

It would be greatly appreciated if you could take 5 or 10 minutes to complete the enclosed survey and return it in the enclosed self-addressed envelope. This survey is also being conducted via Survey Monkey where a unique email address has been available through the NZ Dental Council. The survey data will be collected anonymously and the findings will be published in due course.

Those of you who complete the survey will be eligible to be included in two prize draws for Prezzy Card Gift Vouchers worth $200 each. For the prize draws, the code on the cover page of the survey will be removed prior to the responses being recorded. This will ensure survey data will remain anonymous. The prize draws will take place on December 10, 2015. To be eligible please return your survey to me before this date.

If you wish to find out further information about this study, please contact me (Donna.Kennedy@nmdhb.govt.nz) or the Lead Supervisor for this study (Professor Murray Thomson; murray.thomson@otago.ac.nz) at the Department of Oral Sciences in the University of Otago.

Your participation in this study is very much appreciated.

Yours sincerely

Dr Donna Kennedy, BDS
Hospital Dental Surgeon
Nelson Hospital

Reminder letter for survey

05 December 2015

Dear Dentist

Thank you to all the dentists and dental technicians who have completed this survey. We have received a lot of great feedback on the importance of researching this field and we are very grateful to all of you who took the time to complete it.

We appreciate it is a very busy time of year and some of the questions may be a bit challenging, but by participating in this survey you will enable us to develop an understanding of the diagnosis of mouth cancer in New Zealand. It is hoped this understanding will ultimately lead to developing some strategies to improve the early diagnosis of mouth cancer.

It is expected the survey will take only 5-10 minutes to complete and all responses are anonymous. All those who complete the survey by December 14, 2015 will be entered into the pre-Christmas prize draws to win a Prezzy Card worth $200.00. It is hoped by extending the draw by another four days we will receive some more responses.

If you have any other questions about the survey please email me (Donna.Kennedy@nmdhb.govt.nz) or Professor Murray Thomson, the lead supervisor for this study (murray.thomson@otago.ac.nz). Thank you for taking the time to complete this survey.

Yours sincerely

Dr Donna Kennedy, BDS
Hospital Dental Surgeon
Nelson Hospital

Appendix H – Letter to Ministry of Health requesting NZCR data

31 December 2015

Dear Sir/Madam,

I am writing to request information from the NZ Cancer Registry as part of my thesis towards a MComDent through the Faculty of Dentistry at the University of Otago. The study title is 'Exploring the role of primary healthcare clinicians in the detection and diagnosis of mouth cancer in New Zealand by: 1.Assessing whether differential access to dental care impacts on the stage of diagnosis of mouth cancer in the South Island, New Zealand; 2. Assessing the opinions and practices of New Zealand dentists and clinical dental technicians with regards to mouth cancer and whether this impacts on stage of diagnosis; 3. Developing an understanding of the awareness of mouth cancer by general medical practitioners in Canterbury and Nelson and whether this impacts on the stage of diagnosis.

Ethical approval has been granted for this study by the HDEC (ethics ref: 15/CEN/90). I have attached a copy of the approval letter. To gain adequate information to answer the study questions I request the following information:

1. Cancer registrations

For all oral cancer and oro-pharyngeal cancer registrations (ICD-10 codes C00-C10 and C14) for 2000 to 2014, and for the first six months of 2015. I request the following information for records where the NHI has a NZ resident status = N.

For each record I seek the information of the following fields:
Master NHI number
Date of birth
Age at diagnosis
Sex
Prioritised ethnic group
Ethnicity 1
Ethnicity 2
Ethnicity 3
Date of diagnosis
Registration year
Registration month
Basis of diagnosis code
Cancer notes
Extent of disease
Multiple tumours flag
Site code (4 characters)
Site code description
Morphology code
Morphology description
DHB of domicile

DHB at diagnosis
Date of death (from the NHI)
NZ resident status (from the NHI)

2. Mortality

I ask for a file of all registered deaths from 2000 to 2014 of patients listed in section 1 above and provide, where available, the following fields:

Unique patient identifier (this will be a one-off encryption that still uniquely identifies the individual)
Registration year
Death date
Country of birth
Date of birth
Death type
Sex
Age at death
Prioritised ethnic group
Ethnicity 1
Ethnicity 2
Ethnicity 3
Domicile code
Death information source code
Occupation free text
Years in New Zealand
Clinical coding system ID
Underlying cause of death (Diagnosis Type "D")
Other relevant diseases present (B1) (Diagnosis Type "F")
Other contributing causes (B2) (eg, medical misadventure) (Diagnosis Type "G")
Cancer as a non-contributing cause of death (Diagnosis Type "C")
Certifier of death
Post mortem indicator

3. Hospital discharge data

I request a file of all publicly funded hospitalisations from 1988 to the first six months of 2015 for the people registered and listed in section 1 above..

For each record I seek the information of the following fields:

Unique patient identifier (this will be a one-off encryption that still uniquely identifies the individual)
NZ resident status
Specialty code
Event start date
Event end date
MDC code

MDC grouper type
Agency code
Agency type
Facility code
Facility type
Domicile code
DHB of domicile
Admission source
Admission type
Age at admission
Sex
Prioritised ethnic group
Ethnicity 1
Ethnicity 2
Ethnicity 3
Event type
Event end type
Event local identifier
Event leave days
Diagnosis codes (first 15 reported, ICD-9-CMA-II)
Accident/ecodes (first 10 reported, ICD-9-CMA-II)
Accident date (first 10 reported)
Accident date flag (first 10 reported)
Operation codes (first 15 reported, ICD-9-CMA-II)
Operation dates (first 15 reported)
AN-DRG v3.1 code
CCL
AR-DRG current
DRG grouper type
Purchase unit
Costweight code
Costweight

Your assistance with gathering this data is very much appreciated. If you require further information please contact either myself, or one of my study supervisors Prof Murray Thomson (murray.thomson@otago.ac.nz) or Assoc. Prof. Brian Cox (brian.cox@otago.ac.nz).

Thank you again.

Yours sincerely

Dr Donna Kennedy Langley, BDS
Dental Surgeon
7 Van Diemen Street
Nelson

Appendix I – List of CDHB patient-identified signs and symptoms of OC and OPC

Neck lump
Non-healing ulcer
Painful mouth/tongue
Bleeding lesion
Persistent cough
Lump/swelling in mouth
Neck swelling
Submandibular lump
Hoarse voice,
Jaw bruising
Weight loss
Painless swelling side of tongue
Voice change
Otalgia
Sore throat
Persistent tonsilitis
Tonsil swelling/asymmetrical tonsil
Difficulty swallowing
Trismus
Discomfort while eating
Ill-fitting denture
Preauricular swelling
Throat irritation
Leukoplakia
Dysarthria,
Limited tongue movement
Loose teeth
Expanded upper arch
Multiple skin lesions on face/lip/ear
Boil on cheek
Swelling behind jaw
Blood stained sputum
Paraesthesia or numbness
Non-healing extraction site
Unusual sensation
Painful dry mouth
Delirium
Confusion
Mucosal colour/texture change
Oral lichen planus
Fever