Oral health knowledge and behaviours amongst adults with diabetes and their healthcare professionals

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Submitted in total fulfillment of the requirements of the degree of Masters of Philosophy

June 2017

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Abstract

Background
Diabetes and periodontal diseases are common chronic diseases in the community. Diabetes, particularly if sub-optimally managed, is associated with an increased prevalence and severity of periodontal diseases, and severe periodontal disease adversely effects glycemic control. Studies have demonstrated that treating periodontal diseases may help improve a person’s glycemic control. Thus, understanding the association between diabetes and oral health has important implications for people with diabetes and the healthcare professionals that assist with their management.

Despite the bidirectional relationship between diabetes and oral health, overseas studies have reported low levels of oral health knowledge and sub-optimal self-care behaviours in people with diabetes and few studies have explored this in Australia.

Preventing and managing the chronic complications that arise from diabetes requires a multidisciplinary approach. However, research indicates that there are gaps in the knowledge of medical and oral health professionals with regards to the link between oral health and diabetes. Little is known about how oral health is incorporated into the clinical practice of healthcare providers assisting people with the management of their diabetes in Australia and the extent of collaboration between medical and oral health professionals.

Aim
To investigate oral health knowledge and behaviours of adults with diabetes. Additionally, to explore the oral health knowledge of healthcare professionals that provide self-management support, health education and treatment interventions to adults with diabetes.
Methods
A mixed methods study comprised of:

(1) Online survey of adults with type 1 and type 2 diabetes. The survey results were analysed using STATA software and the findings summarised using descriptive statistics.

(2) Qualitative study in which semi-structured interviews were conducted with 10 healthcare professionals: three dentists, two general practitioners (GPs), two dental hygienists and three diabetes educators. Interviews were audio recorded, transcribed verbatim and analysed thematically.

Results
154 people with diabetes completed the survey. A significant proportion (20%) of people with diabetes were unsure if diabetes could worsen their oral health. Many did not report oral self-care behaviours consistent with recommendations for people with diabetes, for instance 41% did not brush twice a day, 49% did not floss daily and 33% did not visit a dentist annually.

Three main themes emerged from the interview study. (1) Healthcare professionals reported uncertainty about the relationship between diabetes and oral health, and were unclear about the bidirectional nature of this association. (2) Healthcare professionals do not routinely discuss the link between oral health and diabetes with people with diabetes. (3) Medical and oral healthcare professionals do not actively communicate and collaborate in the management of people with diabetes.

Conclusions
Adults with diabetes are in a high-risk group for oral diseases and yet a significant proportion report being uncertain about the relationship between diabetes and oral health and practice less than ideal oral self-care behaviours. Medical and oral healthcare professionals are a primary source of information for people with diabetes. Therefore they require a clear understanding of the bidirectional links between oral diseases and diabetes so that they may provide patient education, support oral self-care and diabetes self-care and perform timely treatment interventions.
Using the Chronic Care Model (CCM) as an organising framework, interventions can be instituted at a patient, healthcare professional and healthcare system level in order to improve diabetes care and health outcomes for people with diabetes.
Declaration

This is to certify that:

- The thesis comprises only my original work towards the Masters of Primary Health Care except where indicated in the Preface.
- Due acknowledgement has been made in the text to all other material used.
- The thesis is fewer than 50,000 words in length, exclusive of tables, maps, bibliographies and appendices.
Acknowledgments

I wish to acknowledge the contribution of my supervisors A/Professor John Furler and Dr. Jo-Anne Manski-Nankervis who throughout the course of my research project have provided me with invaluable advice, knowledge, and support. They have always done this with grace and patience, and without their guidance I would not have been able to complete this project.

I would like to also thank my supervisory panel, especially Professor Hanny Calache for additional help and advice throughout the course of this study. A special thanks to A/Professor Meredith Temple-Smith for providing me with an introduction to research and continuing encouragement throughout my project.

I also acknowledge the people with diabetes and healthcare professionals who participated in the study. Without their participation, this research study would not have been possible. Thanks also to Colgate for providing some funding for this study, and Diabetes Victoria for their help in promoting the research and distributing the invitations to the survey participants.

Finally, my biggest thank you to the most important person in my life, my wife Vanessa, who has supported me unreservedly throughout this endeavor. Without her unwavering belief in me and the selfless sacrifices she has made along the way, this study would not have been completed.
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Glossary of Terms

**Periodontal diseases** are gingivitis and periodontitis. They are inflammatory diseases that affect the gums (gingivae), connective tissues and the jaw bone, which support teeth [1]. Risk factors for developing periodontal diseases include poor oral hygiene habits; smoking; the effects of some medication; and systemic conditions such as diabetes [2].

**Gingivitis** is a plaque-induced inflammation of the gingivae (gums) characterised by red, swollen tissues which bleed on brushing, flossing and probing [3].

**Periodontitis** is characterised by the destruction of the structures that support the tooth. As the disease progresses and bone is lost teeth may eventually become loose and be lost [3].

**Dental caries**: dental decay

**Oral health professionals**: dentists, dental hygienists, dental therapists and oral health therapists.

**Dental hygienists** provide diagnosis, periodontal/gum treatment, preventive services and other oral healthcare to people of all ages.

**Dental therapists** examine and treat diseases of the teeth in preschool, primary and secondary school children under the general supervision of a dentist.

**Oral health therapists** are dual qualified as a dental therapist and dental hygienist. They provide oral health care for children and adolescents and with additional education and training they may treat adults.
HbA1c refers to glycated haemoglobin (A1c), which reflects average plasma glucose concentration. Because red blood cells survive 8-12 weeks, measuring HbA1c reflects average blood glucose levels over that time.

**National Survey Adult Oral Health (NSAOH)** was last conducted in 2004–06. Information is collected using interviews and standardised dental examinations.

**National Dental Telephone Interview Survey (NDTIS)** is a telephone survey of a random sample of the Australian population aged five years and over. The survey collects information on oral health and dental care, including oral healthcare service utilisation.
Chapter 1

Introduction

1.1 My interest in diabetes and oral health

In my thesis, I will explore what adults with diabetes know about the relationship between diabetes and their oral health, and the behaviors they practice in relation to their oral health. I will also investigate if any differences exist in oral health knowledge and behaviors between adults with type 1 and type 2 diabetes. Finally, I will examine how the health care professionals (medical and dental) who assist people manage their diabetes, view oral health and diabetes, and what factors influence the oral health information they provide their patients.

This thesis has its origins nearly 25 years ago, when I was first diagnosed with type 1 diabetes. At the time of diagnosis, I was practicing as a dentist and striving to improve the oral health of my patients. The new and relentless daily schedule of injections and blood glucose testing that my diagnosis imposed upon me, led me to think more deeply about my own health behaviours and those of the patients I cared for.

Frequent medical appointments with endocrinologists, ophthalmologists, GPs, diabetes educators and podiatrists, made me consider how we as health care professionals communicate and collaborate with each other to achieve the best results for our patients. I also observed during these frequent visits, that the topic of oral health and diabetes was never discussed. Whether this was because my clinicians knew I was a dentist, or whether it was because of what I eventually came to see as a separation of the management of oral health from the management of general health and the rest of the body, was unclear. What clearer example of this separation, than with a condition like diabetes, whose complications affect nearly all the systems of the body including the oral cavity.
Later I studied diabetes education as a way of being more prepared for the challenges of managing my own diabetes and the chronic oral diseases of the patients I treated. This also allowed me to view how other health professionals are taught and trained, and what emphasis, if any, is placed on oral health in their training.

As my exposure increased to the emerging research about how chronic inflammation of the mouth may influence general health and potentially negatively impact on diabetes, I wondered what people with diabetes knew about the oral complications of their condition. Were they aware that common oral diseases may worsen their glycemic control and thus lead to poorer health outcomes?

These personal interests, and my experience as both a health care provider and a health care recipient, became the basis for what would become this research project and the questions it explores.

1.2 Background

Diabetes and periodontal diseases (gum diseases) are common conditions worldwide. It is estimated there are 422 million adults living with diabetes [4]. The World Health Organization (WHO) reported that 10–15% of the world population suffers from severe periodontitis [5]. In Australia approximately 23% of adults have moderate to severe periodontal disease [6].

Oral health is essential to an individual’s overall health and quality of life [7]. Recently the FDI (Fédération dentaire international) World Dental Federation defined oral health as “the ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort and disease of the craniofacial complex”[8, 9].
In terms of general health and wellbeing, poor oral health can compromise overall nutrition by affecting an individual’s chewing ability [10, 11]. Poor oral health can also negatively impact a persons’ psycho-social wellbeing [12] and retention of teeth is related to improved oral health related quality of life[13, 14]. Dental decay and periodontal diseases are the main reason for tooth loss [15, 16]

1.2.1 Type 1 and Type 2 Diabetes

A common media and public misconception is that type 1 and type 2 diabetes are one disease. A recent episode of the popular UK series East Enders highlighted the angst this confusion can cause to people with type 1 diabetes, when it was suggested that children get diabetes from too much sugar [17].

Type 1 diabetes accounts for approximately 13% of people with diabetes in Australia [18]. It is characterised by an absolute deficiency in insulin due to the autoimmune destruction of the pancreatic beta cells. The exact cause of type 1 diabetes is unknown, but it is believed environmental factors may trigger the immune-mediated destruction of pancreatic beta cells in susceptible individuals. It can present at any age but usually occurs in childhood and adolescence [19]. Patients with type 1 diabetes require insulin for survival, and the condition is usually managed by an endocrinologist. Type 1 diabetes has several significant acute complications including hypoglycaemia and ketoacidosis resulting from hyperglycaemia [20]. To prevent these acute complications, which can result in loss of consciousness, coma and hospitalisation, the person with type 1 diabetes requires careful self-management of insulin dose, carbohydrate intake and activity levels. This includes the need for regular self-monitoring of blood glucose levels [21, 22].

Type 2 diabetes is the most common form of diabetes and accounts for approximately 85% of people with diabetes in Australia [18]. In people with type 2 diabetes, the body is able to produce insulin, but insulin resistance and then pancreatic islet cell dysfunction, results in a relative insulin deficiency and hyperglycaemia.
Type 2 diabetes usually presents in adults after the age of 40, but it is increasingly being seen in children and adolescents. The “epidemic” of type 2 diabetes has been associated with the rising problem of obesity and is strongly associated with lifestyle factors such as diet and inactivity [19]. Indeed modifications to life style risk factors may prevent or delay the onset of diabetes in individuals with pre-diabetes.

The diagnosis and management of the person with type 2 diabetes is usually carried out by the GP. The initial management may include life-style modification with addition of oral hypoglycaemic medications [23]. Type 2 diabetes is a progressive condition, and in time as maximal doses of oral hypoglycaemics are reached, the person with type 2 diabetes will often require insulin initiation [24]. The self-care behaviors for people with type 2 diabetes are similar to those with type 1 diabetes, but until the initiation of insulin for instance, there is less need self-blood glucose monitoring [25]. In general, the person with type 2 diabetes is older at diagnosis, develops diabetes due to different aetiological factors, is under the care of a GP, is treated with different medications, uses a different self-care regime, and is at a lower risk of hypoglycaemia and ketoacidosis than the person with type 1 diabetes.

1.2.2 The diabetes and oral health relationship: a two-way street

Regardless of whether a person has type 1 or type 2 diabetes, the condition results in chronic hyperglycaemia, which is responsible for many of the long-term complications of the disease. The chronic complications of diabetes include retinopathy, neuropathy, nephropathy, cardiovascular complications (coronary arterial disease, stroke and peripheral vascular disease) and delayed wound healing [26]. Diabetes mellitus has also been associated with several oral complications, with most research interest focused on the relationship between diabetes and periodontal diseases [27]. Diabetes is now recognised as a risk factor for increased prevalence, severity and progression of periodontal (gum) diseases [28] and is now referred to as the “sixth complication” of diabetes [29]. The increased risk of periodontitis in a person with diabetes is related to their glycaemic control and duration of diabetes. In those with good glycemic control, diabetes has little effect on their risk for periodontitis, whereas suboptimal metabolic control increases their risk of periodontal disease significantly [30, 31].
Periodontal disease is associated with the development of diabetes and its associated complications, including nephropathy, stroke, ischemic heart disease, and cardiac failure [32, 15]. Studies have also shown that periodontal disease increases HbA1c in people without diabetes, suggesting that periodontitis may increase the risk of developing diabetes [33]. Intervention studies have demonstrated that treatment of periodontal disease may improve metabolic control, resulting in improved overall health outcomes for people with diabetes [34]. Recent systematic reviews have found that treatment of periodontitis alone is associated with improved metabolic control and reductions in HbA1c of around 0.4% [34-38]. Periodontitis may also be an early sign of diabetes and may be a helpful risk indicator for diabetes screening [39].

This complex association between diabetes and oral health occurs on many levels. At a molecular and biological level, the mechanisms responsible for the association between these two conditions are thought to involve aspects of immune functioning, neutrophil activity, and cytokine biology [40]. In addition, type 2 diabetes and oral diseases, share common chronic disease risk factors such as smoking, an unhealthy diet, harmful alcohol consumption, being overweight or obese and physical inactivity [41].

Diabetes and oral health also share some of the same social determinants of health [42-46]. Social determinants of health are important factors in the prevalence of diabetes and periodontal diseases, for instance in 2014–15 the self-reported prevalence of adults with diabetes was twice as high in the lowest socioeconomic group compared to the highest socioeconomic group [18]. The prevalence of periodontitis also demonstrates a socioeconomic gradient, being almost twice as prevalent in lower income households compared to higher income households after adjusting for age and sex [47]. Socioeconomic gradient refers to the stepwise manner health outcomes improve as socioeconomic position improves and can be measured by an individual’s income, occupation, or the highest level of education he or she has attained [48]. In Australia, concession cardholders are more likely to report that their tooth extraction was due to periodontal disease than non-card holders [49]. Socio-economic status has been shown to affect a person’s ability to access dental services and pay for preventive products which can negatively impact on oral health.
Diabetes is over represented in disadvantaged populations. For instance, Indigenous Australian adults are almost four times as likely to have diabetes as non-Indigenous individuals. In addition the National Survey of Australian Oral Health (NSAOH), demonstrated the Indigenous population experienced approximately 1.3 times the prevalence of moderate and severe periodontitis than non-Indigenous individuals [50].

1.2.3 Health education of people with diabetes

I have demonstrated that appropriately managing periodontal disease in a person with diabetes is essential for the optimal control of their diabetes and vice versa. Reflecting the substantial evidence about the association between diabetes and oral health, the European Federation of Periodontology and the American Academy of Periodontology recently released a statement on the management of people with diabetes. It recommends that people with diabetes should be advised of their increased risk of periodontal disease, and that the presence of periodontal disease may make managing their diabetes and preventing complications more difficult [51]. The statement advises people with diabetes to have a comprehensive dental exam, receive detailed oral self-care education and regular monitoring of their periodontal condition. For those with periodontal disease they should receive timely intervention and regular follow-up [51].

Despite the inter-relationship between diabetes and oral diseases, oral health is frequently overlooked in most diabetes management programs, education sessions and complication screening processes [52]. Overseas studies suggest that adults with diabetes are generally unaware of the bidirectional link between diabetes and oral health, are often unaware of the need for stringent oral self-care, and attended oral health professionals less than people without diabetes [53].

A major barrier to people with diabetes receiving optimal diabetes management is a health care system that is fragmented and not structured to deliver coordinated care. Oral health has traditionally been viewed as separate from the health of the rest of the body [54]. Oral health professionals have been responsible for the oral cavity and associated structures and health care for the rest of the body has been delivered by medical professionals.
This separation of the health care system, extends to the health funding in Australia with oral health services treated differently to other health services. The national health insurance scheme, Medicare, provides free access to public hospital treatment and rebates for out-of-hospital medical services including GP and specialist services, but most dental services are not covered by Medicare and are instead funded directly by individuals [55].

The separation of oral health from general health has its origins in the nineteenth century, when Chapin Harris and Horace Hayden approached the Baltimore Maryland Medical School to introduce dental training into the medical curriculum. The proposal was rejected, and because of this rebuff, Harris and Hayden established the first dental school in 1840 giving rise to the dental profession. This fragmentation of health care system into organisational “silos” persists today, despite the strong evidence linking oral health and systemic health. One way of addressing this fragmentation of healthcare is by adopting the Chronic Care Model (CCM).

1.2.3 The Chronic care mode

An organised and integrated healthcare system has been demonstrated to improve health outcomes for people with chronic diseases such as diabetes [56]. One well accepted model in chronic disease management is the Chronic Care Model (CCM). The aim of CCM is to change the management of patients with chronic diseases from being reactive to proactive by adopting a planned and population based approach [57]. The original CCM consists of six key interrelated components of the health care system. These elements include organisation of health care, enabling patient self-management, decision support, delivery system design, improvement of patient sharing systems and formation of community linkages [58] (see Table 1). An expanded version of the model has also been proposed that adds three additional strategies that includes patient safety, care coordination and cultural competency [59].
### IMPROVED PRACTICE AND HEALTH OUTCOMES IS DEPENDANT ON:

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<td><strong>The Community</strong></td>
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*HCP- healthcare professional

#adapted from [57]
In this section I am going to reflect upon the elements of the CCM as they relate to improving care for people with diabetes.

The first component of the CCM is the organisation of health care. Support for diabetes care is essential at the healthcare system level in order to improve health outcomes for people with diabetes. The organisation of healthcare system involves strategies that promote improvements at all levels in order to achieve safe and optimal quality of care for people with diabetes [57]. This may include providing incentives to healthcare providers based on quality of care and developing agreements between and within organisations to facilitate coordination of care [59].

The second element of the CCM is supporting self-management of chronic diseases through education, teaching skills and empowering patients [58]. For a person with diabetes this involves the self-management of both diabetes and oral diseases. To achieve this people with diabetes need to be informed about the oral complications of their condition, how these may impact on their general health, and self-care routines to improve health outcomes [51]. To provide this information, healthcare professionals need to be aware of the bidirectional association between diabetes and oral diseases and how these two conditions may influence each other, so that they may support the person with diabetes manage their condition effectively.

The third component of CCM addresses supporting decision making by healthcare professionals. Substantial evidence exists about the relationship between diabetes and periodontal diseases but this has only recently been included in clinical guidelines released by professional organisations involved in diabetes care [60]. By providing evidence based recommendations, clinical guidelines can enable healthcare professionals to consider the appropriateness of their clinical decisions and practices, promote consistency of care and result in improved health outcomes for patients [61]. From a health policy perspective, guidelines may influence public policy by highlighting an under recognised health problem such as the oral complications of diabetes. This may result in an increased focus on preventive regimes, improving health services, and targeting services to those in need [61].
The next component of the CCM in diabetes is the delivery of healthcare. Collaborative, multidisciplinary teams are effective in providing care for people with diabetes [62]. To ensure optimal health outcomes, there needs to be coordination of services between oral healthcare providers and medical professionals. This requires interprofessional collaboration and communication between healthcare professionals that addresses barriers to care, diabetes and oral health knowledge gaps, low awareness of health service accessibility, and lack of psychosocial support [63, 64].

