Evaluating the effectiveness of Digital Oral Health promotion on knowledge, self-check, and self-care practices of students at a Durban college, South Africa

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A mini thesis submitted in partial fulfilment of the requirements for the degree of Master in Public Health in the School of Public Health, University of the Western Cape

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November, 2022

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KEYWORDS

Oral Health

Dental caries

Periodontal disease

Self-care

Self-check

Awareness

Health Education

Digital health promotion

Behaviour Change Technology

National Health Insurance

Universal Health Care

Primary Health Care

ABSTRACT

Background

A novel concept in oral health is the use of digital healthcare communication tools in a primary preventative approach to address the enormous challenges posed by oral health disease burdens on limited health budgets. This study aimed to evaluate the efficacy of a digital medium in enhancing students' oral health knowledge, self-checking, and self-care practices.

Study design

A quasi-experimental design employing a quantitative research methodology was used to collect pre- and post-test exposure data regarding the efficacy of the digital application.

Methodology

A self-administered questionnaire in a Google document format was developed to evaluate the knowledge, awareness, attitude, and practices of students towards oral hygiene pre-and post the digital coaching program. The training was done using validated Federal Dental International survey guidelines. The Mc Nemar and Wilcoxon signed-ranked tests were used to assess the difference between the pre- and post-intervention program. All analyses were conducted using the Statistical Package for Social Science version v27. The Biomedical Research Ethics Committee of the University of the Western Cape granted ethical approval for this study and permission was granted from the Durban University of Technology Institution Research and Innovations Committee to undertake the study.

Results

The level of oral hygiene knowledge displayed by the students improved noticeably (94.9%) after the intervention. A considerable increase in the number of individuals who knew how often and how to brush their teeth before bed significantly increased from 47.2% pre-test to 85.4% post-intervention, which is vital for preserving oral health and self-care.

After using the digital tool, the students' capacity to provide correct self-evaluations grew significantly, from 35.4% to 65.4%.

Conclusion

Digital promotional tools may be highly effective in fostering improved oral health awareness, better self-care practices, and enhanced oral disease knowledge. It is recommended that South African students and communities embrace digital technology to increase oral health awareness, knowledge, and self-directed oral health ownership. This fundamentally has potential for early interventions leading to positive outcomes on oral health status, beliefs, and experiences.

DECLARATION

I declare that evaluating the effectiveness of digital Oral Health promotion on knowledge, self-check and self-care practices of students at a Durban college, South Africa is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Lesley Sebastian Naidoo

November 2022

DEDICATION

I hereby dedicate this research to the continued global efforts and honourable work of the Alliance for a Cavity Free Future (SA) and Global (ACFF) , the Centres for Disease Control (CDC) , The World Health Organisation (WHO), the Federation Dental International (FDI) and all global and local organisations, dental associations and Universities that enshrine the prevention of dental disease and the vast knowledge that exists in the broader contexts of Oral Health. To those preventative based cadres of Oral health professionals such as dental assistants, oral hygienists, dental therapists, oral health therapists and dentists who are at ground zero in the war against dental diseases and to those who champion dental preventative strategies. To our South African Government, the ministry of Health and the many colleagues and professionals who work long and hard to deliver oral health care services, management, planning and delivery to our vast population in the many clinics and hospitals in valleys, over mountains and across rivers running through our beautiful land, may your efforts be eternally rewarded. To those we serve, I pray that this research work that has taken much time, effort and determination, that traversed through vast professional, personal and physical challenges. That the findings and recommendations included in this work be taken to heart and used to empower those individuals who wish to keep their teeth for life.

In memory of my Late Dad Logan Naidoo (medical technologist) who inspired me to be more than I thought possible.

To God be the Glory Great things He has Done …

Isaiah 12:5

ACKNOWLEDGEMENTS

The summation of this work was made possible through determination, steadfastness and a belief that all things are possible through Christ who strengthens me . Although a long journey where often times I felt remorseful, I wish to hereby thank my wife Laura Naidoo and sons Ocean and Storm for their kindness, love, support and encouragement.

This work would have not been possible without the concretised support of the School of Public Health in memory of the late Prof. David Sanders (my initial supervisor) who inspired me and believed in this work, Corrine Carolissen and associate supervisors who often times almost thought it impossible for me to complete this work. Dr Verona Mathews who had a unwavering belief in this effort, for her skill, guidance and efforts through tough times in the research process. Without her consistent encouragement, patience and enthusiasm I would not have been able to complete this work. Dr Razia Adam (University of the Western Cape) for her inputs and support. Dr Stanley Chibuzor Onwubu (Durban University of Technology) for his assistance with data analysis and statistics. I'd like to further acknowledge the Durban University of Technology (Mr Ori) and Prof. Jamilla Adams for their encouragement and guidance. A Special thanks to the Alliance for a Cavity free Future (UK) headquarters and Prof Nigel Pitts for their guidance and support in the belief that we can have a cavity free future in the world. A special acknowledgement to various patients who presented with their beliefs, perceptions and discussions at my dental practice, who discussed their habits and thoughts about oral health that led me to investigate further through non formal research inquisition that led to this formal research protocol and final work.

Thank you to all those specifically mentioned individuals and the many other technicians, academic, clinical and administrative staff at the various institutions and organisations that made this work possible. May God bless each of you abundantly.

Thank you !

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CHAPTER 1

1.1 Introduction

Oral diseases are among the most widespread diseases in the world, posing a significant public health and economic burden with potential to diminish the quality of life for people affected (Peres et al., 2019). It has been observed that periodontitis, which refers to diseases affecting the gums and bones, and dental caries, which refers to tooth decay, are among the most widespread and substantial burdens of oral diseases globally (WHO, 2018; Peres et al., 2019). Both these conditions have high incidence across all demographic and age categories, which contribute to major public health expense, tooth loss, reduction in quality of life and orofacial impairment (Federation of Dental International, 2018). Even while oral disease are mostly preventable with education, self-care, and diet, their prevalence is still considerable, estimated to affect more than 3.5 billion people. Tooth decay is the most prevalent global adult health problem, while gum disease affects one in two individuals worldwide (FDI, 2018; FDI, 2020). Large-scale social and economic inequalities and a lack of funding for prevention and therapy, particularly in low and middle income nations, contribute to this disturbing disease incidence (Naidoo, 2015; Peres et al., 2019).

The oral health environment in South Africa has been historically shaped by socio-political issues resulting in inequity, unaffordability, carelessness, misinformation, and lack of timely access to appropriate dental treatment (Ramphoma, 2016). Due to these social determinants and political backdrop, there are fewer oral health facilities and professionals available, and dental services are not distributed equally across the country (Ramphoma, 2016). Ramphoma has called for a different approach to managing oral health in South Africa that places an emphasis on disease prevention and oral health promotion in light of these concerns. Ramphoma's appeal has resonance around the globe at a time when dentistry is transitioning from a more curative to a more preventative approach to oral wellness (Glick et al., 2016).

Moreover, from an economic standpoint, therapeutic dental interventions are overwhelmingly costly, involving significant investment in equipment, materials, human capital, and time. For instance, according to the South African health economic statistics for 2014/2015, an astounding two-thirds of the national health budget was allocated to human resources for health (STATS SA, 2017). The high expense of biomedical and dental interventions are problematic since it is unsustainable and generates subpar results in a cycle of biomedical clinical reliance. Human resources, equipment, facilities, expensive pharmaceuticals, and therapeutic interventions account for the majority of health expenditure which characterise this model (Petersen and Ogawa, 2012). In addition to this, and despite the 1978 Alma Ata Declaration that emphasizes the significance of "Health for All" (Hall and Taylor, 2003), there is substantial dependence on healthcare professionals to provide remedial treatments for avoidable oral health problems.

Communities can be empowered to reduce oral epidemiology and improve oral and general health outcomes through oral health campaigning, education, personalized dental coaching, nutrition, timely detection of oral disorders, and awareness of dental and oral functionality (Atkins and Hart, 2012; Tadin et al., 2022). These preventative approaches are readily implemented using increasingly accessible digital resources, encouraging individuals and groups to engage in self-care, preventative, mindfulness, and improved health and wellbeing practices (Institut Montaigne, 2016). In recent years, a shift is noted toward the application of healthcare interventions in the realm of digital technology. For instance, the application of digital tools such as Big Data, Artificial Intelligence (AI), and migration maps supported by smartphones, were recently used to halt and track the spread of the global Coronavirus epidemic in 2019 (Covid-19) (Whitelaw et al., 2020). It was noted that Big Data and AI assisted in the tracking of individuals and the spread of the Covid-19 virus in multiple

countries, while migratory tracking and mapping were used to gather real-time information on the whereabouts of people (Whitelaw et al., 2020).

Moreover, considering the need for self-distance and the difficulty accessing curative therapy, this study employs a quasi-experimental methodology to assess the efficacy of the Tooth Keepers digital application on individuals' oral health knowledge, awareness, and self-checking and self-care habits. The Tooth Keepers digital tool is a multimedia online system that teaches, analyses risk, and guides behaviour (coaching), hygiene, and diet practices of participating persons via cell phone or web connection (Tooth Keepers, 2019).

1.2 Problem statement

Untreated oral conditions including tooth decay and periodontal disease are preventable conditions that have been implicated in serious chronic conditions including heart disease, stroke and cancers (Kim et al., 2013). As a result, there is an overwhelming and growing concern regarding general health implications connected to oral health (Bagramian et al., 2009; FDI, 2018). Both tooth decay and gum disease have a high incidence of over 60% across all population groups in SA (Chikte et al., 2019). The connectedness of oral diseases to systemic illnesses such as heart disease, stroke and malignancies, contribute to the rising expense of public healthcare in a number of different countries resulting in a growing global concern according to the World Health Organisation (WHO) and International Dental Federation (FDI) (WHO, 2016; FDI, 2018). Furthermore, the widespread reactive demand for dental care outpaces the capacity of state health and private doctors to deliver curative dental care resulting in service gaps and unmet needs (Bhayat and Chikte, 2019). Due to a lack of consumer comprehension, knowledge, and appropriate self-care practices, this continuum of clinical biological interventions are typically accompanied by a lack of proactive people-centred care and self-management (FDI, 2018). Dental caries is a preventable oral disease however in South Africa tooth decay has a prevalence of roughly 66.4% (Ramphoma, 2016). According to

Ramphoma (2016), this high incidence is chiefly due to a lack of widespread national preventative campaigns or health education and promotion programs supported by the Government. Primary dental public health programs are capable of enabling community groups like first-year college students to take responsibility for their oral health and enhance self-care and self-checking practices that could mitigate high oral disease incidence in South Africa (Ramphoma, 2016; Mthethwa et al., 2020). While the researcher has identified a digital tool for oral healthcare, there is, however, limited evidence on its effectiveness to improve self-care and self-checking amongst communities to take ownership of their oral health. Against these backdrops, this research proposed to measure the effectiveness of the Tooth Keepers digital system on individuals' oral health knowledge, awareness, self-checking and self-care practices.

1.3 Aim

The aim of the study was to evaluate college students' oral health knowledge, awareness regarding the ability to self-check and self-care before and after exposure to a digital oral health promotion tool at the Durban University of Technology (DUT) KwaZulu Natal, South Africa.

1.4 Research Objectives

The objectives are to: -

- Evaluate the oral health knowledge, awareness, self-care, and self-checking skills of students at Durban University of Technology.
- Evaluate the oral health knowledge, awareness, self-care, and self-checking skills of students at the Durban University of Technology after exposure to Tooth Keepers digital media tool.
- Determine whether Tooth Keepers digital media tool is effective in improving oral health knowledge, awareness, self-care, and self-checking skills of students at the Durban University of Technology.

1.5 Rationale

The diagnosis of oral disease and systemic conditions requires that patients receive routine medical and dental consultation with appropriately trained healthcare workers. This is essential for the maintenance of excellent oral and general health, however, dental care continues to present the highest level of financial obstacles compared to other forms of health services (Vujicic et al., 2016; Botros et al., 2020). The evidence indicates that dental care is prohibitively expensive and out of reach for the majority of people, particularly in underdeveloped countries (Bernabé et al., 2017). Whilst governments around the world, including that of South Africa, have been urged by the WHO to move toward universal health coverage for their citizens leading to parliaments working together in a program called UNITE (WHO, 2005; WHO, 2022). In South Africa the oral health landscape is still characterised by interprofessional conflict, lack of leadership, poor political support and a disinterest in public dental health reforms (Ramphoma, 2016). In low- and middle-income countries, out-of-pocket payments have been identified as the predominant mechanism for financing health, particularly dental health care (WHO, 2010; Jaspers et al., 2015). It has been suggested in the literature that substantial and unpredictable out-of-pocket payments for dental care services may push households into poverty (Wagstaff, 2008; Bernabé et al., 2017). Given this global economic health concern, the use of digital oral health promotion technologies will be an essential tool to consider for possibly reducing the total oral health cost burden of curative therapy and furthermore the implicated costs on health budgets and planning. Nonetheless, the study takes into account the cost of using the tool, the price of data in South Africa, and the country's digital divide. Additionally, educating communities and people on the importance of good oral health, disease pathogenesis awareness, early detection and intervention strategies, whilst promoting self-care practices, improving oral health education and fostering attitudes that support better oral hygiene and behavioural changes for health, ultimately empowers people and communities

(Vollmer et al., 2015). These behavioural adjustments may lead to individual actions that might enhance self-care and self-check (evaluate) oral health parameters, hence reducing risks associated with oral illnesses. In light of the aforementioned context, it is anticipated that the study's findings will serve as baseline information for the creation of a protocol for oral health promotion communication technology. This, in turn, will assist in eliciting behaviour modifications that may lead to improved oral health results. In addition, the study is limited to college students on the notion that social norms and environment influence people's oral health knowledge, behaviour, and status.

