

# Embracing Change In Dental Practice To Deliver Better Health Outcomes- A Type 2 Diabetes Screening and Oral Health Pilot Program

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## Abstract

Disadvantaged communities carry the highest burden of disease with respect to oral and general health. Diabetes is a growing chronic-condition in Australia with those living in regional or lower socio-economic areas at a higher risk of developing diabetes and experiencing the associated complications. Oral and periodontal disease has been linked to diabetes. Within the community dental clinic we aimed to determine the feasibility of screening for diabetes and reduce the burden of both diseases. All patients presenting to the community dental clinic of the Colac Area Health Service were given the opportunity to participate in a Diabetes screening assessment. Adults who consented completed the Australian Type 2 Diabetes Risk Assessment (AUSDRISK) with those at high risk offered an HbA1c blood test. Six hundred and seventy patients were invited to participate. Seventy-five reported confirmed diabetes and 125 were currently being monitored by their general practitioner. Ninety-six of the remaining 470 eligible patients declined to participate (participation rate 80%). The AUSDRISK was completed by 371 patients (n=3 incomplete) and identified 56 (15%) as low risk, 123 (33%) at intermediate risk and 192 (52%) at high risk. Following HbA1c blood testing, 14 patients were in the high risk range (>6.0%). The high risk category according to the AUSDRISK included 31% emergency patients, an average of 25 (IQR 19-29) Decayed Missing or Filled Teeth, 49% with early signs of periodontal disease, 73% aged 55 years or older, 48% male, 36% had a direct relative with diabetes, 18% had hypertension, 29% currently smoked and 75% had waist measurements >90 cm for men and 80cm for women. The study demonstrated that 68% of patients willing to participate in the study presenting to the community dental clinic had either confirmed diabetes, were being tested by their general practitioner or were in a high risk category (AUSDRISK).

**Keywords:** AUSDRISK; CPI; Diabetes; DMFT; HbA1c Oral health

**Abbreviations** AIHW: Australian Institute of Health and Welfare; AUSDRISK: Australian Type 2 Diabetes Risk Assessment Tool; CPI: Community Periodontal Index; DHSV: Dental Health Services Victoria; DMFT: Decayed; Missing, Filled Teeth; DWAU: Dental Weighted Activity Units; IL-1 & IL-6: Interleukin 1 & 6; ROS: Reactive Oxygen Species; TNF-alpha: Tumour Necrosis Factor alpha

## Introduction

Dental caries is a largely preventable multifactorial disease that results in many adverse outcomes for those affected. It is often caused by inadequate access to fluoride, poor oral hygiene and high cariogenic diets. If left untreated, dental caries can lead to difficulty eating, speaking and pain. Socially disadvantaged people are often affected by dental caries because of inadequate nutrition and poor oral health practices.

Eating unhealthy foods is a major risk factor for chronic diseases such as oral disease and diabetes. Sweet drinks and lollies are often blamed for the increase in sugar in our diets. Other commonly consumed foods that are high in sugar include cereals, sauces, syrups,

dried fruits, cakes, biscuits, jams, canned fruit, ice cream and yoghurt, to name a few. Sugar is an under acknowledged cause of adverse effects when assessing the nutritional value of foods. One quarter of cereals investigated in a New Zealand study did not meet their 'healthy' criteria [1]. Louie et al. [2] undertook a study of the nutritional quality of breakfast cereals in Australia between 2004 and 2010 and expected to find a decrease in sugar content. However, they actually found that the sugar content was constant across the years. Recent reports proposing introducing a sugar tax suggest that the saving in health costs could be substantial [3,4].