Improving health outcomes requires collection of data on individual patients, the population of interest and healthcare professional behaviours to facilitate effective care. The fifth component of the CCM is clinical information systems that provide this information and enable effective communication and exchange of information between oral health professionals and medical professionals.

The final component of CCM aims to meet the needs of people with diabetes through community programs and partnerships between health organisations and community organisations. To achieve this community resources and health policy must recognise oral health is integral to a person’s general health.

The CCM has been demonstrated to be effective for improving the quality of diabetes care [65, 66]. Given the importance of oral health to the overall health of people with diabetes, I have used the CCM as a conceptual framework to approach the analysis and reporting of my research findings. I will now outline the chapters in my thesis.

1.4 Thesis plan

I have offered some explanation into my personal relationship with diabetes, and how my interest in diabetes and oral health evolved into the research questions this thesis addresses. I have also provided some background into the relationship between oral health and diabetes and the way these conditions are managed by healthcare professionals.
Chapter two is a review of the current literature relating to oral health knowledge and behaviours of adults with diabetes, and the knowledge and clinical practices of health professionals with regards to the link between diabetes and oral health. Chapter 2 concludes with the aims of my study and the research questions that are investigated.

I have used a mixed methods approach to explore my research questions and the two phases of my research study were done sequentially. The initial phase of my study is presented in Chapter 3 and uses an online survey to explore what adults with diabetes know about the bi-directional relationship between oral health and diabetes. It also examines the oral health behaviours of adults with diabetes including brushing, flossing and visits to oral health professionals.

Informed by the results of the survey, the second phase of my research presented in Chapter 4, is a qualitative study exploring what health professionals managing patients with diabetes know about oral complications of diabetes, their understanding of the bi-directional relationship between oral health and diabetes what factors may influence their discussions with patients about oral health what contact and collaboration they have with each other.

I will discuss the major findings of my studies in Chapter five, examine how these results compare with findings from previous research and consider the limitations and strengths of this study and implications for research and future practice. In Chapter six I will present the general conclusions of my thesis.
Chapter 2

Literature Review: Oral health knowledge, attitudes and behaviour amongst adults with diabetes

2.1 Background

Diabetes mellitus represents a major worldwide health problem. This common chronic condition affects an estimated one in eleven adults globally [67], and in Australia, based on self-reported data from the Australian Bureau of Statistics (ABS) 2014–15 National Health Survey, approximately 1.2 million people (6.0%) have diabetes [68].

Periodontal diseases and diabetes are common chronic diseases. In Australia, approximately a fifth of individuals have gingivitis and a nearly quarter (22.9%) have moderate to severe periodontal disease [69]. Like diabetes, the prevalence of periodontal diseases increases with age, with over half of people over 65 years having moderate to severe periodontitis [69]. Diabetes is considered a major risk factor for periodontal diseases and periodontal diseases have been termed the ‘sixth complication’ of diabetes. Based on epidemiological studies, people with diabetes have an increased prevalence of severe periodontitis compared to people without diabetes and the severity of periodontitis is associated with poor glycaemic control [70]. Since glycaemic control may fluctuate over time, it should be assumed people with type 1 and type 2 diabetes are at higher risk of periodontal diseases. Thus, all adults with diabetes should be informed of, and have a clear understanding about the relationship between diabetes and oral health.

Diabetes results in elevated blood glucose levels and over time this leads to serious damage to many of the body’s systems, especially the blood vessels and nerves. The morbidity and mortality related to diabetes is due to the development of complications including, retinopathy, neuropathy, nephropathy and increased risk of cardiac, peripheral arterial and cerebrovascular disease [70].
Diabetes has also been associated with a number of important oral complications including an increased prevalence, extent, and severity of periodontal disease (gingivitis and periodontitis), increased risk of dental caries, xerostomia, Candida infections, oral mucosal disorders, taste disturbances and altered tooth eruption [71]. Recently research has emerged suggesting the link between diabetes and periodontal disease is bi-directional, in that periodontal disease is a risk factor for poor glycaemic control and thus the development and progression of diabetes complications [70]. Intervention studies have demonstrated that treatment of periodontal diseases may improve metabolic control as measured by the HbA1c, resulting in improved outcomes for people with diabetes [33]. Mosen and colleagues [72] found that people with diabetes receiving regular dental care over a three-year period was independently associated with lower diabetes-specific Emergency Department visits and hospital admissions.

Oral health is integral to an individual’s overall health and quality of life. Poor oral health affects a person’s ability to eat, speak, taste food, swallow, smile, and show emotion [73-75]. Loss of teeth and oral disease is associated with real and perceived decrease in chewing ability, food avoidance and modification of food intake. This is particularly relevant to a person with diabetes, as a major component of their management revolves around dietary intake and nutrition [76].

The key to good oral health is good self-management, such as brushing twice a day, daily interdental cleaning, and regular professional assessment and treatment. Knowledge and awareness about the relationship between diabetes and oral health, and oral disease prevention is an important element in the pathway to better oral health outcomes. Studies of people with diabetes have shown the more knowledge a person has; the more likely they are to adopt positive lifestyle changes and self-care behaviours, resulting in better metabolic outcomes [77]. Thus, oral health knowledge and awareness and oral health self-management behaviours are an important element of good self-management of diabetes.
Internationally little is known about the knowledge, attitudes and behaviours of people with diabetes in relation to the link between diabetes and oral health. In Australia, our understanding of the oral health status and behaviours of the general population comes from the National Dental Telephone Interview Survey (NDTIS), and the National Survey of Adult Oral Health (NSAOH). Although providing valuable information about oral self-care behaviours and visiting patterns, neither has specifically addressed the oral health knowledge and behaviours of adults with diabetes. A report from the Australian Research Centre for Population Oral Health did examine the dental attendance of people with a chronic disease finding that only 47.5% of adults with diabetes had visited the dentist in the previous 12 months, which was significantly lower than people without a chronic disease [78].

The aim of this literature review was to assess the current level of knowledge about the link between diabetes and oral health, attitudes to oral health, adherence to recommended oral self-care behaviours and frequency of visits to oral health professionals (dentists and dental hygienists), among adults with diabetes.

2.2 Search Methods

I searched the following databases for relevant articles published between January 1990 and February 2015:

- Medline
- CINAHL
- PsycINFO
- Cochrane Database of Systematic Reviews
- Google scholar

Data bases were searched using various combinations of the following key words: “diabetes mellitus”, “oral health”, “knowledge”, “attitudes”, “awareness”, “dental visit”, “dental attendance”, “behaviour”, “periodontal disease” “self-care”, “dental care”, dental hygiene” “self-mang*”, periodont* and “dental caries”.

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Only original studies that included an empirical measurement of oral health knowledge and/or oral health behaviours were included in this review. Exclusion criteria included: publication in a language other than English, study subjects less than 18 years of age, opinion pieces and reviews, and publication dates before 1990. The references from the original and review articles were then hand searched for to identify potentially relevant papers. The authors of relevant studies were contacted to clarify details from their own studies, and establish whether they knew of additional studies that did not appear in their reference list.

The search identified 2336 records, after duplicates were removed and abstracts and titles were screened 75 full text articles were assessed for eligibility and 56 studies were included in the analysis.

2.3 Results

Fifty-six studies [78-134] were examined for this literature review. Three of the studies examined only participants with type 1 diabetes, in twenty-two studies the participants had type 2 diabetes, twenty-eight studies were a mixed population of people with type 1 and type 2 diabetes and in three studies the type of diabetes was not identified. Most studies had a near equal mix of males and females, apart from two studies that investigated the quality of care women with diabetes received [107, 82].

2.3.1 Oral health knowledge

One Australian investigated whether people with chronic diseases reported that their oral health impacted on their general health. In that study 13.5% of people with diabetes thought their oral health could influence their general health [78]. Studies from the U.S.A [105, 117-119], Europe [81, 87, 120], the Middle-East [80, 82,121, 122], Africa [123]and Asia [103, 124, 125] found that between 13% and 60% of people with diabetes were aware that diabetes could adversely affect their periodontal health.
With the exception of one study [121], less than half the respondents were aware of the relationship between diabetes and periodontal disease. For example in the U.S.A, only 18.2% of respondents believed their oral health would be better without diabetes, and 44.1% denied a link altogether [105].

Two studies examined whether people with diabetes were aware of the bidirectional relationship between periodontal disease and diabetes, with between 23.4% [119] and just over a third of adults with diabetes aware that periodontal disease could adversely affect their glycaemic control [80]. Sheila and colleagues [119] found only 39.6% (n=44) knew that “people with diabetes have gum problems more often if their blood sugar stays very high.”

There was also a low level of knowledge concerning the other oral complications of diabetes, with between 40-43% of people with diabetes aware of its association with xerostomia [87, 91, 121], 23.9% delayed healing [87] and 42% fungal infections [121].

Three qualitative studies of adults with type 2 diabetes, one using focus groups [118] and two interview studies [123, 126] found adults with diabetes were mostly unaware of the link between oral health and diabetes.

Several studies compared the patient’s knowledge of periodontal disease as a complication of diabetes, with their knowledge of the other complications of diabetes. For instance in the U.K while only a third of adults with diabetes recognised periodontal disease as a complication of the condition, 84% were aware of an increased risk of heart disease, 98% of eye disease, 99% of circulatory problems and 94% of kidney disease [81].

2.3.2 Dental Attendance

In the studies reviewed, 8% to 86% of people with diabetes had visited the dentist in the last 12 months. Only one Australian study was found that investigated the dental attendance of people with chronic diseases including diabetes. This study found people 47.5% of people with diabetes reported visiting a dentist in the previous 12 months [78].
In studies that compared dental attendance among those with diabetes and those without diabetes (controls), people with diabetes attended less than the control group in all but one of the studies [86, 101, 105, 107, 111, 112] and in that study people with diabetes were more likely to have not visited the dentist for four or more years compared those without diabetes [100]. Caudhari and colleagues used a statistical hurdle model to characterise differences in the use, type and intensity of dental services between adults with and without diabetes concluding adults with diabetes had 26% lower odds of visiting the dentist than those without diabetes [127].

Several studies the examined the potential barriers to utilising dental services for adults with diabetes. Cost was cited as the principal reason people with diabetes attended the dentist less than those without diabetes in many of the studies [101, 105, 128]. Other barriers to dental visitation included lack of perceived need [79, 87, 112, 125], not having dental insurance coverage [101] and fear and anxiety [120].

A number of studies compared dental visitation with attendance to diabetes care providers and medical professionals, with most finding people with diabetes were less likely to have visited a dentist than they were to have had diabetes care, foot care or eye care [101, 106, 107]. In Jordan for example while only 10% of respondents regularly attended the dentist, 83% attended their diabetes care provider regularly [80].

### 2.3.3 Oral self-care behaviours

Oral self-care behaviour of adults with diabetes, as measured by frequency of tooth brushing and dental flossing, was recorded in most of the studies. Tooth brushing twice a day was reported by 3% to 88% of respondents with diabetes. In studies that compared tooth-brushing behaviour between people with and without diabetes, people with diabetes reported brushing and flossing less, than those without diabetes [93, 94, 100, 105, 110, 129, 130].
Interdental cleaning in the studies was defined as flossing, use of toothpicks and other interdental cleaners. The rates for interdental cleaning varied from 5% in Hong Kong [99] to 82% in Saudi Arabia [80, 131]. A large number of participants reported not flossing at all: USA 42% [132], India 42% [79], [133], Jordan 48% [80], U.A.E 66% [121], Italy 67.8%[134], U.S.A 67% [105] and Taiwan 70 % [124].

In terms of oral self-care, in the U.K and the USA, respondents rated oral self-care tasks as less important than diabetes self-care tasks, with flossing for instance rated the least important health related activity [87, 105].

2.3.4 Sources of Knowledge

Several studies investigated the source of the oral health information amongst adult with diabetes. In the U.S.A Yuen and colleagues found that for information relating to the association between diabetes and periodontal disease, 50.6% received the information from dentists, 47% from physicians, 46.6% from diabetes/nurse educators, 41.1% from dental hygienists and 6.3% from pharmacists [114]. In the U.A.E, less than half of the adults with diabetes had learnt the information from oral health professionals, instead accessing other sources such as the Internet, television and print media and friends [121].

2.4 Discussion

This review indicates adults with diabetes have a low level of knowledge of the relationship between diabetes and periodontal disease. Equally they have low level of knowledge about the other oral complications of diabetes, such as xerostomia and oral mucosal conditions. A consistent finding of this review was that knowledge about the relationship between oral health and diabetes was very low compared to knowledge about the other systemic complications of the disease, such as retinopathy, neuropathy, nephropathy and cardiovascular disease.
Although there is debate regarding the optimal frequency of tooth brushing and flossing [135], a significant number of adults with diabetes in this review reported that they did not brush twice daily and rarely cleaned the interdental area. In most studies when compared to controls without diabetes, people with diabetes reported brushing and flossing less, despite being at an elevated risk for periodontal disease.

Adults who regularly attend an oral health professional are more likely to receive care focused on prevention, advice on oral self-care, and benefit from early diagnosis and prompt treatment of oral disease [136, 137]. The majority of studies reviewed show people with diabetes have low annual attendance rates to oral health professionals, and in nearly all the studies people with diabetes attended the dentist less than those without diabetes [86, 112]. When oral health visits were compared to visits to the other members of the diabetes management team, many of the studies found frequency of attending oral health professionals to be far lower than for other health visits, such as foot care and eye care [101].

I found limited Australian data on oral health knowledge and awareness of the link between diabetes and oral health, among adults with diabetes. The National Dental Telephone Interview Survey (NDTIS) in 2010 did examine the impact of oral conditions on people with a chronic disease including, diabetes, and found among adults with diabetes only 13% believed their oral health could impact on their general health [78].

Some of the studies reviewed have explored the possible reasons behind the low level of knowledge, and less than ideal self-care and dental visiting patterns among adults with diabetes. These include social, psychological, environmental and economic factors that influence oral health-related behaviour and ultimately oral health.

Knowledge alone rarely translates into improvements in adherence to recommended self-care behaviours. The degree to which a patient follows advice regarding self-management behaviours is determined in part by psychological factors and personal health beliefs [138]. Health beliefs, self-efficacy [139], self-esteem [140], health locus of control [141] and attribution theory [98] may influence the oral health behaviours of adults with diabetes.
For instance, Syrjala and colleagues found that high self-efficacy for tooth brushing, interdental cleaning and dental visiting correlated with a high frequency of these behaviours among adults with diabetes [142]. The low levels of oral health knowledge and self-care behaviours found in this review may reflect a didactic approach to diabetes and oral health education. Medical and oral health professionals need to use patient centred interventions that focus on improving self-efficacy and patient empowerment.

Low oral health literacy may also be important [118]. Health literacy is the set of skills required for functioning effectively in a health care environment [143]. Oral health literacy is a subset of health literacy, and is the degree in which an individual can access, process and understand basic oral health information and services needed to make appropriate health decisions [144]. Diabetes requires advanced health literacy skills because of the complex self-care tasks required to manage the condition, and evidence has linked inadequate health literacy to adverse health care outcomes for people with diabetes [145]. Although further studies are required on the impact of oral health literacy, it has been associated with low levels of knowledge, and poorer oral health status [146].

Oral health knowledge, beliefs and behaviours are also influenced by the environmental and economic context within which people live. Lack of access to appropriate oral health information may explain some of the findings. This can create misconceptions that may lead to harmful behaviours, for example the avoidance of brushing and flossing because of bleeding gums [114]. Results from this review suggest that oral health professionals do not routinely discuss how diabetes may affect oral health with their patients, nor the oral self-care measures required to prevent the oral complications of diabetes. A significant proportion of people with diabetes were not informed about the link between diabetes and oral health [126, 130], were not advised to be extra diligent with their oral hygiene and dental attendance [105, 126], and in some cases the dentist was even unaware of their diabetes status. Recent studies of oral health professionals have cited a lack of time, insufficient knowledge, ambivalence from patients, a belief that it is peripheral to their scope of practice and inadequate training, for a reluctance on behalf of dentists/hygienists to assume an active role in diabetes management [147-149].
Visits to the medical professionals involved in diabetes management, represent an additional source of information on the relationship between oral health and diabetes. This review found that while adults with diabetes visited these health providers far more frequently than their oral health professional, discussions around oral health and diabetes and screening for oral complications occur infrequently, suggesting a missed opportunity. For instance, a study of diabetes educators found just over half reported adequately covering oral health in their consultations due to lack of time, lack of knowledge related to oral health, and insufficient training [150, 151].

There also appears to be a reluctance on behalf of medical professionals to refer to oral health providers in the same way they would to other health professionals involved in diabetes management, perhaps reflecting a view that oral health visits are not part of routine diabetes care [123, 152, 153]. Healthcare provider recommendations and referrals to other health professionals are influenced in part by their own knowledge and attitudes, and this in turn may be influenced by professional guidelines and recommendations for diabetes care. Until recently professional guidelines for diabetes care had no robust recommendations for oral health screening, as opposed to screening for the other systemic complications of diabetes [154].

Access to affordable and timely oral healthcare services is also important. Financial constraints may impact on an individuals’ access to dental treatment and in several overseas studies, cost was cited as the principal reason for adults with diabetes not visiting the dentist [105, 120]. In the U.S.A it has been suggested that socioeconomic disparities were more exaggerated for dental visits, than any other health care visits for a person with diabetes [102]. Dental treatment in Australia is provided both in the public sector for eligible individuals and the private sector, with the majority of people accessing private dental care compared to public dental services [136]. Unlike the general health system with its subsidies and safety nets, in the private dental sector the individual pays for most their care, thus the cost of services can be a significant barrier.
In the U.S.A there is a strong relationship between lack of health insurance and not having a dental visit [89]. In Australia a higher proportion of adults with insurance make an annual dental visit compared to adults without insurance [155] and people with diabetes are less likely to have insurance than those without diabetes [156].

Diabetes self-management requires a significant time commitment for self-care and regular visits to health care professionals. People with diabetes may be preoccupied with other health related activities and less likely to attend to oral self-care, particularly if they perceive it to be less important and unrelated to their overall health [96]. Most people with diabetes have one or more co-morbid conditions, and the added burden of managing an additional condition can affect a person’s ability to adhere to self-care behaviours [157], making it less likely for an individual to receive preventive dental care [92].

Diabetes may negatively impact a person’s quality of life and studies have found high levels of depression and diabetes distress amongst individuals with type 1 and type 2 diabetes [158]. It has been proposed that both depression and diabetes distress may negatively influence self-efficacy which in turn may affect a person’s ability to perform self-care behaviours [159]. People with higher levels of self-efficacy have been shown to perform better diabetes self-care practices [160].

Finally the existing literature makes no distinction between patients with type 1 and type 2 diabetes in studies of oral health knowledge and oral health self-care behaviors amongst adults with diabetes. The complications of both type 1 and type 2 diabetes arise from chronic hyperglycaemia and this is also true of the oral complications of the disease [161], but type 1 and type 2 diabetes differ in their aetiology, pathophysiology, acute complications and medical management [23]. No studies were found that compared oral health knowledge and behaviours between people with type 1 and type 2 diabetes.
2.5 Limitations of the Studies

The studies examined in this review are cross-sectional and descriptive, so causal inferences can’t be made. Many of the studies rely on self-reporting of dental visits and this and self-reporting oral self-care behaviours can be influenced by recall bias and the desire to provide socially desirable responses. Most of the studies reviewed have sourced participants from a single treatment facility, therefore the results are not necessarily generalisable to the broader population [162].