CHAPTER 2: LITERATURE REVIEW

This literature review investigates the prevalence of dental problems and their causes in South Africa and in a global context. It examines the current oral healthcare measures and strategies in private and government clinical environments where the bulk of citizens seek dental treatment. The review focuses on the primary oral healthcare strategies implemented, in contrast with the national health policies of South Africa to uncover what broad-based primary oral health awareness and self-care empowerment systems exist. Additionally, evaluating the effectiveness and affordability of various initiatives and outcome results from other evidence-based primary oral health initiatives. It concludes with a discussion of the advantages of employing digital tools in health promotion and measuring behavioural change.

2.1 Oral Health landscape in South Africa and globally

Compounding the oral health risk factors that are already well-known, are smoking and nutrition, the World Health Organization (WHO) acknowledges that poverty, inequality, and systemic disease are additional factors contributing to the widespread problems endemic to oral health (Petersen et al., 2005; Peres et al., 2019). When people do not take care of their dental health, it can lead to systemic diseases like diabetes and cardiovascular disease, which can be

detrimental to quality of life, economic productivity and society (Lalla et al., 2011). Oral diseases are largely preventable and successfully treatable early in the disease pathogenesis (Lambert et al., 2020). Despite this, devastating consequences are evident and continue to develop in South Africa and globally. Around 3.5 billion people around the world are affected by oral health disorders such as edentulism (no teeth due to extractions), severe periodontal disease, and tooth decay, as stated by Kassebaum et al. (2017). Data analysis from a 2015 report that nearly 2 billion people, or around 35 percent of world population, had tooth decay on adult (permanent) teeth that required treatment yet were unable to access the appropriate care. This percentage makes dental caries one of the most frequent health disorders in the history of medicine (Kassebaum et al., 2015). In addition, it is estimated that approximately 10% of the world's population has severe periodontal disease, with rates that have stayed the same since the nineties, it is among the ten most common health problems globally (Kassebaum et al., 2015; FDI, 2018).

There is a general agreement that dental caries and periodontal disease are important expenses to oral health on a global scale, with tooth decay ranking only second to the cold or flu in terms of prevalence (WHO, 2016). Dental caries poses a significant public health risk that affects the vast majority of developed countries where 63 to 90 percent of school children and a preponderance of adults suffering from tooth loss, problems with restorative work, and oral impairment as a direct result of oral diseases that go untreated or are neglected (FDI, 2018). As medical science evolved in the later part of the 20th century, numerous infectious diseases were eradicated and managed. In today's modern society, chronic diseases including diabetes, stroke, heart disease, and cancer have emerged as the leading causes of mortality and disability (CDC, 2018). Thus, the focus and attention on better outcomes switched from pathology treatment to disease prevention (WHO, 2016). National Oral Health surveys undertaken in South Africa two decades ago indicate that tooth decay and gum disease are on the rise in some sectors of

the population (DOH, 2003). According to the most recent National Children's Health Survey conducted in South Africa between 1999 and 2002, more than 80 percent of tooth degradation in children goes untreated and undetected, documented by the Unmet Treatment Need Index (DOH, 2003; Smit and Osman, 2017). Despite the oral health challenges in the country, there has not been a National Oral Health survey in the past 17 years. However, the Department of Health, in partnership with the University of Witwatersrand's Oral Health Faculty, is planning to coordinate a National Oral Health Survey, however this has still not been forthcoming since 2019 (NDOH, 2019). Owing to restricted infrastructure, further compounded by shortages of qualified oral health professionals employed within the public sector results in poor access to appropriate and quality oral health care (WHO, 2018). This is especially important for communities with low per capita incomes and limited access to resources (Lambert et al., 2020). Furthermore, the present health care service delivery systems typically obstruct early diagnosis and treatment due to various infrastructure and service delivery challenges. These among a plethora, include a shortage of professionals and treatment possibilities, compounded by a lack of diagnostic tools, and a lack of self-care and oral health awareness of the appropriate interventions that are available to communities (Petersen, 2003; WHO, 2016). This lack of self-directed ownership of oral health typically leads to a dependency on clinics for oral health interventions. The next section begins with a discussion of the oral health care concerns in South Africa and globally.

2.2 Challenges of Oral Healthcare in South Africa

South Africa features a dual health system commonly called the public service and private healthcare sector, where a smaller portion of the population are either insured or pays out-of-pocket to access, while the vast majority approximately 80% (mainly impoverished) rely primarily on government-funded (public service) healthcare (WHO, 2018). The South African primary health care system serves just under 62 million individuals in nine provinces and fifty-

two districts (HST, 2015; Worldometer, 2022). 82% of the population has undetected dental disease (STATS SA, 2015). Only a select number of clinics, central or district hospitals, and mobile outreach programs can afford dental and oral health centres because of the significant costs associated with operating these facilities. The pool of human resources available to the state has been reduced as a result of the fact that more than 80 percent registered professionals working within oral health are currently self-employed or employed in the more profitable private health sector (HPCSA, 2018). In general, South Africans do not pay enough attention to their dental health, and they only go to the dentist when they are in discomfort or when they have an infection (NDOH, 2018). Notable is the fact that only 17% of the population is covered by medical plans, which has resulted in a significant reduction in insured oral health benefits coverage over the previous ten years (Momentum Health, 2019). Due to the restrictions placed on dental benefits, these members are compelled to pay out of their pockets for their dental care simultaneously receiving lower dental and overall health benefits. However, this has not been congruent with medical and dental inflation as the cost of medical care or doctor's fees, which can be up to 300 percent higher than the rates of benefits provided by the medical scheme systems (DOH, 2018; Momentum Health, 2019). On the other hand, state health services are under a lot of pressure and are ill-prepared to offer complete oral and dental care; as a result, they place a greater emphasis on extractions than they do on preventative and restorative procedures, since extractions are the only possible and facilitated procedure to perform in state clinics (SADA, 2018). Private dentists in South Africa routinely treat approximately 17% of the insured population that seek private dental care whilst the majority of South Africans pay for their private dental care out of their own pockets or utilize the public healthcare system. Dentistry being one of the most costly health service specialties to access (NDOH, 2017).

Another concern is that clinical services such as tooth restorations, gum treatment, and extractions accounted for the majority of dental needs in South Africa, and it was clear that

public clinics performed a disproportionately high number of tooth extractions. The Department of Health in South Africa indicated that the majority of dental needs in South Africa remain unmet (DOH, 2018). Restorations and prostheses are not interventions that can be financially sustainable in either the public or private dentistry sectors due to the amount of time, human resources, equipment and materials that are required to successfully undertake and provide routine maintenance and post operative care (Lambert et al., 2017). The cost of rehabilitative dental care, which includes dental restorations and prostheses, are frequently referred to as specialised high-tech dental care. It is perceived to be out of reach for the majority of people, and in most cases, cost of procedures become the affordability barrier to access, most people simply cannot afford such interventions (Lambert et al., 2020). Notwithstanding an individual's Oral Health-Related Quality of Life (OHRQoL) that could suffer if oral structures were impaired due to extractions or through oral diseases such periodontitis and tooth decay (Lambert et al., 2020). This may be linked to a cascading poor prognosis and outcome where the loss of teeth and orofacial structures lead to consequential malocclusion, poor digestion, speech impediments, loss of self-esteem, lack of confidence and various aesthetic functional and general health implications (Yashpal et al., 2022).

2.3 Current Oral Healthcare strategies implemented at dental practices and government clinics

As noted earlier, tooth decay is among the most prevalent oral health issues commonly disregarded and left untreated, even though recognised as one of the most common health concerns globally (WHO, 2016; FDI, 2018). The vast majority of people in South Africa who live in disadvantaged communities do not have access to the resources and information necessary for oral health education consequently leading to extractions resulting in tooth loss. This is essentially related to cognitive understanding of an individual's role and importance of maintaining a healthy diet, practicing excellent oral hygiene, and being aware of the nature and

priority of oral health (SADA, 2018). There is very little to no emphasis placed on preventative dental care; hence, the majority of the current strategies utilized in both public and private dental facilities are similarly based on biomedical treatment approaches (NDOH, 2003, 2009; SADA, 2018). In addition, a study conducted by academics Peerbhay and Barrier (2012) and Lambert et al. (2017), investigated how patients from low socioeconomic status experienced accessing oral health care, the researchers discovered that these individuals' general understanding of care delivery comprised nearly exclusively of teeth extractions. The purpose of the research was to determine how patients from low socioeconomic status experienced accessing oral health care. The authors referenced above assert that as a direct consequence of this, the members of the community were dissuaded from obtaining dental care (Peerbhay and Barrier, 2012; Lambert et al., 2017). Individuals who have problems with their oral health present themselves at medical institutions that do not provide oral health services usually at a later stage in the progression of the disease often resulting in extractions, as Lambert et al. (2020) discovered. The researchers also cited a lack of access to preventative treatment and availability as contributing factors to their findings. Additionally, they cited patient misunderstanding of oral health care services as a factor in their research (Lambert et al., 2020). Of concern, patients who visited these institutions frequently received care of a mediocre standard, were referred to oral health clinics with a limited number of treatment options, or were completely denied care. These recent research findings suggest that a lack of self-determination, hygiene practices, and mindfulness leads to clinical reliance on oral health care interventions, which in turn causes people to be clinically driven to oral health clinics for physician-led therapies that are frequently extraction based. Contrastingly in the private health sector the nature of care is intrusive, expensive, and biomedically driven overlooking the important role individuals play in fundamentally preventing oral diseases (Watt, 2005; Vernazza et al., 2015). In order for a preventative approach to be successful, the paradigm

needs to shift from expensive and highly specialized therapies to an approach that is widespread, community-based, and preventative (SADA, 2018). This lends credence to the argument put forth by other authors Peerbhay and Barrier (2012) and Vernazza et al. (2015), that dependable and long-term approaches to guaranteeing the provision of adequate oral health care may involve combining medical and dental services and placing a greater emphasis on oral disease prevention at both dental and medical institutions. This finding lends support to this contention (Singh et al., 2010; Maxey, 2015; Lambert et al., 2020), according to Lambert et al. (2020), that basic oral health counselling (dental coaching) has the promise to enhance oral and general health outcomes in areas where preventative dental care and high-quality dental services are not readily available. They believe that if they streamline the delivery of preventative care and broaden access to dental care, this could potentially improve the quality of care that is provided to all patients (Lambert et al., 2020). A literature analysis on oral health strategies that have been adopted and/or put into practice led to the discovery of multiple methods that can be used to improve access to oral healthcare. For instance, after acknowledging the need for increased access to high-quality dental care, the United States initiated a program to improve care integration (Lambert et al., 2020). Integration on a continuum of approaches are evident, as an example for the Medicaid enrolees, the Early Childhood Oral Health Program incorporates dental health into primary healthcare., were initiated in 2011 by the Dentaquest foundation, a non-governmental organization. This program is one example of the continuum of integration approaches (Doherty, 2011). Other models include expanding the scope of the responsibilities of providers by training medical professionals to provide preventive oral healthcare solutions such as the application of dental sealants and fluoride varnish, as well as providing oral healthcare professionals with the tools necessary to screen for systemic diseases and clinical manifestations of those diseases (Manski et al., 2015; Scherrer and Naavaal, 2019).

According to a consistent pattern that emerged from the study, the proposed model was designed in order to promote inclusivity and access to oral health care while placing an emphasis on preventative and primary based preventative treatments. There are many different integrated care models available, for example, for paediatric populations in the United States may have paternal learning classes incorporated into maternity programs and child assessments. These models were developed with the goal of improving access to medical care for people living in low-income areas, as stated in a review that was conducted in 2018. (Gauger et al., 2018). These in-depth evaluations highlight the fundamental significance of promoting a primary oral healthcare strategy while also providing support for self-care promotion elements. These elements have been shown to lower overall cost burdens and additionally improve the oral health outcomes of children and communities (Manski et al., 2015; Gauger et al., 2018; Scherrer and Naavaal, 2019; Lambert et al., 2020).

2.4 Cost of dental care

Since many individuals and families cannot afford certain procedures, many people opt for lower-cost options, which are unfortunately tooth extractions, resulting in a perpetual cycle of tooth loss (Broers et al., 2022). This has been historically observed for decades and not exclusively in South Africa. The enormous burden of oral health concerns causes disturbing extraction rates nationwide, with over 88% of decaying teeth extracted even when they can be preserved through dental restorations (Strachan et al., 2011; Broers et al., 2022). People who cannot afford private healthcare usually seek medical treatment at state or low-cost facilities (Singh et al., 2010; DOH, 2018). Additionally, due to budgetary restrictions on materials, equipment, time, and human resources, government dental clinics are unable to perform clinical interventions to save teeth through dental restorations due to the high input costs and time these procedures consume (Strachan et al., 2011). Due to the basic and historical promotion of a work-based and community oral health culture, faster extraction-based dental care delivery

methods have emerged, with the management of pain and sepsis as a secondary effect due to the lack of prophylactic measures (Strachan et al., 2011). Additionally, the public in general frequently ignores early signs of dental deterioration and only seek help when they are experiencing extreme pain, which leaves dentists with little or no recourse but to extract the teeth (Du Plessis, 1997; Singh et al., 2010). In the section that follows, the expenditure for therapeutic intervention is contrasted with the value of preventive treatment.

2.4.1 Cost of Curative treatment

The World Health Organization (WHO) predicts that the total cost of providing curative dental care (a class of treatments intended to improve dental health and have an impact on the bones or gums) would exceed the entire healthcare budget in low-income nations, placing a significant financial load on provincial and national fiscus (WHO, 2017). Curative treatment is technologically advanced and dependent on expensive imported dental materials and drugs. It also requires the use of expensive technology, highly trained experts, and prolonged periods of time and related maintenance costs (Medina-Solís et al., 2020; WHO, 2022).