Consumption of foods high in sugar is linked to increased caries. Oral disease, caries [5-7] and periodontal disease [6,8-10] are associated with diabetes. Hyperglycaemia over a long period of time and glucose variability may result in chronic inflammation that affects the immune system. Diabetes and its complications may result from long term activation of the immune system that results in chronic inflammation [11,12]. Inflammatory changes increase the risk of insulin resistance, features of the metabolic syndrome and type 2 diabetes [11,13,14]. Inflammatory markers include the pro-inflammatory cytokines: tumour necrosis factor-alpha (TNF-alpha), and interleukin-1 and 6 (IL-1 and IL-6) in adipose tissue. These pro-inflammatory cytokines affect insulin regulation, lead to the formation

of reactive oxygen species (ROS) [12], and play a significant role in the development of diabetic macrovascular and microvascular complications [13].

Inflammatory markers, including IL-1 and IL-6, are found in periodontal tissues along with neutrophils, T-Cells, B-Cells and osteoclasts [15]. Directly and indirectly they lead to destruction of the periodontal ligaments and surrounding bone leading to oral disease. Chronic inflammation also has systemic effects such as atherosclerosis and there is an association between atherosclerosis and periodontal disease [16].

The Australian Institute Health and Welfare (AIHW) reported that recurrent expenditure on dental services in 2013 in Australia was \$8,706 million [17]. Diabetes is a growing epidemic [18]. Health-care expenditure for diabetes increased between 2001 and 2009 from \$811 million to \$1,507 million, respectively [19].

Colac Area Health provides public oral health services for eligible adults (Health Care & Pensioner Concession Card holders) in the Barwon region of South West Victoria. Colac and its surrounding area (Colac Otway Shire: 3,433 km<sup>2</sup>) has a population of 20,345 and is largely a regional/rural area consisting of regional towns, small townships, coastal resort towns, small acreage properties and larger farms. Colac Otway Shire includes many disadvantaged sectors and residents may have to travel 100km to attend a public or private dental clinic. Many people in the local community did not complete Year 12 (49.5%) and 35% of individual incomes are low compared to national standards [20]. Those from disadvantaged communities carry the highest burden of disease with respect to oral [21] and general health.

The community dental clinic provides a potential referral link to individuals who may not attend a medical clinic or who do not have a regular general practitioner. Screening for diabetes in the oral health setting may be a cost-effective activity with the potential for numerous health gains. Our goal was to determine the feasibility of screening in the potentially high risk population at the community dental clinic at Colac.

The community dental clinic provides services to eligible Health Care and Pension Card holders and their dependents. Services include emergency dental care, general dentistry and denture care. There are approximately 7,000 adults eligible for public oral healthcare in the Colac Area Health catchment: 2,500 adults were treated in the 2 year period to the end of July 2016, representing 35% of the eligible population.

The evidence demonstrates a link between poor oral health, periodontal disease and diabetes. We hypothesized that patients presenting to the community dental clinics might be at a high risk of developing diabetes.

## Materials and Methods

### Region

The study was a prospective study involving patients presenting to the Colac Area Health public oral health services in South West Victoria, Australia.

### Recruitment

Adults presenting to the community dental clinic for general or emergency care were asked to participate in the screening for diabetes

study and were presented with a Participant Information and Consent Form. Only participants who provided voluntary consent and understood the purpose, methods, demands, risks and potential benefits of the research were included in the study. Patients with confirmed diabetes or currently being screened for diabetes by their general practitioner were excluded from the study. Those aged younger than 18 years, or with intellectual or mental impairment, highly dependent on medical care, pernicious anaemia and women with gestational diabetes were also excluded. Diabetes screening occurred at point of care and was included in the cost of their visit.