Since the studies reviewed were examining oral health behaviour such as tooth brushing and flossing, edentulous subjects were often excluded from the analysis. Diabetes has been associated with other oral complications such as xerostomia and Candida infection, and since the prevalence of tooth loss like diabetes increases with age, edentulous adults with diabetes may represent a significant group in need of oral health care.

2.6 Conclusion

Although periodontal disease was described as the “sixth complication” of diabetes in 1993 [29], it remains a largely overlooked complication, with oral health rarely included in diabetes education programs, management strategies or complication screening processes [163]. Medical professionals are reluctant to provide oral health education routinely to people with diabetes primarily due to a lack of knowledge, time and limited oral health training [151]. Poor communication and collaboration between oral health professionals and medical professionals is a significant barrier to the coordinated management of adults with diabetes. When oral health has been included in diabetes management education, it can increase awareness of the relationship between diabetes and periodontal disease [114] and improve oral health behaviours [164]. Development and testing of interventions to improve the way oral health and medical professionals work together is needed, to achieve the best possible patient care outcomes for adults with diabetes.
My review of the current literature has identified gaps in our current understanding as to what people with diabetes in Australia know about the bi-directional relationship between oral health and diabetes, and what oral health behaviours they undertake to maintain their health and prevent oral diseases. Additionally, are there any differences in the oral health knowledge and behaviours amongst people with type 1 diabetes compared to type 2 diabetes?

2.7 Aims of my study

My review of the current literature identified only one Australian study that found 47.5% of people with diabetes reported visiting a dentist in the last 12 months and only 13% of people with diabetes believed their oral health could impact their general health. This study did not identify the type of diabetes of the respondent. No Australian studies were found that explored oral health self-care behaviours such as brushing and flossing of people with diabetes, nor did any study compare the oral health knowledge and behaviours of people with type 1 and type 2 diabetes.

The aims of my study were to:

1. Explore people with diabetes’ knowledge about the oral complications of the disease, their understanding of the relationship between diabetes and oral health, and the health behaviours they undertook to prevent oral disease and maintain their oral health.

My study attempts to address gaps in our current understanding about the oral health knowledge and behaviors of people with diabetes in Australia and whether there exists differences between people with type 1 and type 2 diabetes in these parameters.
2. *Explore what healthcare professionals know about the relationship between diabetes and oral health, and what they advise people with diabetes about this association.*

Healthcare professionals provide self-management support for people with diabetes but in overseas studies the oral complications of diabetes were rarely discussed. *My study investigates what factors may influence the oral health information provided* by the health professionals in my sample, and whether this differs for people with type 1 and type 2 diabetes.

3. *To investigate whether healthcare professionals communicate and collaborate with each other when supporting people with diabetes self-management.*

I also explored how healthcare professionals communicate and collaborate with each other in the management of people with diabetes.
Chapter 3

Survey of oral health knowledge and behaviours amongst adults with diabetes

My literature review in Chapter 2 identified a gap in knowledge about what people with diabetes in Australia knew about the oral complications of diabetes and what oral self-care behaviours they routinely perform. The aim of this component of my study was to explore the oral health knowledge and behaviours of adults with diabetes (type 1 and type 2) using a survey. Given that these conditions differ (see Chapter 1 pages 6-7) I was interested to see if there were differences in oral health knowledge and behaviours between the two groups.

In this chapter I will detail the methodology I used for the first phase of my study, an online survey of oral health knowledge and behaviours of people with diabetes in Victoria, Australia. I will begin by describing the development of the survey questions, discuss the rationale for choosing an online deployment of the survey, outline the ethical considerations, piloting of the survey, recruitment of participants, data collection and data analysis I employed for my study. Finally, I will present my results.

3.1 Aim

The aims of phase 1 of the study were to:

1. To explore what adults with type 1 and type 2 diabetes know about the relationship between diabetes and oral health;
2. To investigate the self-reported oral self-care behaviours including frequency of tooth brushing, flossing and visits to oral health professionals; and
3. To compare the oral health knowledge / behaviours of adults with type 1 diabetes to adults with type 2 diabetes
3.2 Methodology

3.2.1 Survey development

In developing questions for the survey, I firstly investigated previous studies and key themes identified from the literature review. Several international studies had used questionnaires to investigate oral health knowledge and behaviors amongst adults and children with diabetes. Authors of these international studies [81, 87, 111, 126] were contacted to gain permission to use or adapt some of the questions from their reports. The oral health knowledge and behavior questions were taken from national oral health surveys conducted in Australia including the National Survey of Adult Oral Health (NSAOH) and the National Dental Telephone Interview Survey (NDTIS). See Appendix 1.

In addition, several validated survey instruments were used to develop a framework of questions to be asked in the survey. With a growing emphasis on the psychological impact of living with a chronic disease such as diabetes, and the impact this might have on self-care behaviours, a validated diabetes distress tool and measurement of depression tool were also included in the survey questions. The measurement of depression tool used was the WHO-5 Well-being Index [165]. It covers 5 positively worded items, each of which is rated on a 6-point Likert scale from 0 (= not present) to 5 (= constantly present) [166].

Diabetes-specific distress is a common condition and it has been related to poor disease self-management. The 2-Item Diabetes Distress Screening Scale (DDS2) [167] is an easily scored screening instrument to detect diabetes-specific distress. Participants rate on a 6-point scale the degree to which the following items caused distress:

(1) feeling overwhelmed by the demands of living with diabetes

(2) feeling that I am often failing with my diabetes regimen
Since patients and their families are responsible for the day-to-day care inherent in managing diabetes, I included in the survey a measure of diabetes self-management. The Summary of Diabetes Self-Care Activities (SDSCA) measure is a brief self-report questionnaire of diabetes self-management that includes items assessing the following aspects of the diabetes self-care: general diet, specific diet, exercise, blood-glucose testing, foot care, and smoking [168].

Following this development process the survey questions developed covered six domains:

1. Knowledge of the relationship between diabetes and oral health and self-reported oral health status
2. Oral health behaviors (dental visiting, tooth brushing and flossing frequency)
3. Diabetes and general health
4. Diabetes self-care behaviours
5. Living and coping with diabetes, measuring diabetes distress and depression
6. Demographic variables

### 3.2.2 Development of online survey

I considered three deployment options for the survey: paper-based, email and online survey methods. I proceeded with the online survey due to logistics, cost, and lack of access to the email addresses of potential participants. I will discuss the advantages and disadvantages of online surveys below.

There are several advantages associated with distribution of surveys using online methods. Firstly, the quality of data collected in online surveys has been found to be equal or better than paper surveys [169]. Other benefits offered by the online survey formats include reduction of cost and research time, increased ease of recruitment and distribution, improved data accuracy, elimination for the need for data entry as respondents directly enter the data, improved access for certain groups such as those with mobility issues and living in remote areas, and anonymity since it is not a face to face format [170-172].
Online surveys can be programmed to allow respondents to skip to a later page or a specific question on a later page, based on their answer to a previous closed-ended question, making the survey less daunting in terms of length and the time needed to complete. With the study operating on a limited budget the online survey methodology represented a significant logistic and cost advantage.

3.2.3 Piloting of survey

The Survey Monkey survey was piloted to test the face validity of the survey, record the length of time required to complete the survey, and identify any ambiguous or difficult questions. It was piloted at two clinics: Dandenong Diabetes & Vascular Medicine Unit, Dandenong Hospital and Corio Medical Centre, a general practice with an onsite endocrinologist and diabetes clinic. These clinics were chosen because they specialised in providing care to adults with diabetes. The survey piloting was performed over two days. Subjects attending these diabetes specific clinics were approached in the waiting room prior to their appointments with their GP or endocrinologist, to gauge their interest in participating in the pilot survey and subsequent debriefing interview. To reproduce the conditions of the online survey the pilot survey was completed on an iPad provided by myself. The survey was conducted in a private room separate from the waiting room. It was estimated the pilot survey would take 20 minutes and was to be followed by a 10 minute debriefing interview.

A total of eight subjects were interviewed for the pilot survey, five in Corio and three in Dandenong. All the subjects had type 2 diabetes, and the mean age of participants was 61 years old. On the days the pilot was conducted, no patients with type 1 diabetes attended the clinics. The survey took participants on average 38 minutes to complete, which was greater than the 20-30 minutes expected. One possible explanation for this was some of the participants expressed unfamiliarity with using the touch screen of the iPad and had a preference using a keyboard for data entry. It was anticipated that most potential survey respondents would use their home PC or laptop to complete the survey, thus decreasing the time to complete.
Following the debriefing of the interview subjects from the pilot survey a number of changes were made to the final format of the survey. The wording of some questions was modified, for instance several subjects in the pilot survey expressed confusion over the term “endocrinologist” so this was replaced with the term diabetes specialist. The option of “don’t know” was included in question 3 (Do you believe diabetes can affect a person's gums and teeth?).

Demographic information, which was included in the first section of the pilot survey, was relocated to the last section of the survey. For this study, the demographic data was used to help describe the sample and was not used to help answer the research question, thus including it in the end was thought to reduce respondent fatigue resulting in increased item response rates for non-demographic questions, in case participants didn't finish the survey.

3.2.4 The final format of the survey

The final format of the survey consisted of 50 questions (see Appendix 1). Questions were grouped into the following categories: oral health related questions, diabetes specific questions, coping with diabetes questions using diabetes distress and depression tools and demographic information. Those who participated in survey were first invited to read an electronic plain language description of the study and provide their consent.

3.2.5 Ethical considerations and approval

Ethical approval was obtained from the University of Melbourne Human Research Ethics Committee (HREC) Ethics ID: 1339541 (see Appendix 2). Participation posed minimal risk for survey respondents, as the survey was voluntary, anonymous and conducted over the Internet. Data collection and storage measures ensured anonymity and privacy for the participants. A plain language statement was included with the online survey providing a brief explanation outline of the purpose of the research and informing participants of any potential risks associated with their involvement.
The survey contained links where participants could seek further information on oral health and diabetes related distress.

My contact details, as well as those of my supervisor and that of Executive Officer, Human Research Ethics, Melbourne Research and Innovation Office at The University of Melbourne were included in the Plain Language Statement (PLS), should participants have any concerns with the conduct of the research (see Appendix 2).

3.2.6 Recruitment and deployment

Recruitment for the survey was intended to be from Victoria only. I approached Diabetes Australia Victoria (DAV) to get permission to use the National Diabetes Services Scheme (NDSS) database to recruit participants to complete the online survey. The NDSS is an initiative of the Australian Government and until July 2016 was administered by Diabetes Australia. The NDSS delivers subsidised diabetes-related products, information and support services to people with diabetes. Using the NDSS database, a random sample of 1000 adults, selected by the manager of the NDSS database in Diabetes Australia Victoria (DAV) using a random number generator, was created. The sample was stratified to invite and recruit an equal number of respondents with type 1 and type 2 diabetes. This was important because at the time of recruitment (September 2015) there were 1,176,961 people with diabetes nationally registered on the NDSS and of these 86% had type 2 diabetes and 10% had type 1 diabetes [173].

The stratified random sample of 1000 adults with diabetes was invited to participate in the online survey by a mail out of invitation postcards. The post cards (see Appendix 4) contained the address of the online survey (https://www.surveymonkey.com/s/dentaldiabetes). The original intention was to conduct the mail out in two waves: an initial mail out of 1000 postcards, followed four weeks later by a mail out of reminder postcards which were to be sent to the original 1000 recipients.
The post cards were printed and sent to Diabetes Victoria Direct-mail Centre for distribution. The initial mail out occurred on the August 27\textsuperscript{th}, 2015. Four weeks later, 750 reminder post cards were mailed to the original recipients; the reduced number was secondary to budget constraints.

Four weeks after the initial post card invitation, only 20 participants had completed the survey, a response rate of 2%. It was decided to adopt additional strategies to recruit participants and this included publicising and promoting the survey invitation in the October 8\textsuperscript{th} edition of Diabetes Victoria main membership e-newsletter, Membership Matters, which is distributed to over 15,000 Victorians. The survey was also listed on Diabetes Victoria website under the section entitled “Diabetes Trials” http://www.diabetesvic.org.au/research/diabetes-trials#Diabetes. This part of the website informs people about current research and promotes participation in diabetes related research. The survey was available for completion from 1st September 2015 and closed on 31st December 2015.

I adopted an evidence based approach to maximise recruitment including pre-notification and follow up, a deadline for the survey, an attractive graphic design for the survey and postcard, and offering to make the survey results available to participants. Additional strategies were considered including the use of extra reminders and incentives [174] to increase the response rate [175, 176]. Follow up reminders for non-responders were not possible, since survey participation was anonymous and no unique identifiers were used for the surveys. Further post card mail outs and participation incentives were not possible due to the costs involved and lack of resources.

### 3.2.7 Inclusion and exclusion criteria

The inclusion criteria for the survey was adults 18 years or over, with type 1 or type 2 diabetes and with at least one remaining tooth. The exclusion criteria for the survey included people less than 18 years of age, individuals with no teeth (edentulous) and people who did not have either type 1 or type 2 diabetes. The survey was in English and the survey was intended for residents in Victoria but I accepted responses from interstate participants.
\textbf{3.2.8 Data collection, entry and quality control}

Data was automatically collected and collated by the Survey Monkey tool. The resulting numerical data was downloaded into Microsoft Excel for Mac Version 15.29.1 format and data subsequently deleted from the Survey Monkey server. The variables were coded, outliers were identified along with true missing data and those subjects that met the exclusion criteria (under 18 years of age and no remaining teeth) were excluded from analysis.

\textbf{3.2.9 Data analysis}

Data was analysed using STATA Version 14.0 (College Station, Texas).

Participants were described with respect to:

1. Demographic variables including age, gender, employment status and possession of dental insurance.
2. Behaviours including utilisation of dental services, visitation to medical health professionals and oral health self-care behaviours including frequency of brushing and flossing.
3. Knowledge of how diabetes may adversely impact oral health and if aware of this complication of diabetes relationship between diabetes and oral health where the person sourced the information.

Numbers and percentages were reported for counts, mean and standard deviation for normally distributed continuous variables and the median (IQR) for non-parametric continuous variables. Chi squared test was used to compare the knowledge and health behaviours of respondents with type 1 diabetes and type 2 diabetes groups.
3.3 Results

3.3.1 Study Sample

In total, 154 people responded to the Dental Health and Diabetes survey. Of those that participated in the survey, 42 (33.9%) reported receiving a postcard invitation and the remainder were recruited via the Diabetes Victoria newsletter and Diabetes Victoria website. Five respondents (3%) did not tick a box to indicate that they consented to participate in the study and exited the survey at this point. A further 6 respondents (5%) that consented to participate did not answer any of the 50 questions and were not included in the study results.

To be included in the survey sample participants had to be adults with at least one remaining natural tooth and have either type 1 or type 2 diabetes. Of the 144 respondents that answered: Q3 Do you have any of your NATURAL teeth? 8 (5%) answered they had no natural teeth and therefore were excluded from further analysis. A total of 135 respondents answered the question: What type of diabetes do you have? One respondent did not know what type of diabetes they had and were excluded from further analysis. After applying the exclusion criteria, the final study sample consisted of 124 respondents. Subsequent analysis presented in this study refers to the final sample of 124 respondents.

It was decided to focus on the research question, which is investigating the knowledge and behaviours of people with diabetes in relation to their oral health. Thus, questions relating to the domains four and five (see page 27) were not included in final statistical analysis.
### 3.3.2 Demographics

The characteristics of the survey respondents are summarised in Table 2.

<table>
<thead>
<tr>
<th></th>
<th>All respondents N=124</th>
<th>Type 1 diabetes N=47</th>
<th>Type 2 diabetes N=77</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)* Missing</td>
<td>57.6 (13.5) 11 (8.8)</td>
<td>49.3 (15.1) 5 (4.0)</td>
<td>62.5 (9.7) 6 (4.8)</td>
<td>0.000</td>
</tr>
<tr>
<td>Gender Male Missing</td>
<td>50 (42.4) 6 (4.8)</td>
<td>17 (38.6) 3 (2.4)</td>
<td>33 (44.6) 3 (2.4)</td>
<td>0.526</td>
</tr>
<tr>
<td>H.C.C. or pension Missing</td>
<td>65 (55.1) 5 (4.0)</td>
<td>22 (48.9) 2 (1.6)</td>
<td>43 (58.9) 3 (2.4)</td>
<td>0.288</td>
</tr>
<tr>
<td>Health insurance Missing</td>
<td>66 (55.5) 5 (4.0)</td>
<td>23 (51.1) 2 (1.6)</td>
<td>43 (58.1) 3 (2.4)</td>
<td>0.456</td>
</tr>
<tr>
<td>Employed Missing</td>
<td>44 (37.0) 5 (4.0)</td>
<td>24 (54.5) 2 (1.6)</td>
<td>20 (26.7) 3 (2.4)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

**Table 2. Demographics of sample**

n(%) unless otherwise specified

* Mean (SD)

H.C.C- healthcare card

The mean age (SD) for survey respondents was 58 (13) years. Respondents with type 1 diabetes were, on average younger (49 (15) years) than those with type 2 diabetes (62.5(9.7) years), the only significant difference between type 1 and type 2 diabetes. Both genders were well represented in the sample with males accounting for 42% (n=50) of the total sample. Just over half (55%) of the survey participants reported having a health care card or pension. A total of 55 % (n=66) of respondents reported possessing private health insurance.
3.3.3 Diabetes and general health

The survey was for adults with type 1 and type 2 diabetes only. A total of 62% (n=77) of the sample had type 2 diabetes and the remaining 38% (n=47) had type 1 diabetes (see Table 3).

<table>
<thead>
<tr>
<th>Type of diabetes</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>47</td>
<td>37.9</td>
</tr>
<tr>
<td>Type 2</td>
<td>77</td>
<td>62.1</td>
</tr>
<tr>
<td>Total</td>
<td>124</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 3. Diabetes type

A total of 5% respondents (n=6) were newly diagnosed (diagnosed less than one year ago) with type 1 or type 2 diabetes. Of those with type 1 diabetes, 78% (n=37) had the condition for 10 or more years. For those with type 2 diabetes, 45% (n=35) reported being diagnosed 10 or more years ago. There was no significant difference in duration of diabetes between those with type 1 and type 2 diabetes.

The glycated haemoglobin test (HbA1c) enables the health professional to measure a person with diabetes level of glycemic control over the previous three months. For those participants that recalled their HbA1c, 69% (n=60) reported an HbA1c of 7% or less. For those with type 1 diabetes 59% (n=16) reported a HbA1c of 7% or less and for people with type 2 diabetes 73% (n=44).