In the private health sector, where medical schemes previously insured oral health risk and paid for curative based interventions, it has been noted over the last two decades that oral health benefits have been drastically reduced from an historic 20% and currently limited to just under 2% of the total risk adjusted medical scheme payment contributions in the South African private healthcare setting (Strachan et al., 2011; CMS, 2021). This has been ascribed to the high number of spiralling dental restorative, root canal, and prosthetic rehabilitative dental claim profiles. Schemes injuncted by resorting to drastic restrictions on dental benefit plans as a method to reduce the overall cost of dental benefits and, as a result, reduced the financial risk to schemes (Strachan et al., 2011; CMS, 2021).

2.4.2 Preventive treatment

Dental flossing, brushing, and fluoride therapy are helpful self-care practices for maintaining oral health and preventing periodontal and dental deterioration (Bratthall et al., 1996). According to Mohamadkhah et al. (2013), educational interventions with a particular focus on those who might not brush and floss regularly seem to have a key effect in changing unhealthy habits and preventing oral diseases. In the past, health educators' primary methods for preventing diseases related to oral health were health education and community outreach (Pakshir, 2004). As a result, some scholars and specialists from around the world have highlighted the use of media, particularly visual media, as one of the most crucial approaches in health education (Naseriazar and Badrian, 2010).

This preventative approach requires advocacy, commitment and leadership to foster a widespread mindset shift from high-cost, highly-skilled, heavily-invested approach to a community-based self directed, preventative strategy. Individuals ought to be empowered to assume greater responsibility for their own oral health outcomes, and their reliance on professionals should diminish. The three main factors that most strongly predict whether oral health will improve or deteriorate are daily oral hygiene routines, nutrition, and knowledge. The most significant determinants of overall health are these three variables, which are heavily influenced by behaviours that impact dental and overall health complications or benefits (Hobdell et al., 2003). Adopting habits that ensure dental health is preserved throughout life, prevent oral disease, and promote good oral health will help prevent the most prevalent oral diseases in South Africa and around the world (Faisal et al., 2022). A conceptual shift is required, as is the creation of a reliable channel through which people in communities and throughout society can connect with as a coach or mentor in order to guide people to engage in these self-directed tasks. This coaching or guidance serves as a guide, coach, educator, assistant, and champion for the community's overall welfare, may promote and has potential to track this paradigm shift. A person who feels that it is best to maintain one's own teeth for the

duration of one's life in order to avoid the wide range of adverse oral and general health outcomes that are frequently connected with high out-of-pocket costs. This endeavour may have promise for people with privately paid coverage as well as those who rely on government healthcare. The usefulness and efficiency of technology in the communication processes in social media cannot be overstated. It has been observed over the past two decades how individuals, families and communities have adopted technology, where information, education and digital media has connected the world and individuals (Zolfaghari et al., 2021). In order to enable such individualized and pervasive connectedness at the individual and family level in this path towards improved oral health outcomes, software applications and devices leveraging digital technology have enormous potential for enhancing the health and wellness of large populations (Zolfaghari et al., 2021).

2.5 Mobile technology penetration and adoption in South Africa

Since 2016, internet usage and South Africa's mobile phone and data usage has risen considerably. Nevertheless, a recent PEW research report (PEW, 2018) discovered that smartphone prevalence in South Africa was slightly over 51%. Forty percent South Africans, according to the research, had basic phones like switch phones or smart phones, while 9% seemed to have no cell phone whatsoever. According to Stats SA's most recent Household Survey, from 85.5% in 2015 to 87% in 2016 and 88.2% in 2017, more households were using their cell phones as their exclusive means of communication (PEW, 2018). More recently during the Covid 19 pandemic many South Africans had to work and study from home due to national and provincial lockdowns, these consequences resulted in a significant high demand for computers, smart phones and devices that helped people connect to data and others (STATS SA, 2022). The COVID 19 global pandemic has plausibly contributed to mass adoption of these digital technologies and reliance on the internet for communication and information sharing. According to the Independent Communications Authority of South Africa (ICASA),

more than 12.6 million South Africans used 4G/LTE devices in 2018 (ICASA, 2018). With 4.3 million LTE devices, Gauteng had the most, followed by KwaZulu-Natal (1.9 million) and the Western Cape (almost 1.6 million) (PEW, 2018). The province with the fewest LTE devices in 2018 was Northern Cape, with only 220 700 LTE devices. Between 2017 and 2018, the number of mobile data customers increased by 7.1%, from 61.4 million to 65.8 million, according to ICASA (ICASA, 2018). Mobile data subscriptions increased by 12.3% over a four-year period, from 2015 to 2018. Users' need for less expensive data suggests the usage of data to interact online in a downturn in socioeconomic conditions (ICASA, 2018). These studies showed that people use the internet to search out information. Cell phones, and specifically smartphones, are becoming more and more common (ICASA, 2018).These findings and the lower costs for data use and consumption make digital communication and e learning new possibilities for South Africans.

2.6 Digital Health Transformation

Personalized monitors, social networking sites, online services, dynamic web technologies, and mobile applications all have the power to significantly improve health by encouraging behaviours that lead to disease prevention, early detection of illnesses in oneself and others, self-management of illnesses, and participation in evidence-based healthcare practices (Morrissey et al., 2016; PEW, 2018). Digital technology has the capacity to interact with a range of people, target population groups, and society at large to reduce disease profiles in a carefully designed health prevention system. Evidently, there has been a surge in interest in using modern technology, such as smartphone programs (apps), to encourage healthy living and hygiene practices (Zolfaghari et al., 2021). For instance, a thorough survey of app stores in 2019 alone turned up 612 apps pertaining to dental health (Fijako et al., 2020). Another study found that using mobile health techniques could be an extra tool for improving dental hygiene, particularly to treat gingivitis, and increasing understanding of oral health (Toniazzo et al.,

2019). Additionally, some apps, according to Santi Lozoya et al. (2019), are made to affect parents' attitudes, beliefs, and behaviours towards their kids' oral health. The aforementioned data demonstrates that people are genuinely interested in having access to their health information on their cell phones. According to earlier research by Garca-Gómez et al. (2014), there are over 500 million smartphone users globally who use health-related apps. In agreement with Aitken and Guantlett (2013), this is probably due to the fact that digital apps simply offer simple information and have a simple performance. Given the interest in digital technology for oral healthcare, the researcher came across the Tooth Keepers Project as part of a program to assist individuals and groups in taking control of and accountability for their dental health and lifelong maintenance of their oral health (Tooth Keepers, 2019). This concept for digital oral health promotion was presented in 2019 to the SA National Oral Health Consultative forum, two insurance companies, and a provincial health department. Partnerships with professional dentistry associations are being created to increase oral health promotion behaviours (Tooth Keepers, 2019). Since the Alma-Ata Declaration in 1978, there has been a global push for primary healthcare development, which has helped to shift attention to needs-based primary healthcare. The internet, devices, information, software, digital communication systems, and streamlined data are now assisting with diagnostics, health assessment and performance whilst improving the efficacy of healthcare interventions, and programs quantified in real-time after more than 40 years of the Alma -Ata declaration of 1978 (WEF, 2019). These trends, which include the digitisation of money like bitcoin and cryptocurrencies, are frequently described as the fourth industrial revolution, upending social and industrial reforms. These robust healthcare systems can analyse data in real-time and provide suggestions based on findings in accordance with international clinical standards, supporting individuals, communities, physicians, and decision-makers in the management of healthcare needs (WEF, 2019). This was seen recently with the Covid 19 pandemic, where real-time global surveillance was made possible using

global online counters that could connect via the internet to evaluate and appropriately intervene to manage the epidemic (STATS SA, 2022).

2.6.1 Digital health integration

Three fundamental pillars which are core strengths in primary health driven strategies are that interventions can; maintain service delivery, encourage self-care, and undertake essential public health services. These fundamental strategies must be considered in a multisectoral policy with actions, empowered people, and communities at the centre of integrated health services which has the potential to holistically integrate interventions into health systems (WHO, 2016; FDI, 2018). In primary care settings and health management over the past ten years, a variety of digital tools have become important (WHO, 2016; WEF, 2019). It's particularly intriguing to look at recent study on the expanding use of technology in domains that support primary care and crucial public health responsibilities (CMS, 2018; WHO, 2018; WEF, 2019). Digital technologies are frequently used in this context to track the supply and use of materials, tools, medications, and vaccines as well as to look up medical knowledge and information, offer clinical support, track public health care initiatives and quality assurance, trace and monitor communicable diseases, and track treatment strategies and outcomes (Michie & Johnston, 2012; WEF, 2019). Applications for digital health promotion can incorporate the twin health promotion idea of health education and self-awareness of disease continuums (Michie et al., 2011). The use of images, films, and animated cartoons to communicate a story is likely to pique the interest of individuals, communities, and/or small groups in a variety of situations, including families, classrooms, workplaces, churches, and many others. Personalized health data and information may empower people in this situation to not only increase awareness but also create self-assessment routines and encourage proactive rather than reactive behaviours that seek prevention of pain, oral disease, or tooth extractions and loss (Michie et al., 2013; WEF, 2019).

2.6.2 Digital Disruption

Systems that are not restricted by geographical boundaries, language barriers, cultural norms, or regulatory constraints are observed to have an impact on the healthcare industry (Morrissey et al, 2016). When used and streamlined with sufficient governance and data management, this status quo disruption offers distinctive healthcare service delivery mechanisms and guided therapeutic practices that are beneficial to larger population groups (WEF, 2019). In order to more effectively meet the demand for services from the community and society as a whole, the existing health and regulatory institutions need to modernize themselves and adopt new digital technologies (WHO, 2016; WEF, 2019).

It is possible that traditional systems will be disrupted by digital healthcare due to its ability to question established clinical procedures and routine service operations. This unique quality might be incompatible with certain health systems or cultural norms. The British health system has saved between 6% and 10% annually, which is equivalent to between US$ 17 billion and US$ 28 billion due to the improvements that digital technology has brought to service delivery and the quality of care (Institut Montaigne, 2016). The adoption of healthier dietary habits, exercise with devices that track weight, heart rate, and BMI index, integration of these practices at the family and individual levels, and encouraging the purchase of wholesome foods from associate retailers while rewarding exercise tracking and defensive driving are just some of the things that many insurance programs encourage. For example, many insurance programs reward exercise tracking and defensive driving (Momentum Health, 2018; Discovery Health, 2019). Numerous sectors all over the world, made possible by the technology that is already in use, are now able to gather, monitor, and share the health data of an individual with a reasonable amount of simplicity. In South Africa, where its use is increasing despite being in the early adoption stage, many users are encouraged or rewarded with points, decreased medical premiums, discounts, rebates, and loyalty rewards for using the technology (Discovery Health,

2018). Patients have traditionally and normatively been subjected to a paternalistic relationship with oral health providers, which has resulted in patients not participating in dental care, treatment planning, or decisions that affect their oral status. As a result of this paternalistic relationship, patients have typically not been involved in making decisions that affect their oral status (Wilkinson, 2005). As a consequence of this, many patients overlook the role that they play in influencing the results of their oral health and essentially visit their dentists or physicians when they are experiencing severe discomfort or when they have an urgent requirement for dental care (WHO, 2007). This reactive strategy results in a dependency on the part of the biomedical practitioner, which leads to a significant rise in the demand for advanced prosthetic dental procedures like endodontic, restorative, and implant dentistry, or, tooth extraction resulting in early tooth loss in the public sector (DOH, 2003). Socioeconomic disparities, additionally, are one of the numerous factors that have been related to an increase in the demand for costly dental prosthesis treatments. This association has been made in relation to oral health, where it is also surprising to find that there is an increase in demand for dentures among individuals in their younger years, specifically between the ages of 24 and 31 (Chisini et al., 2021). People, families, and society as a whole have the opportunity to participate in self-care and monitoring using digital technologies. This strategy would encourage preventative care, autonomy in decision-making at the individual level, habits that increase access to healthcare, and information exchange (Vollmer et al., 2015). In order to promote health-related behaviours, practitioners may also engage with patient data and encourage patient involvement of oral disease management and surveillance and foster a more optimistic attitude toward healthier outcomes. These goals can be accomplished by encouraging patients to take responsibility for their own illness management and monitoring. It is possible that adopting this strategy will require practitioners to abandon the stereotypical doctor-centric culture prevalent in biomedical paradigms of intervention in the oral healthcare

context in South Africa (Thorpe, 2006). There is a possibility that digital healthcare will mark the beginning of a health reform that will modify methods to healthcare systems in order to achieve higher levels of efficacy and efficiency, which will ultimately be to the benefit of the general public (Vollmer et al., 2015). Institutions and independent service providers lack both an incentive and an economic motive for such interventions underpinned by traditional payment systems. These payment systems do not assess or recognize preventive gains and outcomes as providers are paid for clinical biomedical intervention. This approach results in a systemic abandonment of primary healthcare approaches (Watt, 2005). Health and regulatory improvements should favour primary care methods and should be made to facilitate the implementation of patient-centred care (Watt, 2005). In the current phase of the development of digital health, health care systems ought to demonstrate an awareness of their social responsibilities, encourage the processes of change, and make it possible for citizens to participate in the resolution of health problems (Vollmer et al., 2015). If policymakers and supporters of the existing healthcare systems choose to ignore this digital opportunity, it could inspire other global initiatives that could supplant the existing healthcare systems in favour of patient empowerment, where people could turn to alternative medicine and unregulated therapies (Blaggana et al., 2016). As a result of the convergence of current and future digital healthcare developments, individuals, communities, and the global community should experience a transformation in healthcare and health ownership (Vollmer et al., 2015). This will enable the integration of various systems, procedures, and services into a thorough, patient-centred approach to care and the management of health outcomes. This transformation in healthcare and health ownership is expected to take place (Wilkinson, 2006; WEF, 2019).