The Victorian Government funds Dental Health Services Victoria (DHSV) to provide a dental health program to eligible Victorians. The Purchasing Agreement details the service provided to eligible Victorians, with a targeted number of people to be given dental care at a total cost measured in Dental Weighted Activity Units (DWAU). Item numbers used in this study have included:

- 015 – Extended consultation (0.18 DWAU)
- 018 – Written report (0.08 DWAU)
- 019 – Letter of referral (0.02 DWAU)
- 055 – Blood sample (Nil value)
- 131 – Dietary advice (0.06 DWAU)
- 141 – Oral hygiene instruction (0.09 DWAU)

### Process for Screening for Diabetes in the Dental Clinic and Data collection

A team approach is vital to success in a preventative based practice model. All members participate in the clients' experience; establish trust and create a safe, welcoming place [22]. On examination by a dentist or Oral Health Therapist the measure of dental pathology was recorded by noting the number of Decayed, Missing or Filled Teeth (DMFT) and the Community Periodontal Index (CPI). In 1978 the World Health Organization developed a global standard called the Community Periodontal Index (CPI) involving assessment of the gums. The CPI for this study was recorded by a single examiner. A score of zero depicts no gingival pockets on the gums whilst at the other end of the scale a score of 4 identifies deep periodontal pockets greater than 6 mm.

Oral health educators: Dental Assistants trained in oral health promotion working directly with clients is a feature of this model. In the clinical setting they provide oral hygiene instruction including the use of preventive products (tooth paste, Tooth Mousse, mouthwash), plaque and saliva testing, dietary analysis/advice and manage reviews and follow up. They are classified as "clinicians" by DHSV and their activity can be recorded and claimed for funding.

The Oral Health Educators administered the Australian Type 2 Diabetes Risk Assessment (AUSDRISK) tool [23]. The AUSDRISK identifies the level of risk of diabetes and includes questions on age, gender, country of birth, indigenous status, relatives with diabetes, blood pressure, smoking status, diet, physical inactivity and waist measurement.

People whose scores were in the High Risk level (12 or more) for diabetes was offered a point of care HbA1c blood test to determine their five year likelihood of developing diabetes. Figure 1 describes the process of screening for diabetes in the dental clinic. An Alere Afinion™ AS100 analyser was used to measure HbA1c (Alere Afinion™) [24]. Quality control testing was performed and the coefficient of variation was an acceptable 0.8%.