Approximately three quarters (74%, n=92) of the total respondents reported having experienced a non-oral complication of diabetes. The rates were similar for type 1 diabetes (72%, n= 34) and type 2 diabetes (75%, n=58)

Nearly all the people with diabetes were aware of the link between diabetes and foot problems. For those with type 1 diabetes, 98 % (n=45) reported being aware that feet problems were a potential complication of diabetes, and 92 % (n=70) of those with type 2 diabetes acknowledged this association. Similarly, most people with diabetes were cognizant of the potential for eye disease related to their diabetes. Of those with type 1 diabetes, 93% (n=43) reported an association between eye disease and diabetes compared to 89% (n=67) of those with type 2 diabetes.
### 3.3.4 Knowledge about diabetes and oral health

The survey participant’s knowledge about the relationship between diabetes and oral health is summarised below in Table 4.

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>All respondents N=124</th>
<th>Type 1 diabetes N=47</th>
<th>Type 2 diabetes N=77</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Believe diabetes can affect a person’s gums and teeth? Yes</td>
<td>97 (78.2)</td>
<td>41 (87.2)</td>
<td>56 (72.7)</td>
<td>0.131</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>If yes, source of the information was Dentist</td>
<td>59 (60.8)</td>
<td>24 (58.4)</td>
<td>35 (62.5)</td>
<td>0.693</td>
</tr>
<tr>
<td>Dental hygienist</td>
<td>8 (8.2)</td>
<td>4 (9.8)</td>
<td>4 (7.1)</td>
<td>0.644</td>
</tr>
<tr>
<td>GP</td>
<td>22 (21.5)</td>
<td>10 (24.4)</td>
<td>12 (21.4)</td>
<td>0.731</td>
</tr>
<tr>
<td>Diabetes educator</td>
<td>42 (40.4)</td>
<td>16 (39.0)</td>
<td>26 (46.4)</td>
<td>0.467</td>
</tr>
<tr>
<td>Family and friends</td>
<td>6 (6.2)</td>
<td>2 (4.9)</td>
<td>4 (7.1)</td>
<td>0.647</td>
</tr>
<tr>
<td>Media</td>
<td>40 (41.2)</td>
<td>17 (41.5)</td>
<td>23 (41.1)</td>
<td>0.969</td>
</tr>
<tr>
<td>Other</td>
<td>10 (10.3)</td>
<td>4 (9.8)</td>
<td>6 (10.7)</td>
<td>0.878</td>
</tr>
<tr>
<td>Agree that diabetes can cause: Loose teeth</td>
<td>53 (42.7)</td>
<td>21 (44.6)</td>
<td>32 (41.6)</td>
<td>0.490</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Increases risk of infection following extraction</td>
<td>93 (75.6)</td>
<td>41 (89.1)</td>
<td>52 (67.5)</td>
<td>0.036</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Gums to bleed</td>
<td>60 (48.8)</td>
<td>28 (59.6)</td>
<td>32 (42.1)</td>
<td>0.046</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A dry mouth</td>
<td>63 (51.2)</td>
<td>24 (52.1)</td>
<td>39 (50.7)</td>
<td>0.585</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Believe diabetes is associated with gum disease</td>
<td>79 (68.1)</td>
<td>35 (77.8)</td>
<td>44 (62.0)</td>
<td>0.200</td>
</tr>
<tr>
<td>Missing</td>
<td>8</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4.** Oral health knowledge of people with diabetes

All data reported as n (%)
78% (n=97) of people with diabetes, believed diabetes could adversely affect oral health and 13% (n=6) of those with type 1 diabetes and a quarter (n=19) of those participants with type 2 diabetes reported being unsure. When asked about whether diabetes was associated with gum disease, 68% (n=79) of the overall sample acknowledged an association. This consisted of 78% (n=35) of people with type 1 diabetes and 62% (n=44) of people with type 2 diabetes.

Less than half of the total survey respondents believed diabetes could be responsible for loose teeth (43%, n=53) and bleeding gums (49%, n=60), which are both characteristic signs of periodontal diseases. People with type 1 diabetes in the survey had significantly greater knowledge that diabetes may cause gums to bleed and increase the risk of post-extraction infection than respondents with type 2 diabetes.

Those that were aware of the relationship between diabetes and oral health reported the source of information most commonly came from their dentist/dental hygienist 69% (n=67), with only 21% (n=22) reported having received this information from their GP and 6% from family or friends.

Nearly a third of people (33%, n=40) with diabetes were not told to be extra diligent about tooth brushing and flossing 11% (n=5) of those with type 1 diabetes and 8% (n=6) of those with type 2 diabetes reported that their dentist was unaware of their diabetes status.

3.3.5 Oral health behaviour

The survey explored two important oral health behaviours: tooth brushing and flossing. Of the total sample surveyed, 59% of people with diabetes reported brushing their teeth at least twice a day. Similar rates of optimal tooth-brushing frequency were reported between people with type 1 diabetes (59%, n=28) and type 2 diabetes (58%, n=45). Just over half the participants with diabetes flossed at least once a day (51%, n=61). Less than half the respondents with type 1 diabetes (46.8%, n=22) and 54% (n=39) people with type 2 diabetes flossed at least once a day.
The survey also investigated health service usage of people with diabetes. The utilisation of healthcare services by survey respondents is summarised in Table 5.

<table>
<thead>
<tr>
<th>Last seen a dental professional</th>
<th>All respondents</th>
<th>Type 1 diabetes</th>
<th>Type 2 diabetes</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 year</td>
<td>83(66.9)</td>
<td>29(61.7)</td>
<td>54(70.1)</td>
<td>0.699</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Usual reason for dental visit</td>
<td>71(57.7)</td>
<td>21(44.7)</td>
<td>50(65.8)</td>
<td>0.071</td>
</tr>
<tr>
<td>Check-up</td>
<td>26(57.8)</td>
<td>50(65.8)</td>
<td>54(70.1)</td>
<td>0.699</td>
</tr>
<tr>
<td>Problem</td>
<td>25(53.2)</td>
<td>54(70.1)</td>
<td>54(70.1)</td>
<td></td>
</tr>
<tr>
<td>Visit to other health professional in last 12 months</td>
<td>64(57.60)</td>
<td>28(59.6)</td>
<td>36(56.2)</td>
<td>0.726</td>
</tr>
<tr>
<td>Diabetes Educator</td>
<td>13</td>
<td>0</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>9</td>
<td>2</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Podiatrist missing</td>
<td>73(63.5)</td>
<td>26(57.8)</td>
<td>47(67.1)</td>
<td>0.309</td>
</tr>
<tr>
<td>missing</td>
<td>9</td>
<td>2</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Eye specialist Missing</td>
<td>108(87.8)</td>
<td>41(89.1)</td>
<td>67(87)</td>
<td>0.726</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Dietician/nutritionist Missing</td>
<td>34(34.0)</td>
<td>8(20.5)</td>
<td>26(42.6)</td>
<td>0.002</td>
</tr>
<tr>
<td>Missing</td>
<td>24</td>
<td>8</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Diabetes specialist Missing</td>
<td>66(66.2)</td>
<td>39(84.8)</td>
<td>27(45.0)</td>
<td>0.000</td>
</tr>
<tr>
<td>Missing</td>
<td>18</td>
<td>1</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>GP Missing</td>
<td>119(96.8)</td>
<td>45(95.7)</td>
<td>74(97.3)</td>
<td>0.622</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4.** Health service usage

All data reported as n (%)

In the survey sample, 66.9% (n=83) reported visiting an oral health professional (dentist or dental hygienist) in the last 12 months. The usual reason given for visiting the dentist/dental hygienist was for a check-up for 58% (n=71) of people with diabetes and for a problem for 40% of the sample.
Significantly more people with type 1 diabetes (84%, n=39) reported visiting a diabetes specialist than people with type 2 diabetes (45%, n=27). Most people with diabetes had visited a GP 97% (n=119) and eye specialist 87% (n=108) in the previous 12 months. Most people with diabetes (80%, n=98) reported having an eye examination in the last 12 months and nearly all had received an eye examination within the last 2 years (98%, n=121).

3.4 Summary of key findings

My survey found that a quarter of people with type 1 and type 2 diabetes reported being unsure whether diabetes could affect their gums and teeth. More than half of the respondents reported being unaware that two of the common signs of periodontal diseases, bleedings gums and tooth mobility, could be related to their diabetes. There was some increased recognition that diabetes could influence the propensity of gums to be bleed and increase the risk of infection following an extraction amongst respondents with type 1 diabetes compared to respondents with type 2 diabetes. There was no statistical difference between people with type 1 and type 2 diabetes, with respect to their awareness of the relationship between diabetes and oral health. This was in contrast to a high level of recognition about the other chronic complications of diabetes including eye, foot, heart and kidney disease.

On the question of self-care behaviours such as brushing and flossing, many patients with type 1 and type 2 diabetes reported not being informed to be extra careful with their oral hygiene, despite their increased susceptibility to oral disease. Many participants reported a flossing and tooth brushing frequency that is less than is recommended for individuals at a high risk of periodontal diseases.

My survey also explored the frequency people with diabetes visited an oral health professional, and whether the reason the person attended was for a check-up (preventative) or whether it was for pain or a problem.
Approximately one third of people with diabetes reported not visiting a dentist in the last 12 months, and 40% of those who did attend reported the reason for presenting was for a problem. There was no significant difference in healthcare behaviours between people with type 1 and type 2 diabetes.

3.5 Limitations and strengths

The online survey methodology used in this study does have limitations including small sample size, missing data, selection bias, response bias and self-report bias.

My original intention for the survey was to recruit a stratified random sample of people with type 1 and type 2 diabetes. But a low initial response lead to additional recruitment tactics being employed, including advertising in online newsletters and publications of Diabetes Victoria Australia. This has resulted in a convenience sample that may no longer be representative of the population of interest, as indicated by the relatively high proportion of survey respondents with HbA1c in the optimal range. The reduced effective sample size also has implications for the statistical analysis of the results, making it more difficult to detect meaningful differences between variables of interest.

3.5.1 Response rate

One reason for the low response rate could be the format of the survey. One meta-analysis found that response rates in online surveys on average are 11% lower than in other types of survey [177]. Another potential cause for the low response rate is the issue of salience. Salience is the respondents level of interest in the survey topic [181]. Oral health may not have been perceived to be an interesting or important topic to people with diabetes and therefore few responded to the survey invitation. Data security and data protection may impact on survey response numbers, especially at a time where people are increasingly concerned about online security and privacy given the recent publicity of data breaches and controversies over the privacy of online services [182]. Some potential respondents may have suspicions about online survey administration and may have concerns about confidentiality that discourage their participation [182, 183].
This is an exploratory study and because of the small sample size I have interpreted the results of the survey accordingly. This is a mixed method study, so the intention has always been that the data from the survey would help inform and guide the next phase of the study (see Chapter 4).

3.5.2 Missing data and survey design

Several participants that commenced the survey did not complete all the questions, and there was missing data that varied across the questions. The survey length and thus the time to taken to complete it, and the clarity of the questions may influence whether all the questions are answered. For my questionnaire, during survey development, the number of potential questions was carefully considered with regards to the time needed to complete the survey. This was tested during piloting of the survey at several locations and the length of the survey was decreased and the format simplified ensuring all the questions were clear and unambiguous. Research on how survey length influences response rate has found it to be a less important factor than other variables such as pre-survey mail notification and multiple follow-up.

3.5.3 Selection bias

Like all data collection methods, online collection can introduce bias. For this study the risk is that people with better online access and more confidence in the Internet, will be more likely to complete the survey. In 2014–15 in Australia 85% of people were Internet users. Those people in the 15–17 years age group had the highest proportion of Internet use (99%) compared with the older age group (65 years and over), which had the lowest proportion of Internet users (51%) [184].

The likelihood an individual aged 55 and over using the Internet or not, includes factors such as age, income, household composition, self-perceived health status, sex, mobility and memory or ability to concentrate (self-rated). Since the proportion of people with type 2 diabetes increases with age, this older cohort may be unwilling to participate in the online survey (13). In my survey the average age of the participants was 57 which suggests this may not have been a significant factor in the low participation rate.
3.5.4 Response bias

The online survey and the interview phase of my study both may be subject to response bias from the participants. To interpret my data correctly I am relying on honest and accurate responses from the participants. Response bias refers to a range responses that include providing socially desirable answers, always agreeing or always disagreeing irrespective of the question and the extremity response (always choosing an extreme position) [178].

The questionnaire and interviews covered topics that the participants may have found socially sensitive, for example oral hygiene regimes. Socially desirable responding is the tendency for participants to answer questions in a way that conforms to social norms thus gaining social approval and avoiding criticism [179,180]. Studies have shown that the phenomenon of socially desirable responding can explain between 10% to 75% of variance in participants’ responses [185].

Another limitation of the online survey methodology is less control over the identity of participants, for example ensuring the respondent is genuinely who they say they are [180]. This is important since my survey has very specific criteria for the respondents, in that they must be dentate adults with diabetes.

3.5.5 Self-report bias for healthcare utilisation

The online survey has used self-reporting to estimate health care utilisation amongst adults with diabetes. However research has shown self-report data of health care utilisation can be of variable accuracy [186]. Factors that influence accuracy include the age and cognitive abilities of the respondents, recall time frame and the type and frequency of the utilisation [187]. It has been recommended that questions avoid recall times of greater than one year as this increases inaccuracy of self-reporting [188]. For my study participants were asked to report on the health care visitations over the last 12 months.
My study has indicated that healthcare professionals are a primary source of health information and health education. I was interested to discuss with healthcare professionals their knowledge of the relationship between diabetes and oral health, what they told people with diabetes about this association, and whether they communicated and collaborated with other healthcare professionals in the diabetes management team. I was also interested to explore whether their experiences and clinical management differed for people with type 1 and type 2 diabetes.

The next chapter will describe the second phase of my research project which investigates the knowledge, attitudes, and clinical practices of healthcare professionals involved in the management of patients with diabetes.
Chapter 4

Healthcare professional’s knowledge and behaviours regarding diabetes and oral health

In chapter 3 I presented the results of my quantitative study of the knowledge of people with diabetes regarding oral health. The key findings of this study were that significant proportion of people with diabetes were unsure whether there was a link between diabetes and oral health. In some cases, survey respondents reported having not been told to be extra careful about their oral hygiene. Those aware of the link between oral health and diabetes, did not always receive this information from their primary care health care provider.

In order for people with diabetes to self-manage their oral health and diabetes effectively, they need to be informed that diabetes may negatively impact on their oral health and the steps to minimise this. Despite being at increased risk of oral disease many of the survey respondents did not practice ideal preventative behaviors such as optimal oral hygiene and dental visitations.

Oral health information for people with diabetes may come from a variety of sources, including oral health professionals and other primary health-care providers, but little is known about the extent to which this is occurring in Australia. Hence the qualitative study (phase 2) was conducted to follow up on findings from the phase 1 of the study and help explore and gain an understanding as to the types of oral health information provided by different healthcare professionals, and barriers and facilitators to the provision of that information. In-depth interviews were conducted to explore health professional’s awareness of the link between diabetes and oral health and discussing their individual experiences with patients with type 1 and type 2 diabetes with regards to oral health.

In this chapter I will present the methodology used in the second phase of my study, the face to face interviews with healthcare professionals. I will outline how I analysed the data and then present the results.
4.1 Objectives

The objectives of phase 2 of the study were to:

1. Explore the knowledge and understanding of primary care health professionals (GPs, Diabetes Educators, Dentists and Dental Hygienists) about the relationship between diabetes and oral health;
2. Understand how beliefs and attitudes about oral health and diabetes influences their clinical practice and inter-professional communication and collaboration; and
3. Determine whether they perceived differences in their approach to patients with type 1 and type 2 diabetes.

4.2 Method

4.2.1 Ethical considerations and approval

Ethical approval was obtained from the University of Melbourne Human Research Ethics Committee (HREC ID/1647377.1) (see Appendix 5). Participation posed minimal risk for the health professionals involved, as the interviews were voluntary and the privacy and confidentiality of the participants was protected. Participants were de-identified with pseudonyms in transcribed interviews and in reports. I nominated the pseudonyms to reduce the likelihood that participants could be identifiable to anyone other than myself. The plain language statement sent to the potential participants outlined any anticipated risks along with the contact details of the Executive Officer, Human Research Ethics, Melbourne Research and Innovation Office at The University of Melbourne should participants have any concerns with the conduct of the research (see Appendix 6).

4.2.2 Interview development

The preliminary survey analysis informed the design of the interview schedule for this study. The interview schedule (Appendix 7) was developed with the research questions of the study in mind. The interview began with an introduction that described the background to the research project, the objectives of the interview, topics to be addressed and the expected length of the interview. Permission was sought to record the interview.
The body of the interview schedule included the topics to be covered and potential questions and prompts. Interview questions with health professionals focused predominantly on their knowledge of oral complications of diabetes, awareness of the bi-directional link between diabetes and periodontal disease, the information and messages they disseminate to their patients with diabetes, whether their approach differs between people with type 1 and type 2 diabetes, and the level and nature of their collaboration with other health professionals.

The conclusion of the interview summarised the main points discussed during the interview and asked the respondent whether there was any more they would like to add or discuss and concluded with thanking the respondent for his or her participation.

Interviews were expected to run between 25-30 minutes because of the time demands of the professionals interviewed. The interviews took place during lunch time or scheduled breaks between patient consultations.

Two pilot interviews were conducted with dentists, and these ran to the expected time frame. No changes were made to the interview schedule following the pilot interviews.

### 4.2.3 Recruitment

The setting for the study was greater metropolitan Melbourne as defined by Australian Bureau of Statistics Greater Capital City Statistical Area (ABS 2012). I intended to recruit two of each of the following health professional groups: general medical practitioner, diabetes educator, dentist and dental hygienist. There were no specific exclusion criteria for health professionals.

I used a purposive sampling strategy looking for a mix of genders, practice locations, public and private practice and recently graduated and more experienced health care professionals.
My aim was not to obtain generalisability of my findings, but to capture a range of experiences and professional responses to some of the preliminary findings about low levels of appropriate behaviors and knowledge of health information of adults with diabetes. To this end, potential participants who were GPs and diabetes educators were identified by my supervisors through their network and connections. Dentists and dental hygienists were identified through my professional network. I then contacted each participant individually by email (see Appendix 8) to introduce the project and to invite the them to participate in a semi-structured interview.

The email invitation briefly outlined the research study, explained the nature of the interview and invited the respondent to choose a time and place for the interview to take place. The email also included the Plain Language Statement and a Consent form for the participant to read. A total of 10 key stakeholders were recruited into the study. This was made up of 3 diabetes educators, 2 GPs, 2 dental hygienists and 3 dentists (see Table 6).