2.7 Theory of behaviour change

Oral health diseases such as dental caries are largely preventable and significantly moderated by behaviour (Asimakopoulou and Newton, 2015). According to earlier research, individuals' proactive attitudes can be sparked by knowledge of their oral health, personal hygiene, oral health awareness, and early detection, which can lead to positive behaviour changes that directly affect disease aetiology (Blaggana et al., 2016). Health improvements and a decrease in reliance on doctors will occur from people and families taking responsibility for their health outcomes and development (Vollmer et al., 2015). Any intervention in primary care should transmit knowledge and empower patients with self-care skills and the awareness to seek appropriate and timely care. Such approaches result in consistent and long-lasting behavioural changes in individuals, families, and communities (Michie et al., 2013). These strategies are developed to make behaviour modification strategies or behaviour change procedures easier to use, usually referred to as Behaviour Change Technology (BCT). As a result, it is possible to establish communication techniques and tools to create these BCTs by synthesizing medical knowledge, philosophy, psychology, pathophysiology, and knowing the boundaries and scope of primary care and self-care (Morrissey et al., 2016). Recent studies on the utilisation, value, and patient impact assessment of digital health applications have determined their utility and efficacy. Conroy et al., (2014) evaluated the behaviour modification of the highest-scoring mobile applications for physical exercise. Conroy et al., (2014) discovered that the most prevalent behaviour modification strategies in physical apps were educational. Consequently, and in accordance with Bandura (1989), information about how to practise the desired health behaviour is a prerequisite for behaviour modification since it contributes to task self-efficacy, which helps the formulation of intentions to be physically active. Other researchers have examined behaviour change using the Taxonomy of Behaviour Change developed by Abraham and Michie (Abraham & Michie, 2008), including Direito et al. (2014), Middelweerd et al.

(2014), and Vollmer et al. (2015). These well-crafted methodologies and measures are dependable for discovering behaviour modification techniques in health programme interventions. Prior research on BCTs in digital applications (apps) has improved our understanding of the role of behavioural interventions in this setting (Michie & Abraham, 2004). A study discovered that good BCT integration increases an app's effectiveness and user engagement (Hannah et al., 2013). The programs for health promotion may then transform, from one that only increases awareness to one that can influence behaviour. Behaviour Change Techniques (BCT) designed digital tools that are easily understood have the ability to empower individuals to take action and could lead to behavioural modification and change that permits improved health outcomes (Michie et al., 2013).

2.8 The Tooth keepers digital tool techniques

The researcher identified the Tooth Keepers Project as a tool to assist individuals and groups regain control over their oral health and save their natural teeth (Tooth Keepers, 2019). The South African National Oral Health Consultative forum, two medical plans, and the KZN provincial health department have all heard about the concept of digital oral health promotion. In an effort to promote behaviours that enhance oral health, efforts are being made to form partnerships with professional dental associations. (Tooth Keepers, 2019). The Alliance for a Cavity free Future (ACFF), an international health alliance which promotes self-care and awareness in people regarding oral health is also reviewing the Tooth Keepers concept as an endorsement for digital oral health promotion. The idea behind the development of the Tooth keepers digital tool is premised on the assumption that any intervention in primary care should have as a long-term effect the dissemination of knowledge, the acquisition of self-care skills, and the ability to recognise when to seek appropriate care. Using digital media to raise public awareness of health issues, such as pictures, cartoons, and videos, is essential for establishing

baseline standards for oral health knowledge and assisting people in recognizing impacts to their health (Middelweerd et al., 2014). In addition to educating and promotion of health and coaching, this study's oral health visual media tool also portrays the serious and real-world effects of diet, poor oral hygiene, and neglect. It was designed to teach, train and develop improved behaviours through imparting oral health awareness detection skills with constructed consequential disease progressions (pathogenesis) (Tooth Keepers, 2019). There hasn't been any prior studies evaluating the effectiveness of the Tooth Keepers tools in altering oral health behaviour, despite their ongoing development. As a result, it is envisioned that evaluating the Tooth Keepers digital tool intervention for oral healthcare improvement through self-examination and self-care, it may be conceivable for digital oral health education and promotion to equip people, communities, and societies with the fundamental concepts and knowledge required to promote oral health and dental autonomy.

2.9 Conclusion

The preceding analysis demonstrates the need for a paradigm shift from curative dentistry to preventative dentistry in South Africa. Moreover, considering the expense and difficulty of gaining access to healthcare in developing and low-income nations, it is reasonable to assert that preventative dentistry should be the standard in South Africa. More-so the promotive components of broad based personalised oral health care interventions through the utilisation of digital media incorporation BCT's shouldn't be a missed opportunity for the industry. Given the strong mobile and growing internet prevalence in South Africa, it can be claimed that digital technology will not only disrupt but also transform health care delivery in South Africa. In a nutshell, digital solutions such as the Tooth keepers could assist in bridging the oral health access gap not only and particularly for patients with low socioeconomic status but for all citizens.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

The research design and methodology of the study are presented in this chapter. The chapter reports on the research approach selected, the process of data collection, the sampling proposes, and the method of data analysis.

3.1 Study Design

This research employed an explanatory research strategy because the researcher seeks to establish or explain causal links (Saunders et al., 2016).

3.2 Research Strategies

This research study employs a quasi-experimental design. The design investigates the existence of a causal connection between dependent and independent variables. The dependent variable (digital oral health promotion tool) causes the effect of the independent variable (impact on self-care and self-checking) (Loewen & Plonsky, 2017). This study employed a quasi-experimental design since its purpose was to compare first-year college students' oral health knowledge and awareness regarding their ability to self-check and self-care before and after exposure to a digital oral health promotion tool. In a quasi-experimental approach, the researcher manipulates an independent variable without randomly assigning individuals to conditions or ordering of conditions (Price, Jhangiani & Chiang, 2015). Although there are other types of quasi-experimental research designs, this study employed the pretest-posttest method. The dependent variable is measured twice in this design: once before and once after the application of the intervention. (Price, Jhangiani & Chiang, 2015). It is presumed that the students have improved if the average posttest score is greater than the average pretest score. One could conclude that the intervention may have contributed to the improvement (Price, Jhangiani & Chiang, 2015).

3.3 Study Population

Population, according to Collis and Hussey (2013), is any group of individuals or units taken into consideration for research. College students at the Durban University of Technology comprised the study population. This demographic was chosen since they are of consenting age and able to participate in the research sessions.

3.4 Sampling strategy

Sampling strategy, according to Brink and Van Rensberg (2012), is the process of choosing a sample from a population in an effort to compile data regarding a phenomenon. The population of interest must be represented in this procedure (Brink, Van Der Walt and Van Rensburg, 2012). The sampling process is highly important given that accuracy of the research is largely dependent on the process by which the samples are selected (Kumar, 2014). Kumar (2014) therefore, reveals the two main sampling methods to include probability and non-probability. First-year registered students were recruited voluntarily for the purposes of this study using a non-random convenience sample selection procedure. Due to the disruption of the Covid 19 and the limited number of students permitted to return, as well as the limited data capacity of the internet or devices, the researcher selected by invitation only those students who are available to participate. This type of sampling represents the sample population without bias (Huck, 2007). In order to conduct a successful study, a pilot test was conducted to ensure that the questions were phrased in an acceptable and understandable manner. According to Johnson and Christensen (2012), conducting a pilot study improves the research's reliability, validity, and applicability. To check the validity and reliability of the data collecting instrument, a minimum of 10 participants from the study population were chosen at random and excluded from the main study. Except for minor grammatical adjustments, the questionnaire remained unchanged.

3.5 Sample size

The estimated sample size included 380 registered Durban University of Technology students. Using a Cochran sample size formula with a 95% confidence interval and a 5% margin of error, this was estimated based on 30000 registered first-year students (Appendix 5). There were a total of 254 participants in the study, which constitute a response rate of 66.8%. While the response rate can be considered high for statistical purposes, the inability to reach the actual estimated sample size of 380 students was due to several factors beyond the control of the researcher. First, the Covid-19 pandemic resulted in many institutions including the selected institution adopting the blending model in their teaching and learning. Secondly, the KwaZulu Natal province had experienced mass rioting and severe flooding during these periods with many devastations, moreover there had been severe electricity load shedding. These challenges made recruiting, communicating and interactions with students difficult and challenging as most were not on campus nor responding to the invitation. More than 380 indicated willingness, 87 did not proceed to the training process and dropped off without completing the second questionnaire. 254 participants successfully completed the research process.

3.6 Data collection instruments

Data for this study were gathered through a well-structured survey. The questionnaire is a research tool made up of a list of inquiries and other "prompts" intended to gather information from respondents (McKee, 2015). In a pre-test post-test quasi-experimental research design, data were collected using pre-test structured questionnaires and post-treatment identical questionnaires. Using a self-administered questionnaire (Appendix 4). Questionnaires ought to be created in a way that makes it easy to evaluate the existing beliefs, positions, attitudes, and opinions of a recognized population (Creswell, 2014). The questionnaire contains closed-ended questions designed to assess oral health knowledge and practises. Questions were simple dichotomous ordinal measurements with only two possible answers of "Yes" and "No",

True/False or Agree/Disagree. The questionnaire also uses a Likert scales:1 to 5 rating scale and scales ranging from "strongly agree" to "strongly disagree") quantitative data analysis easier (Dudovskiy, 2017). The questionnaire consisted of six sections: 1. Demographics, 2. Oral Health Knowledge, 3. Oral Health Awareness 4. Oral Health status, 5. Accessibility and Affordability and 6. Self-Checking and Self-Care Methods. Notably, the questionnaire was adapted from Slade (1997) and Tubert-Jeanin et al., (2003), in addition to the Alliance for a Cavity–Free Future (ACFF) and World Dental Federation (FDI) survey guides.

The Covid-19 pandemic created the adherence to social distancing measures, which promoted the collection of data through an online survey. This was generated using a Google form, and the survey link was emailed to students who indicated a willingness to participate. Respondents were given 30 minutes to complete the initial portion of the Pre-test questionnaire. The participants thereafter received a multimedia oral health primary care promotional presentation based on the Tooth Keepers oral health journey. This technique was carried out over the course of three days and lasted around 20 minutes every day covering the various aspects of oral health education, awareness and self-care practices. The presentation was delivered via the Microsoft Teams video-conferencing application tool, which included the transmission of digital oral health education content via the Microsoft Teams application. Using the identical pre-test questionnaire, a post-test questionnaire was then delivered by posting an email link to the post questionnaire once all three media were completed. All students who completed the initial questionnaire and viewing completed the post-test questionnaire. Of the invited students 425 students indicated a willingness to participate, yet only 254 fully completed the research process. An automated tooth brush and dental products valued at R3500 was drawn as the award for completing the full online participation in the study.

3.7 Data analyses

Statistics were used for both descriptive and inferential analysis of the acquired data. Descriptive statistics are frequently used to organize, summarize, and characterize survey data, as noted by Grand-Clement, Baruch, and van Gorp (2018). In the pre-test and post-test analyses, the obtained descriptive data were given as frequencies for categorical variables and as means including standard deviations for continuous variables and are depicted using graphs and tables. The inferential statistics data were presented with arithmetic means and standard deviations. According to Johnson and Christensen (2012), inferential statistics uses probability laws to form inferences and draw conclusions about sample data.

A standardised questionnaire was utilised for both the pre- and post-testing of oral health knowledge scores. The appropriate response was rated as 1, while the wrong response was rated as 0. With SPSS version 28.0, the collected data were statistically analysed (IBM Statistics Inc., Chicago, Illinois, USA). The difference in scores between those taken before and after the digital oral health training was determined using the Mc Nemar and Wilcoxon signed-rank tests. Statistical significance was set at P 0.05. (two-tailed).

3.8 Limitations of research

This research demonstrates the complexity of recruiting participants during a lockdown period in the global Covid 19 pandemic. The global impact of COVID-19 and the ensuing statewide lockdown to prevent its spread made it difficult to communicate with the university and recruit participants for the study. In addition, new protection of personal information legislation (POPI ACT) had taken effect in South Africa, necessitating senior management engagement in administrative processes pertaining to participant data access. Nevertheless, this caused a significant delay in access and communication to students, the data collection process and resulted in only 254 successful respondents that participated in the complete study instead of the proposed and expected 380 participants. 87 students completed the initial questionnaire

however did not follow through in finalizing their daily training sessions and did not complete their posttest questionnaires.

3.9 Elimination of bias

Sarniak (2015) stated that there is a possibility of bias in all research projects. Given that the researcher is a licenced oral care provider, there is a chance that his experience and understanding of oral care techniques may inhibit data collection and interpretation. This could be mitigated, however, if the researcher carefully considers the elements that contribute to research bias. Utilizing an electronic survey decreased the likelihood of this bias. The selection of the sampling technique is a potential source of bias in a research project. Despite the fact that convenience sampling contains a degree of bias, this is addressed by the use of electronic forms to gather data, where participants had entered their own selections.

3.10 Rigor

The extent to which one's study findings are applicable to other research contexts is known as external validity, also known as generalizability (Saunders et al., 2007). The quasi-experimental pre-test post-test design approach determined sample size, and inclusion of both male and female participants contribute to the generalizability of the findings to the research population. A total of 254 out of 380 estimated sample recruited participants successfully completed the pretest and posttest questionnaires, and the three digital coaching and training sessions. The manipulation of the independent variable in quasi-experimental research eliminates concerns with directionality (Patton, 1997). This study examines the pre- and post-exposure oral health knowledge and self-care and self-checking abilities of participants who were exposed to a digital oral health promotion tool.