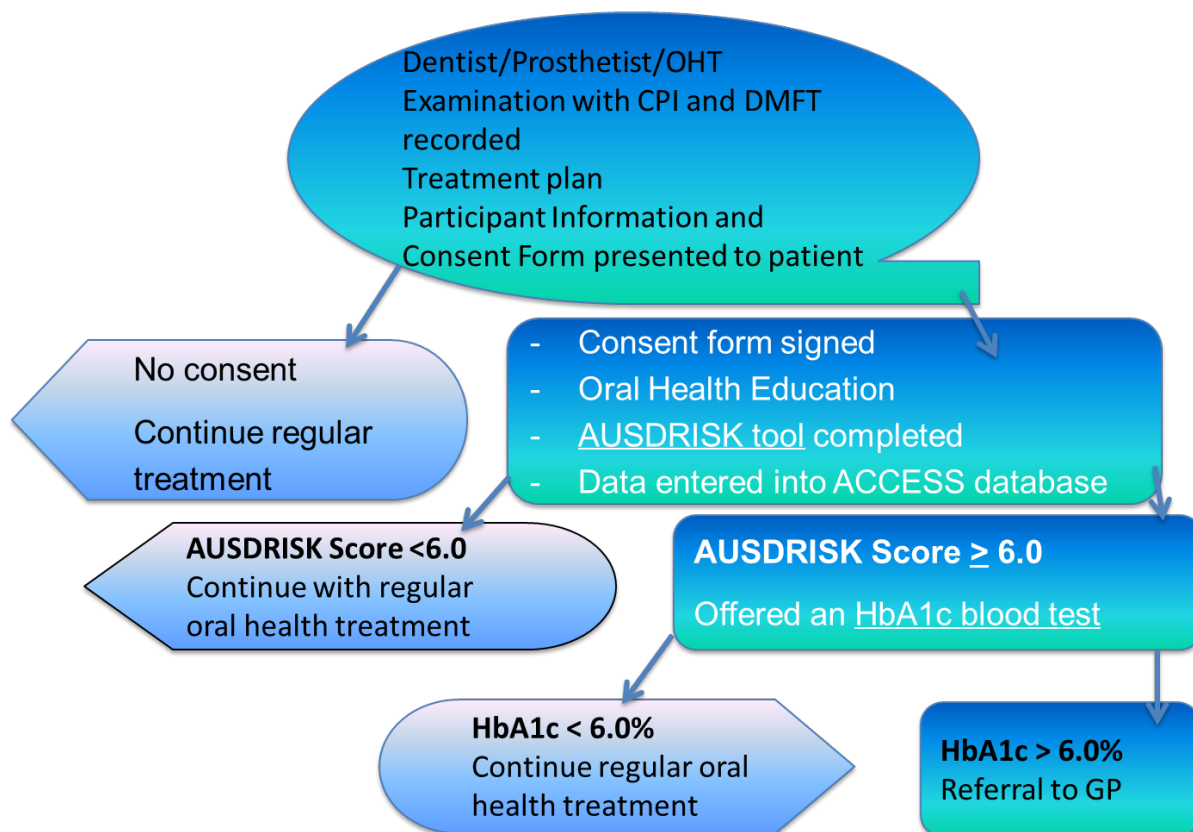


Figure 1: Process of screening for diabetes in the dental clinic.

## Ethics Approval

The study was approved by the Human Research Ethics Committee at Barwon Health (15/169) and written informed consent was obtained from each participant prior to their participation in the study.

## Results

During the project pilot period, April 2016 to April 2017, 1463 individual adult patients presented to the Colac community dental clinic for 3227 visits. The introduction of this project into the dental clinic was a gradual process. During this time period, 670 patients (46%) were approached to participate in the study. Seventy-five reported they already have confirmed diabetes and 125 were currently being monitored by their general practitioner (Figure 2). From the remaining 470 eligible patients, 96 declined to participate. Of those invited into the study 80% participated (Figure 2).

Three hundred and seventy-four patients completed the AUSDRISK assessment tool (n=3 incomplete) with 56 (15%) in the low risk category, 123 (33%) were intermediate risk and 192 (52%) at high risk

(Figure 2). Forty-six percent of females completing the assessment tool were in the high risk category and 60% of males. One hundred and ninety-three patients agreed to an HbA1c blood test; 179 were in the normal range and 14 (7 male and 7 female) were in the high range (>6.0%) for non-diabetics according to the manufacturers recommendations (Figure 2).

Of those in the high risk category according to the AUSDRISK assessment tool 31% (n=59) were emergency patients, the average DMFT was 25 (IQR 19-29), 49% (48/98) displayed at least early signs of periodontal disease, 73% (n=141) were aged greater than 55 years, 48% (n=93) were male, 36% (n=69) had a direct relative with diabetes, 42% (n=80) with high blood pressure medication, 29% (n=55) currently smoked and 74% (n=143) had waist measurements greater than 90 cm for men and 80 cm for women.

Sixty-eight percent of patients presenting to the community dental clinic had either 1) previously confirmed diabetes, 2) were being tested by their general practitioner or 3) fell into the high risk category according to the AUSDRISK assessment tool.