4.2.4 Data collection

The 10 health professionals who agreed to participate in the interviews suggested the location for the interview. A hard copy of the Plain Language Statement and Consent forms were given to the participants prior to commencement of the interview. Consent was obtained and the consent form was signed and collected. Permission was confirmed prior to commencement of recording the interviews. Audio recordings of interviews with the health professionals were collected with an Iphone 5 using the Voice Memos app. The completed interviews were then transcribed verbatim by an official transcription service - GoTranscription (https://gotranscript.com) and the audiofiles were deleted. The transcribed files were stored securely on a password protected server at the Department of General Practice.
4.2.5 Data analysis

The transcripts were compared to the original audio recordings to confirm accuracy and to familiarise myself with the data. The data was then managed using NVivo for Mac version 11.1.1 software. The survey results generated some key areas of interest such as people with diabetes being uncertain about the relationship between oral health and diabetes and their sources of information about this association. The pilot interviews of healthcare professionals produced themes such as professional knowledge of the diabetes and oral health link and the communication and collaboration that occurs between healthcare professionals. These areas of interest influenced my initial coding. After repeated re-reading of the interview transcripts, an initial list of ideas about what was in the data was compiled. I adopted an inductive approach to the interview data and tried to limit predetermined assumptions influencing my interpretation of the data. Following the coding and collating of all data, a list of different codes were identified across the data set. The different codes were then sorted into themes. The themes identified were reviewed with my supervisors prior to drawing conclusions from the work. The candidate themes were further refined through repeated rereading, cross-coding, development of overarching themes, sorting and grouping of themes before the final themes that will be presented for analysis were produced.

4.3 Results

4.3.1 Sample

Ten health care professionals participated in the interviews: three dentists, two dental hygienists, three diabetes educators and two general medical practitioners (GPs).
The characteristics of the health professionals are described in Table 6 below.

<table>
<thead>
<tr>
<th>Practitioner ID</th>
<th>Gender</th>
<th>Number of years since graduation*</th>
<th>Practice Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dentist 1</td>
<td>Male</td>
<td>30</td>
<td>Public</td>
</tr>
<tr>
<td>Dentist 2</td>
<td>Female</td>
<td>17</td>
<td>Private</td>
</tr>
<tr>
<td>Dentist 3</td>
<td>Female</td>
<td>3</td>
<td>Private</td>
</tr>
<tr>
<td>Dental hygienist 1</td>
<td>Female</td>
<td>7</td>
<td>Public &amp; Academic</td>
</tr>
<tr>
<td>Dental hygienist 2</td>
<td>Female</td>
<td>8</td>
<td>Public &amp; Academic</td>
</tr>
<tr>
<td>GP 1</td>
<td>Male</td>
<td>19</td>
<td>Private</td>
</tr>
<tr>
<td>GP 2</td>
<td>Female</td>
<td>3</td>
<td>Private</td>
</tr>
<tr>
<td>Diabetes Nurse Educator 1</td>
<td>Male</td>
<td>20</td>
<td>Public &amp; private</td>
</tr>
<tr>
<td>Diabetes Nurse Educator 2</td>
<td>Female</td>
<td>16</td>
<td>Public &amp; private</td>
</tr>
<tr>
<td>Diabetes Nurse Educator 3</td>
<td>Female</td>
<td>15</td>
<td>Public &amp; private</td>
</tr>
</tbody>
</table>

Table 5. Healthcare professionals interviewed for study

*Number of years since qualification with primary health care professional degree.

### 4.3.2 Themes

I identified three main themes from the interviews with health care professionals.

- Healthcare professional knowledge and awareness;
- Communicating with people with diabetes; and
- Interprofessional communication.

### 4.3.3 Health care professional's knowledge and awareness

All health care professionals reported being aware that adults with diabetes were at risk from oral complications of diabetes including gum disease, increased tooth loss and delayed healing. However, this knowledge about the relationship between diabetes and oral health was incomplete. Only the diabetes educators interviewed suggested that poor oral health could worsen glycaemic control and thus impact on the general health of an adult with diabetes. Oral health professionals in general did not acknowledge that treatment and prevention of periodontal diseases could help people with diabetes regulate their glycaemic control. GPs also did not report that treating oral diseases may improve people with diabetes overall health by improving their glycaemic control. Oral health professionals and GPs did not appear to recognise the importance of addressing both the oral disease and diabetes, in order to improve the management of both conditions.
Overall health care professionals were unsure of the bi-directional relationship between diabetes and oral health as reflected by this comment from a dentist:

“I know there's a lot of studies on cause and effect relating to, for instance, gum disease and heart disease and diabetes but I think there's just been association at this stage. There's no proof if any that gum disease could cause these issues but as far as the reverse, diabetes having a causative link to the gum disease or more exacerbating the gum disease, there might be more evidence behind that.” Dentist 3

Several health professionals cited a lack of emphasis on the oral complications of diabetes in their original education and training as a reason for a reluctance to incorporate oral health messages in their clinical practice. Having received very little oral health training in their curriculum healthcare professionals feel ill-equipped to provide appropriate advice and counseling. Knowledge about the link between diabetes and oral health was only gained recently, and often came from attending continuing professional development courses. Reflecting on his/her previous undergraduate education a diabetes educator stated:

“it wasn’t actually given as a complication at that time [when I trained]. It wasn’t taught I don’t think at that time.” Diabetes Educator 2

Apart from the diabetes educators interviewed, the other health care professionals had limited experience managing patients with type 1 diabetes. The overwhelming majority of patients they managed had type 2 diabetes. As noted by a dentist:

“I would probably be struggling to think of any which were actually type 1. Majority would be type 2.” Dentist 2
4.3.4 Communicating with people with diabetes

Health care professional awareness that diabetes may lead to oral complications such as severe gum disease did not translate into them routinely discussing the relationship between oral health and diabetes with their patients. Several subthemes emerged during the interviews as to why the diabetes and oral health link is not routinely discussed with people with diabetes, and these included the resources available, perceived access to care, and professional boundaries and responsibilities. Although all the participants viewed the oral complications of diabetes to be potentially serious, they didn’t discuss oral health with the same frequency and detail as the other chronic complications of diabetes. This was characterised by remarks such as:

“Look, again I think most people know about say, eyes and heart disease. Your type 1’s usually have had it hounded into them. Again, I think, dental health is the poor cousin of everything else.” GP 1

The bi-directional relationship between diabetes and oral health was not discussed despite health professionals perceiving their patients to have a low level of knowledge about the link between diabetes and oral health. As stated by a diabetes educator:

“Their knowledge is quite poor about it, as a general rule. And so I’d say, “Do you brush your teeth?” “No, I never floss.” Diabetes educator 2

Several practical aspects of providing oral health education to adults with diabetes would either facilitate or hinder the inclusion of oral health information into discussions with patients. These include the health care professional’s education and training, resources and their evaluation of their patient’s access to dental care.

Notwithstanding all health professionals acknowledging a link between oral health and diabetes, some reported a lack of confidence in being able to apply that knowledge and incorporate discussions about oral health and diabetes into their clinical consultations.
This lack of confidence arose from the link between oral health and diabetes not being covered in the curriculum and training of health professionals. A dental hygienist observed:

“I think honestly, it probably ends where your confidence and knowledge base is.
.... I think it’s really based on your scope, and your knowledge, and your confidence of knowledge in terms of what you provide.” Dental hygienist 1

4.3.5 Resources

The time, availability, cost and format of teaching resources for educating patients about the relationship between diabetes and oral health was a factor in whether the patient received this education for some of the health professionals interviewed. For instance, written material or visual aids explaining the link between diabetes and oral health were considered to be helpful in facilitating patient education.

“Yes. Because when you’ve got a one-on-one consult for patients – normally takes one hour – they can’t retain at all. It’s really important to have handouts that they can look back on. It is really, really important.” Diabetes Educator 2

The time available to cover oral health in consultations was a barrier for some health care professionals, especially considering the other chronic complications that must be screened and assessed during visits. This created a hierarchy or list of priorities when providing a consultation with an adult with diabetes. Oral health was not seen as a top priority in the hierarchy of topics to be covered during a consultation. As one GP remarked:

“and the only thing is we are very time poor and it’s a very busy service, but I think things need to change so that we can target groups” GP 2


4.3.6 Access to dental care

A theme that recurred with the GPs and diabetes educators interviewed was the issue of access to dental care for disadvantaged adults with diabetes. Commonly patients unable to afford access to private dentists or on long public waiting lists, would present to their GP with general queries or concerns about their oral health.

Medical professionals would like to refer people with diabetes to dentists for preventive treatment, but since they are unable to directly refer disadvantaged patients, even if they have dental pain and infections, this was a disincentive to try to arrange preventative care. GPs and diabetes educators were also aware of the long waiting lists in the public dental system, particularly for preventative treatments. The perceived lack of access to preventative dental care for adults with diabetes meant the focus on oral health care was palliative treatment and not appropriate health education and disease prevention counseling.

“Again, the problem was, once you diagnose something like that, to treat it, like, if I wanted to refer them, most of them couldn’t’ afford a private dentist, which means that they had to wait three years to see the public dentist.” GP 1

4.3.7 Professional responsibilities and roles

When managing a complex disease like diabetes, healthcare professionals will have areas of overlapping scope of practice and therefore share varying degrees of responsibilities. The way the health care professionals viewed their professional roles and responsibilities influenced how they would manage their patients with respect to the patient’s diabetes and oral health.
The GPs interviewed, although acknowledging that diabetes caused oral complications, did not believe discussing oral health was their responsibility. One GP noted:

“We don’t talk about routine oral health. That they should be flossing, that they should be brushing teeth on a regular basis and then get checked at least annually. That conversation [is] certainly not something I instigate on regular basis or routine basis. I’m not sure if my nurse does or my diabetes educator does.” GP 1

Oral health professionals, while confident diagnosing and managing oral conditions related to diabetes, did not feel it was their responsibility to discuss diabetes management with patients and how this might directly influence their oral health.

Healthcare professionals were reluctant to provide health information to patients that might conflict with or contradict what was being provided to the patients by the other health professionals managing the case.

“I think sometimes there’s a lot to be said for specific practitioners who look at one thing directly and in their focus. I think that as soon as you begin to make someone have to put their fingers in too many different parts, it dulls down the emphasis of their message and their ability to provide the messages to patients.”

Dental hygienist 1

Healthcare professionals reported frustration with their experience in collaborating with other healthcare professionals. It could be difficult to contact other healthcare professionals and busy patient schedules provided little time for detailed discussions.
Dental and medical professionals acknowledged that a lack of time was a consequence of clinical practice, as one dentist remarked:

“It’s difficult because it’s time-consuming and it’s not easy to get hold of GPs. The patient will give you the practice details and when you contact them and the person who they normally see is not there, then you have to speak to someone else who looks at the record and doesn’t really know the patient. It’s very difficult getting a good response because, ideally, you want to get to someone who knows the patient because you’re trying to find out details about their history.” Dentist 3

How the healthcare professionals interviewed perceived diabetes as a disease, influenced their clinical practice. Aside from treatment considerations such as the risk of hypoglycaemia and the refractory nature of oral diseases in patients with diabetes, dentists were confident in treating the oral complications of diabetes without communicating and collaborating with medical professionals managing the patient. Dentists didn’t think communication was important with GPs when managing adults with diabetes.

“There is plenty of other conditions that we are more concerned about, that we contact doctors for at times, which is concerned about how our treatment will affect their condition and possible complications that could arise because of the condition.” Dentist 1

4.3.8 Interprofessional collaboration

Health care professionals interviewed were either medically trained (GPs and diabetes nurse educators) or dentally trained (dentists and dental hygienists). Oral health professionals and medical professionals reported that they did not actively collaborate with each other in the management of their patients with diabetes. Communication between medical and dental professionals was rare. When communication did occur, it was treatment orientated and limited to seeking assistance and support for medical emergencies and queries regarding patient treatments.
Preventive care and health education for the adult with diabetes was not discussed between medical and dental professionals.

“There doesn’t seem to be a lot of inter-professional communication that happens. The commonest phone call I’ve had is, ‘This person is on aspirin. Can we stop it? This person is on Clopidogrel. What do you think?’ That sort of phone call. Apart from that, yes, nothing much seems to occur between the GP and the dentist, I must say. And perhaps there’s not enough education, or maybe I’m not aware of the education that’s out there” GP 2

Shared facilities and organisation was viewed as a factor that promoted collaborative management of adults with diabetes by health care professionals, and helped incorporate oral health discussions into overall diabetes management.

Most health care professionals worked in isolation from each other at separate physical locations. When dental services were integrated with diabetes treatment services communication, collaboration and referral were encouraged and patient access was improved. A diabetes educator who worked in an organisation that employed a dental hygienist that provided a direct and formal referral pathway for adults with diabetes in the clinic commented:

“We also have an arrangement with the oral health program here where they do a lot of preventive work and we cross-referrer to them. If anyone hasn’t had any oral health examination or care in the last year, we will refer to the oral health hygienist who will do an assessment and give some education on dental care, oral healthcare. When she sees other people referred to her, she will administer the AUSDRISK test to assess for risk of diabetes and refer them over to us. If they already have diabetes and haven’t seen anyone, she’ll refer them to us as well.”

Diabetes educator 1
Shared communication tools such as group emails were suggested to overcome the communication barriers and facilitate communication between various members of the diabetes management team in some organisations.

“we’re on the same email; the dietitian and myself and sometimes the obstetrician. We’re all on the same page. So, we can all see what’s happening. When we say reply-all, you need to see what’s happening.” Diabetes educator 2

4.4 Limitations of qualitative phase of the study

The qualitative phase of the study also has several limitations including sample size and the qualitative analysis.

4.4.1 Sample size

The small number of healthcare professionals interviewed for the qualitative phase of the study is a limitation. I interviewed 10 health care professionals and this included three dentists and diabetes nurse educators, and two GPs and dental hygienists. In qualitative research there are no firm guidelines on the size of the sample to be studied, and often small numbers of subjects are examined in great depth and detail [189]. I employed a purposive sampling technique, a commonly used methodology in qualitative research [190]. Purposeful sampling selects people from which one can learn a substantial amount about the issues of central importance to the research [190]. Through my professional connections and those of my supervisors, I was able to select “information rich” healthcare professionals with a diverse range of experiences working in both the private and public sector to participate in the interviews [191].

This sampling method does introduce selection bias to my research, but the purpose of this study was not to achieve generalisability with my findings, instead the intention was to explore an area in which very little is known and thus identify key issues and themes that may inform future larger studies.
4.4.2 Limitations of qualitative research analysis

For the analysis of the interviews I used thematic analysis and like other analytical methods it has several limitations that can result in error and bias. [192]. As the chief investigator I recognise my knowledge, prior experiences and beliefs and attitudes have influenced each stage of the research including the interview, analysis and final interpretation of the data [193]. My aim has been to make the analysis as inductive as possible and to allow themes to emerge from the data rather than be created by my personal experiences, knowledge and bias. I have used triangulation to assess the legitimacy of my analysis. Triangulation uses several methods or data sources to test the validity of findings through the seeking convergence of information from different sources [194, 195]. For this study, I have used triangulation of data (interviews and the survey result) to cross check the findings across the two data sets to search for areas of convergence as a means of validating my findings. For example, only 42% of people with type 2 diabetes in the survey reported believing diabetes can result in gingivitis matches with most healthcare professionals reporting not discussing the link between diabetes and oral health with their patients. A limitation of using this technique is the data sets contain different groups, one group is people with diabetes and the other group is healthcare professionals.
Chapter 5.

Discussion

In this chapter I will provide a summary of the principal findings of my study, summarise and address the study limitations and acknowledge the strengths of my work, discuss the implications my thesis has for health service design, interprofessional collaboration and improving patient care, and outline directions for future research.

5.1 Summary of findings

When I began this study, my aim was to explore the knowledge and behaviours of both adults with diabetes and the healthcare professionals who support people with diabetes to manage their condition, focusing on the links between oral health and diabetes. Hence, I will present the findings as two broad categories, the oral health knowledge and behaviours of adults with diabetes (phase 1), and the healthcare professionals knowledge of the association between diabetes and oral health and how that influences their clinical practice (phase 2).

The main findings from phase 1 of the study the survey were that a significant proportion of survey respondents reported being unsure whether there was a link between diabetes and oral health, brushed and flossed less than is recommended for an individual at high risk of periodontal diseases, and often only visited an oral healthcare professional when in pain or with a problem. The main source of information about the relationship between diabetes and periodontal disease was oral healthcare professionals, with only 6% being informed through family and friends.
The principal findings from phase 2 of the study were that healthcare professionals are uncertain about the bidirectional association between diabetes and oral health. Furthermore, healthcare professionals don’t routinely discuss the link between diabetes and oral health with their patients. Healthcare professionals don’t talk to each other about the management of their patients with diabetes.

5.2 Limitations and strengths of my study

I have identified some key limitations to my studies that are important to acknowledge. The online survey methodology used in this study does have disadvantages and limitations which have been outlined in Chapter 3 page 40-43. These include small sample size, missing data and the use of a convenience sample rather than a random sample. The main disadvantage of convenience sampling, is that it introduces potential bias into my results and it may not be representative of my population of interest, people with diabetes. But the aim of the initial quantitative phase of the study was not to reach conclusions that could be generalisable to all people with diabetes in Australia, but generate understanding of some of the issues and questions that would be explored in greater depth in the qualitative phase of the research.

The qualitative phase of the study also has several limitations summarised in Chapter 4 page 57-58. These include a small sample size and a dependence on the skill of the researcher (also applicable to the quantitative phase). However qualitative analysis studies usually use small numbers of participants with the intention of studying them in great depth and detail. For this study I used a purposive sampling technique, and chose informants with knowledge and experience in my area of interest. Although only ten participants were interviewed, consistent themes emerged across the professional groups. When compared to the results of the survey of people with diabetes, there was some convergence between the two data sets. The methodology used in this study is appropriate for what is essentially an exploratory investigation about an important area of healthcare practice about which very little is known.
This leads me to the strengths of my study. The research I have undertaken is innovative, as I have found only one study that has been conducted in Australia that included some aspects of oral health knowledge and behaviours of people with diabetes, and none that explored healthcare professional’s awareness of the link between diabetes and oral health. Thus my study helps address a gap in our knowledge about this important area.

The mixed methods approach I have used for my study also provides several advantages. I have been able to strengthen the validity of my findings by comparing the results of my survey with the results of the qualitative phase of the study, and examining these for consistency. My interviews with healthcare professionals has provided some explanation for the findings of my survey of people with diabetes.

The final strength of my study relates to my background as a dentist, diabetes educator and as a person with diabetes. This has enabled me to bring a unique perspective to my study on diabetes care and oral healthcare. Granted, with this comes the risk that my personal experiences and attitudes may have introduced biases, for example the healthcare professionals I interviewed knew I was a dentist and this may have influenced their response to my questions. But wherever possible I have tried to limit any potential biases and instead use my background to enhance all aspects of this study.

5.3 Results in relation to previous research

5.3.1 Oral health knowledge amongst people with diabetes

Despite periodontal diseases being so common, knowledge of the relationship between diabetes and oral health was low amongst the survey respondents. A quarter of adults with type 2 diabetes and 13% of people with type 1 diabetes reported being uncertain about the oral complications of diabetes. Overall less than half the adults with diabetes reported that diabetes could result in bleeding gums, loosening teeth and a dry mouth. These results from an Australian population match studies overseas that have shown people with diabetes have low levels of knowledge of the oral complications of diabetes [81, 87].
Research suggests that the relationship between periodontal disease and diabetes is bidirectional, in that the chronic inflammation of periodontal diseases may make it more difficult for people with diabetes to control their blood glucose levels. The presence of moderate to severe periodontal disease may potentially increase blood sugar levels thus increasing the risk of a person with diabetes developing other chronic complications of the disease [51] such as kidney [196] and cardiovascular disease [197]. Adults with diabetes should be informed that their condition can result in worse periodontal health, and measures to prevent and control their oral diseases may improve their glycaemic control and overall health. In other words, they should be aware that a two-way relationship exists between diabetes and oral health.