3.11 Ethics consideration

The Biomedical Research Ethics Committee (BMREC) granted ethics approval to conduct the study. Additionally, the Directorate of Research and research committee at the Durban University of Technology (IRIC) provided authorisation to implement the study at the Durban University of Technology (Appendix 3). The research purpose and objectives of the study were disclosed to the participants in order to obtain their informed consent. The researcher guaranteed the confidentiality of all participants. The Participant Information Sheet, Consent form, and questionnaire (Appendices 1, 2, & 4) detailed the study's purpose and data collection procedure. The researcher stated that their involvement was entirely voluntary and that they might quit at any time without consequence. Participants were not asked for their names or other identifying information. All participants were required to sign a consent form (Appendix 2) acknowledging that their participation in the study was entirely voluntary, this was done via electronic acceptance and linkage. Consent was obtained electronically via a Google form. In compliance with the protection of personal information (POPI) act the names of participants personal identification were not used but pseudonyms, identifiable data were removed. The data was collected electronically and stored on an external hard disc which was password-protected. The external hard disc is secured in a password protected safe and secure location. The computer used for storage and analysis was password protected and only the researcher has access. The data will be destroyed after 5 years.

3.12 Conclusion

This chapter describes the research methods employed in the study, including the sampling strategy, data collection instruments, data processing procedure, pilot study details, and ethical considerations. The following chapter will present the surveyed instrument's results.

CHAPTER 4: PRESENTATION OF RESULTS

Introduction

This chapter describes the degree of oral knowledge, including awareness, practices, oral health attitudes, self-care and self-checking awareness, before and after the digital oral health behaviour change technology intervention (training). There are 254 college students from the Durban University of Technology as the responders (DUT).

4.1 Socio-demographic characteristics of the college students

The socio-demographic characteristics of the college students are described in Table 4.1. The results indicate that respondents were mostly female (64.2%), within the age group of 18-24 years (55.5), and mostly in their 1st year of study (48.4%).

Table 4. 1: Socio-demographic characteristics of the respondents (n=254)

Variable	Categories	n (%)
Gender	*Male*	83 (32.7)
	Female	163 (64.2)
Age group	18-24 years	141(55.5)
	25-30 years	95(37.4)
	31-40 years old	18(7.1)
Level of study	1st year	122(48.4)
	2nd year	38(15.0)
	3rd year	55(21.7)
	4th year	24(9.4)
	Unspecified	14(5.5)

4.2 Assessing the level of knowledge

Table 4.2 details the respondents' oral health knowledge levels before and after training. There was visible evidenced that the students level of knowledge significantly improved in all of the eight questions assessed after intervention. For example, the data reveals that just 48 percent of the respondents answered correctly to the question "I should only visit the dentist if I'm

experiencing pain before training," whereas 93 percent did so after evaluation, and the difference was highly statistically significant (p = 0.001*). Similarly, and before training, only 47.2% of the respondents correctly stated that brushing before night is more important than brushing in the morning. This increased to 85.4% after training, and this difference was determined to be highly statistically significant (p = 0.001*). Similar trends that shows significant improvement in the participants' oral health knowledge were equally observe in other statements measured in the study.

Table 4 2: Assessment of students' level of knowledge pre and post-training programme (n=254)

Statements	Oral health knowledge		*p*
	Before training ***correct response*** n=254 (%)	After training ***correct response*** n=254 (%)	
1. Tooth brushing must be done twice a day	201 (79.1%)	254 (100%)	0.000*
2. Flossing must be done once daily	129 (50.8%)	249 (98%)	0.012*
3. It is not necessary to brush the tongue	183 (72%)	236 (92.9%)	0.004*
4. It is ok if my gums bleed when I brush	173 (68.1%)	236 (92.9%)	0.000*
5. I should go for a dental check-up only when I have pain	122 (48%)	237 (93.3%)	0.000*
6. brushing before bed is more important than brushing in the morning	120 (47.2%)	217 (85.4%)	0.000*
7. I can substitute brushing and flossing with a simple mouth wash or rinse	142 (55.9%)	232 (91.3%)	0.000*
8. Teeth are not so important as with new technology teeth are easily replaced	142 (55.9%)	231 (90.9%)	0.000*

P≤0.05. Mc Nemar test. *correct response : the correct oral health response to the question posed*

4.2.1 Knowledge of self-tooth checking

Figure 4.1 depicts descriptive data indicating that whereas 37% of respondents disagreed with the statement "I know how to inspect my own teeth and gums for issues," this proportion decreased to 2% after review. On the post-test responses, the percentage of respondents who strongly agreed increased from 15.7% to 63.0%, indicating that after receiving instruction, a

significant number of respondents could now inspect their own teeth and gums for potential concerns.

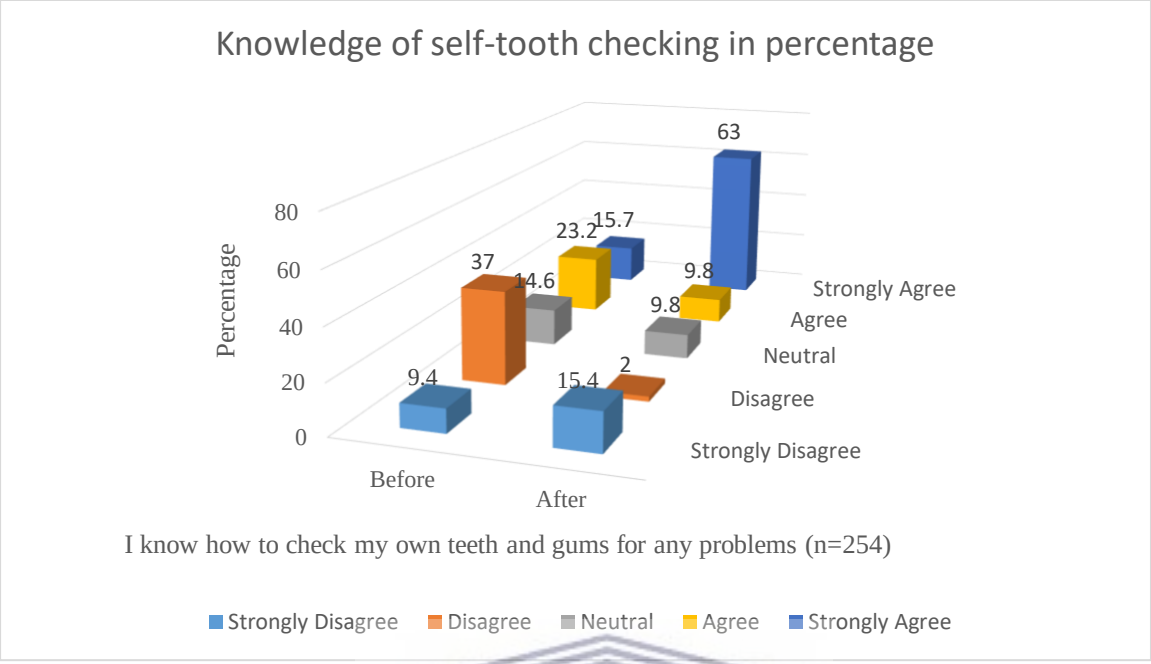


Figure 4. 1: Difference before and after oral health training on self-tooth checking knowledge (n=254)

4.2.2 Knowledge of self-tooth checking and oral disease diagnoses

Figure 4.2 reveals that while 66.1% of respondents agreed with the statement "I am able to check my own teeth and mouth, I am unaware of the early warning signs of oral illness. Following the review, this improved to 76.8%.

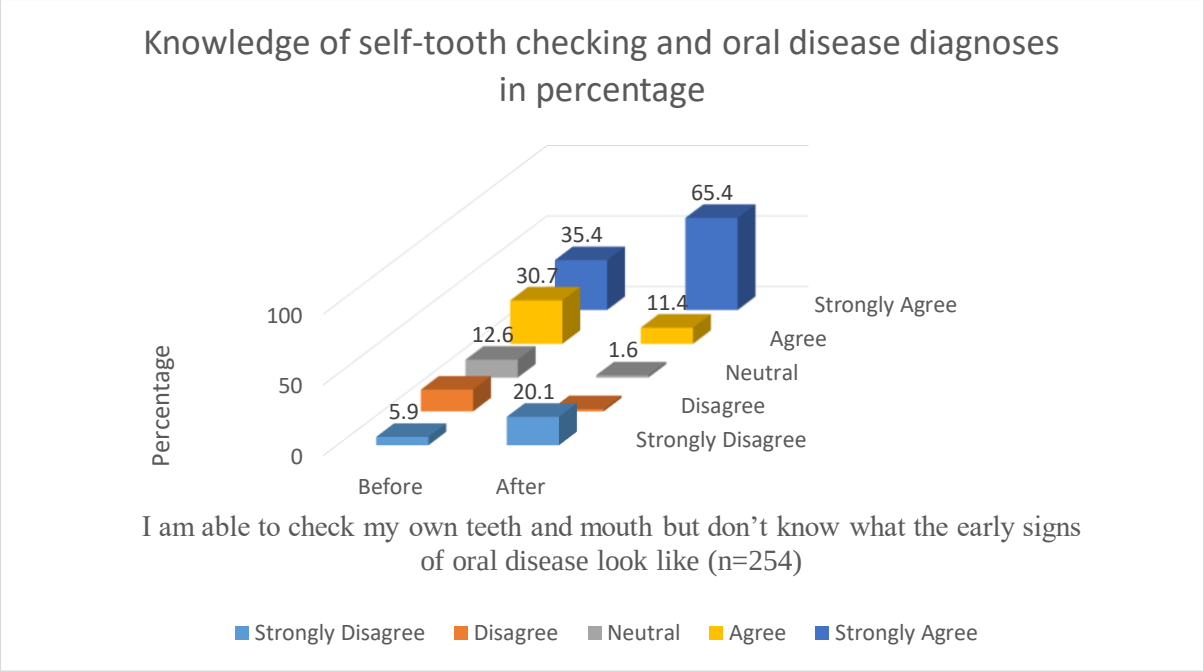


Figure 4. 2: Difference before and after oral health promotion on self-tooth checking knowledge of tooth and oral disease (n=254)

4.2.3 Distribution of the respondents self-assessment Knowledge

Table 4.3 depicts the distribution of respondents' knowledge levels. Overall, 67.7% of respondents had good oral knowledge; this grew to 94.9% after evaluation, and the difference was statistically significant ($p<0.001$).

Table 4. 3: Distribution of oral health knowledge (n=254)

	Before	After	P value
Poor	82 (32.3)	13 (5.1)	0.000*
Good	172 (67.7)	241 (94.9)	

4.3 Assessing oral health awareness

Table 4.4 compares the respondents' oral health awareness levels before and after coaching. There were evidenced in the improvement of the respondents' oral health awareness after intervention. Prior to training, for instance, only 42.5% of the respondents were aware that using toothpicks to remove food from teeth is harmful to teeth and gums; after training, this percentage climbed to 96.5% and this difference was shown to be statistically significant (p =

0.004). Similarly, prior to the coaching program, only 51.2% of individuals were aware that brown and black stains on teeth are unacceptable. This difference was discovered to be very statistically significant (p 0.001) after a post-evaluation revealed that everyone became aware of this (100 percent). Similar pattern of improvement were observe in all the statements post intervention.

Table 4. 4: Assessment of students' level of oral health awareness pre and post-training programme (n=254)

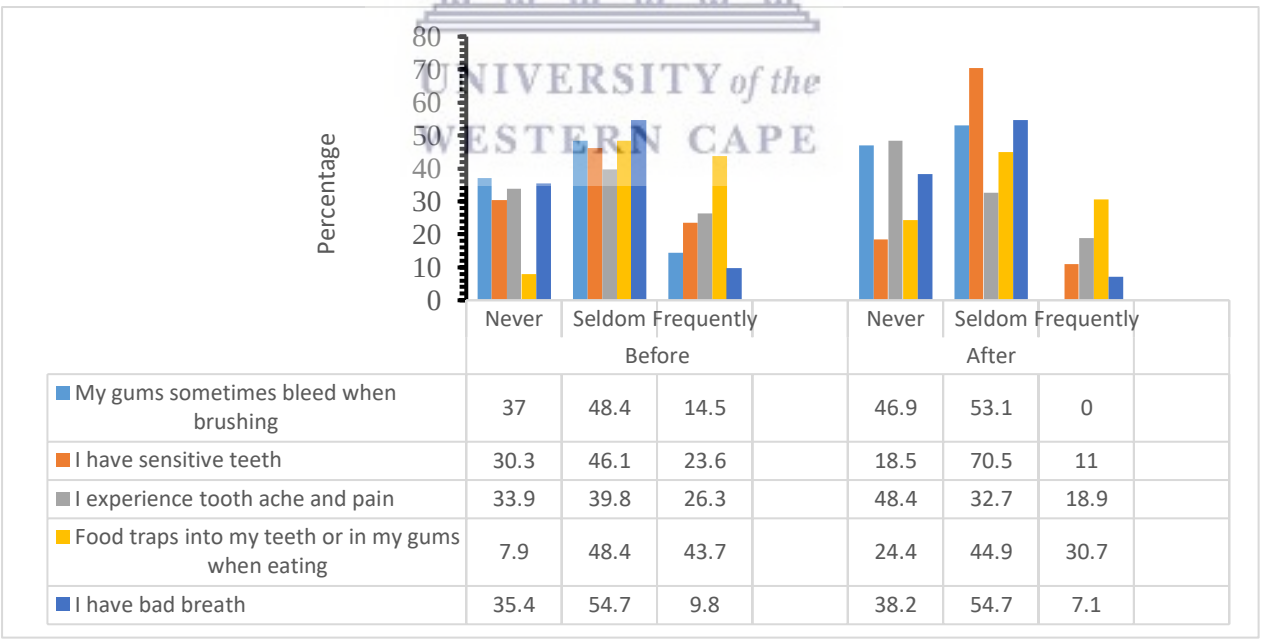
Statements	Expected Ideal response	Oral health knowledge						*P*
		Before training			After training			
		Incorrect n(%)	Correct n(%)	I don't know n(%)	Incorrect n(%)	Correct n(%)	I Don't know n(%)	
1. Adults have a total of 32 teeth	True	9(3.5%)	178(70.1)	67(26.4%)	0	254 (100%)	0	0.000***
2. Swollen bleeding gums are normal	False	21 (8.3%)	180(70.9%)	53(20.9)	19 (7.5%)	235 (92.5%)	0	0.012***
3. Using toothpicks to dig out food from teeth is good for teeth and gums	False	61 (24%)	108(42.5%)	85(33.5%)	4 (1.6%)	250(98.4%)	0	0.004***
4. I must brush teeth very hard to remove food and plaque	False	16 (6.3%)	189(74.4%)	49(19.3%)	9(3.5%)	245 (96.5%)	0	0.000***
5. brown and black spots on my teeth are ok	False	59 (23.2%)	130(51.2%)	65(25.6%)	0	245 (100%)	0	0.000***
6. white spots on my teeth are ok	False	12 (4.7%)	196(77.2%)	46(18.1%)	0	245 (100%)	0	0.000***
7. Bad breath is usually normal	False	44 (17.3%)	146(57.5%)	64(25.2%)	0	245 (100%)	0	0.000***
8. pain in teeth from time to time is normal	False	45 (17.7%)	152(59.8%)	57(22.4%)	0	245 (100%)	0	0.000***
9. a small hole (cavity) in my tooth is ok as long as there is no pain	False	70 (27.6%)	143(56.3%)	41(16.1%)	0	245 (100%)		0.000***
10. I should visit a dentist only when I have	False	93 (36.6%)	146(57.5%)	15(5.9%)	5 (2%)	236 (92.9%)	13 (5.1%)	0.000***

dental pain or tooth infection								

*$P \leq 0.05$Wilcoxon test.