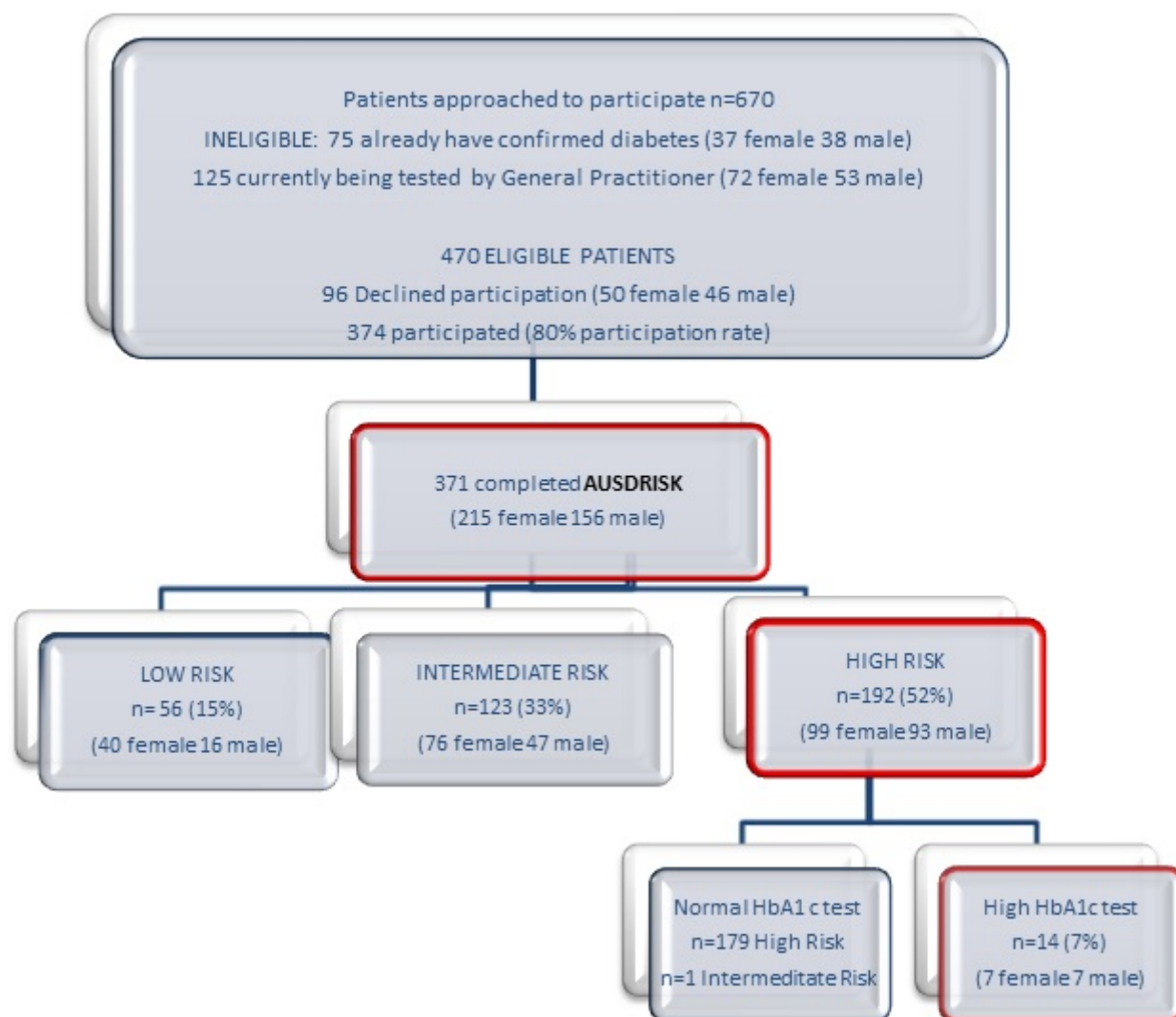


Figure 2: Flowchart showing participant flow through the diabetes screening process in the community dental clinic.

## Discussion

The current study identified a population at high risk for diabetes. Sixty-eight percent of participating patients had either been diagnosed with diabetes, were being investigated for diabetes or were in the high risk category for diabetes according to the AUSDRISK assessment tool. Of patients invited into the study 80% participated, however, 26% of patients presenting to the dental clinic participated suggestive that more work was needed to acclimatise both staff and patients to the new model of care.

Malo et al. (2015) [25] reported the findings of a population-based survey of people aged 40-74 years from a similar region in southwest Victoria that showed 39.5% were in the high risk diabetes category. Our current study presented a higher risk population and potentially due to the low socio-economic background of many of the patients. In addition, 29% of those in the high risk category for diabetes currently smoked, which is much higher than the 13.3% of adults who currently smoke in Australia [26].