5.3.2 Oral health behaviours of people with diabetes

My survey investigated people with diabetes oral hygiene behaviours (tooth brushing and flossing) and their frequency in visiting oral healthcare professionals. I found many people with diabetes practiced suboptimal oral hygiene, with 41% of people with diabetes reporting brushing their teeth less than twice a day and just over half the participants with diabetes flossed at least once a day (51%, n=61). Comparing my results to Australian community data collected as part of the National Survey of Adult Oral Health (NSAOH) 2004–06 found a similar tooth brushing frequency (55.5%) but higher rates (60.6%) of interdental cleaning than in my survey [198].

The prevention and management of periodontal disease requires removal of dental plaque (the aetiological factor) through tooth brushing and interdental cleaning [199,200]. Plaque control is fundamental to every person’s oral self-care regime, and therefore the importance of oral hygiene must be understood by adults with diabetes. It is concerning that my study found that although people with diabetes are at a higher risk of developing periodontal diseases, they report practicing less than the recommended oral hygiene.
Despite the increased risk for oral complications that diabetes confers, approximately a third of respondents in my survey had not visited an oral health professional in the last 12 months. This is similar to the 36% of people that reported not making a dental visit in the previous 12 months in the 2010 NTDIS [69].

Patterns of dental visiting including frequency and the reason for attendance can influence a person’s oral health. Preventive dental visits permit early detection and intervention of oral diseases, for example if gingivitis is not controlled, it will result in periodontitis in most individuals. No official guidelines currently exist in Australia on the recommended frequency of dental visits, but dental diseases are largely preventable [201]. Thus it is appropriate to assign an individual risk level based on the person’s diabetes and oral health status and schedule recall appointments accordingly.

A check-up was the reason reported for attending an oral healthcare professional by 58% of people with diabetes in my survey. Approximately two thirds of people with type 2 diabetes 66% (n=50) reported visiting an oral health professional for a check-up compared to (45%) of people with type 1 diabetes. The motivation for attending oral healthcare providers may be important. People who usually make a dental visit for a problem have 1.5 times the prevalence of periodontitis than people who visit for a check-up and are more likely to lose teeth to decay [44]. People who usually make a dental visit for a check-up may be more preventively oriented and have better self-care and therefore may reduce the risk of developing periodontitis.

Dental visits are also an important opportunity to discuss the risk factors that are shared by oral diseases and many other chronic diseases. These risk factors include smoking, diet, excessive alcohol use and lack of activity. The presence of these risk factors may either increase the risk of developing periodontitis or compromise its successful treatment, as well as increase the risk and progression of other chronic complications [41].
5.3.3 Healthcare professional’s oral health knowledge and behaviours

The second part of my study explored what healthcare professionals know about diabetes and oral health, and what they do about it. A team approach is required to effectively manage the many chronic complications that can result from diabetes [60, 202] and may include multiple healthcare professionals (see Figure 1).

Figure 1. Diabetes management team adapted from [58]
The interviews I conducted with healthcare professionals demonstrated their uncertainty about the bidirectional relationship between diabetes and oral health. There is a considerable body of evidence surrounding the bidirectional relationship between diabetes and oral health. Studies have also demonstrated that measures to improve periodontal diseases, such as teeth cleaning, may improve a person with diabetes blood glucose levels as measured by the HbA1c [34,203, 204], although the effect this ultimately has on health outcomes remains controversial [205]. Yet this information does not seem to have disseminated to the healthcare professionals managing people with diabetes in my sample. This corresponds with overseas studies that have also demonstrated low levels of knowledge about the relationship between diabetes oral health amongst dentists and medical professionals [206].

Healthcare professionals interviewed for my study declared the absence of oral health content in their education and training as a barrier to providing advice to people with diabetes. Medical students in Australia and Malaysia have very limited training in oral health [207] and in the USA approximately 70% of medical schools include four hours or less on oral health in their curriculum, and 10% have no oral health content at all [208].

Understanding the bidirectional relationship between diabetes and oral health requires knowledge about the aetiology, symptoms, complications and management of each individual disease. As would be expected the oral healthcare professionals interviewed were more aware of signs, symptoms and management of oral diseases than their medical counterparts. However, the oral health professionals only considered a person with diabetes glycaemic control in relation to how it might impact on treatment during a dental visit, while overlooking the influence it may have on oral health and general health outcomes. For example, they did not ask the patient about their diabetes self-care behaviours and metabolic control unless it related to the risk of a hypoglycaemic emergency in the dental office. These gaps in the oral healthcare provider’s knowledge regarding diabetes and its management, could result in not addressing the underlying issue of chronic hyperglycaemia, and not fully appreciating the potential benefits their interventions may confer on a person’s metabolic control.
The oral healthcare professionals interviewed were comfortable when focusing on treatment and prevention oral disease and approached treating patients with diabetes in much the same way as they would treat patients without diabetes. This reflects my survey finding that despite being in the high-risk group for periodontal diseases, nearly a third of patients (33%, n=40) with diabetes were not told by their healthcare professional to be extra diligent about tooth brushing and flossing.

Oral healthcare professionals also did not discuss with people with diabetes how their diabetes management may impact their oral health. This attitude corresponds with overseas studies that have reported that dentists do not feel they have the knowledge to involve themselves in their patient’s diabetes management and view this as outside their responsibilities and not something their patients or colleagues expect of them [147].

The oral health professionals interviewed did not feel they had the skills, training or confidence discussing diabetes management with patients in case they would provide incorrect information or contradict the medical professionals. Recent studies in the U.S.A and New Zealand have shown an unwillingness on behalf of oral health professionals to become actively involved in their patient’s diabetes management. A majority of general dentists did not feel they had the knowledge, believed such activities were peripheral to their role as dentists, lacked time to provide counselling and did not believe colleagues and patients expected them to perform such activities [147, 148]. Dental hygienists in the U.S.A did not routinely provide education on diabetes related oral health due to a lack of time, patient ambivalence, paucity of information and insufficient training [149, 209].

GPs are potentially another important source of information on the link between diabetes and oral health. In my survey, nearly all adults with diabetes reported visiting a GP in the previous 12 months (97%) and yet only a fifth of respondents received information about diabetes and oral health from this source. Patients with dental problems seeking subsidised dental consultations (Medicare) from non-dentally trained healthcare professionals (GPs) occurs frequently in Australia [210].
However studies of GPs and other healthcare professionals have found that they do not receive adequate training in oral health and do not feel comfortable performing periodontal examinations or advising patients on their oral health care needs [153]. Studies in the US of medical professionals have also found that although most reported an awareness of the oral complications of diabetes, their knowledge regarding periodontal disease was inadequate, and they were uncomfortable performing periodontal screening of their patients [152]. A study of endocrinologists in the US found only 26.6% of endocrinologists reported they would frequently advise patients with diabetes to visit a dentist [211].

Diabetes educators are in a unique position to discuss the oral complications of diabetes. The study found that they were knowledgeable about the links between diabetes and oral health, but their awareness had come from recent continuing professional development they had attended, and not their original education and training. In the US, a survey of diabetes educators found only a fifth of participants reported feeling confident in screening for oral complications of diabetes due insufficient knowledge and most (79%) educators had not received oral health education in their training [150]. Another study of diabetes educators in the USA found only 50-60% reported adequately covering oral health in their consultations[151]. Barriers to discussing oral health with their patients included lack of time and knowledge related to oral health, and insufficient training [150, 151].

5.4 CCM for diabetes and oral health

Improving health outcomes for people with chronic diseases like diabetes and periodontal diseases needs a multi-layered approach. The CCM is an organising framework for improving chronic disease management that involves interventions at the patient, healthcare professional and healthcare system level [212] (see pages 7-10). I will now discuss my results and interpret the findings of my study with the CCM in mind.

I have summarised my findings for oral health knowledge and behaviours of people with diabetes, how these results relate to the relevant component of the CCM, and the interventions that may improve health outcomes in Table 7 below.
People with diabetes | CCM | Intervention
--- | --- | ---
Uncertain about the oral complications of diabetes | Self-management support | Health education
 |  | Psycho-social support
Brush and floss less than is recommended | Self-management support | Health education
 |  | Skills training
 |  | Psycho-social support
Visit dentists less than recommended and reason for attending often for a problem | Self-management support
 | Health education
Delivery design systems |  | Psycho-social support
Clinical information systems |  | Integrated health services
 |  | Referrals/follow-up
 |  | My Health Record

Table 6. People with diabetes survey findings and Chronic Care Model (CCM)

# My Health Records are online summaries of an individual’s health information, such as medications, any allergies they may have and treatments they have received.

5.4.1 People with diabetes

My survey found people with diabetes were uncertain about the oral complications of diabetes and brushed and flossed less than is recommended for individuals at high risk of oral diseases. The self-management support component of the CCM emphasises that the primary role of healthcare professionals is in supporting people with diabetes self-manage their condition. This is achieved through health education, teaching self-care skills and providing psycho-social support to sustain these behaviors. By supporting self-management healthcare professionals can improve the oral health knowledge and behaviours amongst people with diabetes.

The aim of the design delivery component of the CCM is to ensure the delivery of effective, efficient clinical care and self-management support [213]. My study found that many people with diabetes, despite being in the high-risk group for periodontal diseases, reported not visiting the dentist annually or only visiting only when they had pain or a problem. This highlights the need for more planned interactions between the person with diabetes and healthcare professionals. Planned interactions are visits instigated by the healthcare professional that concentrate on issues not covered during acute appointments for example the prevention of disease and self-management support [214].
The current structure of Australia’s health care system with its fragmented approach to oral health and general health makes it difficult for people with diabetes to access effective and efficient health care including oral healthcare. This is also an issue in the UK where Bisset et al. investigating collaboration between medical and oral health professionals concluded that even if the associations between diabetes and periodontitis were known, the separation of the medical and dental healthcare systems meant structures were not in place to promote or organise the management of the oral health of people with diabetes [215].

The CCM recognises that interventions are needed at the healthcare system level in order to improve diabetes care and thus produce better outcomes for people with diabetes [216]. Within the healthcare system component of the CCM is care coordination. Care coordination has been defined as “the deliberate organisation of patient care activities between two or more participants involved in a patient’s care to facilitate the appropriate delivery of health care services” [217].

One of the goals of care coordination is referrals between health professionals that are timely, effective and equitable [218]. With patients seeing multiple health professionals, having a clear referral pathway is important to providing cohesive healthcare. Referrals made between medical and dental professionals in my study were usually informal, and often involved simply advising the patient to contact the relevant clinician. One way the design delivery system component of the CCM can be improved is by integrating medical and dental healthcare services to achieve better co-ordination and effectiveness of care.

A lack of coordination between healthcare professionals has been identified as a factor in exacerbating the burden of treatment imposed on the person with diabetes [219]. The accumulation of demands that self-care places on the person with diabetes has been described as the burden of treatment [220]. Coping with self-care tasks requires a significant amount of time and effort. The person’s capacity to meet these demands can result in poor adherence to treatment regimens and healthcare utilisation, resulting in poorer health outcomes [221]. Healthcare delivery should therefore be cohesive and coordinated so as not to impose additional burdens on people with diabetes.
Timely referrals and regular follow-up for people with diabetes also demands that healthcare professionals are able to freely exchange information between each other. My study indicates that this is not currently happening. Improved clinical information systems such as the introduction of electronic health records, have the potential to improve the quality, efficiency and coordination of diabetes care by providing the healthcare professional access to timely and complete patient information at the point of care [222]. Supportive information technology could include prompts for instance to remind medical healthcare professionals to organise oral examinations for people with diabetes, or to remind oral healthcare providers to discuss common chronic disease risk factors [223].

Table 8 below summarises the findings from phase 2 of the study exploring healthcare professional’s knowledge of the association between diabetes and oral health and links these findings to the CCM. I will now go into detail about each of these elements.

<table>
<thead>
<tr>
<th>HCP</th>
<th>CCM</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncertain about bidirectional relationship between diabetes / oral health</td>
<td>Decision support</td>
<td>HCP education and training&lt;br&gt;Clinical guidelines</td>
</tr>
<tr>
<td>Don’t routinely discuss with people with diabetes about its relationship with oral health</td>
<td>Self-management support</td>
<td>HCP education and training&lt;br&gt;Clinical guidelines&lt;br&gt;Public health campaign</td>
</tr>
<tr>
<td>Dental and medical professionals do not routinely communicate or collaborate with each other</td>
<td>Delivery system design</td>
<td>Interprofessional education&lt;br&gt;Integrated health services&lt;br&gt;Roles and responsibilities</td>
</tr>
<tr>
<td></td>
<td>Clinical information systems</td>
<td>My Health Record</td>
</tr>
</tbody>
</table>

**Table 7. Healthcare professionals and the Chronic Care Model (CCM)**

HCP: Healthcare professional

CPD: Continuing Professional Development
5.4.2 Healthcare professional knowledge and awareness

The first theme that arose from interviews with healthcare professionals was that they were uncertain about the bidirectional relationship between diabetes and oral health. The health education provided to people with diabetes is determined in part by healthcare professional’s own knowledge about the relationship between diabetes and oral health. The healthcare professionals interviewed for this study knew about some aspects of the relationship between diabetes and oral health, but their understanding was incomplete. All healthcare professionals believed that adults with diabetes were at greater risk of oral diseases such as periodontal diseases and tooth loss, than patients without diabetes. Beyond this, the healthcare professional’s knowledge was primarily about treatment aspects of care. For instance, they acknowledged that sub-optimal metabolic control may negatively influence treatment outcomes, and that hypoglycaemia is a potential medical emergency that can occur in their healthcare setting. But aside from the diabetes educators interviewed for this study, the healthcare professionals did not acknowledge the negative influence periodontal diseases can have on glycaemic control of people with diabetes.

An important element of the CCM is supporting the decision-making process for healthcare professionals through their education and training and clinical guidelines. This study highlights the importance of including information about oral health and its connection to systemic health in the education and training of all healthcare professionals. As the education of a healthcare professional is ongoing and lifelong it is also important to include contemporary information about the bidirectional relationship between diabetes and periodontal diseases in continuing professional development programs for oral health and medical professionals and in clinical guidelines from professional associations and healthcare organisations.
5.4.3 Communicating with people with diabetes

The second key finding of phase 2 of my study was that healthcare professionals did not routinely discuss the link between diabetes and oral health with people with diabetes. Health education is a key component of the healthcare professional’s role in providing the self-management support in the CCM. Healthcare professionals are a primary source of health information for people with diabetes therefore they must understand the two-way relationship between diabetes and oral health. They must then provide the evidence-based information to people with diabetes, and teach them the self-care skills required to manage diabetes and oral diseases. Despite all the healthcare professionals interviewed acknowledging the adverse influence diabetes can have on oral health, they did not routinely incorporate this information into discussions with people with diabetes.

The reluctance to provide oral health information to adults with diabetes may be in part due to fact that until recently there has been no detailed professional guidelines for screening the oral complications of diabetes. Clinical guidelines are developed to educate and train healthcare professionals and to improve health outcomes for their patients. Prior to 2014 general practice guidelines for managing type 2 diabetes only mentioned the need for annual dental visits, these have been updated to now include a brief discussion on periodontal disease and the two-way relationship between oral health and diabetes [60]. This follows recent changes to some international guidelines, including the most recent American Diabetes Association guidelines which advise oral disease to be incorporated into medical history taking and for referring patients to the dentist for a periodontal examination (20).

Decision support is an important component of the CCM that targets changing healthcare professional behavior to improve health outcomes for people with diabetes. Decision support involves incorporating guidelines, education and practice resources into routine clinical practice [224].
My study demonstrates that the development of clinical guidelines for diabetes and oral health has not translated into evidence based clinical practice in my sample of healthcare professionals. This corresponds with research that has shown low levels of uptake of clinical practice guidelines in medicine [225, 226]. Many factors have been suggested for this, including a lack of awareness, time constraints, cost, limited access, overcoming habits and outcome expectancy [227, 228]. Multiple strategies targeting the characteristics of the guidelines, healthcare professionals, patients and environment may be required to improve the implementation guidelines amongst healthcare professionals [229, 230]

For people with chronic diseases like diabetes healthcare professionals are the primary source of information. However family and friends also play a significant role. In a US study 65% of adults living with one or more chronic conditions reported receiving information from family and friends [231]. My survey of people with diabetes, found family and friends were a source of information reported by only 6% of respondents. This may reflect a low level of knowledge of oral complications of diabetes in the wider community. Raising community awareness of this important complication through a public health campaign could increase the profile of the importance of oral health.

5.4.4 Interprofessional collaboration and communication

The delivery system design of the CCM aims to provide effective, efficient clinical care and self-management support to people with diabetes. To achieve this it is essential that communication and collaboration occurs between the individual healthcare professionals. The final finding of my qualitative study phase was that medical and dental health professionals do not routinely communicate and collaborate with each other about their patients with diabetes. The GPs and diabetes educators in my study rarely were contacted by oral healthcare providers, and never contacted regarding their patient’s diabetes. Similarly, oral healthcare professionals were not contacted by medical professionals.
All healthcare professionals collaborate to some degree as part of their clinical practice, for instance a dentist may ring a GP to discuss a patient’s medication and how that may impact proposed treatment. But interprofessional collaboration or collaborative practice goes far beyond this concept. The World Health Organization (WHO) defines collaborative practice as “when multiple health workers from different professional backgrounds work together with patients, families, carers and communities to deliver the highest quality care” [232].

Little is known about interprofessional collaboration between medical professionals and dentists. Several international studies have explored collaboration between GPs and dentists and found it to be limited and mainly focused on treatment rather than preventive care [233]. Participants in an Australian study perceived that communication between dentists and GPs was poor and that referrals between the two professions rarely occurred [234]. Knowledge gaps on the part of GPs and dentists and the perceived distance between the two professions were thought to be barriers for communication and collaboration [233].

5.4.4.1 Healthcare professional Education and training

Enhanced interprofessional collaboration begins with health care professionals understanding what each member contributes and their roles and responsibilities in supporting a person with diabetes self-management and detecting and treating the complications of diabetes. The first step in collaboration is learning about other professions and that starts during the education and training of healthcare professionals. Interprofessional education (IPE) involves different professionals meeting and interacting in learning to enhance collaborative practice and improve health outcomes of patients [235]. By sharing skills and knowledge healthcare professionals gain knowledge and respect for the roles of other healthcare professionals [236].
5.4.4.2 Roles and responsibilities: professional boundaries

The delivery design element of the CCM for diabetes recognises the need to define the roles and responsibilities of healthcare professionals in ensuring people with diabetes receive optimal care. Participants in this study described a lack of knowledge and recognition about the role of each professional in the management of the patients with diabetes. Uncertain of what the role of each professional was, they were sensitive to professional boundaries and were reluctant to overstep their responsibilities regarding educating patients about oral health and diabetes. Knowledge about the roles of other health professionals promotes mutual understanding and results in trust in the professional abilities of colleagues leading to enhanced cooperation [237].