4.4 Oral Health Status

Figure 4.3 depicts the respondents' oral health status before and after training. Based on the responses to questions there were evidenced that the intervention led to significant increases in the oral health status of the participants. For example, none of the respondents reported their gums frequently bled during brushing in the post-evaluation assessment. Similarly, those who never experienced tooth sensitivity dropped from 30.3% to 18.5% in the post-training examination, whereas those who rarely experienced tooth sensitivity grew from 46.1% to 70.5%. More so, the percentage of respondents who never experience toothache and pain improved from 33.9% to 48.4% in the post-training evaluation, whereas the percentage of respondents who rarely experience toothache and discomfort reduced from 39.8% to 32.7%. Overall, the study results reveals that the oral health status had marginally improved after the evaluation and respondents were possibly correctly aware of their oral health status.



	Before				After		
My gums sometimes bleed when brushing	37	48.4	14.5		46.9	53.1	0
I have sensitive teeth	30.3	46.1	23.6		18.5	70.5	11
I experience tooth ache and pain	33.9	39.8	26.3		48.4	32.7	18.9
Food traps into my teeth or in my gums when eating	7.9	48.4	43.7		24.4	44.9	30.7
I have bad breath	35.4	54.7	9.8		38.2	54.7	7.1

Figure 4. 3: Oral health status before and after intervention (n=254)

4.5 Affordability and Access to Dental Care

This section assesses respondents' perspectives on the affordability and accessibility of dental treatment before and after the coaching program. The graph in Table 4.5 clearly demonstrated that respondents' perspectives on the affordability and accessibility of dental treatment were distinct before and after the training evaluation. Compared to prior training, it is readily apparent that there was a high level of agreement on all questions following evaluation. For example, the majority agreed that dental treatment is costly, hence while they avoid dental visits (90.9%),they are afraid of the dentist and thus avoided visiting a dentist (86.2%). The post-training survey suggests that respondents are more aware of the cost of dental treatment, the hurdles to receiving dental care, and the necessity to care for their own teeth than they were before the coaching program.

Table 4. 5: Respondents' perception of the affordability and access to dental care before and after training (n= 254)

Statements:	Respondents' perception of the affordability and access to dental care before and after training							
	Before (%)				After (%)			
	Disagree	Neutral	Agree	Median	Disagree	Neutral	Agree	Median
Dental treatment is costly so I avoid dental visits	23.6%	16.1%	60.3%	4.00	7.1%	2%	90.9%	5.00
I'm afraid of the dentist and I avoid Visiting a dentist	45.3%	9.4%	45.3%	3.00	12.2%	1.6%	86.2%	4.50
I need help to fix my teeth but do not have medical aid cover to fix teeth	32.2%	7.1%	60.6%	4.00	5.1%	1.6%	93.3%	5.00
Dental clinics are far away and I only go when I have pain	38.1%	22%	39.7%	3.00	3.1%	9.8%	87%	5.00
I cannot afford dental treatment that was recommended to me	31.9%	23.2%	44.8%	3.00	5.1%	6.7%	88.2%	4.00
Oral Neglect consequently leads to costly dental treatment	16.1%	12.2%	71.6%	4.00	7.1%	1.6%	91.3%	5.00
If I had more understanding of my teeth problems I would be able to take better care of them	22.9%	15.4%	61.8%	4.00	7.1%	3.1%	89.8%	5.00

4.6 Oral health beliefs

Table 4.6 details the oral health of the respondents both before and after training. There was statistically significant evidence in the improvement of the respondents' oral health beliefs post-intervention. This is supported by the fact that all of the respondents correctly believed their teeth are an important part of their body, brushing their teeth every day could prevent tooth decay; using fluoridated toothpaste is good for their teeth; brushing twice daily as being crucial to maintaining low bacteria levels and improving overall dental hygiene.

Nevertheless, there was no differences post-intervention in their beliefs on the statements, which include "If I have no pain, it means that all of my teeth are perfectly well", and "Consuming sweetened food products or drinks does not cause dental care". Overall, one could draw out that with the exception of the statements "Consuming sweetened food products or drinks does not cause dental caries," and If I have no pain, it means that all of my teeth are perfectly well", collectively the respondents' beliefs about oral health have generally improved.

Table 4. 6: Assessment of students' oral health believe pre and post-training programme *(n=254)*

Statements	Expected Ideal response	Oral health knowledge						*P*
		Before training n(%)			After training n(%)			
		Incorrect n(%)	Correct	I don't know	Incorrect	Correct	I Don't know	
1. Teeth are an important part of my body	True	9(3.5%)	236(92.9%)	9(3.5%)	0	254 (100%)	0	1.000
2. Daily cleaning of teeth can prevent tooth decay	True	5 (2%)	232(91.3%)	17(6.7%)	0	254 (100%)	0	0.011
3. Using fluoridated toothpaste is good for your teeth	True	9 (3.5%)	164(64.6%)	81(31.9%)	0	254 (100%)	0	0.000
4. Brushing twice a day every day is very important to keep bacteria levels low	True	5 (2%)	186(73.2%)	63(24.8%)	0	254 (100%)	0	0.000

5. Tartar is a bacterial cement that causes gum disease and bone loss	True	4 (1.6%)	133(44.5%)	137(53.9%)	0	254 (100%)	0	0.000
6. I can replace brushing and flossing with just mouth washing	False	52 (20.5%)	147(57.9%)	55(21.7%)	31 (12.2%)	149 (58.7%)	74 (29.1%)	0.224
7. If I have no pain it means all my teeth are perfectly well	False	87 (34.3%)	98(38.6%)	69(27.2%)	37 (14.6%)	143 (56.3%)	74 (29.1%)	0.078
8. A black white or brown spot on my tooth could mean there is decay or risk of decay	True	22 (8.7%)	151(59.4%)	81(31.9%)	60 (23.6%)	194 (76.4%)	0	0.000
9. Consuming sweetened food products or drinks does not cause dental caries	False	70 (27.6%)	139(54.7%)	45(17.7%)	86 (33.9%)	128 (50.4%)	40 (15.7%)	0.914
10. A dental check up is important to check teeth for problems	True	9 (3.5)	211(83.1)	34(13.4)	4 (1.6)	250 (98.4)	0	0.000
11. I need to be more visually aware of my teeth and gums	True	14 (5.5%)	189 (74.4%)	51 (20.1%)	4 (1.6%)	250 (98.4%)	0	0.000

*$P \leq 0.05$ Wilcoxon test

4.7 Self-Care and Self-Checking Knowledge

This section assesses the respondents' prior and subsequent training-related knowledge of oral self-care and self-checking. All of the statements emphasised in Table 4.7 demonstrated a statistically significant difference respectively before and after training. For example, the respondents' perception of maintaining their teeth measured by questions (1-4) demonstrate significant improvement in brushing of teeth before going to bed. This could have also informed the desire to keep all of their teeth for life.

Self-care behaviours evaluated by questions (10–13) demonstrated significant increases post evaluation. In the areas of "Do you look at your mouth, teeth, and gums in the mirror when

brushing your teeth" (96.5%), "Do you brush your gums and tongue, when brushing your teeth" (98.4%), "Do you clean your mouth before sleeping" (98.4%), and "Do you floss your teeth" (80.7%), there was a significant improvement in self-care practises.

The respondents' intentions to practise oral self-care evaluated by questions (14–15) reveals significant improvement in the areas of "I should floss my teeth at least once a day" (94.6%), and "I should brush my teeth and gums at least twice a day" (100%). The respondents' capacity to self-evaluate their oral health conditions evaluated by questions 16 through 18 shows significant improvement in the respondents self-checking skills after the training. For example, there were improvement in the respondents' ability to detect that their teeth had some brown, black, or white spots.

The intention of the respondents to alter their perspective on oral health evaluated using questions 19 and 20 showed a marked increase in their intention post-intervention. It was found that the percentage respondents who seemed dissatisfied with their teeth and thought they could be better rose from 64.2% to 96.1% post-evaluation. The percentage of those who agreed that they would benefit from more knowledge and information on how to maintain their teeth in good health for life rose from 78% to 100% post-intervention.

Table 4. 7: Respondents' self-care and self-checking knowledge (n =254)

Statement:	Self-care and self-checking knowledge										P value
	Pre-intervention (%)					Post-intervention (%)					
	Yes	No	Some Times	Maybe	I don't know	Yes	No	Some times	Maybe	I don't know	
1. Do you brush teeth before sleeping?	46.9	19.7	33.5			98.4	1.6	0	0	0	0.000
2.I am able to keep all my teeth for life	32.7	21.7	9.4	32.7	3.5	100	0	0	0	0	0.000
3. I will lose most of my teeth as I get older and may need false teeth	26.8	29.1	7.5	26	10.6	33.1	63.4	0	3.5	0	0.000

4. I will lose some of my teeth in my lifetime and its ok	22	35	5.9	29.5	7.5	31.9	64.2	0	3.9	0	0.000
5. Do you snack at night before sleeping ?	35.8	42.5	17.7	3.9		31.1	61.8	7.1	0	0	0.012
6. Energy drinks and soft drinks damage teeth ?	66.1	9.8	10.2	10.2	3.5	96.7	3.1	0	0	0	0.000
7. Sour sweets damage teeth	50	20.1	10.6	14.2	5.1	100	0	0	0	0	0.000
8. Do you eat sweets, chocolates and snacks	70.5	3.9	22	3.5	0	78.7	6.7	13	1.6	0	0.002
9. Do you use any tobacco containing products cigarette, vape, weed	22.4	66.9	8.7	2		31.5	63	5.5	0	0	0.003
10. Do you Look at your mouth teeth and gums in the mirror when brushing teeth	51.6	25.2	23.2	0	0	96.5	0	3.5	0	0	0.000
11. Do you brush your gums and tongue , when brushing teeth	64.6	21.3	12.2	2	0	98.4	1.6	0	0	0	0.000
12. Do you clean your mouth before sleeping	46.9	24	27.2	2.0	0	98.4	1.6	0	0	0	0.000
13. Do you floss your teeth	21.3	54.7	18.5	2.0	3.5	80.7	12.2	7.1	0	0	0.000
14. I should floss my teeth at least once a day	40.2	10.2	20.5	21.7	7.5	94.9	5.1	0	0	0	0.000
15. I should brush teeth and gums at least twice a day	69.7	7.9	12.6	9.8	0	100	0	0	0	0	0.000
16. my teeth has some brown and black or white spots	35	48.4	5.1	9.4	2	63.4	34.6	2	0	0	0.000
17. Is it normal to have pain when eating or drinking cold or hot things	22.4	55.1	9.1	7.5	5.9	20.9	73.6	5.5	0	0	0.000
18. food gets stuck in my teeth when eating	50.8	19.3	24	5.9	0	67.7	28.3	3.9	0	0	0.000
19. Im not happy with my teeth it could be better	64.2	16.9	9.1	5.9	3.9	96.1	0	3.9	0	0	0.000

20. I will benefit from more knowledge and information on how to keep my teeth in good health for life	78	5.1	5.1	9.8	2	100		0	0	0	0.000

4.8 Conclusion

The preceding analyses exhaustively assessed and evaluated the impact of digital tools on college students' oral health knowledge, self-care, awareness, and beliefs. The statistical analyses were performed to provide evidence that the behaviour change directed digital tool is an effective oral health knowledge, awareness and self-care intervention system. Following training and coaching, the students' oral health knowledge, awareness, and beliefs significantly improved. The data also indicates that the student's overall health status improved significantly following training, indicating the efficacy of behaviour change technology interventions in digital tools used for oral health promotion in eliciting greater awareness, appreciation and responsibility in self-care routines. After training, students' knowledge of self-care and self-checking also improved significantly. The chapter concludes, based on the data presented above, that the digital interventions based on behaviour change technology has the potential to play a key role among individuals understanding of oral health, teeth, gums and indicators for early detection of pathology. Improved self-care practices in the preventative areas of oral health and fundamentally challenges misplaced oral heath beliefs, thus impacting attitudes to oral health and dental preservation. The study result has demonstrated that the Tooth keepers intervention is an effective oral health promotion tool.

CHAPTER 5: DISCUSSION

5.1 Summary of key findings

From the data analysed, the key findings emerging from the study include:

- There was statistically significant improvement in the respondent's oral health, awareness, and health status post-intervention with digital training and coaching.
- There was a significant improvement in respondents self-care and self-checking and knowledge after the intervention.
- There is clear evidence that affordability, fear of dentists and location of dental clinic constitute a barrier to dental access.