Herman et al. [27] suggested many Americans see a dentist at least once a year, which is not the case in our community dental clinic patients, who often have to wait a considerable amount of time on the waiting list for any dental procedures including initial dental examination (up to 2 years). Herman et al. [27] introduced dysglycemia screening in 13 general dental practices using a questionnaire similar to the AUSDRISK tool and identified 30% of patients in a high risk diabetes category, considerably lower than our 52% at a high risk.

Studies in the USA report a prediabetic HbA1c range as 5.7% to 6.4% and suggest people with HbA1c > 6.4% on more than one reading has diabetes [27,28]. Genco et al. [28] investigated the utility of screening for diabetes in dental settings and concluded forty percent had an HbA1c level of greater than 5.7% and were referred on for further diagnosis with 12% confirmed and 23% with prediabetes. This study was performed in both private dental offices and in a community



health centre [28]. In contrast our pilot study was confined to the public community health dental setting with high risk patients.

Teamwork, effective communication and trust among staff members were important in this pilot study incorporating point of care testing for diabetes. Regular team meetings and liaison improved quality assurance monitoring by the Research Administrative team located off site. Initially, the staff engaged with general dental patients who generally attend more than one clinic visit and as staff became more familiar with the process emergency dental patients who attend for one clinic visit and generally do not visit the oral health educator, were included in the study. Considerable change management processes was necessary to move towards engaging with all adult dental patients. Teleconferences and electronic communication with the Diabetes consultant and Head of Oral Health at Barwon Health facilitated modifications to processes at the point of care. A team approach is vital to success in a preventative based practice model. All members participate in the clients' experience; establish trust and create a safe, welcoming place. Dental Assistants trained in oral health promotion working directly with clients is a feature of this model. In the clinical setting they provide oral hygiene instruction including the use of preventive products, plaque and saliva testing, dietary analysis/advice and manage reviews and follow up. They are classified as "clinicians" by Dental Health Services Victoria and their activity can be recorded and claimed.

These studies beg the question: 'How can we improve oral health?' The drill or scalpel will not eliminate dental disease or decay. It is time to move towards a health promoting practice model that considers factors such as access, prevention, early identification, treatment options, referrals and workforce innovation. A health promoting strategy could encompass clients of risk of future dental disease, improves oral health literacy and focuses on prevention and minimal intervention dentistry. There is evidence that health outcomes in the vulnerable improve by early identification of risk and high quality prevention.

A health promoting model with a mission for clients to avoid the consequences of poor oral health, maintain function and social confidence and therefore enjoy a better quality of life is ideal. Our aim is to have a consistent approach to the detection of oral disease, prediction of future disease, disease management planning and setting of appropriate recalls. Our goals are to have our clients tooth brushing with fluoride toothpaste twice a day and reduce the intake and frequency of fermentable sugars; implement workforce innovation; and develop and review policies and procedures that reflect best practice. We aim for our clients to feel safe, respected and empowered as partners in decision making regarding their health outcomes.

A recent report in the Medical Journal of Australia stated that the key to health improvement of those with diabetes is behavioural [29]. Many experience worry and feel unsupported in their condition and the simple act of personalised intervention reduced distress and HbA1c levels. Personalised oral health and diabetes discussions in the community dental clinics of our study have been well received by patients with those not consenting on their first visit, often returning for more dental care and agreeing to participate at the second subsequent visit.

## Conclusions

The significance of this study is to facilitate a new model of care that intervenes with diabetes testing. Of those in the high risk category

according to the AUSDRISK assessment tool, fourteen had an HbA1c greater than 6.0%. Sixty-eight percent of patients presenting to the community dental clinic had either:

- Previously confirmed diabetes
- Were being tested by their general practitioner or
- Fell into the high risk category according to the AUSDRISK assessment tool.

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