As discussed previously healthcare professionals in this study were uncertain about the relationship between diabetes and oral health. Knowledge is essential to identify situations in which a patient could benefit from interprofessional collaboration. Healthcare professionals are more likely to communicate with each other if they perceive this will enhance quality of care [238]. Professional boundaries may prevent knowledge exchange between dental and medical professionals. Educational experience and sources of information differ for each professional group and evidence is not shared and rarely and debated between different professions [239].

The management of diabetes requires a multidisciplinary approach and coordination of health care is required to enable a person to access the services necessary to treat their diabetes. Ideally interprofessional collaboration involves a sharing of power or a “clinical democracy”[240]. This introduces the question as to which healthcare professional should have the role of leading or coordinating care for the patient. Oral health professionals in this study expected the GP to provide leadership and overall coordination of patient care. In Australia in 2014-15, 28% of people with a long-term condition like diabetes, saw three or more health professionals. Amongst this group 71% reported that a health professional helped coordinate their care, usually a GP (59%) or medical specialist (25%) [241].
5.4.4.3 Information exchange between healthcare professionals

Another key constituent of the CCM is clinical information systems that organise patient and population information to enable efficient and effective care and meet the needs of the healthcare professionals. This requires sharing information with patients and healthcare professionals to coordinate care, as people with diabetes move from oral health professionals to medical professionals. An Australian health survey found that people with a long-term health condition were more likely than those without, to report issues caused by a lack of communication between healthcare professionals [241]. My study found that healthcare professionals work independently of each other and the communication needed to coordinate patient care does not take place.

The healthcare professionals in my study reported frustrations about the lack of interprofessional communication. With all health professionals working to a very busy schedule being able to discuss patient management in an appropriate and timely manner was a barrier to communication. Medical professionals preferred referral letters as the preferred mode of communication between healthcare professionals. Oral health professionals on the rare occasions they contacted GPs would do so by phone and often encounter difficulties in accessing busy GPs. They were also sensitive to the idea of taking up the GPs valuable time.

The use of a digital health records that includes details of a person’s health status, medications, treatments and allergies that GPs, dentists and other healthcare providers have access to, can facilitate the flow of information between healthcare professionals thus leading to collaboration between healthcare professionals.

5.5 Implications for practice and policy: Improving diabetes care

Diabetes and oral health share a bidirectional relationship that has ramifications for managing both diseases and yet my study found many people with diabetes are unaware of this association.
I believe the following interventions are indicated to improve care for people with diabetes:

- Routine screening of the oral complications of diabetes
- HCPs supporting diabetes self-management
- Integrate oral health services with medical services
- Interprofessional communication and collaboration

Periodontal diseases are an important and yet neglected chronic complication of diabetes. It is important to screen for periodontal diseases in the same way the other complications of diabetes are routinely screened for by healthcare professionals. My study has demonstrated that despite the large body of evidence supporting the links between diabetes and periodontal diseases and the inclusion of oral disease in medical and clinical guidelines for diabetes care this is not occurring. Therefore, more needs to be done to investigate how to facilitate the translation of evidence based guidelines to the clinical practice of healthcare professionals.

The primary role of healthcare professionals is to support a person with diabetes manage their condition and to provide early treatment interventions when needed. This involves providing the necessary education to enable the person with diabetes to make informed decisions about their self-care behaviours and provide the skills needed to perform the daily self-management tasks. Healthcare professionals must also offer the psychological support required to help the person with diabetes maintain these behaviours over a lifetime.

This study found that including oral health in clinical guidelines for healthcare professionals did not translate into changes in their clinical practice. Other approaches need to be considered to facilitate this. One might be the incorporation of oral health into the diabetes annual cycle of care. The diabetes annual cycle of care is a checklist for reviewing a person with diabetes management and general health (see Table 9 below).
<table>
<thead>
<tr>
<th>What</th>
<th>When</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c</td>
<td>At least every 6-12 months</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>At least every 6-12 months</td>
</tr>
<tr>
<td>Foot assessment</td>
<td>Low risk feet: At least every year</td>
</tr>
<tr>
<td></td>
<td>High risk feet: At least every 3-6 months</td>
</tr>
<tr>
<td>Eye examination</td>
<td>At least every two years</td>
</tr>
<tr>
<td>Kidney health</td>
<td>At least every year</td>
</tr>
<tr>
<td>Blood fats</td>
<td>At least every six months</td>
</tr>
<tr>
<td>Weight</td>
<td>At least every six months</td>
</tr>
<tr>
<td>Weight circumference</td>
<td>At least every six months</td>
</tr>
<tr>
<td>Healthy eating review</td>
<td>At least every year</td>
</tr>
<tr>
<td>Medication review</td>
<td>At least every year</td>
</tr>
</tbody>
</table>

Table 8. Diabetes annual cycle of care adapted from [60]

The GP conducts the review in collaboration with other healthcare professionals, with the aim being to help reduce the risk of diabetes-related complications. The addition of an annual dental check-up to the cycle, will remind the GP to advise the person with diabetes to visit an oral healthcare professional.

Following the aims of the CCM, oral healthcare needs to be proactive and focused on the prevention and progression of oral disease. Therefore it is important that people with diabetes have access to timely and appropriate oral healthcare. The healthcare providers interviewed for this study highlighted the inability of people with diabetes, particularly those from disadvantaged backgrounds, accessing oral healthcare. Barriers such as cost and long public dental waiting lists were suggested by the participants as reasons for this. This corresponds with recent Australian data where 19% adults delayed seeing a dentist, hygenist or dental specialist due to cost [242]. Considering the strong links between oral health and general health, my study provides evidence for improving access to oral health care as part of diabetes management.

Universal health coverage in Australia does not extend to oral healthcare, with most dental treatment (80%) delivered through the private sector [243]. The public dental system has eligibility criteria that varies from state to state, and in Victoria there is substantial waiting times (16.5 months) for general dental treatment for those that meet the eligibility criteria [244]. Governments both State and Federal have to recognise the importance oral health has to general health and the need to be incorporate oral health into primary healthcare.
This may be through improved funding for public dental services, prioritising people with chronic diseases on public waiting lists and revisiting a scheme like the Chronic Disease Dental Scheme (CDDS). The CDDS operated from 2007-2012 and provided subsidised dental care for people with chronic medical conditions where their oral health was impacting on, or likely to impact on their general health [245]. The Federal Government currently supports chronic disease management by providing payments to GPs and some allied health professionals (oral health professionals are excluded) to institute a General practice management plan (GPMP) [60]. This could be extended to include subsidised oral healthcare to people with diabetes.

A person with diabetes will often consult with multiple healthcare providers. Currently in Australia, medical health services are separated from dental services leading to disjointed care for the person with diabetes. To improve coordination and effectiveness of diabetes care there needs to be an integration of oral health services with medical services. Community health centres are well placed to overcome the problems associated with the separation of health services because many provide both medical and dental care. Some private medical and dental services are also located in the same physical premises providing affording the opportunity to integrate services. For service integration to occur electronic health records that allow an exchange of information between medical and dental practices would help facilitate health service incorporation.

Diabetes is a complex disease that requires a diverse group of healthcare professionals to work together to help a person with diabetes manage their condition. When working within the framework of the CCM interprofessional collaboration has been shown to result in improved outcomes for people with diabetes [246]. Healthcare professionals work within a fragmented healthcare system and to improve the healthcare delivery system interprofessional collaboration needs to be promoted through interprofessional education, defining roles and responsibilities of healthcare professionals and improving clinical information systems [247]. Interprofessional collaboration will lead to effective and cohesive healthcare for people with diabetes [248].
Chapter 6.

Conclusion

I began this thesis explaining my interest in diabetes and oral health and how this influenced the research questions I have studied. I would like to conclude my thesis by reflecting upon my personal experiences with diabetes.

For a person living with diabetes, my consultations with healthcare professionals often revolve around numbers: random blood glucose, HbA1c, blood pressure, cholesterol, dental plaque scores and gum pocket depths. But perhaps the most important numbers are the two above. In 2016, I spent 525600 minutes managing my diabetes and 40 minutes with my healthcare professionals. As a person with type 1 diabetes every day I can choose to commit to self-care, make multiple self-management decisions and perform self-care behaviors to reduce my risk of complications and maintain my health. The role of my healthcare professionals is to provide me with the education I need to make informed decisions, demonstrate the self-care skills I require and offer the psychological and social support to sustain these behaviors over time.

I intended this to be an exploratory study into an area of diabetes care about which very little is known. In the small sample of people in Victoria that I surveyed, I found that unlike the other chronic complications of the condition, people with diabetes were often are unaware of the oral complications of the disease and the consequences these may have on their health.
The healthcare professionals I interviewed, were also uncertain about the bidirectional relationship between diabetes and periodontal diseases, did not routinely discuss it with people with diabetes and collaboration between different healthcare professionals rarely occurred.

This study is about improving the overall health of people with diabetes and so I have used the CCM as a conceptual framework in which to interpret my findings. The CCM offers a framework in which improvements can be made through interventions at a patient, healthcare professional and systems level. For a person with diabetes, what appeals to me about this model is its recognition of the central importance of the individual’s self-management of their chronic disease and the healthcare professional’s role in supporting this.

To achieve improved health outcomes for people with diabetes I recommend the following:

1. Further research into the oral health knowledge and behaviours of both people with diabetes and healthcare professionals. Although clinical guidelines already exist to assist healthcare professionals in managing the oral health of people with diabetes, this study found they are rarely implemented, so more research is also needed into the barriers and enablers to adopting these guidelines.

2. The integral relationship between oral health and general health, especially the associations between periodontal disease and systemic disease, needs to be covered in the University curriculum of all healthcare professional students and the continuing professional education of all healthcare professionals.

To ensure the delivery of high quality and effective patient care healthcare professionals must communicate and collaborate with each other. This begins with interprofessional education, where increased joint education of healthcare professional students could help promote interprofessional collaboration upon graduation.
3. Changes to clinical practice enabled by enhanced knowledge, robust clinical guidelines, improved communication and sharing of information between healthcare professionals.

I hope my findings on oral health knowledge behaviours of people with diabetes and healthcare professionals can highlight what is an often neglected but important complication of diabetes, leading to further research that generates evidence based interventions that will improve the oral health of people with diabetes and ultimately their overall health and wellbeing.
Bibliography


Welcome to Your dental health and diabetes survey

Thanks for visiting the dental health and diabetes survey. Having a healthy mouth is essential to maintaining good general health, especially for someone with diabetes. We are conducting a survey that explores what adults with diabetes know about dental health, and what they do to look after their teeth and gums and overall health. The survey is completed on-line, and should take around 20 minutes to complete. Your responses are strictly confidential.

1. ELECTRONIC CONSENT: Please select your choice below.

Clicking on the "agree" button below indicates that:

• You have read the above information
• You voluntarily agree to participate
• You are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

Agree
Disagree

Section A: Your dental health and diabetes

The questions in this section are about your current dental health, what you know about diseases of the teeth and gums, and how your diabetes may affect your teeth and gums.

2. Do you have any of your NATURAL teeth?

Yes
No
3. Have you experienced any of the following?
   You may tick more than one answer
   
   Bleeding and swollen gums
   Dry mouth
   Cavities
   Loose teeth
   Burning sensation and pain in the mouth

4. How would you rate your own DENTAL health? Would you describe it as...
   
   Excellent
   Good
   Fair
   Poor
   Don't know

5. Do you believe diabetes can affect a person's gums and teeth?
   
   Yes
   No
   Don't know

6. If yes, where did this information come from?
   
   From my dentist
   From my dental hygienist
   From my doctor
   From my diabetes educator
   Family and friends
   Internet, television, newspaper, magazine or other media
   Other

7. Does your dental professional (dentist or dental hygienist) know you have diabetes?
   
   Yes
   No
   Don't know

8. Have you been told by your dental professional (dentist or dental hygienist) that you should be extra careful to brush, floss and see a dentist regularly because you have diabetes?
   
   Yes
   No
   Don't know
9. Please indicate by ticking the box if you agree or disagree with the following statements?

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes can cause teeth to become loose</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A person with diabetes is at a greater risk than someone without diabetes, of getting an infection following the removal of a tooth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes can cause the gums to bleed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes can cause a dry mouth</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Section B: Looking after your teeth and gums

This section explores how you look after your teeth and gums, and when and why you visit a dentist.

10. How often do you brush your teeth?

- Less than once a day
- Once a day
- Twice a day
- More than three times a day
- All my teeth are missing

11. How often do you floss, use an interdental brush or tooth pick to clean in between your teeth?

- Never or less than once a week
- Once a day
- Twice a day
- More than twice a day
- All my teeth are missing

12. How long ago did you LAST see a dental professional (dentist or dental hygienist) about your teeth, gums or dentures?

- Less than 12 months
- 1 year to less than 2 years
- 2 years to less than 5 years
- 5 years to less than 10 years
- More than 10 years
- Never visited
13. What was the reason for your last visit to a dental professional (dentist or hygienist)?

Checkup  
Problem  
Don't know

14. Was the dental visit necessary for the relief of pain?

Yes  
No  
Don't know

15. What is your usual reason for visiting a dental professional (dentist or dental hygienist), for checkups or when you have a dental problem?

Checkup  
Problem  
Don't know

16. Do you avoid visiting the dentist or do you visit the dentist less often than you believe you need to?

Yes  
No

17. If yes what is the reason for avoiding or delaying of a dental visit?

Lack of time/too busy  
Cost/ too expensive  
Do not like dentists  
Inconvenient to get to  
Fear or anxiety  
Just don't get around to it  
Other reason

18. Should dentists be involved in testing for diabetes in patients who are not known to have the condition?

Yes  
No  
Don't know
Section C: Your diabetes and general health

The questions in this section ask about your diabetes, how you manage the condition and how you cope with living with diabetes.

19 Do you have

Type 1 diabetes
Type 2 diabetes
Don't know

20. To the best Less than 1 year ago of your ability, estimate when were you diagnosed with diabetes?

1 2 years ago
2-5 years ago
5-10 years ago
> 10 years ago

21. A blood test called HbA1c (or A1c) measures the average blood glucose levels over the past 2 to 3 months. To the best of your knowledge, what was your most recent Hb A1C?

7% or less
Greater than 7% but less than 8%
Greater than 8%

22. What type of doctor looks after your diabetes?

General practitioner
Diabetes specialist
Both GP and Specialist
None
23. Have you ever been diagnosed with any of the following conditions?
   Anxiety
   Coeliac disease
   Fatty liver disease
   Protein (albumin) in the urine
   Heart disease/heart attack
   High blood pressure (hypertension)
   Vascular disease (poor circulation in the legs/feet)
   Retinopathy (damage to the eye (retina))
   Neuropathy (damage to nerves e.g. in feet)
   Surgical removal of toes, foot or lower leg
   Kidney damage/renal failure
   Sexual dysfunction
   Sleep apnoea
   Stroke

   Yes
   No
   Don't know

24. If yes, have you been hospitalised with any of these conditions in the last 12 months?

   Yes
   No
   Don't know

25. Which of the following health issues do you believe are associated with diabetes?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gum disease</td>
<td></td>
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<td></td>
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<tr>
<td>Eye disease</td>
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<td></td>
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<tr>
<td>Nerve disease</td>
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<tr>
<td>Kidney disease</td>
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<td></td>
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<tr>
<td>Depression and anxiety</td>
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<tr>
<td>Skin conditions</td>
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<td>Foot problems</td>
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<td></td>
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<tr>
<td>Heart disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High blood pressure</td>
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<td></td>
<td></td>
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</tbody>
</table>
26. Approximately how often do you visit a doctor for your diabetes?

- 5 or more times a year
- 3 to 4 times a year
- 1 or 2 times a year
- Once every 2 or 3 year
- Once every 5 years
- Never

27. Within the past 12 months have you visited any of these health professionals?

<table>
<thead>
<tr>
<th>Health Professional</th>
<th>Yes</th>
<th>No</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes Educator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Podiatrist</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Eye specialist</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Dietician/nutritionist</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Endocrinologist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

28. How long has it been since you've had the back of your eyes (retina) checked?

- Within 1 year (< 1 year)
- 1 to 2 years (> 1 year and < 2 years)
- 2 to 5 years ( > 2 years and < 5 years)
- 5 to 10 years ( > 5 years and < 10 years)
- More than 10 years
- Don't know
Section D: Managing your diabetes

The next section asks questions about your diabetes self-care activities during the past 7 days. If you were sick during the last 7 days, please think back to the last 7 days you were not sick.

29. Diet:
How many of last SEVEN DAYS have you followed a healthy eating plan?

0 1 2 3 4 5 6 7

30. Diet:
On average, over the last month, how many DAYS PER WEEK have you followed your eating plan.

0 1 2 3 4 5 6 7

31. Diet:
On how many of the last SEVEN DAYS did you eat five or more servings of fruits or vegetables?

0 1 2 3 4 5 6 7
32. Diet:
On how many of the last SEVEN DAYS did you eat high fat foods such as red meat or full fat dairy product?

0
1
2
3
4
5
6
7

33. Exercise:
On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity? (Total minutes of continuous activity, including walking).

0
1
2
3
4
5
6
7

34. Exercise:
On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or part of your work?

0
1
2
3
4
5
6
7
35. Blood Sugar testing:
On how many of the last SEVEN DAYS did you test your blood sugar?
0
1
2
3
4
5
6
7

36. Blood Sugar Testing:
On how many of the last SEVEN DAYS did you test your blood sugar the number of times recommended by your health care provider?
0
1
2
3
4
5
6
7

37. Foot Care:
On how many of the last SEVEN DAYS did you check your feet?
0
1
2
3
4
5
6
7

38. Foot Care:
On how many of the last SEVEN DAYS did you inspect the inside of your shoes?
0
1
2
3
4
5
6
7
39. Smoking: Have you smoked a cigarette even one puff during the past SEVEN days?

Yes
No

Section E: Your feelings about diabetes

The next two questions ask about how diabetes affects your life and how you feel about living with diabetes.

40. Living with diabetes can sometimes be tough. It can lead to problems that range from minor hassles to major life difficulties. Listed below are 2 potential problem areas that people with diabetes may experience. Consider the degree to which each of the 2 items may have distressed or bothered you DURING THE PAST MONTH and circle the appropriate number. If you feel that a particular item is not a bother or a problem for you, you would circle “1”. If it is very bothersome for you, you might circle “6”.

| Feeling overwhelmed by the demands of living with diabetes | Not a Problem (1) | Not a Problem (2) | Moderate Problem (3) | Moderate Problem (4) | Serious Problem (6) | Serious Problem (6) |
| Feeling that I am often failing with my diabetes regimen | Not a Problem (1) | Not a Problem (2) | Moderate Problem (3) | Moderate Problem (4) | Serious Problem (6) | Serious Problem (6) |
41. Please indicate for each of the five statements which is closest to how you have been feeling over the last two weeks. Notice that higher numbers mean better wellbeing. Over the last 2 weeks

<table>
<thead>
<tr>
<th>Statement</th>
<th>All of the time (5)</th>
<th>Most of the time (4)</th>
<th>More than half the time (3)</th>
<th>Less than half the time (2)</th>
<th>Some of the time (1)</th>
<th>At no time (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have felt cheerful and in good spirits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have felt calm and relaxed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have felt active and vigorous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I woke up feeling fresh and rested</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My daily life has been filled with things that interest me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Section F About you

42. What is your age?

43. What is your post code?

44. What is your gender?

Male
Female
45. Are you currently employed?