5.1.1 Oral knowledge

Prior to the digital intervention, nearly half of the students' oral health knowledge such as frequency of dental check-ups (48%), and brushing before bed (47%) was inadequate, as indicated by the findings. There was considerable improvement in oral hygiene awareness of students following the intervention. There was significant increase in knowledge regarding brushing before bed (85.4%), the need for dental examination and self-checking (93.3%). These results were comparable to those obtained by Mohamadkhah et al., (2013) who found that digital intervention effectively improved students' oral health knowledge. The significant improvements identified demonstrated the usefulness of the digital promotion tool in modifying the students' health behaviours towards positive oral health outcomes. In accordance with Zolfaghari et al., (2021), digital tools can be employed to promote oral health-related healthy practises. It therefore implies that using the digital tool provides students with the knowledge required to execute better oral health self-care practises. This is further demonstrated by the fact that after the digital tool intervention, pupils' self-evaluation skills improved considerably.

For example, the percentage of respondents who strongly agree that they knew how to inspect their own teeth and gums for issues increased from 15.7% to 63.0% after intervention. The plausible explanation for this is that digital health tools can significantly expand access to oral health solutions, making them easier to deploy (Bastani et al., 2022). This finding supports Vollmer et al., (2015) 's assertion that empowering communities and individuals with knowledge about the importance of oral health, disease awareness, early detection methods, and self-care would improve healthcare communication and foster attitudes that result in improved oral hygiene and health-related behaviour change.

5.1.2 Oral health awareness

The data reveal that self-reported oral health awareness increased dramatically after the implementation of digital promotive tools. For example, understanding of oral disorders such as “brown and black spots on my teeth are okay” increase from 51.2% before intervention to 100% after intervention. Similarly, the understanding of the effective brushing techniques rose dramatically from 74.4% to 96.5% after the intervention. The Self - checking and Knowledge findings resonated with Asimakopoulou and Newton (2015) study where knowledge of one's oral health, good hygiene, oral health awareness, and early disease detection resulted in proactive attitudes in individuals. Blaggana et al. (2016) also found that reliable oral health knowledge and oral health awareness results in positive behaviour changes that have a direct effect on disease aetiology. Importantly, each student realised that white, black or brown spots, occasional pain, cavities, bleeding gums and bad breath are not normal and that these are possible signs and symptoms of oral disease onset. The results demonstrate that the digital self-assessment tool is successful at increasing oral health awareness. Presumably, the improved oral health status measured after the digital tool intervention training was a result of greater oral health awareness among the students. Vollmer et al. (2015) similarly argued that primary care interventions should impart knowledge, enhance patient self-care skills, and raise

awareness of the need for timely and appropriate dental care, more especially recognising the need for prevention and importance of self-care and awareness. In this vain Morrissey et al. (2016) further reinforced this concept in utilising self-directed tactics that lead to sustained and long-lasting behavioural changes in individuals, families, and communities. These tactics are made to make behaviour modification strategies or behaviour change procedures easier to use (BCT). Thus, medical theory, pathophysiology, and knowledge of the limits and scope of self-care are all important aspects of self-awareness. For example, none of the respondents reported their gums frequently bled during brushing in the post-evaluation assessment. Similarly, those who never experienced tooth sensitivity fell from 30.3% to 18.5% in the post-training examination, whereas those who rarely experienced tooth sensitivity grew from 46.1% to 70.5%. Michie et al. (2013) highlighted a similar thread found by Hannah et al. (2013) where health promotion tools evolved from a campaign that only increased awareness to one that changed behaviour. Conroy et al. (2014) found that educational Behaviour Change Techniques (BCT) have the power to inspire people to act and may result in behavioural modification and change that allows for improved health outcomes due to a sense of awareness. Other researchers have also found the value of BCT technology through instructional methods, such as Direito et al. (2014), Middelweerd et al. (2014), and Vollmer et al. (2015). Consequently, it is necessary to assert that the use of digital tools will likely increase the level of oral health knowledge, awareness, and preventative self-care practices among university students.

5.1.3 Affordability and access to dental care

Compared to other types of health services, dental care presents the most budgetary challenges (Vujicic et al., 2016; Botros et al., 2020). Bernabé et al., (2017) demonstrate that dental care is prohibitively expensive and out of reach for the majority of people, particularly in developing nations. This present study found that the digital promotive tool increased the proportion of students who agreed that dental care is costly and identified this as a reason for delaying dental

visits. For example, the percentage of respondents who agreed that dental treatment is costly, hence while they avoid dental visits rose from 60.3% before intervention to 90.9% after the intervention. Fear of the dentist was discovered in the research as another reason for a lack of attending to timely dental care. Equally, the percentage of respondents who agreed to be afraid of the dentist and thus avoided visiting a dentist rose from 45.3% before intervention to 86.2% after intervention. Fear of dentists is an alternate justification for delaying dental care. According to Crego et al., (2014), dental phobia hinders access to and use of dental care. This is supported by the finding of this study, which indicates that the number of students who acknowledged that have a dental phobia and consequently avoid dental visits increased after receiving digital tool training. This is concerning, especially for mental health implications, since dental phobia can have serious oral and general health consequences (Crego et al., 2014). Given this concern, it would be advantageous to deploy digital oral health promotion technology to enhance awareness, early identification, and improved self-care, hence decreasing the cost of curative treatment and moreover dispelling misplaced beliefs regarding oral health and dental anxiety. In addition, the distance to the dental clinic is an additional reason why some students do not visit dental clinics. This supports Al-Shammari et al., (2007) claim that a lack of access to dental treatments is a barrier. This may explain why so many students (87%) visited dental clinics only when they were in pain. Of concern, the number of students who agreed they could not pay the necessary treatment increased from 44.8% to 88.2% after receiving instruction on digital tools. This is reinforced by Bernabe et al., (2017), who noted that dental care in poor nations remained expensive and mostly unaffordable. This result is also consistent with Naidoo et al. (2001) 's finding that the majority of South Africans cannot afford private health care. As a consequence, oral neglect may develop as highlighted by Kumar et al., (2015) emphasising that dental neglect has major financial, societal, and personal implications. This is consistent with the study's conclusion that digital coaching

increased the proportion of students who believed that oral neglect is linked to expensive dental treatment. This indicates that the digital tool raised awareness of the expense of dental care and the catastrophic consequences of delaying receiving timely and effective dental care. This is consistent with the call for preventative rather than curative dental care. Moreover, digital applications can engage individuals, families, and society in self-care and self-health monitoring. This technique described by Vollmer et al., (2015) would promote proactive care and individual autonomy regarding decisions, healthcare-seeking behaviour, and information exchange. Individuals who realise the consequences involved with neglecting their dental health will make diligent efforts to prevent oral problems. This is confirmed by the rising number of students who agreed (89.8%), after receiving digital coaching, that they would be able to take better care of their teeth if they were more aware of dental and oral health conditions. Vollmer et al. (2015) predicted that such knowledge would enhance healthcare communication and foster attitudes that would result in better dental hygiene and behaviour modification for individuals, communities, and society at large.

5.2 Conclusion

In conclusion, the preceding chapter includes evidence and debate on the significance of digital technologies for enhancing college students' self-care, self-checking, knowledge, and awareness. The results of the study provide statistical evidence that the digital tool for behaviour change (Tooth keepers) was extremely effective in promoting the oral health knowledge, awareness, and oral health status of the participating students. These findings are deemed crucial as it may aid in reducing the burden of oral health and related diseases, along with the cost of dental treatment and visits. Consequentially improving oral health outcomes and decreasing oral impairments caused by tooth loss. In addition, the present study demonstrates that the expense of dental treatment and visits is an impediment to oral health care, which may lead to individuals neglecting their wellbeing. This chapter concludes that the

use of digital tools combining behaviour change technologies (BCT) would encourage college students to engage in positive oral health behaviours.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATION

6.1 Conclusions of the Findings

Evidently, the digital tool intervention considerably enhanced the self-reported knowledge, awareness, and health status of college students regarding oral health. Training improved the student's understanding of self-checking for oral diseases, according to the summative research findings. This is of the paramount relevance, given that early detection and intervention will save teeth, prevent disease, and save lives. The study determined that high private dental expenditures, fear of the dentist, and the possibility that clinics are far from home or inaccessible are obstacles to accessing routine dental services. A freely accessible digital tool will be able to educate and coach individuals on preventative approaches to oral health and how to preserve oral health status by preventing the onset of dental diseases and the subsequent need for dental care through self-surveillance. The research findings suggest that empowerment of individuals in taking ownership of their oral health is a significant individual responsibility in improved oral health outcomes primarily driven by self-care and self-awareness through the facilitation and guidance of appropriate, accessible and reliable oral health digital tools.

6.2 Recommendations

Drawing from the above analysis and discussion, the following was proposed:

6.2.1 Promotion of preventative care

This study strongly recommends self-assessment and awareness of preventive care as a means of improving the general oral health of individuals, communities, and society in South Africa and possibly the world. In addition, digital self-care, notably the Tooth Keepers concept and digital support and coaching, will eliminate the barrier to accessing relevant and appropriate oral health information, oral health awareness and self-care practices

fundamentally moving people from a reactive disease based approach to a proactive prevention based strategy of self-care, hence reducing the disease burdens including the consequent associated cost implications of dental, thus making oral healthcare more affordable and perhaps accessible for many South Africans.

6.2.2 Areas for Future research

While the present study findings imply that the majority of respondents approve of the digital self-assessment tool, the cost-benefit analysis for its long-term application in South Africa need to be determined. Therefore, future research will explore the public health benefits of the Tooth Keepers digital tool in terms of cost and adoption. This is a subject worth investigating in the future. In terms of the digital development of applications geared towards oral health, further research and investment would be required to assess the implications of utilising artificial intelligence (AI) in preprogramed and self-learned computer digital capabilities in oral health communication within such applications and the recreation of guided communication patterns in oral health coaching and promotion systems when interfacing with individuals.

There remains a vast array of health information and related data on the world wide web, however the appropriate considerations for the correct application of such data and the synthesis thereof and more significantly the self-directed use of such data ought to be synthesised and symphonised for the individual. The opportunity does exist for leadership in this world wide space where medical and dental information merely exists, so does misinformation and worse harmful data regarding health and dental information such as using acidic lemon juices and abrasive bicarbonate pastes to whiten teeth, where these result in tooth enamel wear and loss, yet there simultaneously exist the opportunity for public healthcare advocacy in development of communication that may illicit healthier behaviours and correct processing and validation of such data. The assimilation of health data can be synthesised for its appropriate use and outcomes. The use of AI to synthesise such data and provide meaningful

real life application of data would be the result of the next evolution of the Tooth Keepers concept and would be worth further research. The concept of health care coaching using digital mediums to connect to people remotely provides immense reach and possibilities in the healthcare industry when it is fundamentally rooted in a people centred and primary care philosophy.

6.3 Conclusion

In conclusion, this study provided a comprehensive analysis of the advantages of a self-empowerment preventative dental care approach to combat and manage oral diseases in South Africa. The findings demonstrated the significance of using the digital tool is in increasing one's self-reported oral health knowledge, awareness, and oral health status. Following the training and coaching with the digital tool, several students reported having good oral health knowledge. Given the high cost of dental care, travel distance, and patient phobia of dentists, this became even more imperative. The adoption of the digital tool, according to this research findings clear evidence, will considerably reduce the risk of oral health neglect, which has been evidently associated with an increase in oral pathology and high treatment costs that may act as barriers to access. More specifically, and as a means of enhancing South Africans' general oral health, this study strongly encourages utilisation of a self-care digital tool as a supportive means for individuals, communities and society to become more responsible for self-initiated care. Future research will therefore look into the beneficial role that digital self-care tools can play in the advancement of South Africans' oral health.

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APPENDIX 1: RESEARCH ETHICS POLICY UNDERTAKING AND UWC BIOMEDICAL RESEARCH COMMITTEE ETHICS (BMREC) APPROVAL

To be signed by all masters and doctoral students and where appropriate, honours students, and all staff.

I Lesley Naidoo hereby acknowledge that I am familiar with the provisions of the University of the Western Cape Code of Conduct for Research and undertake to comply with its requirements.

.

Student Number: **ST: 20NA31868L**

BMREC REF : BM 20/9/16

UNIVERSITY of the WESTERN CAPE

60 YEARS of hope, action & knowledge

25 November 2020

Mr LS Naidoo
School of Public Health
Faculty of Community and Health Sciences

Ethics Reference Number: BM20/9/16

Project Title: Evaluating the effectiveness of digital Oral Health promotion on knowledge, self-check and self-care practices of students at a Durban college, South Africa.

Approval Period: 25 November 2020 – 25 November 2023

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report annually by 30 November for the duration of the project.

Permission to conduct the study must be submitted to BMREC for record-keeping.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

Director: Research Development
University of the Western Cape
Private Bag X 17
Bellville 7535
Republic of South Africa
Tel: +27 21 959 4111
Email: research-ethics@uwc.ac.za

NHREC Registration Number: BMREC-130416-050

APPENDIX 2: LETTER OF PERMISSION TO CONDUCT RESEARCH AT DUT AND GRANTED CERTIFICATE OF PERMISSION BY (IRIC)

Director for Research and Postgraduates Support
Tromso Annex, Steve Biko campus
Durban University of Technology
P.O. Box 1334
Durban
4000

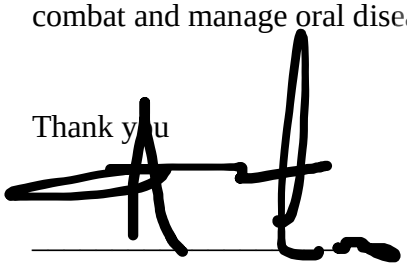
22 August 2020
School of Public Health
University of Western Cape
Bellville
7535

Dear Prof Linganiso

I am studying towards a Master's Degree in Public Health at the University of Western Cape. My research study is entitled: Evaluating the effectiveness of digital Oral Health promotion on knowledge, self-check and self-care practices of students at a Durban college, South Africa.