Yes
No

46. If yes, what is your occupation?

List of occupations
Manager or Administrator
Professional (e.g., Accountant, Sales Reps, Medical Practitioner, Nurse, Teachers, Legal Professional, etc.)
Associate Professional (e.g., Technical Officers, Financial Advisors, Supervisors, Enrolled Nurses, Police Officers, etc.)
Tradesperson or Related Worker (e.g., Secretary, Personal Assistant, Bookkeepers, etc.)
Intermediate Production or Transport Worker (e.g., Forklift Driver, Boiler/Engine/Machine Operator, etc.)
Elementary Clerical, Sales or Service Worker (e.g., Sales Rep, Carer, Hospitality, etc.)
Labourer or Related Worker
Student
Other (please specify)

47. If NO are you currently...

Unemployed and seeking paid work
Unemployed and unable to work
In unpaid household duties
Retired
Other
48. Do you currently have a pension or allowance from the Government, or have a pensioner concession card, a Health Care Card?

Yes
No
Don't know

498. Do you have private health insurance for dental expenses?

Yes
No
Don't know

50. How did you find out about this survey?

Postcard invitation
Email invitation

Thank you for completing the survey. Maintaining healthy teeth and gums is essential to your overall health and it may also help you better manage your diabetes. For more information on oral health and diabetes, and how to maintain a healthy mouth please click on the link below:


Appendix 1

Question 2, 4, 12, 13, 14, are from National Survey Adult Oral Health
Question 10, 11 are from National Dental Telephone Interview Survey
Question 28 to 38 is the Summary of Diabetes Self-Care Activities
Question 39 is the 2-item Diabetes Distress Screening Scale (DDS2)
Question 40 is the WHO (Five) Well-being Index
Appendix 2: Ethics Approval letter for Phase 1 of Study

University of Melbourne Human Research Ethics Committee (HREC) Ethics ID: 1339541

20 November 2013

Dr J.S. Furler
General Practice
The University of Melbourne

Dear Dr Furler,

I am pleased to advise that the Health Sciences Human Ethics Sub-Committee approved the following Project:


Researchers: Dr J S Furler, A Pridie

Ethics ID: 1339541

The Project has been approved for the period: 6-Nov-2013 to 31-Dec-2014

It is your responsibility to ensure that all people associated with the Project are made aware of what has actually been approved.

Research projects are normally approved to 31 December of the year of approval. Projects may be renewed yearly for up to a total of five years upon receipt of a satisfactory annual report. If a project is to continue beyond five years a new application will normally need to be submitted.

Please note that the following conditions apply to your approval. Failure to abide by these conditions may result in suspension or discontinuation of approval and/or disciplinary action.

(a) Limit of Approval: Approval is limited strictly to the research as submitted in your Project application.

(b) Variation to Project: Any subsequent variations or modifications you might wish to make to the Project must be notified formally to the Human Ethics Sub-Committee for further consideration and approval. If the Sub-Committee considers that the proposed changes are significant, you may be required to submit a new application for approval of the revised Project.

(c) Incidents or adverse effects: Researchers must report immediately to the Sub-Committee anything which might affect the ethical acceptance of the protocol including adverse effects on participants or unforeseen events that might affect continued ethical acceptability of the Project. Failure to do so may result in suspension or cancellation of approval.

(d) Monitoring: All projects are subject to monitoring at any time by the Human Research Ethics Committee.

(e) Annual Report: Please be aware that the Human Research Ethics Committee requires that researchers submit an annual report on each of their projects at the end of the year, or at the conclusion of a project if it continues for less than this time. Failure to submit an annual report will mean that ethics approval will lapse.

(f) Auditing: All projects may be subject to audit by members of the Sub-Committee.

If you have any queries on these matters, or require additional information, please contact me using the details below.

Please quote the ethics registration number and the title of the Project in any future correspondence.

On behalf of the Sub-Committee I wish you well in your research.

Yours sincerely,

Ms Jennifer Hassell - Secretary
Health Sciences HREC
Phones: 93451341, Email: hassellj@unimelb.edu.au

cc: HEAG Chair - General Practice
Mr Andre Pridie

The Office for Research Ethics and Integrity
The University of Melbourne, Level 1, 780 Elizabeth St Melbourne Victoria 3010 Australia
T: +61 3 9345 8907
W: www.cre.unimelb.edu.au
Appendix 3: Plain Language Statement for Online Survey

Dental health knowledge, attitudes and behaviours amongst adults with diabetes survey.

Principle Investigator: Dr Andre Priede
Supervisor: Dr John Furler
Department of General Practice and Primary Health Care, University of Melbourne

Introduction:

This is an optional survey being conducted by the University of Melbourne as part of a Masters in Primary Health Care (Research) project. Participation in this study is voluntary and participants are free to withdraw consent at any time.

Aims of the study:

I am investigating what people with diabetes know about dental health, how they look after their teeth and gums and how they manage their general health.

What am I asking of you?

I am inviting you to take part in a research project that involves completing a survey that will take approximately 20 minutes. Your responses will help me understand the dental health needs of adults with diabetes and what might be done to improve their dental health and overall health. Your participation is voluntary and it will not affect your relationship with Diabetes Australia/N.D.S.S if you do not participate. You may stop the survey at any time and skip any questions you do not wish to answer. The results of this survey will be used to explore how people with diabetes look after their teeth and gums and what can be done to improve the dental health of adults with diabetes. A summary of the survey findings will be made available through the Department of General Practice University of Melbourne website: http://www.gp.unimelb.edu.au/

Confidentiality

The survey responses you provide will be anonymous. To help protect your confidentiality, the survey will not contain information that will personally identify you, and I will not ask for your name. All information provided by you will be destroyed 5 years after the study is completed. A report of the study will be submitted for publication, but individual participants will not be identifiable in any way.
Ethical approval

The risks to you by participating in this survey are minimal. Ethics approval for the study has been given by The University of Melbourne, Human Research Ethics. Should you have concerns about the conduct of this study you may contact the Manager, Human Research Ethics, The University of Melbourne, Level 5, Alan Gilbert Building, 161 Barry Street, University Square, Carlton Victoria 3053, phone: 8344 2071; fax: 9347 6739.

Who is carrying out the study?

The study is being conducted as part of the requirements of a Masters in Primary Health Care (Research) by Dr Andre Priede, the Department of General Practice, University of Melbourne. The project is being conducted under the supervision of Dr. John Furler, the Department of General Practice, University of Melbourne. The cost of printing and postage of the survey post card invitations has been provided for by Colgate, Australia.

Project contact details

If you have any questions about completing the questionnaire or about being in this study, you may contact me at ph.: 90359847 or email: agpriede@unimelb.edu.au. You may also contact my research supervisor at 83444747.

How to participate

If you would like to participate, please indicate that you have read and understood this information by clicking on agree on the consent form.

Kind regards

Dr Andre Priede
Appendix 4: Post card invitation for survey

Your dental health & diabetes

GETTING YOUR TEETH INTO DIABETES SURVEY

Having a healthy mouth is essential to maintaining good general health. We are conducting a survey that explores what adults with diabetes know about dental health, and what they do to look after their teeth and gums and overall health. The survey is completed on-line, and should take around 20 minutes to complete. Your responses are strictly confidential.

If you would like to take part please type https://www.surveymonkey.com/s/dentaldiabetes into your web browser to start the survey.

CONTACT
Dr Andre Priede | T: 9335 8847 | E: agpriede@unimelb.edu.au
12 August 2016

A/Prof J.S. Furler
General Practice
The University of Melbourne

Dear A/Prof Furler,

I am pleased to advise that the General Practice Human Ethics Advisory Group has approved the following Minimal Risk Project.

Project title: Diabetes, oral health and health professionals: a qualitative study
Researchers: Dr J E Manski-Nankervis, A/Prof J S Furler, A Priede
Ethics ID: 1647377

The Project has been approved for the period: 11-Aug-2016 to 31-Dec-2016.

It is your responsibility to ensure that all people associated with the Project are made aware of what has actually been approved.

Research projects are normally approved to 31 December of the year of approval. Projects may be renewed yearly for up to a total of five years upon receipt of a satisfactory annual report. If a project is to continue beyond five years a new application will normally need to be submitted.

Please note that the following conditions apply to your approval. Failure to abide by these conditions may result in suspension or discontinuation of approval and/or disciplinary action.

(a) Limit of Approval: Approval is limited strictly to the research as submitted in your Project application.

(b) Amendments to Project: Any subsequent variations or modifications you may wish to make to the Project must be notified formally to the Human Ethics Advisory Group for further consideration and approval before the revised Project can commence. If the Human Ethics Advisory Group considers that the proposed amendments are significant, you may be required to submit a new application for approval of the revised Project.

(c) Incidents or adverse effects: Researchers must report immediately to the Advisory Group and the relevant Sub-Committee anything which might affect the ethical acceptability of the protocol including adverse effects on participants or unforeseen events that might affect continued ethical acceptability of the Project. Failure to do so may result in suspension or cancellation of approval.

(d) Monitoring: All projects are subject to monitoring at any time by the Human Research Ethics Committee.

(e) Annual Report: Please be aware that the Human Research Ethics Committee requires that researchers submit an annual report on each of their projects at the end of the year, or at the conclusion of a project if it continues for less than this time. Failure to submit an annual report will mean that ethics approval will lapse.

(f) Auditing: All projects may be subject to audit by members of the Sub-Committee.

Please quote the ethics registration number and the name of the Project in any future correspondence. On behalf of the Ethics Committee I wish you well in your research.

Yours sincerely,

Dr Sandra Davidson — Acting Chair
General Practice Human Ethics Advisory Group
Appendix 6: Plain language statement for Phase 2 of study

PLAIN LANGUAGE STATEMENT

Oral health, diabetes and health professionals: a qualitative study.

Investigators: Dr Andre Priede, A/Prof John Furler and Dr Jo-Anne Manski-Nankervis
Department of General Practice, University of Melbourne

Introduction and background:

This is a qualitative study being conducted as part of a Masters in Primary Health Care (Research) project. This interview study follows on from a survey study, which explored the views of people with diabetes about oral health. One issue arising from the survey was how people with diabetes sourced information about oral health and the links between oral health and diabetes. Hence, we are undertaking this interview study to explore the views of health professionals.

Aims of the study:

To investigate health professional’s views on oral health and diabetes and the influence these views have on their clinical practice and interprofessional collaboration.

What are you being asked to do?

You are being invited to participate in a 25-30-minute interview with Andre Priede, a Masters student at the Department of General Practice. The interview will be audio recorded. It is up to you to decide to participate in this research or not. Participation in this study is voluntary and participants are free to withdraw consent at any time. If you do participate you have the right to withdraw at any stage without giving a reason. The results of this project will be used to explore how health professionals who manage patients with diabetes view oral health and the oral complications of diabetes, and how they communicate and collaborate with other health professionals about this. A summary of the project findings will be made available through the Department of General Practice, University of Melbourne website.

Confidentiality

Your anonymity and the confidentiality of your responses will be protected to the fullest possible extent, within the limits of the law. The information collected about you during the course of the research will be kept confidential and secure in a locked cabinet, where only the researchers have access to this information. Prior to data analysis, interviews will be de-identified and transcribed. In the final report, individual participants will not be identifiable in any way and you will be referred to by a pseudonym. Any references to personal information that might allow someone to guess your identity will be removed. Following the study, a de-identified transcription of the original audio recording will be stored in a locked filing cabinet.
within the Department of General Practice for five years from the date of publication, before being destroyed as per the University of Melbourne guidelines.

How do I agree to participate?

If you would like to participate, please indicate that you have read and understood this information by signing the accompanying consent form and returning it. You will then be contacted to arrange a mutually convenient time for you to complete the interview.

What will happen to the results and data of the study?

The results of the research will be published in a report, in journal articles and potentially be presented at conferences. If requested, you will be sent a copy of the results, which are likely to be published late 2016. You will not be identified in any reports or publications. Your research information and records will be kept securely in the Department of General Practice as described above.

Ethical approval

The risks to you by participating in this survey are minimal. Ethics approval for the study has been given by The University of Melbourne, Human Research Ethics. Should you have concerns about the conduct of this study you may contact the Manager, Office for Research Ethics and Integrity, The University of Melbourne, Level 3, 780 Elizabeth Street The University of Melbourne Vic. 3010, Phone: (03) 8344 0162.

Who is carrying out the study?

The study is being conducted as part of the requirements of a Masters in Primary Health Care (Research) by Dr Andre Priede at the Department of General Practice, University of Melbourne. The project is being conducted under the supervision of A/Prof John Furler and Dr Jo-Anne Manski-Nankervis in the Department of General Practice, University of Melbourne.

Project contact details

If you have any questions about completing the questionnaire or about being in this study, you can contact Andre Priede at ph: 0413731703 or email: agpriede@unimelb.edu.au. You may also contact John Furler at via e-mail j.furler@unimelb.edu.au or phone: 03 8344 4747.
Appendix 7: Interview Schedule for Phase 2 of study

INTERVIEW SCHEDULE

Checklist of points of explanation prior to the interview

My study is about oral health in people with diabetes. As a health care professional managing people with diabetes I wanted to get your views about this. There are no wrong or right answers. I’m particularly interested to hear any stories or examples form your own clinical experience related to this topic.

This is a very open questions sort of interview and will probably take about ½ hour.

Your identity will be protected, and your name or that of any individual discussed in our interview will be replaced with a pseudonym. All data and materials used will be kept in a secure location with access only by myself (chief investigator) and my supervisors Dr John Furler and Jo-Anne Manksi-Nankervis.

Is it OK for me to use the digital recorder to record our interview? Only myself as chief investigator and supervisor will listen to the recording.

Please ask at any time if you are unsure of or do not understand the question I am asking. And of course, you are able to decline answer the question at any stage.

Any questions?

Interview Questions

Tell me about your experience of oral health issues in managing people with diabetes?
- How do you understand the relationship?
- Talk to people?
- Manage?
- Work across the diabetes team?
- Examples??
- Differences between T1 and T2?

Tell me your thoughts about whose responsibility this issue is?
Appendix 8. Consent form for participation in interview

Consent form for persons participating in a research project
Oral health, diabetes and health professionals: a qualitative study.

Name of participant:
Name of investigator(s): Dr Andre Priede, A/Prof John Furler and Dr Jo-Anne Manski-Nankervis

1. I consent to participate in this project, the details of which have been explained to me, and I have been provided with a written plain language statement to keep.

2. I understand that after I sign and return this consent form it will be retained by the researcher.

3. I understand that my participation will involve an interview and I agree that the researcher may use the results as described in the plain language statement.

4. I acknowledge that:
   (a) The possible effects of participating in the interview have been explained to my satisfaction;
   (b) I have been informed that I am free to withdraw from the project at any time without explanation or prejudice and to withdraw any unprocessed data I have provided;
   (c) The project is for the purpose of research;
   (d) I have been informed that the confidentiality of the information I provide will be safeguarded subject to any legal requirements;
   (e) My name will be referred to by a pseudonym in any publications arising from the research;
   (f) I have been informed that a copy of the research findings will be forwarded to me, should I agree to this.

I consent to this interview being audio-taped □ yes □ no (please tick)

I wish to receive a copy of the summary report on research findings □ yes □ no (please tick)

Participant signature: __________________________ Date: ________________

HREC 1647377.1 July 28 2016 28/07/2016 Priede
Appendix 9. Email invitation to healthcare professional to participate in interview study

Hi (name of healthcare professional)

I am a University of Melbourne Masters student doing a Masters of Primary Health Care by research. My research project is exploring the oral health knowledge and behaviours of people with diabetes. I am interested in the opinions and attitudes of health professionals caring for people with diabetes about oral health and diabetes, and their experience in collaborating with other health professionals about their patient’s oral health. I would like to invite you to participate in an interview at the time and place of your convenience. I expect the interview will take approximately ½ hour. Your responses to the questions will be kept confidential. I have attached the Plain Language Statement and Consent form for you to read. If you would like any further information about my research project or to discuss the interview further, please do not hesitate to contact me.

(Name of healthcare professional) I'm interested in the views and opinions of dentists treating patients with type 1 and type 2 diabetes. If in the areas you've worked over the last few years the demographic has included some patients with diabetes would you be willing to be interviewed? It will take 20-30 minutes and we can do it at the most convenient location for you i.e your work. So if you think your patient demographic has been suitable and you're able to participate let me know.

Kind regards
Andre Priede
## Appendix 10. Coding framework

<table>
<thead>
<tr>
<th>Final coding framework</th>
<th>Initial coding framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare professional knowledge and awareness</td>
<td>HCP knowledge of the link between diabetes and oral health</td>
</tr>
<tr>
<td></td>
<td>HCP education and training</td>
</tr>
<tr>
<td></td>
<td>Guidelines and checklists</td>
</tr>
<tr>
<td>Communicating with people with diabetes</td>
<td>HCP knowledge and awareness of the link between diabetes and oral health</td>
</tr>
<tr>
<td></td>
<td>Perceived value of interventions</td>
</tr>
<tr>
<td></td>
<td>Patient’s knowledge and awareness of diabetes/oral health link</td>
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<td></td>
<td>Patient’s attitudes to oral health</td>
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<td></td>
<td>Respect for patient autonomy</td>
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<td></td>
<td>Healthcare organisations attitudes</td>
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<td></td>
<td>Patient’s access to dental health care</td>
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<td>Availability of resources</td>
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<td></td>
<td>Time to discuss oral health and diabetes</td>
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<td>Prioritising complications</td>
</tr>
<tr>
<td>Interprofessional communication</td>
<td>Roles and responsibilities (boundaries)</td>
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<td></td>
<td>Professional courtesy and respect</td>
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<td></td>
<td>Referral pathways: formal and informal</td>
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<tr>
<td></td>
<td>Different interpretations of collaboration</td>
</tr>
<tr>
<td></td>
<td>HCP competency and scope of practice</td>
</tr>
</tbody>
</table>

HCP- Healthcare professional
Appendix 11. Signed declaration

Declaration

This is to certify that:

- The thesis comprises only my original work towards the Masters of Primary Health Care except where indicated in the Preface.
- Due acknowledgement has been made in the text to all other material used.
- The thesis is fewer than 50,000 words in length, exclusive of tables, maps, bibliographies and appendices.

[Signature]
Author/s:
Priede, Andre G.

Title:
Oral health knowledge and behaviours amongst adults with diabetes and their healthcare professionals

Date:
2017

Persistent Link:
http://hdl.handle.net/11343/192907

File Description:
Oral health knowledge and behaviours amongst adults with diabetes and their healthcare professionals

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