This is a request to be granted permission to conduct research with some students at the Durban University of Technology to enable me to gather data for my research. The participants for the study will include 1st year students at the Faculty of Health Sciences
It is envisaged that this research will help the investigator learn more about the effectiveness of an oral health digital tool for self-empowerment of preventative dental care strategies to combat and manage oral diseases in South Africa.

Thank you



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9th June 2021
Mr Lesley S Naidoo
c/o School of Public Health
Faculty of Community and Health Sciences
University of the Western Cape

Dear Mr Naidoo

PERMISSION TO CONDUCT RESEARCH AT THE DUT

Your email correspondence in respect of the above refers. I am pleased to inform you that the Institutional Research and Innovation Committee (IRIC) has granted **Full Permission** for you to conduct your research "Evaluating the effectiveness of digital Oral Health promotion on knowledge, self-check and self-care practices of students at the Durban University of Technology, South Africa" at the Durban University of Technology.

The DUT may impose any other condition it deems appropriate in the circumstances having regard to nature and extent of access to and use of information requested.

We would be grateful if a summary of your key research findings would be submitted to the IRIC on completion of your studies.

Kindest regards.
Yours sincerely

DR LINDA ZIKHONA LINGANISO
DIRECTOR: RESEARCH AND POSTGRADUATE SUPPORT DIRECTORATE

APPENDIX 3: INFORMATION SHEET

UNIVERSITY OF THE WESTERN CAPE

INFORMATION SHEET

Project Title : Evaluating the effectiveness of digital Oral Health promotion on knowledge, self-check and self-care practices of students at a Durban college, South Africa.

What is this study about?

This is a research project being conducted by Mr Lesley Sebastian Naidoo at the University of the Western Cape. We are inviting you to participate in this research project because you a first year registered student at the Durban University of Technology in the faculty of health science. The purpose of this research project is to evaluate college student's oral health knowledge and awareness regarding the ability to self-check and self-care before and after exposure to a digital oral health promotion tool at the Durban University of Technology (DUT). Preventative health strategies may be easily achieved using digital tools that are recently becoming widely accessible, empowering individuals and communities to become more involved with self-care, prevention, awareness, improved health and wellness. This study will investigate current oral health self-checking and self-care knowledge of college students

What will I be asked to do if I agree to participate?

You will be asked to complete electronically via the link provided 4 sections of the questionnaire

1. Biographical information
2. Oral Health Knowledge

3. Oral Health Awareness

4 Oral Health Status

5. Affordability and Access

6. Self checking and Self care

Please answer all questions as honestly as possible and try to complete all the questions. It will take approximately 20 minutes to complete the questionnaire.

Would my participation in this study be kept confidential?

The researchers undertake to protect your identity and the nature of your contribution. To ensure your anonymity, the surveys are anonymous and will not contain information that may personally identify you. To ensure your confidentiality, all printed data will be locked in a fireproof cupboard and be disposed after a period of five years. Electronic data will be password protected and only accessible by the researcher. All data will be disposed according to institutional policy and any hard copies shredded.

If we write a report or article about this research project, your identity will be protected.

In accordance with legal requirements and/or professional standards, we will disclose to the appropriate individuals and/or authorities information that comes to our attention concerning child abuse or neglect or potential harm to you or others. In this event, we will inform you that we have to break confidentiality to fulfil our legal responsibility to report to the designated authorities.

What are the risks of this research?

All human interactions and talking about self or others carry some amount of risks. We will nevertheless minimise such risks and act promptly to assist you if you experience any

discomfort, psychological or otherwise during the process of your participation in this study. Where necessary, an appropriate referral will be made to a suitable professional for further assistance or intervention.

What are the benefits of this research?

This research is not designed to help you personally, but the results may help the investigator learn more about the effectiveness of an oral health digital tool to self-empowerment of preventative dental care strategies to combat and manage oral diseases in South Africa. We hope that, in the future, other people might benefit from this study through improved understanding of oral diseases prevention. Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify

What if I have questions?

This research is being conducted Mr Lesley Sebastian Naidoo School of Public Health at the University of the Western Cape. Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact: Mr Lesley Sebastian Naidoo at School of Public Health University of the Western Cape or Cell number: 0829270983 or via Email: lesley@denticaresa.co.za

This research has been approved by the University of the Western Cape's Biomedical Research Ethics Committee:

Biomedical Research Ethics Committee
University of the Western Cape

Private Bag X17
Bellville
7535
Tel: 021 959 4111
e-mail: research-ethics@uwc.ac.za

APPENDIX 4: CONSENT FORM

UNIVERSITY OF THE WESTERN CAPE

CONSENT FORM

Title of Research Project: Evaluating the effectiveness of digital Oral Health promotion on knowledge, self-check and self-care practices of students at a Durban college, South Africa.

The study has been described to me in language that I understand. My questions about the study have been answered. I understand what my participation will involve and I agree to participate of my own choice and free will. I understand that my identity will not be disclosed to anyone. I understand that I may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits. I understand that by continuing in this study I digitally consent by clicking the links provided for the pre test and post test questionnaires or signing thereto.

Biomedical Research Ethics Committee
University of the Western Cape
Private Bag X17
Bellville
7535
Tel: 021 959 4111
e-mail: bmrec@uwc.ac.za

APPENDIX 5: QUESTIONNAIRE

Survey : Section 1

Biographical information

This section seeks out some background information about you. It is essential to acquire this information as this will have a bearing on the results of the survey. This information will be used for comparative purposes only. Please indicate your answer by crossing (x) the appropriate, block or by filling in your answer.

1. What age bracket do you fall in?

18-21 years	
21 to 30 years	
31 to 40 years	
41 years and over	

2. What is your gender?

Male	
Female	
Other:	

3. What is your department?

Dental Sciences	
Community Health	
Somatology	
Homoeopathy	
Chiropractic	
Nursing	
Clinical & Biomedical Technology	
Emergency medical and rescue	
Medical Orthotics and Prosthetics	
Radiography	

Other :	

Section 2
Oral Health Knowledge

Please rate your level of agreement or disagreement with each statement by placing a tick (✓) next to the one number that best reflects your opinion on the 5-point scale.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2.1 Tooth brushing must be done twice a day	1	2	3	4	5
2.2 Flossing must be done once daily	1	2	3	4	5
2.3 It is not necessary to brush the tongue	1	2	3	4	5
2.4 It is ok if my gums bleed when I brush	1	2	3	4	5
2.5 I should go for a dental check-up only when I have pain	1	2	3	4	5
2.6 I know how to check my own teeth and gums for any problems	1	2	3	4	5
2.7 I am able to check my own teeth and mouth but don't know what the early signs of oral disease look like	1	2	3	4	5
2.8 brushing before bed is more important than brushing in the morning	1	2	3	4	5
2.9 I can substitute brushing and flossing with a simple mouth wash or rinse	1	2	3	4	5
2.10 Teeth are not so important as with new technology teeth are easily replaced	1	2	3	4	5

Section 3
Oral Health Awareness

The following lists various oral health statements - Please indicate your choice of answer by placing a tick (✓) next to "true", "false," "maybe," or "don't know"

3.1 Adults have a total of 32 teeth	True	False	Maybe	Don't know
3.2 Swollen bleeding gums are normal	True	False	Maybe	Don't know
3.3 Using toothpicks to dig out food from teeth is good for teeth and gums	True	False	Maybe	Don't know
3.4 I must brush teeth very hard to remove food and plaque	True	False	Maybe	Don't know
3.5. brown and black spots on my teeth are ok	True	False	Maybe	Don't know

Section 4
Oral Health Status
Please indicate your choice of answer by placing a tick (✓)

4.1 my gums sometimes bleed when brushing	Never	Seldom	Frequently	Very Frequently
4.2 I have sensitive teeth	Never	Seldom	Frequently	Very Frequently
4.3. I experience tooth ache and pain whilst eating	Never	Seldom	Frequently	Very Frequently
4.4 food traps into my teeth and gums when eating	Never	Seldom	Frequently	Very Frequently

Section 5
Affordability and Access

Please rate your level of agreement or disagreement with each statement by placing a tick (✓) next to the <u>one</u> number that best reflects your opinion on the 5-point scale.

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
5.1. dental treatment is costly so I avoid dental visits	1	2	3	4	5
5.2. I'm afraid of the dentist and I avoid Visiting a dentist	1	2	3	4	5
5.3. I need help to fix my teeth but do not have medical aid cover to fix teeth	1	2	3	4	5
5.5. dental clinics are far away and I only go when I have pain	1	2	3	4	5
5.6. I cannot afford dental treatment that was recommended to me	1	2	3	4	5
5.7. Oral Neglect consequently leads to costly dental treatment	1	2	3	4	5

Self-Care & Self Checking Knowledge circle the correct answer or write down your choice
Section 6

6.1. How would you describe the health of your teeth and gums?

a. Very good
b. Good
c. Average
d. Poor
e. Very poor
f. Don't know

6.2. Is Gum bleeding and swollen gums a sign of good gum health?

a) Yes

b) No
c) Unsure

6.3. Do you feel or notice food trapping in your teeth or gums?
a) Yes
b) No
c) sometimes

6.4. Is food trapping in and between teeth good for oral health?
a) Yes
b) No
c) Unsure

6.5. Why does food trap in and between my teeth?
a) I know
b) I don't know
c) Not sure

6.6. How should I remove food from in and between my teeth?
a) Brushing
b) Tooth pick
c) Flossing

6.7. What should I do to stop food trapping in and between my teeth ?

a) Don't chew where the food traps
b) Brush and floss regularly
c) don't know
d) go to the dentist for help

6.8. Why will I feel pain in my teeth and gums when chewing or eating ?
a) I know
b) I don't know
c) Unsure

6.9. Do you feel sensitive to hot or cold substances when eating or drinking ?
a) Yes
b) No
c) Sometimes

6.10. Is it normal to feel sensitive in teeth and gums when eating or drinking ?
a) Yes
b) No
c) Unsure

6.11. Why will I feel sensitive in teeth and gums when eating or drinking ?
a) I know

b) I don’t know
c) Unsure

6.12. Do you have bad breath?
a) Yes
b) No
c) Unsure

6.13. Is it normal to have bad breath ?
a) Yes
b) No
c) Unsure

6.14. Why will I have bad breath?
a) I know
b) I don’t know
c) Unsure

6.15. What should I do if I know I have bad breath ?
a) I know
b) I don’t know
c) Unsure

6.16. Did you notice any black or brown lines or spots on your teeth?
a) Yes
b) No
c) Unsure

6.17. How often do you clean your teeth?

a. Never
b. Once in a week
c. Many times in a week
d. Once in a day
e. More than once in a day

6.18. Do you floss between your teeth?

a) Yes
b) No
c) Unsure

6.19. How often should you floss?

a. Never
b. Once in a week
c. Many times in a week
d. Once in a day
e. More than once in a day

6.20. Do you clean your mouth before sleeping?

a) Yes

b) No
c) Unsure

6.21. What do you use to clean your teeth?

a. Finger
b. Toothbrush only
c. Tooth powder
d. Tooth brush and toothpaste
e. Something else

6.22. Do you brush your gums and tongue , when brushing teeth?

a) Tongue only
b) Gums only
c) I brush both my tongue and gums

6.23. Do you Look at your mouth teeth and gums in the mirror when brushing teeth ?

a) Always
b) Occasionally
c) Never
a) Always
b) Occasionally
c) Never

6.24. Do you know what to look for when checking your mouth teeth and gums?

a) Yes
b) No
c) Unsure

6.25. Do you use any of these tobacco containing products?

a. cigar
b. Cigarette
c. weed
d. vapor
e. tobacco
f. Any other ….

6.26. If yes, how often do you use it?

a. Once in a month
b. Once in a week
c. Many times in a week
d. Once in a day
e. Many times in a day

6.27. Select the correct answer for the following sentences

True = 1 /false = 2 / don't know = 3

a. Teeth are an important part of your body
b. Daily cleaning of teeth can prevent dental caries
c. Regular visit to dentist helps to keep your teeth in a healthy state
d. Consuming sweetened food products or drinks does not cause dental caries
e. Using fluoridated toothpaste is good for your teeth
f. Flossing between teeth will reduce the chance of decay between my teeth
g. Tartar is a bacterial cement that causes gum disease and bone loss
h. Brushing twice a day every day is very important to keep bacteria levels low and teeth healthy
i. I can replace brushing and flossing with just mouth washing
j. Fissure sealants can protect the biting surfaces of my teeth and prevent tooth decay
k. A black white or brown spot on my tooth could mean there is decay or risk of decay
l. If I have no pain it means all my teeth are perfectly well
m. I need to be more visually aware of my teeth and gums

Diet

6.28. Do you drink soft drinks and sweetened beverages?

a. Never
b. Once in a week
c. Many times in a week
d. Once in a day
e. More than once in a day

6.29. Do you eat sweets, chocolates and snacks ?

a. Never
b. Once in a week
c. Many times in a week
d. Once in a day
e. More than once in a day

6.29. Sour sweets do not damage teeth /
a)True
b)False
c)Unsure

6.30. Energy drinks and soft drinks do not damage teeth ?
a)True
b)False
c)Unsure

6.31. Do you snack at night before sleeping ?
a)Yes
b)No
c)Sometimes

6.32. Do you brush before sleeping?
a)Yes
b)No
c)Sometimes

6.33. I am able to keep all my teeth for life?
a)True
b)False
c)Unsure
d)Don't know

6.34. I will lose most of my teeth as I get older and may need false teeth?
a)Yes
b)No
c) maybe

6.35. I will lose some of my teeth in my lifetime and its ok?
a)Yes
b)No
c) maybe

Thank you for your time and effort in completing this questionnaire! It is greatly appreciated!